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November 18, 2015

Mr. Aaron Yue
California Department of Toxic Substances Control
5796 Corporate Avenue
Cypress, CA 90630

Ms. Pamela Innis
U.S. Department of the Interior, Office of Environmental Policy and Compliance
One North Central Avenue, Suite 800
Phoenix, Arizona 85004

Subject: Basis of Design Report/ Final (100%) Design Submittal and Construction/ Remedial Action Work Plan for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California

Dear Mr. Yue and Ms. Innis:

In compliance with the 1996 Corrective Action Consent Agreement (CACA) between the California Department of Toxic Substances Control (DTSC) and Pacific Gas and Electric Company (PG&E) and with the CERCLA Remedial Design/Remedial Action Consent Decree (CD), this letter transmits the *Basis of Design Report/ Final (100%) Design for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California* (Final BOD Report) for the Agencies' approval consideration.

Other requirements of the CACA and CD, including the plans and schedules for construction and implementation of the remedy set forth in the design plans and specifications, are addressed in the *Construction/Remedial Action Work Plan for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California* (C/RAWP). This letter also transmits the C/RAWP, which is presented under separate cover and is intended to be a companion document to the Final BOD Report. As directed, PG&E is working on the modeling revisions stipulated in the October 19, 2015 final design directives, and will submit the results to the Agencies in a technical memorandum by February 2016.

PG&E looks forward to the Agencies' approval of this Final Design Submittal and the C/RAWP as it is an important milestone towards completion of site cleanup and protection of the Colorado River.

Please contact me at (805) 234-2257 if you have any questions or comments regarding this submittal.

Sincerely,

Yvonne Meeks
Topock Project Manager

cc: Kevin Sullivan/PG&E, Karen Baker/DTSC

Topock Project Executive Abstract

Document Title: *Construction/Remedial Action Work Plan for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California*

Submitting Agency: DTSC, DOI

Final Document? ☒ Yes ☐ No

Date of Document: 11/18/2015

Who Created this Document?: (i.e. PG&E, DTSC, DOI, Other)

PG&E

Priority Status: ☐ HIGH ☐ MED ☒ LOW

Is this time critical? ☐ Yes ☒ No

Action Required:

☒ Information Only ☐ Review & Comment

Return to: N/A

By Date:

☐ Other / Explain:

Type of Document:

☐ Draft ☒ Report ☐ Letter ☐ Memo

☐ Other / Explain:

What does this information pertain to?

- ☐ Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA)/Preliminary Assessment (PA)
- ☐ RCRA Facility Investigation (RFI)/Remedial Investigation (RI) (including Risk Assessment)
- ☐ Corrective Measures Study (CMS)/Feasibility Study (FS)
- ☒ Corrective Measures Implementation (CMI)/Remedial Action (RA)
- ☐ California Environmental Quality Act (CEQA)/Environmental Impact Report (EIR)
- ☐ Interim Measures
  - ☐ Other / Explain:

Is this a Regulatory Requirement?

☒ Yes

☐ No

If no, why is the document needed?

What is the consequence of NOT doing this item? What is the consequence of DOING this item?

This submittal is required for compliance with the 1996 Corrective Action Consent Agreement (CACA), the CERCLA Remedial Design/Remedial Action Consent Decree (CD), and the Corrective Measure Implementation/Remedial Design (CMI/RD) Work Plan.

Other Justification/s:

☐ Permit ☐ Other / Explain:

Brief Summary of attached document:

This *Construction/Remedial Action Work Plan for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California* (C/RAWP) presents the plans and schedules for construction and implementation of the remedy set forth in the design plans and specifications in the *Basis of Design/Final (100%) Design Report for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California* (Final BOD Report).

The Final BOD Report is presented under separate cover and is intended to be a companion document to this C/RAWP.

Written by: Pacific Gas and Electric Company

Recommendations:

None.

How is this information related to the Final Remedy or Regulatory Requirements:

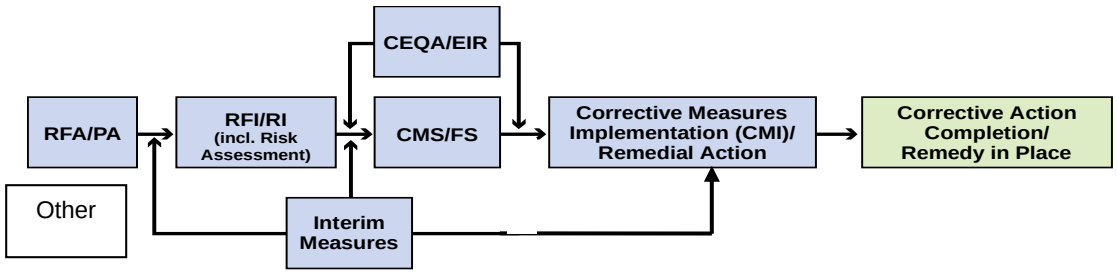
This submittal presents the plans and schedules for construction and implementation of the remedy set forth in the design plans and specifications in the Final BOD Report.

Other requirements of this information?

None.

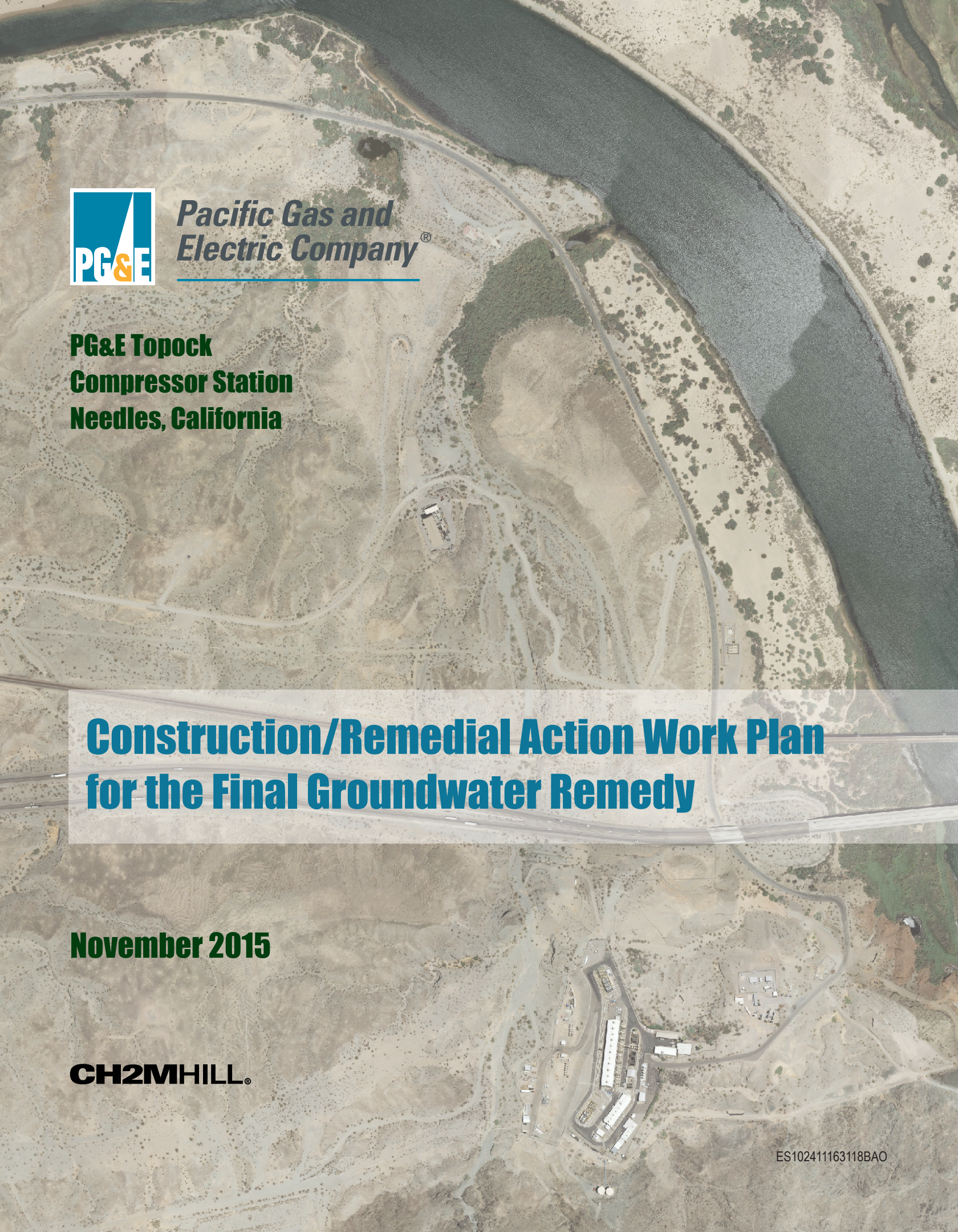
Related Reports and Documents:

Click any boxes in the Regulatory Road Map (below) to be linked to the Documents Library on the DTSC Topock Web Site (www.dtsc-topock.com).



Legend
RFA/PA – RCRA Facility Assessment/Preliminary Assessment
RFI/RI – RCRA Facility Investigation/CERCLA Remedial Investigation (including Risk Assessment)
CMS/FS – RCRA Corrective Measure Study/CERCLA Feasibility Study

Version 9



Pacific Gas and Electric Company®

PG&E Topock
Compressor Station
Needles, California

Construction/Remedial Action Work Plan for the Final Groundwater Remedy

November 2015

CH2MHILL®

ES102411163118BAO

Construction/Remedial Action Work Plan for the Final Groundwater Remedy

PG&E Topock Compressor Station, Needles, California

Prepared for

Pacific Gas & Electric Company

November 2015

CH2MHILL®
155 Grand Avenue
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Oakland, CA 94612

Certification

Construction/Remedial Action Work Plan for the
Final Groundwater Remedy
PG&E Topock Compressor Station
Needles, California

Prepared for
California Department of Toxic Substances Control and
United States Department of the Interior

On behalf of
Pacific Gas and Electric Company

November 2015

This report was prepared under supervision of a California Professional Engineer.

11/18/2015

Julie L. Eakins
California Professional Engineer PE No. C 47243
Project Engineer

Date

I certify that this Construction/Remedial Action Work Plan for the Final Groundwater Remedy at the Pacific Gas and Electric Company's Topock Compressor Station meets the submittal requirements specified in Sections 2.2.5-2.2.7 and 3 of the Scope of Work (Appendix C) of the Remedial Design/Remedial Action Consent Decree (CD), and Attachment 6, Paragraph E of the Scope of Work for Corrective Measures Implementation of the Corrective Action Consent Agreement (CACA).

11/18/2015

Christina H. Hong
California Professional Engineer PE No. CH 4861
CH2M Project Manager

Date

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B Standard Operating Procedures *(on CD-ROM Only)*

C PG&E Program Quality Assurance Project Plan and Addendum *(on CD-ROM Only)*

D Construction Health and Safety Plan

E Cost Estimate *(on CD-ROM Only)*

F Interim Measure No. 3 Decommissioning, Removal, and Restoration Work Plan *(on CD-ROM Only)*

G Havasu National Wildlife Refuge, Habitat Restoration Plan *(on CD-ROM Only)*

H Cultural Impact Mitigation Program *(on CD-ROM Only)*

I Cultural Historic Properties Management Plan *(on CD-ROM Only)*

J Paleontological Resources Management Plan: MMRP CUL-3 *(on CD-ROM Only)*

K Summary of Compliance with EIR Mitigation Measures, CIMP, Identified ARARs, Applicable PA Stipulations, and Applicable Cultural and Historic Property Management Plan Provisions *(on CD-ROM Only)*

L Soil Management Plan *(on CD-ROM Only)*

M Best Management Practices Plan

N Aesthetics and Visual Resources Protection and Revegetation Plan *(on CD-ROM Only)*

O Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats *(on CD-ROM Only)*

P Cultural Resources Protocols *(on CD-ROM Only)*

- CUL-1a-2: Protocol to Preserve Tribal Members' Access to, and Use of, the Project Area
- CUL-1a-3(c): Outreach to Visitors
- CUL-1a-3(d): Post Off-Road Vehicle Use Signage
- CUL-1a-7: Protocols for Nighttime Lighting
- CUL-1a-13: Development of Cultural Sensitivity Education Program
- CUL-4: Discovery of Human Remains

Q Site Security Plan *(on CD-ROM Only)*

R Waste Management Plan

S Bird Impact Avoidance and Minimization Plan *(on CD-ROM Only)*

T Geoarchaeological Assessment for the Topock Remediation Project *(on CD-ROM Only)*

U Programmatic Biological Assessment *(on CD-ROM Only)*

V Technical Memorandum: Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California

W Technical Memorandum: Proposed Use of Certain Areas for Construction, Staging, and Soil Storage at PG&E Topock Compressor Station *(on CD-ROM Only)*

X Responses to Comments on the C/RAWP Dated September 8, 2014 *(on CD-ROM Only)*

Acronyms and Abbreviations

µg/L	micrograms per liter
60% BOD	Basis of Design Report/Intermediate (60%) Design
90% BOD	Basis of Design Report/Pre-Final (90%) Design
100% BOD	Basis of Design Report/Final (100%) Design
ACEC	Area of Critical Environmental Concern
ACP	asphalt concrete pavement
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
AMM	Avoidance and Minimization Measure
ANSI	American National Standards Institute
AOC	Area of Concern
APE	Area of Potential Effect
ARAR	applicable or relevant and appropriate requirement
ATSM	ATSM International
AUA/CD	Appropriate Use Analysis and Compatibility Determination
bgs	below ground surface
BLM	U.S. Bureau of Land Management
BMP	Best Management Practice
BNSF	BNSF Railway (formerly Burlington Northern Santa Fe Railway)
BOD	Basis of Design
BOR	U.S. Bureau of Reclamation
C/RAWP	Construction/Remedial Action Work Plan
CACA	Corrective Action Consent Agreement
Caltrans	California Department of Transportation
CCR	California Code of Regulations
CD	Consent Decree
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHPMP	Cultural and Historic Properties Management Plan
CHQ	Construction Headquarters
CIMP	Cultural Impact Mitigation Program
CMI	Corrective Measures Implementation
CQAPP	Construction Quality Assurance Project Plan

CQCP	Contractor Quality Control Plan
Cr(III)	trivalent chromium
Cr(T)	total chromium
Cr(VI)	hexavalent chromium
CUPA	California Unified Permitting Agency
CWA	Clean Water Act
DOI	United States Department of the Interior
DTSC	California Department of Toxic Substances Control
EIR	Environmental Impact Report
ER	East Ravine (in reference to wells)
ESA	federal Endangered Species Act
FCR	Field Contact Representative
FMIT	Fort Mojave Indian Tribe
gpm	gallons per minute
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDD	horizontal directional drilling
HMBP	Hazardous Materials Business Plan
HNWR	Havasu National Wildlife Refuge
HVAC	heating, ventilation, and air conditioning
I-40	Interstate 40
IM	Interim Measure
IM-3	Interim Measure No. 3
IRL	inner recirculation loop
IRZ	In-situ Reactive Zone
MMRP	Mitigation Monitoring and Reporting Program
MNA	monitored natural attenuation
MWD	Metropolitan Water District of Southern California
NRC	National Response Center
NSF	National Science Foundation
NTH	National Trails Highway (also called National Old Trails Highway)
OES	California Governor's Office of Emergency Services
O&M	operation and maintenance
PA	Programmatic Agreement
PBA	Programmatic Biological Assessment
PG&E	Pacific Gas and Electric Company
PLC	programmable logic controller
PMO	Program Management Office (PG&E)

PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RAO	remedial action objective
RB	River Bank
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RFI	RCRA Facility Investigation
RI	Remedial Investigation
ROD	Record of Decision
ROW	right-of-way
RTC	Response to Comment
RWQCB	Regional Water Quality Control Board
SCADA	Supervisory Control and Data Acquisition
SOP	standard operating procedure
SOW	Statement of Work
STLC	soluble threshold limit concentration
SWMU	Solid Waste Management Unit
SWPPP	Storm Water Pollution Prevention Plan
TBM	tunnel boring machine
TC	toxicity characteristic
TCLP	toxicity characteristic leaching procedure
TCS	Topock Compressor Station
TDS	total dissolved solids
TW Bench	Transwestern Bench
TWB	Transwestern Bench (in reference to wells)
U.S.C.	United States Code
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Services
WDR	Waste Discharge Requirement
WET	Waste Extraction Test

SECTION 1

Introduction

This Construction/Remedial Action Work Plan (C/RAWP) presents the strategy and procedures for construction and startup of the groundwater remedy system at the Pacific Gas and Electric Company (PG&E) Topock Compressor Station (TCS or Compressor Station) in Needles, California. This C/RAWP is packaged with the Basis of Design (BOD) Report/Final (100%) Design Submittal for the Final Groundwater Remedy (Final BOD; CH2M HILL 2015b). This C/RAWP is a companion document to the Final BOD submittal and is focused on the strategy for constructing and starting up the groundwater remedy. (The terms "groundwater remedy" and "final groundwater remedy" are interchangeable as used throughout this document; other equivalent terms used herein include "selected groundwater remedy" and "the remedy.")

PG&E is implementing the groundwater remedy at the Topock site in conformance with the requirements of the Resource Conservation and Recovery Act (RCRA) Corrective Action and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The California Department of Toxic Substances Control (DTSC) is the state lead agency overseeing corrective actions at the Compressor Station in accordance with the RCRA Corrective Action. In 1996, PG&E and DTSC entered into a Corrective Action Consent Agreement (CACA; DTSC 1996) pursuant to Section 25187 of the California Health and Safety Code. The U.S. Department of the Interior (DOI) is the lead federal agency overseeing response actions for land under its jurisdiction, custody, or control near the Compressor Station pursuant to CERCLA. PG&E and the United States executed a Remedial Design/Remedial Action Consent Decree (CD; DOI 2013), on behalf of the DOI, under CERCLA in 2012, which was approved by with the U.S. District Court for the Central District of California in November 2013. DOI and DTSC executed a Memorandum of Understanding (MOU) concerning the coordination in overseeing the implementation of groundwater response action at TCS on November 22, 2011 (DTSC and DOI 2011).

This C/RAWP has been prepared as required by the CACA and the CD. The CACA requires that this C/RAWP be prepared to document the overall management strategy, construction quality assurance procedures, and schedule for constructing the remedy. The CD requires that this C/RAWP be submitted concurrently with the pre-final (90%) and final (100%) design packages. Detailed requirements of the CACA and the CD pertaining to this C/RAWP are included in Section 1.3 of this report.

The C/RAWP was originally submitted to DTSC and DOI on September 8, 2014 with the Basis of Design Report/Pre-Final (90%) Design Submittal (CH2M HILL 2014b). This C/RAWP has been revised to incorporate review comments received on the original version; responses to comments (RTCs) on the C/RAWP (including C/RAWP appendices) are included as Appendix X.

1.1 Purpose and Overview

The purpose of this C/RAWP is to be a standalone document that details the strategy and procedures for constructing and starting up the final groundwater remedy. This C/RAWP is being prepared in conjunction with, and is intended to be a companion document to, the Final BOD submittal. The final (100%) design package includes:

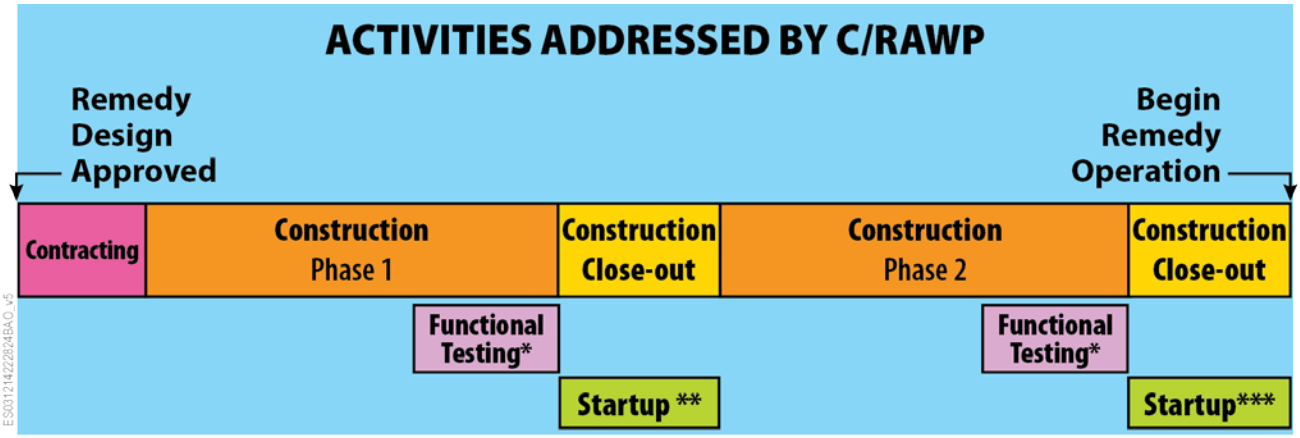
1. The Final BOD report, including engineering plans, providing the design basis, design criteria, drawings, and specifications for the groundwater remedy.
2. The Operation and Maintenance Manual (O&M Manual, which is Appendix L of the Final BOD report), outlining strategies and procedures for performing O&M of the groundwater remedy during the expected decades-long remedy operation phase, including long-term monitoring to evaluate attainment of cleanup goals.

3. This C/RAWP, outlining strategies and procedures for constructing and starting up the groundwater remedy. It also includes a plan for the shutdown, layup, and decommissioning of the existing Interim Measure (IM), as well as post-construction revegetation.

Following approval of the design for the final groundwater remedy and after execution of the appropriate institutional controls, approvals, permits, and agreements, this C/RAWP will be implemented and construction will begin on the remedy.

The construction of the groundwater remedy is expected to be a multiyear process, including contracting, mobilization, site preparation and establishment of construction support facilities, construction of the groundwater remedy facilities, functional testing, shutdown and layup of the existing IM, and groundwater remedy startup. Following functional testing and startup of the groundwater remedy, O&M of the remedy will begin. Construction of the groundwater remedy is anticipated to occur in two phases. Exhibit 1.1-1 shows a simplified timeline of the activities covered by the C/RAWP, starting at the approval of the Final Design and ending with initiation of the operational phase of the remedy. Throughout this work plan, the term “construction” or “construction and startup” are typically implied to mean all activities addressed by this C/RAWP, following completion and acceptance of the design and prior to the operation and maintenance phase of the project.

EXHIBIT 1.1-1
C/RAWP and Construction Timeline
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California



* This period is often referred to as “commissioning” or “shakedown”, which is the period when the construction contractors make minor adjustment as necessary to ensure the system or components is operating and functioning as designed.
** The IM system will be turned off when the In-situ Reactive Zone along National Trails Highway is ready to begin start-up.
*** In-situ Reactive Zone along National Trails Highway is on during start-up of Phase 2 systems.

1.2 Background and Setting

As shown on Figure 1.2-1 (figures are located at the end of each section), the TCS is adjacent to the Colorado River in eastern San Bernardino County, California, approximately 12 miles southeast of Needles, California, south of Interstate 40 (I-40), near the north end of the Chemehuevi Mountains. The selected groundwater remedy addresses existing chromium contamination in groundwater resulting from past TCS operations. The groundwater remedy includes:

- Construction of an In-situ Reactive Zone (IRZ) along National Trails Highway (NTH; also called National Old Trails Highway) using a line of wells that may be used as both injection and extraction wells to circulate groundwater and distribute an organic carbon source to promote reduction of the hexavalent chromium (Cr[VI]) to trivalent chromium (Cr[III]).

- Flushing accomplished through a combination of freshwater injection and injection of carbon-amended water in wells upgradient of the plume.
- Extraction wells near the Colorado River (referred to as the River Bank Extraction Wells) to provide hydraulic capture of the plume, accelerate cleanup of the floodplain, and enhance the flow of contaminated groundwater through the IRZ line.
- Injection wells to re-inject groundwater extracted from the River Bank Extraction Wells, which may be amended with an organic carbon source, and/or freshwater in the upgradient portion of the plume to flush the plume through the IRZ.
- East Ravine Extraction Wells in the eastern (downgradient) end of the East Ravine to provide hydraulic capture of contaminated groundwater in bedrock. Injection wells located upgradient of the TCS for the re-injection of groundwater extracted from the East Ravine Extraction Wells and Transwestern (TW) Bench Extraction Wells, which will be amended with an organic carbon source.
- Institutional controls to restrict surface land uses and prevent the use of groundwater.
- Monitored natural attenuation (MNA) as a long-term component to address residual chromium that may remain in recalcitrant portions of the aquifer after enhanced in-situ treatment and optimized system performance.

Figure 1.2-2 shows planned locations of the groundwater remedy facilities, as represented in the Final BOD submittal.

Information on the history of the groundwater remedy project, objectives of the groundwater remedy, selection of the groundwater remedy, and regulatory setting are included in the Revised *Groundwater Corrective Measure Implementation/Remedial Design Work Plan for Solid Waste Management Unit 1/Area of Concern 1* [SWMU 1/AOC 1] *and Area of Concern 10, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California* (CMI/RD Work Plan; CH2M HILL 2011). The CMI/RD Work Plan provides the framework for implementation of the selected groundwater remedy through design, construction, startup, operation, maintenance, decommissioning, restoration, and long-term monitoring following completion of the active treatment. The Final BOD provides background information on the site and groundwater remedy, baseline site conditions, and design basis and assumptions, design criteria, design drawings and specifications and other supporting information. The Final BOD also describes the existing IM that has been operating to contain the chromium contamination in groundwater since 2004 and the transition from the IM to the groundwater remedy.

The Area of Potential Effects (APE) for the Topock site is contained within what the Fort Mojave Indian Tribe (FMIT) and other Native American Tribes have identified as a larger area of traditional and cultural importance. The Tribes believe that the environmental, cultural, and spiritual resources may not be physically perceptible.

Portions of the Topock site are also located in a Riparian and Cultural Area of Critical Environmental Concern (ACEC), designated under the U.S. Bureau of Land Management (BLM) Resource Management Plan (BLM 2007), and a large portion of the site and surrounding area is the Havasu National Wildlife Refuge (HNWR). In recognition of the cultural, historical, and ecological resources, all construction and remedial activities at TCS are planned in such a way as to minimize impact to the APE. Specifically, impacts to cultural resources will be minimized by implementing the mitigation measures required by the Mitigation Monitoring and Reporting Program (MMRP; DTSC 2011a), adopted by DTSC in 2011 as part of the certified Environmental Impact Report (EIR; DTSC 2011b), and an addendum to the EIR (2013 Addendum; DTSC 2013a). In addition, mitigation measures have been and will continue to be implemented in accordance with the Programmatic Agreement (PA; BLM 2010); the Cultural and Historic Properties Management Plan (CHPMP; BLM 2012); the Cultural Impact Minimization Program (CIMP; PG&E 2014); and in consultation with the Tribes throughout

the construction and startup process. The work will be conducted in a manner that recognizes and respects these resources and the spiritual values of the area.

1.3 Requirements and Organization of the Construction/ Remedial Action Work Plan

In conformance with the requirements of the 1996 CACA and the 2013 CD, this C/RAWP includes specific information related to the construction and start-up of the final groundwater remedy. Those requirements are organized into the sections listed below.

- **Executive Summary** provides a brief summary of the C/RAWP.
- **Section 1** provides the purpose and overview of the C/RAWP, introduces the final groundwater remedy as well as background information and setting information, and describes the requirements, content and organization of the C/RAWP.
- **Section 2** is the Project Management Plan and describes the project team organization responsibilities, project management approach, communication procedures, method for selecting remedial action contractors, worker training/education, regulatory compliance data management, recordkeeping, and reporting.
- **Section 3** describes procedures for construction of the groundwater remedy and outlines the schedule and sequencing considerations for construction of remedial components such as wells, pipelines, aboveground support facilities, and other remedial facilities.
- **Section 4** is the Site Management Plan describing requirements for construction and startup of the groundwater remedy such as worker health and safety, site preparation, site security, decontamination, waste management, best management practices, and other site and coordination procedures.
- **Section 5** summarizes the construction contingency plans and procedures.
- **Section 6** describes construction completion activities, including construction closeout, revegetation, functional testing, and remedy startup.
- **Section 7** provides reference information for the works cited in this report.

The C/RAWP has been prepared to meet the requirements of the CACA and the CD and will be used by PG&E and its contractors as a guide throughout the construction and startup process. Table 1.3-1 (tables are located at the end of each section) provides a cross-reference between the C/RAWP content and the CACA and the CD requirements. The content of this work plan is also guided by other agency requirements such as mitigation measures required by the MMRP (DTSC 2011a) and applicable or relevant and appropriate requirements (ARARs) as discussed throughout this work plan.

TABLE 1.3-1

Corrective Action Consent Agreement and Consent Decree Compliance Checklist for C/RAWP Requirements

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles California

CACA Attachment 6 Requirements Part E – Construction Work Plan (DTSC 1996)	Consent Decree Requirements CD Paragraph 13b, SOW Sections 2.2.5, 2.2.6, 2.2.7, 3 (DOI 2013)	Section of the C/RAWP where the Requirement is Met
E.1 Introduction/purpose		Section 1 – Introduction
E.2 Project management, including construction management approach, levels of authority and responsibility, lines of communication and construction QA/QC responsibilities	Project Management Plan: • Identification of PG&E's remedial action project team, levels of authority, and responsibility • Project management and organization • Communication procedures and protocols • Method for selection of the contractor • Protocol for documenting ARARs compliance	Section 2.1 – Project Team Organization Section 2.3.1 – Communication Procedures and Protocols Section 2.3.2 – Method for Selecting Remedial Action Contractors Section 2.4.3 – Protocol for Documenting ARARs Compliance
E.3 Project schedule, including timing for key element of the bidding process, timing for initiation and completion of major construction tasks, and when the Construction Completion Report will be submitted	Schedule for completion of the Remedial Action: • Schedule for implementing Remedial Action tasks identified in the final design submission • Project schedule, including timing of key elements for bidding purposes, timing of the initiation and completion of major tasks, and when the construction completion report will be submitted	Section 3.3 – Construction Sequencing
E.4 Construction QA/QC Program	Construction Quality Assurance Project Plan (CQAPP): • Methodology for overseeing and implementing the CQAPP • Objectives, requirements, and performance standards • Identification of QA official • Identification of responsibilities and authorities • Personnel qualifications • Inspection activities, schedules, and scope	Section 2.3.4 – Methodology for Overseeing and Implementing the Construction Quality Assurance Project Plan Appendix A – CQAPP
	Schedule for developing and submitting other required remedial action plans	Section 4.1 – Coordination with Other Project or Site Activities
	Site Management Plan: • Site access • Site security • Protocols for site workers, visitors, and monitors	Section 4.3.1 – Site Access and Security Section 4.3.2 – Protocols for Visitors and Monitors

TABLE 1.3-1

Corrective Action Consent Agreement and Consent Decree Compliance Checklist for C/RAWP Requirements

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles California

CACA Attachment 6 Requirements Part E – Construction Work Plan (DTSC 1996)	Consent Decree Requirements CD Paragraph 13b, SOW Sections 2.2.5, 2.2.6, 2.2.7, 3 (DOI 2013)	Section of the C/RAWP where the Requirement is Met
	Decontamination Plan: Procedures and plans for the decontamination of equipment and the disposal of contaminated materials	Section 4.4.3 – Equipment Decontamination
E.5 Waste Management Practices	Waste Management Plan: • Procedures addressing how wastes generated during construction will be managed • Compliance with offsite shipment of waste material requirements in CD Paragraph 17	Section 4.5 – Waste Management Plan Appendix R – Waste Management Plan
E.6 Sampling and Monitoring • Description and purpose of monitoring tasks • Data quality objectives • Analytical test methods and detection limits • Name of analytical laboratory • Laboratory QC • Sample collection procedures and equipment • Field quality control procedures • Criteria for data acceptance and rejection • Schedule of monitoring frequency	Sampling and monitoring during construction: • Compliance with QA, sampling, and data analysis in CD Paragraph 23	Section 3.2.1.2 – Data Collection during Well Construction Appendix B – Standard Operating Procedures Appendix C – Data Quality Assurance Project Plan and Addendum
	Methodology for implementing the O&M Manual	Section 6.2– Functional Testing, Startup, and Transition to Operation and Maintenance
E.7 Construction Contingency Procedures • Design changes due to field conditions • Communications during emergency • Unforeseen events	Contingency plans during construction: • Methodology for implementing the Contingency Plan • Contingencies to address design changes during construction • Contingencies due to unforeseen events • Contingencies to address potential failure modes	Section 5 – Construction Contingency Plan/ Procedures
E.8 Construction Safety Procedures	Health and Safety Plan	Section 4.4.1 – Health and Safety Appendix D – Construction Health and Safety Plan

TABLE 1.3-1

Corrective Action Consent Agreement and Consent Decree Compliance Checklist for C/RAWP Requirements

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles California

CACA Attachment 6 Requirements Part E – Construction Work Plan (DTSC 1996)	Consent Decree Requirements CD Paragraph 13b, SOW Sections 2.2.5, 2.2.6, 2.2.7, 3 (DOI 2013)	Section of the C/RAWP where the Requirement is Met
E.9 Data Management and Documentation Requirements • Progress reporting • Monitoring and laboratory data • Records of construction costs • Personnel, maintenance, and inspection records	Data management and documentation requirements: • Details for the collection/maintenance of information • Compliance with reporting requirements in CD paragraph 32 (SOW Section 5); written monthly progress reports during remedy construction	Section 2.6 - Data Management, Documentation, Recordkeeping, and Reporting Procedures
E.10 Cost Estimate		Appendix E – Cost Estimate
	IM-3 Decommissioning Plan	Appendix F – IM-3 Decommissioning, Removal, and Restoration Work Plan
	Habitat Restoration Plan	Appendix G – Havasu National Wildlife Refuge Habitat Restoration Plan

Notes:

ARAR = applicable or relevant and appropriate requirement
CQAPP = Construction Quality Assurance Project Plan
IM-3 = Interim Measure No. 3
O&M = operation and maintenance
QA/QC = quality assurance/quality control
SOW = Statement of Work

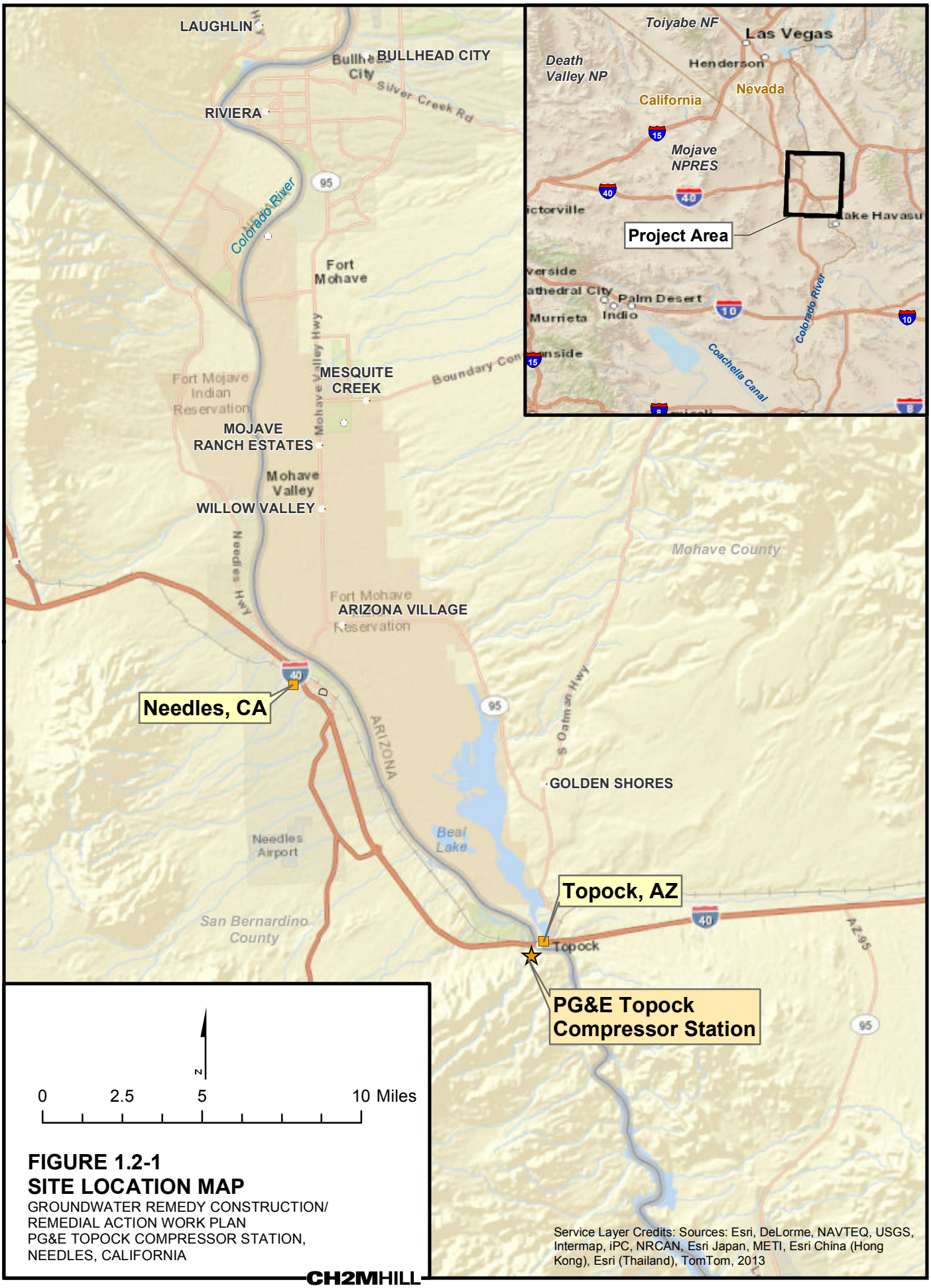


FIGURE 1.2-1
SITE LOCATION MAP
GROUNDWATER REMEDY CONSTRUCTION/
REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

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PIRATE COVE RESORT AND MARINA

MOABI REGIONAL PARK

SEWAGE DISPOSAL PONDS

Park Moabi Road

National Trails Highway

Colorado River

GROUNDWATER TREATMENT FACILITY

BN&SF Railroad Bridge

I-40 Bridge

TOPOCK MARINA

TOPOCK, AZ

NEW EVAPORATION PONDS

PG&E TOPOCK COMPRESSOR STATION

FORMER EVAPORATION POND SITE

FORMER GRAVEL QUARRY

Existing Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- Water Supply Well

Provisional Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- Area for East Ravine (ER) Wells (ER-7 to ER-11)
- Area for Potential Slant Well Screens
- Area for Inner Recirculation Loop (IRL) Wells
- Area for River Bank Extraction Wells

Planned Wells:
- Extraction, East Ravine
- Extraction, National Trails Highway (NTH) In-situ Reactive Zone (IRZ)
- Extraction, Riverbank
- Extraction, Transwestern Bench
- Injection, Freshwater
- Injection, Inner Recirculation Loop
- Injection, NTH IRZ
- Injection, Topock Compressor Station
- Remedy Monitoring Well
- Recirculation Well
- Area for Monitoring Well (MW-T)

Transformers
- Planned Transformer
- Future Provisional Transformer

Pipeline Corridor for Remedy
- Aboveground Pipe
- Underground Pipe/Conduit
- Future Provisional/ Contingent Fresh Water Pipe

Remedy Facilities
- Proposed Remedy Structure
- Contingent Freshwater Pre-injection Treatment System
- Moabi Regional Park Facilities

LEGEND

Area of Potential Effects (APE)

EIR Project Area

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

Notes:

1. The locations of pipelines and existing infrastructure are approximate. The figure is not intended to be a comprehensive depiction of all existing infrastructure in the APE.

2. Note that in compliance with EIR mitigation measure CUL-1a-9 as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Highway is located in an existing, previously disturbed, access road. In addition, the location of the road and the pipeline was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10 and PA and CHPMP mitigation measures.

N

0 375 750 1,500 Feet

FIGURE 1.2-2
GROUNDWATER REMEDY PROJECT AREA AND SYSTEM LAYOUT
GROUNDWATER REMEDY CONSTRUCTION/ REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

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SECTION 2

Project Organization and Management/Project Management Plan

This section presents the project organization and management plan for the construction and startup of the groundwater remedy. This section describes PG&E's management approach, including organization, levels of authority and responsibility, lines of communication, and a summary of the communication procedures and protocols. Similar information for implementing the O&M phase of the groundwater remedy is presented in the main text of the O&M Manual.

In support of the administrative management of the groundwater remedy construction and startup, this section also presents: (1) worker training education requirements; (2) methods for overseeing quality assurance programs; (3) methods for ensuring compliance with the EIR mitigation measures, ARARs, and other agreements and programs (for example, the PA, CHPMP, and CIMP); and (4) procedures for data/records management, documentation, and reporting. Pursuant to DTSC's direction, PG&E will comply with the California Business and Professions Code during implementation of the groundwater remedy.

2.1 Project Team Organization

PG&E has chartered an implementation team with the accountability to ensure that the project goals and management principles are fulfilled. Table 2.1-1 summarizes the organization and roles of key personnel for the groundwater remedy construction and startup, as well as levels of authority, responsibility, and lines of communication. Exhibit 2.1-1 presents the project team organization chart for the construction and startup phase. The project organization is intended to be a "living" element throughout the construction and startup, meaning that it can be updated as new information becomes available as the project proceeds or as site circumstances change.

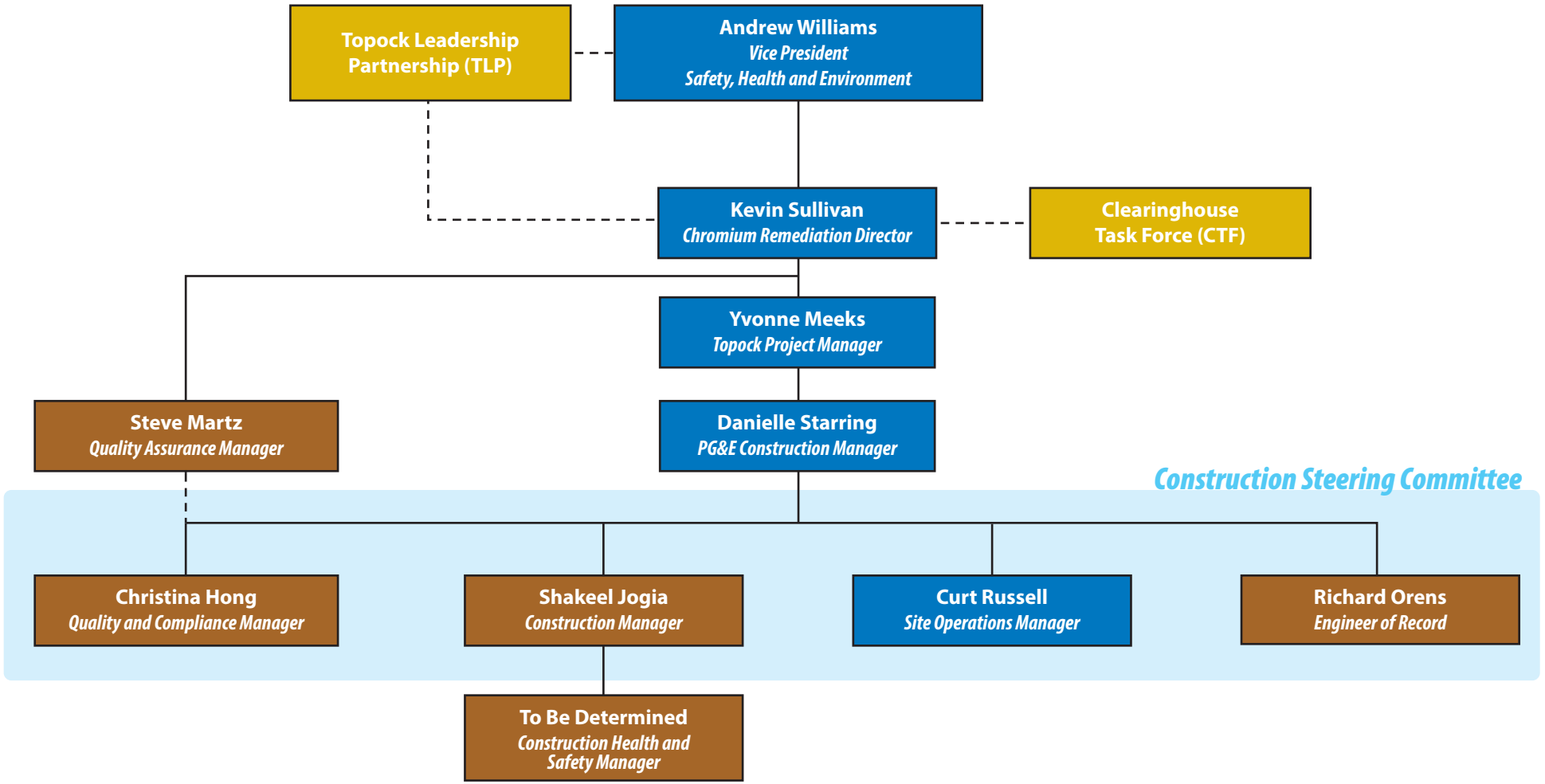
PG&E has established a Construction Steering Committee to efficiently coordinate operations and engineering factors and ensure quality and compliance with regulations during the construction of the remedy. The Construction Steering Committee will be engaged in day-to-day construction activities and will report to the PG&E Construction Manager. The Construction Steering Committee includes PG&E as well as contractor personnel. The Construction Steering Committee will provide oversight and guidance, as independently verified by the Quality Assurance organization, to the construction contractor.

2.2 Project Management Approach

The PG&E Topock project team is committed to effectively implementing the construction and startup of the groundwater remedy in a safe and sustainable manner that is respectful to the sensitivity of the cultural, historical, and biological resources at or near the Topock site while complying fully with regulatory mandates. These principles are described briefly, followed by management approaches and administrative activities to be followed during groundwater remedy construction and startup.

2.2.1 Ensuring Protection of Human Health and the Environment

The PG&E Topock project team is committed to executing the groundwater remedy construction and startup with zero safety incidents. Project protocols have been and will continue to be implemented and enforced to ensure safety for the project team members as well as site visitors, including Tribal monitors, regulatory agencies, and interested stakeholders. Section 4 and Appendix D describe health and safety protocols for the groundwater remedy construction.



Legend

PG&E | Contractors | TLP/CTF

- - - - Line of communication

——— Lines of authority, responsibility, and communication

EXHIBIT 2.1-1
PROJECT TEAM ORGANIZATION

GROUNDWATER REMEDY CONSTRUCTION/
REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

The PG&E Topock project team is also committed to executing the groundwater remedy construction and startup in a manner that protects sensitive habitats and the environment. Project protocols have been and will be enforced to minimize impacts to environmental resources including aesthetic, biological, air quality, cultural, geology and soils, hazardous materials, hydrology and water quality, noise, and water supply. Section 2.4 contains a detailed assessment of compliance with ARARs and mitigation measures to minimize impacts to these resources.

2.2.2 Ensuring Respect of the Sensitivity of the Cultural, Historical, and Biological Resources

The PG&E Topock project team is committed to constructing the final groundwater remedy in a manner that is respectful of the sensitivity of the resources at and near the project area. PG&E and its contractors will fully comply with the mitigation measures set forth to minimize impacts to the sensitive resources, as well as protocols and/or provisions in the CIMP (provided as Appendix H to this C/RAWP) and the CHPMP (provided as Appendix I to this C/RAWP). For example, the EIR mitigation measures mandate that PG&E conduct specific outreach activities with Tribes and nearby communities and report back to DTSC (via quarterly or annual reports). Section 2.4 describes action to be taken to ensure compliance with mitigation measures, ARARs, and other agreements, including those associated with reducing impacts to sensitive resources. Section 2.3.3 describes cultural and historic resource sensitivity training and biological resource sensitivity education for site workers.

2.2.3 Ensuring Opportunities for Inputs

The PG&E Topock project team is committed to supporting the established programs of the state (DTSC) and federal (DOI) lead agencies related to Topock community outreach/public participation (DTSC 2013b; DOI 2012) to ensure that input from agencies, stakeholders, Tribes, and the local community is reflected in remedial activities at Topock. PG&E will continue to provide support to the agencies, as requested, with implementation of these programs.

2.2.4 Ensuring Compliance with ARARs, Mitigation Measures, and Other Agreements

The groundwater remedy is being implemented as required by RCRA Corrective Action and CERCLA. Additionally, implementation of the groundwater remedy is guided by and held to standards required by the following main categories of requirements:

- ARARs specified in the Record of Decision (ROD) (DOI 2010)
- California Environmental Quality Act (CEQA) mitigation measures defined by DTSC in the Final EIR (DTSC 2011b).
- PA and the CHPMP developed in compliance with the National Historic Preservation Act (BLM 2010, 2012)
- Requirements of landowners and leaseholders of property and rights-of-way (ROWs) affected by groundwater remedy construction, operation, and monitoring.

PG&E is committed to maintaining compliance with the identified requirements. Anticipated approvals/ authorizations, as well as compliance with mitigation measures, ARARs, and other agreements, are described in Section 2.4.

2.2.5 Ensuring Quality

The PG&E Topock Team will manage the groundwater remedy construction and startup in conformance with its quality assurance/quality control (QA/QC) programs. A Construction Quality Assurance Project Plan (CQAPP) for the groundwater remedy construction is included in Appendix A to this C/RAWP. The CQAPP details the systems and controls that PG&E has established to ensure that the construction will meet or exceed the design criteria, plans, and specifications. The CQAPP includes inspections and verification

activities, QC testing, QA testing, construction audits, construction surveillance, construction deficiency identification and control and correction, and methods and processes for continuous improvement during construction of the groundwater remedy.

In addition, QA and QC requirements for environmental data collected during groundwater remedy construction and startup are contained in the project Quality Assurance Project Plan (QAPP) and QAPP Addendum, included as Appendix C to this C/RAWP. The QAPP and QAPP Addendum outline the procedures to ensure that environmental data collected during the groundwater remedy construction and startup will be of appropriate quality to achieve the project objectives and consistent with the U.S. Environmental Protection Agency (USEPA) requirements for QAPPs. PG&E will ensure that laboratories for the analysis of site samples adhere to accepted USEPA methods, participate in an USEPA-equivalent QA/QC program, and have a documented quality system. Standard operating procedures (SOPs) for data collection and field measurements provide consistency for QA and QC and are provided as Appendix B to this C/RAWP. During groundwater remedy construction, additional SOPs may be developed and added to the list in Appendix B, or existing SOPs may be modified and amended. Material changes to the SOPs will be reported in the progress reports. For administrative changes to the SOPs, such as changes in point of contact information, a log of changes will be maintained by PG&E. For efficiency, administrative changes will be bundled and/or opportunistically combined with updates to incorporate material changes. Current SOPs and change logs will be made available on a SharePoint site for reference by agencies, stakeholders, and Tribes.

Each contractor is responsible for performing QC of its contracted work to manage, control, and document compliance with these requirements. PG&E, designated QA personnel, and/or designated subject matter experts will perform QA during project implementation to ensure that the groundwater remedy construction and start-up meet project requirements.

2.2.6 Incorporation of Sustainability

Consistent with its Programmatic Sustainable Remediation Guidance (PG&E 2011), the PG&E Topock project team will work to integrate sustainability principles into the groundwater remedy construction and startup. During design, sustainability focus has been on reducing the overall remedial timeframe and reducing O&M requirements for water use, materials use, waste generation, energy use, air emissions generated, health and safety, and hazardous and potential impacts on biological resources. During the construction and startup phases, key sustainability metrics will be identified, along with relevant sustainable best management practices (BMPs), to reduce overall remedy impacts. It is expected that the sustainability practices will focus on reducing emissions from heavy equipment and maximizing onsite injection or reuse of extracted groundwater and disturbed clean soil, as allowed by waste management regulations. Sustainability practices and recordkeeping are included in the documentation and recordkeeping requirements in Section 2.6.2.

2.2.7 Ensuring Efficient Integration with Other Activities

The PG&E Topock project team will manage the groundwater remedy construction and startup in a manner that allows efficient integration with other PG&E activities including operation of the TCS, operation of the IM, eventual shutdown and layup of the IM, and soil RCRA Facility Investigation/Remedial Investigation (RFI/RI) activities.

The PG&E Topock team will also implement the groundwater remedy construction and startup in a manner that respects the operations and use of neighboring landowners and facilities, such as roads, pipelines, businesses, homes, and designated uses of public land.

2.3 Project Management Elements

In support of the principles outlined in Section 2.2, the following subsection describes administrative activities to be implemented during groundwater remedy construction and startup.

2.3.1 Summary of Communication Procedures and Protocols

Communication and outreach are key elements of all phases of project implementation. This section presents a summary of communication procedures and protocols to be used during the construction and startup of the groundwater remedy. The communication procedures and protocols are intended to be used by the PG&E Topock project team to inform and/or seek input from agencies, stakeholders, and Tribes in support of community outreach and public participation efforts; to seek approvals from agencies; to resolve issues; and to comply with certain requirements. This summary is a compilation of the communication procedures and protocols specified in various project directives and agreements (for example, the CACA, CD, EIR mitigation measures, PA, Programmatic Biological Assessment [PBA, provided in Appendix U], CHPMP [Appendix I], CIMP [Appendix H], Hazardous Materials Business Plan [HMBP], and Section 1600 Avoidance and Minimization Measures) and relevant state and federal requirements (for example, those related to reporting of releases of fuels or hazardous materials). This communication framework is intended to be a dynamic "living" element throughout the remedy implementation, meaning that it can be updated as new information becomes available as the project proceeds or as site circumstances change.

In general, communications occur in two forms: routine (regular periodic communication) and non-routine (communication when the project experiences unexpected changes during construction and startup). Communication could be verbal, written, or both. Examples of routine communication include quarterly Consultative Working Group meetings and progress reports. Examples of non-routine communication include notification of a release of U.S. Department of Transportation (USDOT)-regulated hazardous material during transportation or discovery of human-caused disturbance to remedy facilities.

Table 2.3-1 identifies triggering events, party or parties initiating communication, party or parties receiving communication, and a description of the communication protocols and procedures to be followed for routine and non-routine communications during construction and startup of the groundwater remedy.

2.3.2 Method for Selecting Remedial Action Contractors

The PG&E Chromium Project Management Office (PMO) has been established to implement PG&E's chromium remediation program, including construction of the Topock groundwater remedy. Although the specific contracting approach for construction of the groundwater remedy has not been finalized, the PMO will select the remedial action contractors for construction and startup of the groundwater remedy in conformance with PG&E purchasing and procurement requirements and considering factors such as cost; qualifications; ability to meet PG&E requirements for health and safety, insurance, and the CQAPP; as well as the ability to support PG&E's efforts in sustainability and compliance. PG&E plans to use pre-qualified contractors, where appropriate and available, including those who have prior experience working at Topock, to save time on procurement, to reduce time spent on the learning curve, and to reduce the potential for delays/conflicts during implementation. Preference will also be extended to contractors that are certified as disadvantaged businesses through the California Public Utilities Commission.

2.3.3 Worker Training and Education

In support of PG&E's management principles, worker education and training programs for the groundwater remedy construction include cultural and historic resource sensitivity training, biological resource sensitivity education, health and safety, and other training necessary to comply with regulatory requirements and the CQAPP. Attendees to each training will be required to sign a training roster. Copies of training rosters will be kept at the Construction Headquarters (CHQ) and will be available for review by stakeholders upon request.

2.3.3.1 Cultural and Historical Resources

Cultural and historical resources sensitivity education has been a central part of the Topock remediation project to date. Consistent with its obligations under PA monitoring protocol, existing PG&E standard practice, and the EIR MMRP requirements, cultural sensitivity training is required of staff, workers, and contractors engaged in activities within the EIR project area/APE to familiarize them with the sacred nature and cultural significance of the area so that they will perform their jobs in a respectful manner. The training

occurs before field work and design submittal. This training includes discussion of appropriate behavior, activities that are to be avoided, and consequences for noncompliance. Consistent with these obligations, PG&E will not tolerate disrespectful behavior in the field and will remove staff, workers, or contractors who do not comply with this section.

The existing education on cultural/historical resources sensitivity for Topock occurs via periodic training and project initiation meetings. Sensitivity training classes are conducted at least annually and are attended by all workers available to participate. Sensitivity training/education is also provided at project initiation meetings, typically held at the site and prior to field work. Site orientation will stress that site activities will be conducted in a respectful manner. New site workers will be required to receive the training before they can work on ground-disturbing activities. Sensitivity training will be provided by PG&E's Site Operations Manager and Cultural Resources Specialist, their designees, and supporting contractors. PG&E will invite participation from the Tribes, archaeological monitors, and agency staff, as appropriate.

Several EIR mitigation measures associated with the groundwater remedy (for example, CUL-1a-13, CUL-1b/c-4, and CUL-4) are related to continued training of workers regarding cultural resources, historical resources, and the identification of human remains. The development of a worker cultural sensitivity education program per CUL-1a-13 is included in Appendix P; implementation of this protocol is underway.

2.3.3.2 Biological Resources

As with cultural and historical resources, biological resources sensitivity education has also been a central part of the Topock project. PG&E's education program covering threatened and endangered species, wetland awareness, the general project management measures specified under the PBA and other requirements and agreements is provided at project initiation meetings, typically held at the site and prior to field work. The training is provided by the PG&E Topock Site Operations Manager, the PG&E Project Biologist, and supporting contract biologists. Staff, workers, and contractors will receive training prior to working onsite.

In accordance with the PBA, PG&E-designated Field Contact Representatives (FCRs) will be responsible for overseeing compliance with the PBA and EIR mitigation measures. The FCRs have the authority to halt activities that pose a danger to listed species and/or are in violation with the mitigation measures. A qualified biologist will conduct a preconstruction survey for special-status wildlife species immediately prior to initiation of ground-disturbing activities. Within 60 days of completion of construction activities, the FCR and the qualified biologist will prepare a report for submittal to BLM.

2.3.3.3 Other Worker Training and Education

The CQAPP provides typical qualifications for QA/QC positions and for performing QA functions. PG&E recognizes the need to maintain a high-quality, well-trained, and competent construction management and inspection team. PG&E personnel will receive ongoing training to maintain and improve their technical skills and levels of competence to perform the work in their assigned roles. PG&E managers and staff will regularly review and assess training needs to maintain efficiency in existing job functions and to provide additional skills, knowledge, or competence required to adequately adapt to changes in technology, methods, or job functions. Prior to the start of construction—and periodically during the construction period—the PG&E Topock project team will assess the project-specific staffing needs and implement training, as necessary.

Paleontological awareness training is also required for project personnel involved with ground-disturbing activities (for example, grading, trenching, drilling) in conformance with the Paleontological Resources Management Plan (Appendix J).

Construction workers and field personnel will be required to comply with the training requirements specified in the overall Construction Health and Safety Plan (Appendix D) and their own site-specific Health and Safety Plan specific to their definable feature of work. Construction workers will also be trained on the stormwater management program as outlined in Appendix M. In addition, field personnel that manage

hazardous or potentially hazardous waste will be required to comply with the training requirements of hazardous waste regulatory requirements. Other training may be required for specific job activities such as USDOT hazardous material training.

2.3.4 Methodology for Overseeing and Implementing the Construction Quality Assurance Project Plan

A CQAPP for the groundwater remedy construction is included in Appendix A to this C/RAWP in conformance with the CACA (Section Attachment 6, Part E.4) and the CD (Section VI.13.b and Appendix C, Sections 2.5, 3.1). The PG&E Topock team will implement the CQAPP to ensure that the groundwater remedy construction will meet or exceed the design criteria, plans, and specifications. PG&E's approach to implementing the CQAPP includes a combination of QC performed by the construction contractor and QA performed by the Program Quality Assurance Manager. Each contractor is responsible for performing QC of its contracted work to manage, control, and document compliance with these requirements. PG&E will specify a QA official, independent of the construction contractors, to monitor and verify implementation of the CQAPP during construction and startup of the groundwater remedy. Additional detail on QA/QC responsibilities and authorities of key personnel involved in the construction of the groundwater remedy is provided in the CQAPP. The continuous improvement strives to continually improve the effectiveness of the quality management system through the use of quality policy, quality objectives, audit results, analysis of data, corrective and preventive actions, and management review. In support of the process improvement, the PG&E management team will schedule meetings to review and assess plans and progress, document lessons learned, and conduct formal and informal audits of the construction process to measure the success of QA/QC plan and procedures. Documents of lessons learned and best practices are imperative to PG&E's performance and to providing confidence that the construction process has achieved its quality goals.

2.4 Anticipated Approvals and Authorizations and Compliance with Mitigation Measures, ARARs, and Other Agreements

2.4.1 Compliance with Mitigation Measures, ARARs, and Other Agreements

This section provides a summary of actions taken or to be taken by PG&E in compliance with the EIR mitigation measures and the identified ARARs, the PA, the CHPMP, and the CIMP at this stage in the design and during the construction and startup of the groundwater remedy.

2.4.1.1 Summary of Compliance with EIR Mitigation Measures

There are 154 mitigation measures (counting subparts) set forth in the EIR and the adopted MMRP that address 12 resource areas, including aesthetics, biological resources, air quality, cultural resources, geology and soils, hazardous materials, hydrology and water quality, land use and planning, noise, transportation, utilities and service systems, and water supply. A summary of actions taken or to be taken in compliance with the EIR mitigation measures is presented in Appendix K. Identification and demonstration of how the identified ARARs and EIR mitigation measures are being incorporated into the groundwater remedy are summarized and discussed in tables presented in Section 6 of the Final BOD; copies of these tables are presented in Appendix K to this C/RAWP (for the reader's convenience).[1] In addition, a summary of compliance with applicable CIMP protocols, PA stipulations, and the CHPMP provisions is also included in Appendix K.

In compliance with EIR mitigation measure CUL-1a-8, PG&E has developed the CIMP in coordination with the Tribes and has included the plan in Appendix H of this work plan. Compliance with the CIMP protocols is

[1] The compliance tables in Appendix K to this C/RAWP are copied directly from Section 6 of the Final BOD. The table numbers and reference citations are unchanged from those in the Final BOD; the compliance table reference citations therefore correspond to the References List (Section 9) of the Final BOD, not the References List in this C/RAWP. Please refer to Section 9 of the Final BOD to identify the sources cited in Appendix K to this C/RAWP.

described in Appendix K. Additional protocols developed to comply with EIR mitigation measures for cultural resources are included in Appendix P.

2.4.1.2 Summary of Compliance with Identified ARARs

There are 57 ARARs addressing several resource areas, including biological, air quality, cultural, hazardous materials, and waterways (six chemical-specific, 38 action-specific, and 13 location-specific). Because the remedial action objectives (RAOs) were developed based on identified chemical-specific ARARs, attaining the RAOs will result in compliance with the chemical-specific ARARs. Until the RAOs are attained, institutional controls will be maintained to prohibit development of drinking water supply wells within the plume and additional areas outside of the plume footprint where control of groundwater flow directions and gradients is necessary to contain and remediate the chromium plume. One specific RAO is to reduce the mass of total chromium (Cr[T]) and Cr(VI) in groundwater at the site to achieve compliance with ARARs in groundwater; this RAO will be achieved through the cleanup goal of regional background of 32 micrograms per liter (μg/L) of Cr(VI).

Because the final groundwater remedy is a CERCLA response action, activities conducted onsite are covered under the permit exemption codified in Section 121(e)(1) of CERCLA. While the permit exemption applies to the administrative or procedural elements (for example, preparing and submitting permit applications), the substantive requirements of the ARARs remain. A summary of the actions taken or that will be taken to comply with the identified ARARs is presented in Appendix K.

As provided in Appendix K to this C/RAWP, PG&E has prepared a draft protocol to identify procedures to be taken to ensure compliance with ARAR #32, Clean Water Act (CWA) Section 404. Additionally, mitigation measure BIO-1 of the EIR contains applicable mitigation requirements related to CWA Section 404. The draft protocol and proposed procedures for compliance with ARAR #32 and the portion of BIO-1 related to CWA Section 404 are presented in Appendix K.

In addition, in compliance with ARAR #40, the federal Endangered Species Act (ESA), PG&E, the U.S. Fish and Wildlife Service (USFWS), BLM and DOI coordinated on the PBA for the final groundwater remedy to address potential effects on federal listed species. This ESA Section 7 consultation was concluded with receipt of USFWS's concurrency letter on July 7, 2014. Measures outlined in the PBA and associated USFWS determination letter will be implemented before and during construction activities. The PBA is included in this C/RAWP as Appendix U.

The National Wildlife Refuge System Administration Act as amended by the National Wildlife Refuge System Improvement Act of 1997 (16 United States Code [U.S.C.] §§ 668dd-ee, 50 CFR Part 27) was identified by DOI as a Location-Specific ARAR that is Applicable to the project (Item #7 in Table 2 of the ROD). The ROD (DOI 2010) states that "This Act governs the use and management of National Wildlife Refuges. The Act requires that USFWS evaluate ongoing and proposed activities and uses to ensure that such activities are appropriate and compatible with both the mission of the overall National Wildlife Refuge System, as well as the specific purposes for which the Havasu National Wildlife Refuge was established..." and that "[a]s the Selected Remedy is designed and implemented, DOI will continue to consult with USFWS to ensure that proposed activities remain appropriate and compatible with the Refuge mission."

As requested by DOI during the RTC process for the Basis of Design Report/Intermediate (60%) Design Submittal, information to facilitate the HNWR's Appropriate Use Analysis and Compatibility Determination (AUA/CD) is memorialized in Table 6.2-1A of the Final BOD (presented for the reader's convenience in Appendix K of this C/RAWP). Specific information included in Table 6.2-1A includes the proposed actions/facilities; where, when, and how the use would be conducted; what the anticipated impacts will be; planned mitigation for the loss of functional value of the refuge while use is in operation; how and when the actions/facilities will be closed out; and any contingency plans that will be in place. PG&E will continue to coordinate with DOI and USFWS regarding the AUA/CD and mitigation for the ongoing impacts from remedy implementation to the HNWR in Arizona.

2.4.1.3 Summary of Compliance with PA and CHPMP

In addition, a summary of actions taken or that will be taken to comply with applicable stipulations in the PA (BLM 2010) and a summary of actions taken or that will be taken to comply with applicable requirements in the CHPMP (BLM 2012) are presented in Appendix K.

2.4.2 Anticipated Approvals, Authorizations, and Permits

Implementation of the groundwater remedy will require approvals of the Final Design and this C/RAWP from DTSC and DOI, pursuant to their authority under RCRA and CERCLA, respectively.

2.4.2.1 Access to Federal Lands

Remedial infrastructures are planned on federal lands, including lands managed by BLM, lands administered by U.S. Bureau of Reclamation (BOR) (managed by BLM), and the HNWR (managed by USFWS). It is PG&E's understanding that the ROD, the CD, and the DOI's approval of this C/RAWP constitute permission to implement the groundwater remedy and authorization to access federal property for purposes related to implementation of this C/RAWP. No other permit applications or approvals for access to federal lands will be required before field implementation. In addition, the process required for compliance with ARARs is addressed and documented above in Section 2.4.1, and there is not a separate process for compliance required for access to federal lands.

2.4.2.2 Access to Non-federal Lands

Remedial infrastructure is planned on non-federal lands, including lands owned by BNSF Railway (BNSF), Kinder Morgan, FMIT, and private property owners in the Topock Marine area. In addition, infrastructure is planned on county roadways or their ROWs (San Bernardino County, Mohave County), as well as roadways/ROWs of state transportation agencies (California Department of Transportation [Caltrans], Arizona Department of Transportation [ADOT]). Where remedial infrastructure crosses or travels along utility easements, a consent to common use agreement or other notification process will be implemented, as appropriate.

Pursuant to CERCLA Section 121(e), activities conducted onsite are exempt from obtaining federal, state, or local permits or complying with other procedural requirements. However, PG&E is still required to comply with the substantive requirements of the identified location- and action-specific ARARs. Below is a list of anticipated approvals/permits/agreements that PG&E anticipates obtaining for the project:

- Encroachment permits from ADOT and Caltrans for pipeline segment under I-40
- Easement(s) from BNSF for pipeline segments and access roads on land owned by BNSF
- Encroachment permit from the San Bernardino County and license from Mohave County for infrastructure in the county roadways and ROWs
- Any necessary approvals from California and Arizona State Lands for the crossing of the Colorado River on the Arched Bridge
- Consent to common use agreements or other appropriate notification requirements with utility companies for remedial infrastructure on their lands or within their easements and ROWs
- Access agreements with private property owners for remedial structures on their lands, where such agreements do not otherwise exist
- Land Use Covenant for PG&E's TCS parcel

PG&E is working towards obtaining all non-federal access agreements within 30 days of DTSC's approval of the Final Design and C/RAWP and within 90 days of DOI's request for such access agreements, consistent with the timing requirements in the Corrective Action Consent Agreement between PG&E and DTSC and the Remedial Design/Remedial Action Consent Decree between PG&E and the United States, on behalf of DOI.

It should be noted that under the Settlement Agreement between PG&E and the FMIT (DTSC 2012), PG&E has access to the land owned by the FMIT to implement the selected final groundwater remedy. More specifically, the 2009 Easement Agreement between the FMIT and PG&E (FMIT and PG&E 2009) covers access, as well as activities such as facility O&M. The FMIT's preference to limit such activity to the extent practicable and to have as little remedial infrastructure placed on its property as possible is recognized; this preference was considered throughout the development of the design, consistent with the provisions of the Easement Agreement and the 2006 Settlement Agreement (PG&E 2006).

2.4.2.3 Other Anticipated Approvals, Permits, and Agreements

In addition to the above, PG&E is coordinating with the California Regional Water Quality Board (RWQCB) regarding the substantive requirements applicable to the use of the evaporation ponds at the TCS for disposal of certain remedy-produced water streams. The goal is to obtain appropriate Waste Discharge Requirements (WDRs) prior to agencies' approval of the Final Design and C/RAWP. PG&E is currently developing a Report of Waste Discharge (ROWD) that is required by the RWQCB for purposes of amending the existing WDRs for the ponds to accept remedy-produced wastewater. The amended WDRs will include the requirements for discharging the remedy-produced wastewater into the existing ponds.

2.4.3 Protocol for Documenting ARARs Compliance and EIR Mitigation Measures Compliance

In compliance with CD requirements (¶13[b][10] and Statement of Work [SOW] Section 3.4) (DOI 2013), PG&E proposes the following protocol to document attainment of the ARARs identified in the ROD during construction and startup of the groundwater remedy:

1. Continue to document compliance with ARARs in a table similar to the ARARs compliance table in Appendix K. The ARAR tables will be updated to include actions taken to satisfy the ARARs and/or corrective measures taken if non-compliance occurs. The ARARs compliance documentation will be submitted to DOI as a stand-alone document. Quarterly documentation will continue through the first 5-year review period and annually thereafter.
2. Where continued ARARs compliance will be via actions taken to implement other project documents (for example, implementation of the BMP Plan, the Waste Management Plan, etc.), PG&E will prepare and submit to DOI the required submittals (as with current practices, where there are overlapping requirements between state and federal processes, one submittal will be prepared to satisfy both processes).

In addition, PG&E proposes to continue to document compliance with EIR Mitigation Measures. As described in the CMI/RD Work Plan (CH2M HILL 2011), EIR Mitigation Measures Compliance Reports will be submitted to DTSC quarterly during construction of the project, and annually during O&M. The quarterly reports submitted to DTSC document the project's compliance with EIR mitigation measures during the reporting period. In addition, the quarterly reports are used to report on specific events during the reporting period, such as resolutions noted by the designated Disturbance Coordinators for noise and vibration required by mitigation measures NOISE-1b and NOISE-2d, or reports of human-caused disturbance to project facilities required by CUL-1a-3b.

2.5 Compliance Milestones

As required by the CD ¶71b(4), compliance milestones proposed for the groundwater remedy construction are below:

1. **Quarterly reports documenting ARARs compliance during the construction period, as described in Section 2.4.3 above.** Quarterly ARARs compliance reports are proposed to be submitted to DOI 20 calendar days after the end of each quarter (January 20, April 20, July 20 and October 20), for the duration of the remedy construction. For purposes of this milestone, the duration of remedy

construction will begin with DOI approval of the Final Design, and will end with DOI's determination that the remedy is Operational and Functional.

2. **Annual monitoring reports for specified archaeological and historic properties pursuant to Section 6.6.5 of the CHPMP.** Annual monitoring reports are proposed to be submitted to BLM by December 31 of each year for the duration of remedy construction. For purposes of this milestone, the duration of remedy construction will begin with DOI approval of the Final Design, and will end with DOI's determination that the remedy is Operational and Functional.

3. **Submittal of the post-construction biological resources completion report required by the PBA, general Mitigation Measure #24**. The report will be submitted to the BLM and will document the effectiveness and practicality of the mitigation measure and make recommendations for modifying the measures to enhance species protection, as appropriate. The report will also provide information on survey and monitoring activities, observed listed species if encountered, and the actual acreage disturbed by the activities, if any. The report will be submitted within 60 days of completion of construction activities. PG&E and DOI will agree on a specific date for submittal of this report at the time of construction completion and prior to the start of the 60-day report period.

In addition, as required by CD ¶ 71.b(5), PG&E will submit a Final Construction Completion Report within 90 days following DOI final comments on the draft report and notification to proceed consistent with CD ¶ 41.

2.6 Data Management, Documentation, Recordkeeping, and Reporting Procedures

This section describes the overall management and documentation of data, records, and information anticipated to be collected during construction and startup of the final groundwater remedy, as well as the reporting and maintenance of the records.

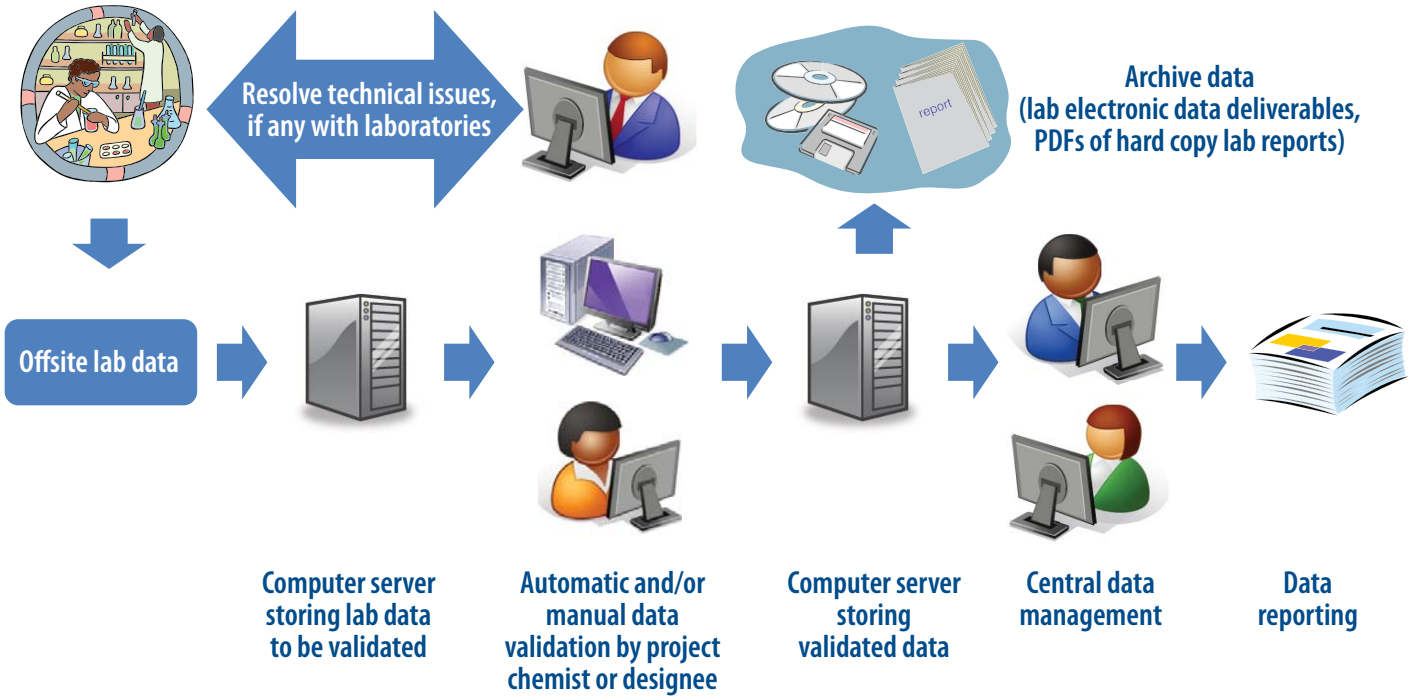
2.6.1 Field Measurements and Laboratory Data

Three types of environmental data are expected to be collected during construction and startup of the final groundwater remedy: field measurement/ process monitoring data, onsite laboratory data, and offsite laboratory data. As required by the CACA (Attachment 6, Part E.9) and the CD (Appendix C, Section 3), the following addresses procedures describing how environmental data and results will be evaluated, documented and managed. The management of each type of data is described below. Exhibit 2.6-1 presents a simplified data management process for the project.

QA and QC requirements designed to ensure that environmental data collected during groundwater remedy construction and startup will be of appropriate quality to achieve the project objectives. The project QAPP and QAPP Addendum are included in Appendix C to this C/RAWP, consistent with the USEPA requirements for QAPPs. PG&E, or its designee, will ensure that laboratories for the analysis of site samples adhere to accepted USEPA methods, participate in an USEPA-equivalent QA/QC program, and have a documented quality system. SOPs for data collection and field measurements provide consistency for QA and QC (Appendix B).

2.6.1.1 Field Measurement/Process Monitoring Data

Field measurements will be collected during construction of the monitoring and remediation well network and during functional testing and startup of the groundwater remedy, including the well network, the carbon amendment facilities, the remedy-produced water conditioning plant, and the freshwater supply system. Measurements will be conducted in accordance with the SOPs included in Appendix B to this C/RAWP and will either be recorded manually in a field logbook, field sampling form, tablet computer, and/or process monitoring checklist, or recorded automatically by stationary or handheld data loggers and transmitted to a database using a telemetry system. Periodic field audits by experienced staff will be conducted to verify that SOPs are being followed. Equipment calibration will follow manufacturers' recommendation to ensure data quality. Manually recorded data will be entered and/or transferred into a



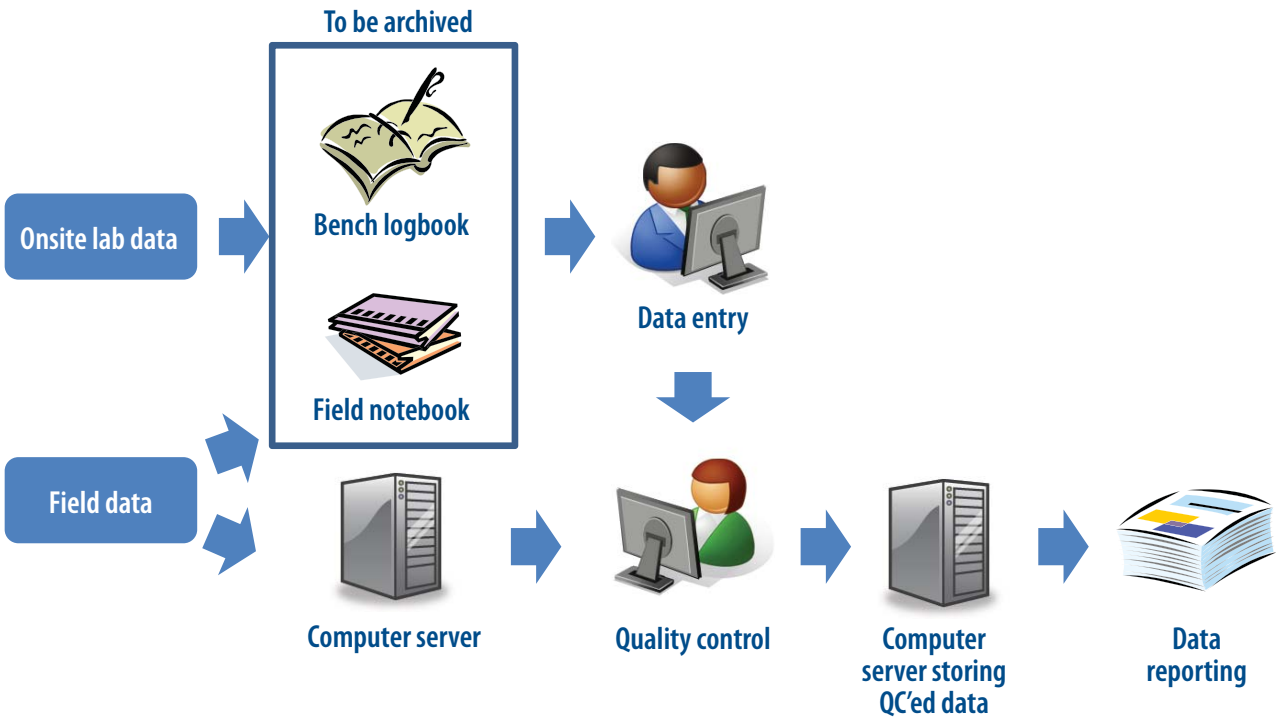


EXHIBIT 2.6-1
Simplified Data Management Process
Groundwater Remedy Construction/Remedial Action Work Plan
PG&E Topock Compressor Station, Needles, California

database. In addition, process monitoring and control data generated in facilities/plants may be automatically recorded into a data historian that resides in the plant control system, if in place. The data will be maintained in a database and will be reviewed by experienced field staff or chemist. Historic trends, water quality data, and well construction details will also be made available to the field crew so that anomalous data (compared to historical values) can be identified in a timely manner and field-verified and -corrected after consulting with an experienced scientist or chemist, as appropriate.

2.6.1.2 Onsite Laboratory Data

Certain testing for process control monitoring will be performed at an onsite laboratory in accordance with site-specific SOPs, provided in Appendix B to this C/RAWP. Onsite lab measurements during construction may include Cr(VI), Cr(T), ferrous iron, conductivity, turbidity, pH, nitrate, sulfate, alkalinity, total organic carbon, orthophosphate, manganese, and total dissolved solids. Additional measurements could be added in the future. Samples will also be analyzed for hydrogen sulfide at an offsite laboratory and the onsite laboratory to establish the onsite laboratory's ability to achieve useable results, so that onsite analysis can be performed as needed.

The onsite lab data will be recorded in a bench log book and entered into a spreadsheet and/or database periodically. Although the onsite data will not be validated using the same procedures as the offsite lab data, they will be reviewed, and anomalous results will be identified and, if needed, reanalyzed at the direction of the Project Chemist. After QC review, data will be stored in a database for use by the project team.

Onsite laboratory samples will be analyzed in conjunction with offsite analysis at a rate of 10 percent for Cr(VI), Cr(T), ferrous iron, conductivity, turbidity, pH, nitrate, sulfate, alkalinity, total organic carbon, orthophosphate, manganese, and total dissolved solids. Data will be reviewed/compared for quality and accuracy and reported to the agencies. The required frequency of comparative analysis will be evaluated after assessment of data.

2.6.1.3 Offsite Laboratory Data

Offsite data reduction, validation, and management are outlined in the project QAPP and QAPP Addendum (Appendix C to this C/RAWP). The data flow (electronic and hard copy) from offsite laboratory to the Project Chemist is tracked to ensure that the data are reviewed and validated in a timely manner. The Project Chemist will discuss and resolve technical issues, if any, with the laboratory. Electronic data will be entered into a database where they will undergo QC checks before being validated. Validated data will be stored in a database for use by the project team. The laboratory will maintain electronic and hardcopy records sufficient to recreate each analytical event. At a minimum, the laboratory will maintain the following records:

- Raw data, including instrument printouts, bench worksheets, and chromatograms, with compound identification and quantitation reports
- Laboratory-specific, written SOPs for each analytical method and QA/QC function implemented during the analysis of project samples

Hardcopy and electronic versions of analytical data will be archived in project files, on electronic archive tapes, and/or on other electronic storage media for the duration of remedy operation as specified in Section 2.6.2 of this C/RAWP. Electronic laboratory data will be subject to routine backup until it is archived for long-term retention.

2.6.2 Recordkeeping

Records will be collected for a variety of efforts during construction and startup of the groundwater remedy, such as for documenting compliance with regulatory requirements and inspections for QA/QC activities. The following describe some of the key recordkeeping activities associated with groundwater remedy construction and startup.

2.6.2.1 Construction Quality Assurance Records

Recordkeeping and documentation are important elements of the CQAPP (provided as Appendix A to this C/RAWP). Examples of records include contractor submittals, daily construction reports, QA logs and records, inspection checklists and reports, surveillance reports, audit reports, material receiving reports, and monitoring and test data.

The CQAPP outlines a process for management of design changes during construction. The original design drawings will be marked up by the construction contractor as the work progresses to indicate as-built conditions. These "red-line" drawings are maintained throughout the construction process. Upon completion of construction, the contractor submits the red-line markup drawings for review. Following review, the Engineer of Record approves the contractor submittal.

The CQAPP also outlines requirements for recordkeeping, construction reports, inspection reports, and test reports. Project documents are managed through a combination of a secure document filing and storage system and a computerized document tracking system. Sufficient records will be prepared and maintained as work is performed to document evidence of the quality of construction and laboratory analysis of activities affecting quality. Examples of inspection forms are provided in the CQAPP. The completed forms are routed to the project QC/QA files and are maintained as part of the project record.

2.6.2.2 Records of Soil, Water, and Waste Materials Generated during Construction

The Soil Management Plan (Appendix L to this C/RAWP) provides procedures for handling and management of soil disturbed during construction of the groundwater remedy. As outlined in the Soil Management Plan and the Revised Management Protocol for Handling and Disposition of Displaced Site Material (PG&E 2015; Appendix B of the Soil Management Plan), PG&E will maintain a Displaced Material Inventory for displaced soil, which will include origin of the material, description of the material, dates of displacement or accumulation, generated activity, approximate volume, storage location and mode, characterization status, and final disposition information. Soil accumulation areas will be inspected routinely, and inspection reports will also be retained (see Sections 2.1, 2.2 and 2.4 of Appendix C of the Soil Management Plan).

In addition, PG&E will comply with the recordkeeping requirements of 22 California Code of Regulations (CCR) 66262.4 for soil or groundwater generated during construction of the remedy characterized as hazardous, including transportation and offsite disposal records, profiles and associated characterization data, manifests, offsite facility waste receipts, trucking logs, and training records. Characterization will be documented on a waste profile form provided by the offsite treatment or disposal facility as part of the waste acceptance process. An approved copy of the waste profile will be received prior to offsite transportation of the material.

In addition, an inventory of water generated during well construction and testing will be maintained, including date, location, quantity of generation, and ultimate disposal or management location (such as the IM-3 treatment and injection facilities or the compressor station ponds).

Best efforts will be made to separate recyclable materials (for example, plastic water bottles) from municipal waste streams and to estimate the percentage of materials diverted from municipal solid waste landfill disposal.

2.6.2.3 Other Recordkeeping during Construction

Additional recordkeeping and tracking efforts during construction, consistent with CD Sections 94 and 97, may include:

- Health and safety training records, incident information, and audit findings
- Information to track sustainability metrics such as greenhouse gas emissions, nitrogen oxides and sulfur oxides, and offsite waste disposal. Information that may be recorded includes vehicle counts, vehicle types, mileage of shipments and deliveries, and materials and waste inventories

- Sampling and laboratory analysis documentation, chain of custody records
- Well installation characterization data and construction records
- Visual inspection reports of storm water BMP effectiveness and information on qualifying storm events
- Annual stormwater compliance reports
- Construction costs and schedules
- Pre- and post-construction photo documentation
- Inspections by FCRs
- Worker training records
- Environmental compliance tracking, inspection, and records
- Other reports, correspondence, documents, information, or data related to construction

Records from the above activities may be in hardcopy form or may be incorporated in an electronic database system. Hardcopy field records and/or inspection forms will be scanned for electronic storage. The CHQ will serve as the primary repository for records during construction. Records kept in hardcopy or electronic form can be made available for review upon request.

2.6.2.4 Retention and Reporting

In compliance with the CACA (Section XII) and the CD (Section XXV), PG&E will maintain records for 10 years following receipt of certification of completion. At the conclusion of the record retention period, PG&E will notify DOI and DTSC in writing at least 90 days prior to the destruction of records and will provide DOI and DTSC with the opportunity to take possession of the records. Deliverables during the groundwater construction and startup, such as the monthly progress reports and the construction completion report, will be submitted to DTSC and DOI in electronic format, with hardcopies available upon request. Deliverables will also be posted to the project SharePoint site for DTSC, DOI, and/or stakeholder review.

During the construction phase of the groundwater remedy, the CHQ will house the centralized repository of the master drawings, specifications, contracts, lease agreements, agency approvals, plans, inspection records, and construction personnel records.

2.6.3 Reporting

2.6.3.1 Progress Reporting

As required by the CACA (Attachment 7) and the CD (Appendix C, Section 5), PG&E will prepare and submit monthly progress reports during construction and startup of the groundwater remedy. Exhibit 2.6-2 presents a monthly progress report template to be completed throughout the construction process.

One electronic copy of each written monthly progress report will be submitted to DTSC and DOI by the tenth day of the following month. Hardcopies will be provided to DTSC and DOI upon request. If requested, PG&E will also provide briefings for DTSC and DOI to discuss progress of the construction activities.

PG&E will use the monthly progress report to communicate progress related to the construction schedule, and will notify DTSC and DOI of changes in the schedule. PG&E will notify DTSC and DOI of a change in the schedule for the performance of any activity no later than 7 days prior to the performance of the activity, or as otherwise agreed to by PG&E, DTSC, and DOI.

Following completion of construction and startup activities, progress reporting and monitoring will be as described in the O&M Manual.

EXHIBIT 2.6-2

Monthly Progress Report Template

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

PG&E Topock Compressor Station Groundwater Remediation Project

Monthly Progress Report for Final Groundwater Remedy Construction and Startup

[Indicate Reporting Period]

Table of Contents

1. Introduction

In compliance with the 1996 CACA (Attachment 6, Part E, Section 9a and Attachment 7) and the 2013 RD/RA CD (¶32 and Appendix C, Section 5), this monthly report describes activities taken during the prior reporting period and activities planned for the next six weeks; presents available results from sampling and testing since the last reporting period; and summarizes progress in the construction of the final groundwater remedy, issues encountered and actions to rectify the issues, and deviations from the design documents and/or the Construction/Remedial Action Work Plan that PG&E have proposed to DTSC/DOI or that have been approved by the Agencies. In addition, this report discusses personnel changes and summarizes activities performed and activities planned in support of DTSC's (2013b) Community Outreach Plan, DOI's (2012) Community Involvement Plan, and contacts with local community, representatives of the press, and/or public interest groups, if any.

2. Description of Activities and Work Completed

Describe completed construction activities; data collected, generated or received; nature and volume of waste generated; waste handling/disposal; issues encountered; actions taken to rectify problems/issues; personnel changes; and work variance requests (i.e., material deviations from the design documents, the Construction/Remedial Action Work Plan, or other approved work plans), agencies' actions on those requests, and potential schedule impacts.

3. Communication

Summary of all contacts with representatives of the press, local community or public interest groups during the reporting period. Summary of other activities provided to assist DTSC and/or DOI in support of the Community Outreach Plan and/or Community Involvement Plan, respectively. Anticipated near-term (approximately next six weeks) activities in support of the Community Involvement/Relations Plan.

4. Planned Activities for Next Six Weeks

Provide planned activities of next six weeks (construction activities, sampling and monitoring events, etc.).

5. Construction Schedule Review

Provide information relating to the construction schedule progress, sequencing of activities, information regarding percentage of completion, unresolved delays encountered or anticipated that may affect the future schedule, and a description of efforts made to mitigate those delays or anticipated delays.

6. Attachments/Appendices including Relevant Project Photos as appropriate

2.6.3.2 Construction Completion Report

As required by the CACA (Attachment 6, Part F) and the CD (Appendix C, Section 4), PG&E will prepare a Construction Completion Report after construction and operational tests are complete. The Construction Completion Report will be prepared by a registered professional engineer, will be submitted to DTSC and DOI, and will include:

- Purpose
- Synopsis of the constructed groundwater remedy, design criteria, and certification that the final corrective measure was constructed in accordance with the final design plans and specifications
- Explanation and description of modifications to the final design plans and specifications and why the modifications were necessary
- Results of operational testing and/or monitoring that may indicate how initial operation of the final groundwater remedy compares to the design criteria
- Summary of significant activities that occurred during construction, including problems and how addressed
- Summary of inspection findings
- Summary of significant deviations (for example, technical field changes, revised assumptions) from the ROD or approved work plans made during construction
- As-built drawings
- A schedule indicating when treatment systems will begin full-scale operations
- Certification by a responsible corporate official from PG&E or PG&E's Project Manager that the information in the report is true, accurate, and complete.

2.6.3.3 Additional Reporting During Remedy Construction

Additional reporting during the remedy construction will include:

- Quarterly groundwater and surface water monitoring reports.
- Annual stormwater compliance reporting, as described in Appendix K.
- Quarterly ARARs and EIR Mitigation Measures compliance reports.
- Post-construction biological resources completion report required by PBA general Mitigation Measure #24 and the protocol and proposed procedures for compliance with ARAR #32 and the portion of BIO-1 related to CWA Section 404.
- Post-construction revegetation efforts monitoring reports as described in Appendices G, N and O.
- Final report, following conclusion of earthmoving activities, as described in the Paleontological Resources Management Plan in Appendix J.

PG&E may elect to combine any of the above with the monthly progress reports or Construction Completion Report, as appropriate.

TABLE 2.1-1

Key Project Personnel, Responsibilities, Levels of Authority, and Lines of Communication

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Key Personnel	Project Role, Summary of Responsibilities, Level of Authority, and Lines of Communication
Andrew Williams	**PG&E Vice President Safety, Health, and the Environment** Mr. Williams is the executive sponsor of the project and represents PG&E (the Owner) at the executive level on the Topock Leadership Partnership.
Kevin Sullivan	**PG&E Chromium Remediation Director** Mr. Sullivan has the overall responsibility for the project direction and implementation and represents PG&E at the executive level on the Clearinghouse Task Force.
Yvonne Meeks	**PG&E Topock Project Manager** Ms. Meeks reports to Mr. Sullivan and is responsible for giving technical and strategic direction to the PG&E Project Team and for execution of the project as a whole. Ms. Meeks also serves as the primary PG&E Topock project team point of contact for external project stakeholders, including regulatory agencies, Tribes, and the community.
Danielle Starring	**PG&E Construction Manager** Ms. Starring is responsible for the construction of the groundwater remedy facilities. Ms. Starring reports to Ms. Meeks and is responsible for the overall management of activities related to the construction program, including technical, financial, safety, and schedule matters.
Curt Russell	**PG&E Site Operations Manager** Mr. Russell is responsible for overall onsite operations of the Topock Remediation project. As a member of the Construction Steering Committee, Mr. Russell is the primary point of contact for field activities related to the construction project. As such, he acts as the liaison with PG&E Gas Operations staff and coordinates activities and processes for site visitors and observers. For the groundwater remedy implementation, Mr. Russell is also a designated disturbance coordinator for noise/vibration.
Steve Martz	**Quality Assurance Manager** Mr. Martz is responsible for monitoring and verifying the implementation of the CQAPP during construction of the groundwater remedy. Consistent with the approach to independence between QA and QC functions, the Quality Assurance Manager reports to the Chromium Remediation Director.
Christina Hong	**Quality and Compliance Manager** Ms. Hong is responsible for compliance and quality monitoring, tracking and reporting. As a member of the Construction Steering Committee, the Quality and Compliance Manager provides input and recommendations to the PG&E Construction Manager to ensure construction activities meet regulatory and permitting requirements.
Richard Orens	**Engineer of Record** Mr. Orens is a registered professional engineer who has responsible charge for the engineering design of the groundwater remedy. The Engineer of Record is a member of the Construction Steering Committee and together with the Construction Manager, reviews contractor quality control records to ensure that the groundwater remedy is constructed in accordance with the design plans and specifications.
Shakeel Jogia	**Construction Manager** Mr. Jogia is responsible for the management of construction contractors, submittals and activities. As a member of the Construction Steering Committee, the Construction Manager provides information and recommendations to the PG&E Construction Manager pertaining to schedule, technical, and safety metrics.
TBD	**Construction Health and Safety Manager** The Construction Health and Safety Manager is independent of the construction contractor(s) and subcontractors and is responsible for construction health and safety. The Construction Health and Safety Manager reports to the Construction Manager.

TABLE 2.3-1
Communication Framework during Construction and Startup
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Type	Triggering Event	Required By[a]	Party Initiating Communication	Party Communication is Addressed to[b]	General Communication Procedures/Protocols
Routine Communication	Notification of planned construction/field activities (including sampling)	EIR MMRP measures CUL-1a-8a, CUL-1a-8j, CUL-1a-8l, CUL-1a-8h Noise-1b, 2d, and 3b CIMP sections 2.1, 2.8, 2.10, 2.12 CD ¶24 CACA X[3]. PA Appendix C Monitoring Protocol Section 1600 AMM #34	PG&E Site Operations Manager or designee	DTSC, DOI, HNWR, Tribes, CDFW, BLM Project stakeholders	Notify agencies and Tribes monthly of scheduled field activities. During periods of extensive construction activity, these notifications will be issued more frequently – weekly and/or daily (CUL-1a-8j/CUL-1a-8h). After issuing these notifications, PG&E will notify the nearby noise-sensitive receptors and Tribes of any schedule changes. Nearby noise-sensitive receptors, including residents at Moabi Regional Park and the Topock Marina area, will be notified of the schedule of construction activities and any subsequent changes when construction activities are conducted within 1,850 feet and 5,830 feet from California receptors and 330 feet and 735 feet from Arizona receptors for daytime and nighttime noise, respectively. Other means of notifications could also include: (1) formal presentations and announcements at meetings, including Consultative Work Group, Technical Work Group, Clearinghouse Task Force, etc.; (2) daily information sheets for site visitors during times of intensive activity (e.g., construction); and (3) posting project activity schedules and other information on a project website (CUL-1a-8j). For Tribal monitoring/observation of ground-disturbing activities, notify Tribes as early as possible, but at least 3 business days in advance of the initiation of the identified project work, whenever possible per the PA's monitoring protocol and not less than one week in advance of the initiation of planned activities and other scientific surveying that is conducted in anticipation of construction activities (CUL-1a-8l). When activity is imminent and advance notification was not possible, PG&E will place telephone calls to key Tribal representatives (CUL-1a-8j). Notify DOI 28 days in advance of sample collection activities, unless shorter notice is agreed to by DOI (CD ¶24). Notify DTSC at least 7 days in advance of sample collection activities (CACA X[3]). In the event short-order sampling/field activity needs occur, PG&E will call DTSC and DOI (prior to proceeding with the activity), and then follow up by email. In the event that email or voice mail is not available to PG&E, a text message will be sent to DTSC and DOI prior to proceeding with the activity and then a follow up by email. Notify CDFW at least 5 days prior to initiation of construction activities and at least 5 days prior to completion of construction activities.
	Progress reporting	CACA Attachments 6 and 7 CD ¶32	PG&E PM or designee	DTSC, DOI	Monthly reports via email during construction and start-up. Exhibit 2.6-2 presents a template for the Monthly Progress Reports.
	EIR mitigation measure compliance reporting ARAR compliance reporting	EIR MMRP measures CUL-1a-2, CUL-1a-3b, CUL-1a-11 CD ¶32.b(10)	PG&E PM or designee	DTSC, DOI	Quarterly reports via email during construction and startup.
	Tribal-specific outreach activities	2006 Settlement Agreement between PG&E and FMIT (Section VIII[A]); PG&E Memoranda of Agreement with various Tribes; EIR mitigation measure CUL-1a-8a	PG&E PM or designee	Tribes and Agencies (on request)	Frequent communications with Tribes to address current issues and provide a forecast of upcoming activities (e.g., PG&E currently holds monthly updates with Tribes) (CUL-1a-8a). Other communications make take place depending on purpose of the communication and type of information to be exchanged.

TABLE 2.3-1
Communication Framework during Construction and Startup
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Type	Triggering Event	Required By[a]	Party Initiating Communication	Party Communication is Addressed to[b]	General Communication Procedures/Protocols
Non-routine Communication	**Request for Variance/Notification of Changes**				
	Material Deviation[e] from Work Plan and design documents, MMRP, action-specific and location-specific ARARs.	This C/RAWP	PG&E PM, PG&E Site Operations Manager, or designee	DTSC, DOI FMIT (for material deviation on FMIT property)	Notify the agencies orally within 3 days of when PG&E first knows of potential deviations. Submit a Work Variance Request Form (Figure 2.3-1) to agencies for approval 5 calendar days before the anticipated work occurs. Agencies will act on the request or notify PG&E that more time is required. See also C/RAWP Chapter 5 (Construction Contingency Plan/Procedures). Notify FMIT that a Work Variance Request has been submitted to the agencies for a material deviation on FMIT property.
	Review of data collected during construction of the groundwater remedy well network	This C/RAWP	PG&E PM, PG&E Site Operations Manager, or designee	DTSC, DOI	Review of data collected at predetermined well locations to finalize well design concurrent with field work, as defined in Section 3.1 of this C/RAWP. The anticipated timing of these events will be forecasted monthly based on the actual construction schedule (through routine communication defined above in this table), and email confirmation will be provided within days of the anticipated event. Review of data collected at key well locations that are not pre-determined in this work plan to finalize well design. If data collected during construction of wells indicate that key design assumptions used in the basis of design are incorrect, PG&E will organize a real-time conference call (i.e., concurrent with field work) with DTSC and DOI representatives. The purpose of the call will be to review the data collected and reach consensus on the appropriate next steps at the given location and examine the potential effects these data might have on the sting of other nearby wells.
	Discovery of event that occurs or has occurred that causes delay in the performance of any obligation under the CD for which PG&E intends to assert a claim of *force majeure*	CD ¶61	PG&E PM or designee	DOI	Orally within 3 working days of when PG&E first knew the event might cause a delay and written notification within 7 days thereafter.
	Discovery of changes to the schedule described in the progress reports (i.e., change in schedule described in the monthly progress report for the performance of any activity including, but not limited to data collection and implementation of work plans)	CD ¶33 CACA	PG&E PM, PG&E Site Operations Manager, or designee	DOI, DTSC	No later than 7 days prior to the performance of the activities, or as otherwise agreed to by DOI and PG&E.
	Water temperature from freshwater supply well increases significantly	Resolution to 90% design comment (RTC #31)	PG&E PM or designee	Hualapai Tribe	Notify the Hualapai Tribe and discuss if requested
	Temporary backfilling pilot boreholes	Resolution to 90% design comment (RTC #930)	PG&E PM or designee	DTSC, DOI	Obtain approval from Agencies for temporarily backfilling boreholes on a case-by-case basis as determined necessary during construction of any remediation or monitoring wells
	Notification when Contingency Triggers				
	Major breakdown includes emergency situations such as fires, incidents that result in hospitalization or death, acts of god (e.g., earthquake, flood), etc.	CACA Attachment 6, Item 7b CD ¶52 PBA #19 and #22	PG&E PM, PG&E Site Operations Manager, or designee	DTSC, DOI, Affected Land Owners/Managers (FMIT, BOR, BLM, HNWR/ USFWS) If there is a potential threat to the river, notify MWD and immediate downstream users such as the Chemehuevi Indian Tribe as soon as possible. Notify the Chemehuevi Indian Tribe orally within 12 hours followed by a written report within 5 days, and a follow-up (verbal or written) within 15 days.	Call 911 if there is an impact to human health that requires immediate medical attention by emergency response/health care professionals. Within 48 hours to BLM (PBA #19 and #22). Immediate notification to DOI's Project Manager, or, if the PM is unavailable, DOI's Alternate PM, then to the responsible bureau for emergency and release events. To comply with this specific CD requirement, PG&E interprets immediate to be "within 24 hours." Within 24 hours to DTSC orally; within 72 hours in writing; include incident in next progress report. Additional notifications may be required (e.g., spills)

TABLE 2.3-1
Communication Framework during Construction and Startup
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Type	Triggering Event	Required By[a]	Party Initiating Communication	Party Communication is Addressed to[b]	General Communication Procedures/Protocols
Non-routine Communication	Releases[d] of EPCRA-listed extremely hazardous substances and CERCLA-listed hazardous substances to the environment that are subject to reporting under EPCRA Section 304.	CACA IV(A)(3) CD ¶34 and ¶35 PBA #19 and #22 Project-specific HMBP CERCLA Section 103(a)	PG&E Site Operations Manager, or designee	NRC, OES, CUPA, DTSC, DOI, Affected Land Owners/ Managers (FMIT, BOR, BLM, HNWR/ USFWS) If there is a potential threat to the river, notify MWD and immediate downstream users such as the Chemehuevi Indian Tribe as soon as possible. Notify the Chemehuevi Indian Tribe orally within 12 hours followed by a written report within 5 days, and a follow-up (verbal or written) within 15 days.	Call 911 if there is an impact to human health that requires immediate medical attention by emergency response/health care professionals. Within 15 minutes verbally to the NRC, OES and the CUPA. Written follow-up report to OES and CUPA within 30 days. Within 24 hours to DOI PM or if DOI PM is not available, DOI's Alternate PM, then to the responsible bureau for emergency and release event. Written reports to DOI within 30 days of onset of event and again, within 45 days after conclusion of event (latter report detailing actions taken in response). Within 48 hours to BLM (PBA #19 and #22). Within 48 hours orally and within 10 days in writing to DTSC; include incident in next progress report
	Releases[d] of CERCLA-listed hazardous substances to the environment that are reportable under CERCLA Section 103.	CACA IV(A)(3) CD ¶34 and ¶35 PBA #19 and #22 HMBP CERCLA Section 103(a)	PG&E PM, PG&E Site Operations Manager, or designee	NRC, OES, CUPA, DTSC, DOI, Affected Land Owners/Managers (FMIT, BOR, BLM, HNWR/ USFWS) If there is a potential threat to the river, notify MWD and immediate downstream users such as the Chemehuevi Indian Tribe as soon as possible. Notify the Chemehuevi Indian Tribe orally within 12 hours followed by a written report within 5 days, and a follow-up (verbal or written) within 15 days.	Call 911 if there is an impact to human health that requires immediate medical attention by emergency response/health care professionals. Within 15 minutes verbally to the NRC, OES and the CUPA. Written follow-up report to OES and CUPA within 30 days. Within 24 hrs to DOI PM or if DOI PM is not available, DOI's Alternate PM, then to the responsible bureau for emergency and release event. Written reports to DOI within 30 days of onset of event and again, within 45 days after conclusion of event (latter report detailing actions taken in response). Within 48 hours to BLM (PBA #19 and #22). Within 48 hours orally and within 10 days in writing to DTSC; include incident in next progress report. Follow this order of communication to the federal agencies: DOI PM or if DOI PM is not available, DOI's Alternate Project Manager, then to the responsible bureau for emergency and release events.
	Releases[d] of hazardous materials to the environment reportable under CHSC Section 25501 and 19 CCR 2703	CACA IV(A)(3) HMBP PBA #19 and #22 CHSC Section 25501, 19 CCR 2703	PG&E PM, PG&E Site Operations Manager, or designee	NRC if over reportable quantity, OES, CUPA, DTSC, DOI, Affected Land Owners/ Managers (FMIT, BOR, BLM, HNWR/ USFWS) If there is a potential threat to the river, notify MWD and immediate downstream users such as the Chemehuevi Indian Tribe as soon as possible. Notify the Chemehuevi Indian Tribe orally within 12 hours followed by a written report within 5 days, and a follow-up (verbal or written) within 15 days.	Call 911 if there is an impact to human health that requires immediate medical attention by emergency response/health care professionals. Immediate verbal report to OES and CUPA. Written follow-up report within 30 days. Include incident in next progress report. Within 48 hours to BLM (PBA #19 and #22). Within 48 hours orally and within 10 days in writing to DTSC; include incident in next progress report. Follow this order of communication to the federal agencies: DOI PM or if DOI PM is not available, DOI's Alternate Project Manager, then to the responsible bureau for emergency and release events.
	Release of oil to navigable waters of the US or adjacent shorelines in quantity that causes a sheen on the water or a violation of applicable water quality standards. Release of any quantity of oil to waters of the state, or release of 1 barrel (42 gallons) or more to a location on land where it could potentially enter waters of the State.	33 U.S.C. 1321 CWC Section 13272 Calif. State Oil Spill Contingency Plan Fuel SOPs (EIR MMRP HAZ-1b)	PG&E PM, PG&E Site Operations Manager, or designee	NRC (for spills to waters of the US), OES, DTSC, DOI, Affected Land Owners/ Managers (FMIT, BOR, BLM, HNWR/ USFWS) If there is a potential threat to the river, notify MWD and immediate downstream users such as the Chemehuevi Indian Tribe as soon as possible. Notify the Chemehuevi Indian Tribe orally within 12 hours followed by a written report within 5 days, and a follow-up (verbal or written) within 15 days.	Within 15 minutes to NRC and OES. Follow this order of communication to the federal agencies: DOI PM or if DOI PM is not available, DOI's Alternate Project Manager, then to the responsible bureau for emergency and release events.
	Release of hazardous waste or hazardous waste constituents that could threaten human health or the environment outside the facility.	CACA IV(A)(3) and Attachment 6, Item 7b CD ¶52 HMBP PBA #19 and #22 22 CCR 66265.56	PG&E PM, PG&E Site Operations Manager, or designee	OES, DTSC, DOI, Affected Land Owners/ Managers (FMIT, BOR, BLM, HNWR/ USFWS) If there is a potential threat to the river, notify MWD and immediate downstream users such as the Chemehuevi Indian Tribe as soon as possible. Notify the Chemehuevi Indian Tribe orally within 12 hours followed by a written report within 5 days, and a follow-up (verbal or written) within 15 days.	Immediate verbal report to OES. Written follow-up report within 15 days to DTSC. Within 48 hours to BLM (PBA #19 and #22). Within 24 hours orally; within 72 hours in writing to DTSC; include incident in next progress report. Follow this order of communication to the federal agencies: DOI PM or if DOI PM is not available, DOI's Alternate Project Manager, then to the responsible bureau for emergency and release events.

TABLE 2.3-1
Communication Framework during Construction and Startup
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Type	Triggering Event	Required By[a]	Party Initiating Communication	Party Communication is Addressed to[b]	General Communication Procedures/Protocols
	Release of USDOT-regulated hazardous material during transportation[c] reportable under 49 CFR 171.15(b)	49 CFR 171.15 CD ¶52 CACA	PG&E PM, PG&E Site Operations Manager, or designee	NRC, DOI, DTSC Affected Land Owners/ Managers (FMIT, BOR, BLM, HNWR/ USFWS If there is a potential threat to the river, notify MWD and immediate downstream users such as the Chemehuevi Indian Tribe as soon as possible. Notify the Chemehuevi Indian Tribe orally within 12 hours followed by a written report within 5 days, and a follow-up (verbal or written) within 15 days.	Call 911 if there is an impact to human health that requires immediate medical attention by emergency response/health care professionals. Immediate verbal report to NRC. Written follow-up report within 30 days. Follow this order of communication to the federal agencies: DOI PM or if DOI PM is not available, DOI's Alternate Project Manager, then to the responsible bureau for emergency and release events.
Non-routine Communication	**Discovery of Human-caused Disturbance/Human Remains or Burials/Previously Unidentified Potentially Significant Cultural, Historic, or Paleontological Resources/Active Dead or Injured Listed Species**				
	Discovery of human-caused disturbance to remedy facilities	EIR MMRP measure CUL-1a-3b Site Security Plan	PG&E Site Operations Manager, PG&E Remediation Resources Specialist or designee	DTSC, DOI, Landowners involved in the incursion (BLM, USFWS, or FMIT)	Notification protocols per Site Security Plan; summarized in quarterly compliance report. Additional notifications may be required (e.g., spills).
	Discovery of human remains or burials	EIR mitigation measure CUL-4 PA Section IX CHPMP (Section 8.2 and Appendix D, Plan of Action)	PG&E Site Operations Manager, PG&E Remediation Resources Specialist, Qualified Cultural Resources Consultant, or designee	PG&E's initial communication is to the San Bernardino County Coroner, and PG&E's and DTSC's project managers. The qualified cultural resources consultant will coordinate the interaction between Tribes, PG&E, the County, and DTSC to determine proper treatment and disposition of any remains. Human remains found on federal land would require notification of BLM. BLM will then notify the Advisory Council on Historic Preservation, California and Arizona State Historic Preservation Officers, BOR, USFWS, DTSC, relevant County Coroner, and Tribes. The County Coroner will contact the Native American Heritage Commission if it determines the remains are Native American and not related to a crime.	Suspend work in the immediate vicinity of the discovery (not less than 5 meters and not to exceed 50 meters from the discovered remains), and if the discovery is on federal land, notify BLM as soon as possible, but no later than 24 hours of the discovery by telephone, followed by written confirmation within three business days. If the remains are found in California, BLM will notify the County Coroner. If the discovery is on non-federal/non-Tribal lands in Arizona, then BLM in consultation with PG&E will report the discovery to the Arizona State Museum. If the discovery is on non-federal/non-Tribal lands in California, then PG&E will notify the County Coroner. Additional notifications and communications are described in the CHPMP, Appendix D, Plan of Action.
	Discovery of previously unidentified potentially significant cultural, historical, and/or paleontological resources	PBA #29 EIR MMRP measures CUL-1b/c-4 and CUL-1a-8b/o CIMP PA Section IX CHPMP (Section 8.1 and Appendix C, Discovery Plan)	PG&E Site Operations Manager, PG&E Remediation Resources Specialist, Qualified Cultural Resources Consultant, or designee	PG&E's initial communication is to BLM and the Tribes, if the resource is Native American in nature. BLM will then notify DOI, the Advisory Council on Historic Preservation, California and Arizona State Historic Preservation Officers, BOR, USFWS, the Tribes (if not already notified) and DTSC.	Suspend work in the immediate vicinity of the discovery (not less than 5 meters and not to exceed 50 meters from the discovered remains), notify BLM and the Tribes, if the resource is Native American in nature, immediately. Qualified archaeologists will inspect and evaluate any new sites that may be discovered during construction and will notify Tribal Monitors of the discovery. Tribal Monitors will then inspect and evaluate the new site(s) (CIMP, Subsection 14.6); EIR MMRP measures CUL-1a-8b and 8o).
	Locate dead or injured listed species	PBA #28	PG&E Site Operations Manager, PG&E Project Biologist or designee	BLM, USFWS	Notify Agencies within 3 working days of its finding.

Notes:

[a] AMM = Avoidance and Minimization Measure, CACA = Corrective Action Consent Agreement (DTSC 1996); CD = Consent Decree (DOI 2013); CHPMP = Cultural and Historic Properties Management Plan (BLM 2012); CIMP = Cultural Impact Mitigation Plan (PG&E 2014); EIR = Environmental Impact Report (DTSC 2011b); HMBP = Hazardous Materials Business Program; MMRP = Mitigation Monitoring and Reporting Program (DTSC 2011a); PA = Programmatic Agreement (BLM 2010); PBA = Programmatic Biological Assessment (CH2M HILL 2014a)

[b] Agencies: ADEQ = Arizona Department of Environmental Quality; BLM = U.S. Bureau of Land Management; BOR = U.S. Bureau of Reclamation; CDFW = California Department of Fish and Wildlife; CUPA = California Unified Permitting Agency; DOI = U.S. Department of the Interior; DTSC = California Department of Toxic Substances Control; HNWR = Havasu National Wildlife Refuge; MWD = Metropolitan Water District of Southern California; NRC = National Response Center; OES = California Governor's Office of Emergency Services; RWQCB = Regional Water Quality Control Board; USFWS = U.S. Fish and Wildlife Service.

[c] Transportation includes loading, offloading, and storage of USDOT-regulated vehicle/trailer. Notify the NRC in the event of a transportation incident involving death, hospitalization, damage greater than $50,000, roadway shutdown or public evacuation exceeding 1 hour, fire, breakage or spillage.

[d] Excludes permitted discharge of materials and release of hazardous materials/waste into secondary containment areas that is not released to the environment.

[e] Material deviation means a change that would (1) render the approved design non-compliant with codes, regulations, and/or engineering standard of practices, (2) render planned well locations and/or constructions fail to meet the project objectives, (3) cause significant schedule delay, and/or (4) cause a significant increase in costs.

FIGURE 2.3-1
Work Variance Request Form
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

PG&E TOPOCK GROUNDWATER REMEDIATION PROJECT
Work Variance Request Form *

Request Prepared By: Request Approval From:

Date Submitted: Date Approval Required:

Variance Request No.: Map Area:

Location:

Landowner: Landowner Parcel Number(s):

Current Vegetative Cover/Land Use:

Existing Sensitive Resource? ☐ No ☐ Yes Specify:

Variance From: ☐ Mitigation Measure ☐ Work Plan/Procedure ☐ Response to Comments
☐ Drawing ☐ Permit Condition ☐ Other

Detailed Description of Variance and Justification (Attach additional information if necessary):

Attachments: ☐ Photo ☐ Construction Drawing ☐ Aerial Photo Mark-Up ☐ Correspondence ☐ Other

Potential Impacts of Variance:

☐ Air Quality	☐ Hazardous Materials	☐ Aesthetic
☐ Biological Resources	☐ Noise	☐ Water Resources
☐ Geology and Soils	☐ Paleo Resources	
☐ Cultural Resources	☐ Hydrology and Water Quality	

Description and Justification:

Approval Signatures:

_____ _____
PG&E Construction Manager or Designee Approving Agency

_____
PG&E QA Manager or Designee

* This form is associated with material deviations from the Work Plan and design documents, MMRP, action-specific and location-specific ARARs for which DTSC and DOI are notified during construction. A material deviation means a change that would (1) render the approved design non-compliant with codes, regulations, and/or engineering standard of practices, (2) render planned well locations and/or constructions fail to meet the project objectives, (3) cause significant schedule delay, and/or (4) cause a significant increase in costs.

SECTION 3

Construction Methods and Sequencing

This section outlines PG&E's current thinking and strategies for constructing the groundwater remedy. This section describes the construction means and methods that could be used to build the remedy, presents a preliminary sequence of those construction activities, and contains a preliminary construction schedule.

It is anticipated that as construction planning progresses and the contracting/procurement process begins, additional details will emerge that will be used to further refine the construction sequencing and schedule. PG&E will develop a detailed construction schedule, including identification of the project's critical path after the approval of the final design and selection of contractors. For this reason, this section has been written with the intent of providing enough detail to facilitate review and comment by agencies, Tribes, and other stakeholders, while still allowing for the uncertainty inherent in construction planning at this stage.

3.1 Key Remedy Features for Construction

As outlined in the Final BOD, the groundwater remedy includes the following key features:

- An IRZ along the NTH using a line of wells that may be used as both injection and extraction wells to circulate groundwater and distribute an organic carbon source to promote reduction of the Cr(VI) to Cr(III).
- An inner recirculation loop (IRL) comprising:
  - Extraction wells near the Colorado River (referred to as the River Bank [RB] Extraction Wells) to provide hydraulic capture of Cr(VI) groundwater concentrations, clean up the floodplain downgradient of the IRZ, enhance the flow of contaminated groundwater through the IRZ line, and control migration of IRZ-generated byproducts.
  - Injection wells to re-inject groundwater extracted from the RB Extraction Wells, which may be amended with an organic carbon source, and/or fresh water in the upgradient portion of the Cr(VI) plume to flush the plume through the IRZ.
- A TCS recirculation loop comprising:
  - East Ravine Extraction Wells in the eastern (downgradient) end of the East Ravine to provide hydraulic capture of contaminated groundwater in bedrock.
  - TCS Injection Wells located upgradient of the TCS for the re-injection of groundwater extracted from the East Ravine Extraction Wells and TW Bench Extraction Wells, which will be amended with an organic carbon source to promote reduction of the Cr(VI) to Cr(III) and remove elevated Cr(VI) groundwater concentrations from the alluvial aquifer in the vicinity of the TCS.
- Injection of fresh water to assist with flushing the chromium plume through the NTH IRZ and to constrain westward spread of carbon-amended water and in situ byproducts from the IRL.
- A monitoring well network consisting of existing site wells and new monitoring wells.

The groundwater remedy also includes supporting features within the project footprint that are not aimed specifically at attaining RAOs but are needed to make the remedy effective and safe over its projected decades-long operation. The key supporting features include a remedy-produced water conditioning system to manage wastewater produced from O&M of the remedy (for example, maintenance of wells and piping, sampling and monitoring of wells, etc.); utilities (for example, power supply for the remedy and distribution conduits, communication and data network, fire water, etc.); site safety and security (for example, alarms, gates/fences, security cameras, etc.); access roads and work areas (for example, primary work zones,

support zones or staging areas) for installation and long-term O&M needs, an operations facility to house site operation and field staff, as well as essential O&M functions (for example, remote control and monitoring equipment/telecom/information technology, Supervisory Control and Data Acquisition [SCADA] system); and a maintenance/storage facility at Moabi Regional Park (serving as the CHQ during construction but reconfigured to support the long-term O&M) that will house a laboratory, a document repository center, a training/conference room, equipment storage, and soil storage areas.

Exhibit 3.1-1 provides a summary of the remedy design parameters/key remedy features at this final design stage. Figures 3.1-1 through 3.1-4 show the locations of remedy features in California, at the TCS evaporation ponds, at the Moabi Regional Park, and in Arizona. Exhibit 3.1-2A and B provides summary of borehole count for well construction.

EXHIBIT 3.1-1
Summary of Engineering Design Parameters and Key Remedy Features
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Remedy Feature	Design Parameters/Quantity	Location
NTH IRZ	– Twenty-four IRZ Injection Wells (plus 30 future provisional wells) spaced along the NTH IRZ line – Four IRZ Extraction Wells (plus one future provisional well) located at the ends and in the central portion of the NTH IRZ line	See Figure 3.1-1 for general locations
IRL	– Five RB Extraction Wells (plus up to four future provisional wells) along the Colorado River – Four IRL Injection Wells (plus three future provisional wells) near the western margin (upgradient) of the groundwater plume north of I-40	See Figure 3.1-1 for general locations
TCS recirculation loop	– Five East Ravine Extraction Wells (plus up to six future provisional wells) and conversion of one existing monitoring well (MW-70BR-22S, to be renamed ER-6) downgradient of the TCS in the southeast portion of the plume existing in bedrock – Two TW Bench Extraction Wells (plus two future provisional wells) in the area northeast of the TCS – Two TCS Injection Wells in the area of the TCS	See Figure 3.1-1 for general locations
Freshwater injection	– Two Freshwater Injection Wells located upgradient of the groundwater plume	See Figure 3.1-1 for general locations
Monitoring wells	• Thirty-six new monitoring well locations (plus four identified future provisional wells) • Up to 10 additional, unidentified future provisional monitoring wells.	See Figure 3.1-1 for general locations
Carbon amendment and carbon storage facilities	• One 15,000-gallon aboveground carbon storage tank and carbon amendment facility at the MW-20 Bench	See Figure 3.1-1 for general locations
Freshwater source/supply well/storage	• Freshwater supply will be primarily from the existing well HNWR-1A, located on the HNWR in Arizona. Fresh water can also be supplied form the existing nearby well HNWR-1 as a secondary source. • One 10,000-gallon freshwater storage tank for use by the remedy	See Figures 3.1-1 and 3.1-3 for general locations
Piping corridor (water pipes, electrical conduits, fibers, etc.)	• Approximately 121,700 feet (ft) of water/liquid/utility pipes and approximately 97,000 ft of electrical conduits and cables. Over 95% of conveyance pipes/conduits will be below ground.	See Figures 3.1-1 and 3.1-3 for general piping layout

EXHIBIT 3.1-1

Summary of Engineering Design Parameters and Key Remedy Features

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Remedy Feature	Design Parameters/Quantity	Location
Supporting facilities during remedy O&M	• The primary power supply source for remedy facilities in California will be power generated by the TCS. Two new natural gas engine-driven generators with associated switchgear and auxiliary systems will be installed in the existing Auxiliary Building, which houses the existing generators and generator switchgear. A new power supply conduit will run underground from the electrical switchgear inside the Auxiliary Building to a connection point outside the nearby Remedy-produced Water Conditioning Building. • Six load centers are planned with a transformer/distribution equipment at each one. The transformers will be mounted aboveground on shallow concrete foundations. • The primary power source for remedy facilities at the TCS evaporation ponds will be power generated on-site. One new natural gas-fueled reciprocating internal combustion engine (RICE) electrical power generator and associated auxiliary systems will be installed in a new enclosed utility building (approx. 425 sq. ft.) located within the TCS evaporation ponds fence line. Auxiliary equipment (e.g., lighting, controls, sensors, security cameras, and valve actuators) will be supplied with 24-volt direct current (VDC) power by new thermoelectric generators (TEGs). The TEGs will be installed in a security fenced area (approx. 500 sq. ft.) adjacent to the new utility building. Natural gas for the new generators will be piped from PG&E's natural gas Line 300B, located approximately 500 feet away. • Connection panel and pad for a portable, rental backup generator of similar make and model to the existing generator (Isuzu Model 6WG1X). Note that backup generator will be mobilized onsite as needed during project implementation to provide power. • Secondary power supply from small photovoltaic solar panels at various locations such as at Moabi Regional Park facilities and at select remote well locations. • A SCADA system for controlling and monitoring the remedy; the remedy SCADA equipment will be located inside the Operations Building at the TW Bench. • One remedy-produced water conditioning system and associated tanks at the TCS. • One Operations Building (approx. 1,480 square feet) to house essential functions for long-term O&M (SCADA system, programmable logic controllers, uninterruptible power supply, communications, etc.) at the TW Bench. Space is reserved in the Operations Building for a small, packaged drinking/potable water system. Shared use of existing TW Bench with Transwestern. • One long-term remedy support area (approx. 0.8 acre) and a soil processing area (approx. 2.56 acres) to the west and southwest of Moabi Regional Park. • Shared use of the Compressor Station Hazardous Material Storage Building with TCS. • Improvements at the TCS evaporation ponds to improve evaporation rate and to minimize trucking offsite; in the event that trucking offsite is necessary during remedy operations, improvements to the existing truck loading station to enhance the ability to pump pond water to tanker trucks.	See Figures 3.1-1 through 3.1-3 for general location

EXHIBIT 3.1-1

Summary of Engineering Design Parameters and Key Remedy Features

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Remedy Feature	Design Parameters/Quantity	Location
Access pathways, roadways, and certain areas for remedy O&M	• Two new graded access roads in the upland area to allow for installation and maintenance of wells IRL-2 and IRL-4 • One new access road east of the TW Bench for access to Transwestern's gas transmission equipment • A new road in the floodplain for the construction and maintenance of the IRZ/RB wells, future provisional wells, and associated piping • Access pathways/roads to remedy infrastructure on private properties in California and Arizona to access the remedy features • Improvements to the existing routes for access to FW-2 (Bat Cave Wash) and to the areas proposed for remedy use in Moabi Regional Park. • In addition to access pathways/roads, access to certain areas will continue to be needed, after construction is complete, for O&M of the installed remedy infrastructures.	See Section 4 for access pathways and roads, and areas
Other ancillary facilities for use during remedy O&M	• Small photovoltaic solar panels at various locations such as at Moabi Regional Park facilities and at select remote well locations; small communication radios at remote monitoring well locations, freshwater supply well in Arizona, and equipment at the TCS ponds to allow for remote data collection • Security equipment (gate, security cameras) for remote facilities	

Notes:

See Basis of Design Report/Final (100%) Design Submittal (Final BOD) for design assumptions and details for key remedy features.

Contingency items such as the Contingent Freshwater Pre-injection Treatment System and the Contingent Dissolved Metals Recovery System are not included in this table; they are listed in Volume 3, Contingency Plan (see Section 5), of the O&M Manual (Appendix L of the Final BOD).

EXHIBIT 3.1-2A

Estimated Borehole Count Associated with Well Construction: Summary

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Well Type	EIR Limit (by Well Type)	Installed	Planned	Future Provisional	Total (by Well Type)
Monitoring Well Boreholes	60	16	56	24	96
Remediation Well Boreholes	110	2	47	46	95
Total (by Status)	**170**	**18**	**103**	**70**	**191**

EXHIBIT 3.1-2B

Estimated Borehole Count Associated with Well Construction: Count Details

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Item	Location Name	Well Type	Status	Est. # of Well Screen Intervals	Calculated # of Boreholes	Number of Boreholes Installed	Est. # of Planned Boreholes	Est. # of Future Provisional Boreholes
1	ER-TCS GW Investigation	Monitoring	Installed	--	--	16	--	--
2	MW-10D	Monitoring	Planned	1	1	--	1	0
3	MW-11D	Monitoring	Planned	1	1	--	1	0
4	MW-70BR-D	Monitoring	Planned	1	1	--	1	0
5	MW-A	Monitoring	Planned	4	2	--	2	0
6	MW-B	Monitoring	Planned	4	2	--	2	0
7	MW-C	Monitoring	Planned	4	2	--	2	0
8	MW-D	Monitoring	Planned	3	2	--	2	0
9	MW-E	Monitoring	Planned	2	1	--	1	0
10	MW-F	Monitoring	Planned	2	1	--	1	0
11	MW-G	Monitoring	Planned	1	1	--	1	0
12	MW-H	Monitoring	Planned	4	2	--	2	0
13	MW-I	Monitoring	Planned	4	2	--	2	0
14	MW-J	Monitoring	Planned	4	2	--	2	0
15	MW-K	Monitoring	Planned	1	1	--	1	0
16	MW-L	Monitoring	Planned	4	2	--	2	0
17	MW-M	Monitoring	Planned	4	2	--	2	0
18	MW-N	Monitoring	Planned	3	2	--	2	0
19	MW-O	Monitoring	Planned	4	2	--	2	0
20	MW-P	Monitoring	Planned	4	2	--	2	0
21	MW-Q	Monitoring	Planned	4	2	--	2	0
22	MW-R	Monitoring	Planned	4	2	--	2	0

EXHIBIT 3.1-2B

Estimated Borehole Count Associated with Well Construction: Count Details

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Item	Location Name	Well Type	Status	Est. # of Well Screen Intervals	Calculated # of Boreholes	Number of Boreholes Installed	Est. # of Planned Boreholes	Est. # of Future Provisional Boreholes
23	MW-S	Monitoring	Planned	2	1	--	1	0
24	MW-T	Monitoring	Planned	TBD	1	--	1	0
25	MW-U	Monitoring	Planned	2	1	--	1	0
26	MW-V	Monitoring	Future Provisional	1	1	--	0	1
27	MW-W	Monitoring	Planned	1	1	--	1	0
28	MW-X	Monitoring	Planned	4	2	--	2	0
29	MW-Y	Monitoring	Planned	4	2	--	2	0
30	MW-Z	Monitoring	Planned	4	2	--	2	0
31	MW-AA	Monitoring	Planned	3	2	--	2	0
32	MW-BB	Monitoring	Planned	3	2	--	2	0
33	MW-CC	Monitoring	Planned	3	2	--	2	0
34	MW-DD	Monitoring	Planned	2	1	--	1	0
35	MW-EE	Monitoring	Future Provisional	2	1	--	0	1
36	MW-FF	Monitoring	Planned	2	1	--	1	0
37	MW-GG	Monitoring	Planned	2	1	--	1	0
38	MW-HH	Monitoring	Planned	2	1	--	1	0
39	MW-II	Monitoring	Planned	2	1	--	1	0
40	Slant Wells Under River	Monitoring	Future Provisional	TBD	2*	--	0	2
41	10 Unidentified MW Locations	Monitoring	Future Provisional	4 (per location)	20	--	0	20
42	Site B	Remediation	Installed	--	--	1	--	--
43	HWNR-1A	Remediation	Installed	--	--	1	--	--
44	ER-1	Remediation	Planned	1	1	--	1	0
45	ER-2	Remediation	Planned	1	1	--	1	0
46	ER-3	Remediation	Planned	1	1	--	1	0
47	ER-4	Remediation	Planned	1	1	--	1	0
48	ER-5	Remediation	Future Provisional	1	1	--	0	1
49	ER-6	Remediation	Installed	0	0	(Included in Item 1)	0	0
50	ER-7	Remediation	Future Provisional	1	1	--	0	1
51	ER-8	Remediation	Future Provisional	1	1	--	0	1
52	ER-9	Remediation	Future Provisional	1	1	--	0	1

EXHIBIT 3.1-2B

Estimated Borehole Count Associated with Well Construction: Count Details

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Item	Location Name	Well Type	Status	Est. # of Well Screen Intervals	Calculated # of Boreholes	Number of Boreholes Installed	Est. # of Planned Boreholes	Est. # of Future Provisional Boreholes
53	ER-10	Remediation	Future Provisional	1	1	--	0	1
54	ER-11	Remediation	Future Provisional	1	1	--	0	1
55	FW-1	Remediation	Planned	1	1	--	1	0
56	FW-2	Remediation	Planned	1	1	--	1	0
57	IRL-1	Remediation	Planned	1	1	--	1	0
58	IRL-2	Remediation	Planned	1	1	--	1	0
59	IRL-3	Remediation	Planned	1	1	--	1	0
60	IRL-4	Remediation	Planned	1	1	--	1	0
61	IRL-5	Remediation	Future Provisional	1	1	--	0	1
62	IRL-6	Remediation	Future Provisional	1	1	--	0	1
63	IRL-7	Remediation	Future Provisional	1	1	--	0	1
64	IRZ-01	Remediation	Planned	1	1	--	1	0
65	IRZ-02	Remediation	Future Provisional	4	2	--	0	2
66	IRZ-03	Remediation	Future Provisional	4	2	--	0	2
67	IRZ-04	Remediation	Future Provisional	4	2	--	0	2
68	IRZ-05	Remediation	Planned	2	1	--	1	0
69	IRZ-06	Remediation	Future Provisional	4	2	--	0	2
70	IRZ-07	Remediation	Future Provisional	4	2	--	0	2
71	IRZ-08	Remediation	Future Provisional	4	2	--	0	2
72	IRZ-09	Remediation	Planned	2	1	--	1	0
73	IRZ-10	Remediation	Future Provisional	4	2	--	0	2
74	IRZ-11	Remediation	Planned	4	2	--	2	0
75	IRZ-12	Remediation	Future Provisional	4	2	--	0	2
76	IRZ-13	Remediation	Planned	4	2	--	2	0
77	IRZ-14	Remediation	Future Provisional	4	2	--	0	2
78	IRZ-15	Remediation	Planned	4	2	--	2	0
79	IRZ-16	Remediation	Planned	4	2	--	2	0
80	IRZ-17	Remediation	Planned	4	2	--	2	0
81	IRZ-18	Remediation	Future Provisional	4	2	--	0	2
82	IRZ-19	Remediation	Planned	4	2	--	2	0
83	IRZ-20	Remediation	Planned	4	2	--	2	0

EXHIBIT 3.1-2B

Estimated Borehole Count Associated with Well Construction: Count Details

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Item	Location Name	Well Type	Status	Est. # of Well Screen Intervals	Calculated # of Boreholes	Number of Boreholes Installed	Est. # of Planned Boreholes	Est. # of Future Provisional Boreholes
84	IRZ-21	Remediation	Planned	4	2	--	2	0
85	IRZ-22	Remediation	Future Provisional	4	2	--	0	2
86	IRZ-23	Remediation	Planned	1	1	--	1	0
87	IRZ-24	Remediation	Future Provisional	2	1	--	0	1
88	IRZ-25	Remediation	Planned	2	1	--	1	0
89	IRZ-26	Remediation	Future Provisional	2	1	--	0	1
90	IRZ-27	Remediation	Planned	2	1	--	1	0
91	IRZ-28	Remediation	Future Provisional	2	1	--	0	1
92	IRZ-29	Remediation	Planned	2	1	--	1	0
93	IRZ-30	Remediation	Future Provisional	2	1	--	0	1
94	IRZ-31	Remediation	Planned	2	1	--	1	0
95	IRZ-32	Remediation	Future Provisional	2	1	--	0	1
96	IRZ-33	Remediation	Planned	2	1	--	1	0
97	IRZ-34	Remediation	Future Provisional	1	1	--	0	1
98	IRZ-35	Remediation	Planned	1	1	--	1	0
99	IRZ-36	Remediation	Future Provisional	1	1	--	0	1
100	IRZ-37	Remediation	Planned	1	1	--	1	0
101	IRZ-38	Remediation	Future Provisional	1	1	--	0	1
102	IRZ-39	Remediation	Planned	1	1	--	1	0
103	IRZ-40	Remediation	Future Provisional	1	1	--	0	1
104	RB-1	Remediation	Planned	2	1	--	1	0
105	RB-2	Remediation	Planned	2	1	--	1	0
106	RB-3	Remediation	Planned	2	1	--	1	0
107	RB-4	Remediation	Planned	2	1	--	1	0
108	RB-5	Remediation	Planned	2	1	--	1	0
109	RB-6	Remediation	Future Provisional	2	1	--	0	1
110	RB-7	Remediation	Future Provisional	2	1	--	0	1
111	RB-8	Remediation	Future Provisional	2	1	--	0	1
112	RB-9	Remediation	Future Provisional	2	1	--	0	1
113	TCS-1	Remediation	Planned	2	1	--	1	0
114	TCS-2	Remediation	Planned	2	1	--	1	0

EXHIBIT 3.1-2B

Estimated Borehole Count Associated with Well Construction: Count Details

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Item	Location Name	Well Type	Status	Est. # of Well Screen Intervals	Calculated # of Boreholes	Number of Boreholes Installed	Est. # of Planned Boreholes	Est. # of Future Provisional Boreholes
115	TWB-1	Remediation	Planned	1	1	--	1	0
116	TWB-2	Remediation	Planned	1	1	--	1	0
117	TWB-3	Remediation	Future Provisional	1	1	--	0	1
118	TWB-4	Remediation	Future Provisional	1	1	--	0	1

Notes:

* The actual number of boreholes required for future provisional slant wells will depend on well design and borehole angle.

Key Assumptions:

1. Up to 2 well casings (screens) will be nested in each borehole at MW locations where there are multiple screens. The estimated number of screened intervals could change based on actual field conditions.

2. Remediation wells will be constructed with one well per borehole (this includes dual screen wells along the IRZ, for which some have up to 2 separate dual screen wells per location).

3.2 Construction Methods

This section describes the typical methods and equipment that will be used to construct the groundwater remedy. These tools and techniques are grouped and presented according to the type of infrastructure with which they are associated; that is, wells, piping and utilities, vertical infrastructure (buildings and other aboveground facilities), and access routes.

The construction methods and equipment described herein are typical and feasible for similar projects constructed in similar site conditions. However, the exact methods and equipment that will be used in the field will be selected by the construction contractor(s) to provide the safest and most efficient construction processes to meet project requirements. It is unlikely that all of the tools and techniques described herein will be brought to bear, and even less likely that all of them would be used simultaneously. It is impractical to predict exactly which methods, equipment, or even numbers of equipment will be chosen or used at any point in the future because selection will depend on variable factors that cannot be known with certainty at this time. Some of these factors are equipment availability, market rates, employee skillsets, construction schedule, the size/structure/scope of the construction contract(s), and site conditions encountered in the field. For that reason, this section has been written with the intent of providing enough detail for regulatory review and approval while still providing flexibility for construction contractors to meet the project requirements in the safest and most efficient manner possible. Preliminary construction activities such as mobilization, utility survey, site preparation, and demarcation are discussed in Section 4 of the C/RAWP.

3.2.1 Wells

This section presents the approach to construction of new wells associated with the groundwater remedy, including extraction, injection, and monitoring wells. While the specific design and function of each well or well type will vary, the approach to construction for each will use similar methods, tools, and procedures. For many wells, the approach to finalizing the design and/or siting will depend on the information collected during location-specific well construction and/or information collected during the construction and testing of other nearby wells. Therefore, to minimize the total disturbance associated with well network construction (the number of individual boreholes required), the construction approach has been developed using the entirety of the well network.

Section 3.2.1.1 details the methods, tools, and general procedures planned to be used to drill and decommission the boreholes, which will be used for data collection (pilot boreholes) and for well construction. The types of data that will be collected during well drilling and the collection methods are further detailed in Section 3.2.1.2. The approach to using the information collected during well drilling to finalize well design and/or siting is presented in Section 3.2.1.3. Construction and development methods and procedures, and key design considerations for each well type are presented in Section 3.2.1.4. Finally, details for well testing and the use of well testing data are presented in Section 3.2.1.5.

Operational fieldwork methods and procedures that are not specific to designing, constructing, developing, and testing wells, such as waste management and site access, are presented in Section 4 of this C/RAWP.

3.2.1.1 Borehole Drilling and Decommissioning

The method used to drill each borehole will vary depending on the required borehole depth and diameter, data collection requirements, and the subsurface conditions encountered. In some cases, a borehole might initially be drilled with one method and subsequently reamed, or over-drilled, with another method. This section presents a description of the typical drilling equipment and specific drilling methods that are planned for remedy well network construction, as well as the approach to borehole stabilization and decommissioning.

Drilling Equipment. The equipment that will be present in the work zone for drilling and well construction activities is generally similar regardless of the specific drilling method. This equipment will include, but is not limited to:

- **Drill Rig.** Drill rigs will be mounted on either a tracked vehicle or highway-rated truck/trailer. In general, the footprint of the drill rig will be approximately 10 feet wide by 50 feet long or less. The height of the derrick when vertical will be approximately 40 feet tall or less. Specific dimensions will vary by rig.
- **Primary Service Truck or Trailer.** A drill rig will be supported by a truck or trailer used to deliver and manage larger drilling tools like the drilling pipe or well casing. In some cases, this will be the same truck that delivers water to the drill rig. This vehicle is usually positioned adjacent to the drill rig and often end-to-end. The dimension of this piece of equipment is typically similar to or smaller than the drill rig.
- **Secondary Support Equipment.** This smaller equipment will vary from rig to rig and is primarily dependent on the drilling method or given task. Examples of secondary support equipment that might be required include, but are not limited to, the following:
  - Auxiliary compressors, pumps, and generators
  - Material management equipment (backhoe or forklift)
  - Solids control unit for management of drill cuttings when drilling fluids are recirculated
  - General equipment trailer(s) to store smaller tools and materials
- **Bins and Tanks.** Drill cuttings and fluids generated during drilling will be temporarily stored in the work zone using tanks and bins. It is estimated that tanks will range in size from fixed-axle tanks that are approximately 9 feet wide by 50 feet long by 12 feet high to those that are smaller and mounted on a skid or trailer. The dimension of a typical bin (20 cubic yard capacity) is approximately 25 feet long by 8 feet wide by 5 feet high; however, smaller bins might also be used. The amount of storage capacity required at each drilling site will vary significantly depending on variables like the production rate of groundwater from the formation and the drilling method; however, it is estimated that up to three tanks and three bins could be required to support the drilling of a borehole at a given time.
- **Crew Vehicles and Facilities.** Vehicles used by the crew to access the work zone will range from standard highway vehicles to smaller off-highway vehicles. The exact number of vehicles will change depending on location and crew size at a given time but would typically be less than five. Temporary bathroom facilities will typically be in the work zone unless the work zone is within a jurisdictional area such as drainage and washes.

Throughout work, the crew will continuously assess what specific equipment is needed for a given task. Effort will be made to minimize the amount of equipment in the work zone. For example, if storage tanks were initially needed but are no longer required for a given task, then they could be removed. Similarly, if several drilling sites are located in the same general area, then a central tank staging area could be used to minimize the number of physical locations where the tanks are staged, thereby minimizing total footprint.

Drilling Methods. During the construction of the groundwater remedy well network, boreholes will be drilled for a variety of objectives that require a range of borehole diameters, depths, and data collection capabilities. To meet the different objectives, several drilling methods are considered in this work plan. The construction of the network will be completed most efficiently and with the least amount of total disturbance (for example, minimizing the total number of boreholes, or the duration of field time required to meet the project objectives) by continuously assessing the chosen drilling methods and maintaining flexibility to change methods.

Rotosonic Drilling. Rotosonic is the preferred method for drilling through unconsolidated materials above bedrock when continuous core is required, but a large borehole diameter is not required. Boreholes drilled with this method are generally between 6 and 12 inches in diameter; however, subsurface conditions can limit the depths to which larger-diameter boreholes can be drilled using rotosonic methods. According to past experience at Topock, the estimated maximum depth for smaller-diameter rotosonic boreholes is approximately 300 to 400 feet below ground surface (bgs). This method involves advancing a rotating and vibrating outer drive casing and inner core barrel through the subsurface. Rotosonic drilling can produce a

continuous core from the land surface to the target drilling depth and results in a temporarily cased borehole for well construction. Boreholes drilled with the rotosonic method can be drilled without adding water or other additives (for example, drilling mud); however, past experience using this method at Topock indicates that injecting water while drilling is required when drilling larger-diameter and/or deeper boreholes to manage borehole pressures (heaving conditions) and tooling temperatures. In general, an advantage of rotosonic drilling is that it generates minimal drilling wastes (that is, drill cuttings and purged groundwater) relative to other comparable methods and typically can drill through the lithology at Topock. Rotosonic methods have been used at Topock for limited applications when drilling in the conglomerate and crystalline metadiorite bedrock.

During the construction of the groundwater remedy well network, it is anticipated that the rotosonic method will be most useful when installing pilot boreholes for data collection or installing smaller-diameter wells (for example, monitoring wells with two or less nested, 2-inch-diameter well casings).

Rotary Drilling with Casing Advance. This method is representative of a category of specific types of tooling (for example, dual rotary, and dual-tube methods, such as Stratex or Odex). This is the preferred method for drilling through unconsolidated materials above bedrock when continuous core is not required and borehole diameters are larger. A primary advantage of these methods is that they are capable of drilling boreholes to the largest diameters and depths required for construction of the groundwater remedy well network; therefore, these methods are particularly important when methods like rotosonic or hollow-stem auger are not sufficient. This method involves advancing an outer drive casing while removing the cuttings from within that drive casing using air and/or water, drilling mud, or other additives as the drilling fluid. The determination regarding how the drilling fluid is engineered, be it simply air and water or another method, is made in the field based on direct observations of the formation and drilling tools during drilling.

During the construction of the groundwater remedy well network, it is anticipated that this method will be most useful when installing pilot boreholes for data collection at depths greater than what can be achieved with the rotosonic method or for installing larger-diameter wells (for example, injection and extraction wells).

Rotary Drilling (Conventional). Rotary drilling is included as a category that includes specific types of tooling (for example, tri-cone roller bit or percussion hammer) used to install boreholes within both unconsolidated and bedrock formations. A wide range of borehole diameters can be drilled to depths larger than what is required for construction of the groundwater remedy well network. With this method, the drill bit is rotated on hollow drill pipes that are used to either inject the drilling fluid (air or drilling mud) and return the cuttings to the surface through the annulus or return the drill cuttings to the surface (in the case of reverse circulation). Conventional rotary drilling does not advance an outer drive casing to stabilize the borehole, so drilling mud is typically used.

During the construction of the groundwater remedy well network, it is anticipated that air rotary (with a downhole percussion hammer) will be used to install the extraction wells at the east end of the East Ravine area. Mud rotary is not currently planned for use, but is included as a potential drilling technology to install larger-diameter, deeper wells (for example, injection wells in the uplands) should the preferred rotary drilling with casing advance method prove unsuccessful or inefficient.

Wireline Core Drilling. Wireline, diamond-bit core drilling methods are preferred for drilling through consolidated bedrock when relatively undisturbed bedrock core is beneficial for well design. This method uses a rotating, dual-barreled drill casing with a diamond-impregnated bit to collect relatively undisturbed core. Additionally, as determined necessary, a triple-tube core barrel, which uses the same tools as the dual-barreled system, but includes an inner sleeve to maximize core recovery in especially fractured rock, can be used. Drilling fluid, typically water with no additives (though a polymer is sometimes needed) is used to move drill cuttings out of the borehole. Coring activities are typically initiated using water with no additives; however, the determination to add an additive to the drilling fluid to facilitate the removal of cuttings from

the borehole or inhibit the loss of drilling fluids to the formation is made in the field based on direct observations of the formation and drilling tools during drilling.

During the construction of the groundwater remedy well network, it is anticipated that wireline core drilling will only be used to drill the portion of monitoring well MW-70BR-D in the East Ravine, which is deeper than the existing MW-70BR-225 borehole. Continuous core has been collected from the shallower bedrock at this location, and core is not necessary for designing the extraction wells that will be installed at the eastern end of the East Ravine area, as discussed in Section 3.2.1.4.

Bucket Auger. A bucket auger is used to drill large-diameter boreholes (that is, 24 to 48 inches, though the upper end of this range is not anticipated to be needed) in unconsolidated material when the primary drilling method would either be less efficient or not capable of installing the borehole. This method is typically used to install large-diameter conductor casings to predesigned, generally shallow (less than 100 feet) depths. The method uses a "bucket" with a cutting edge on the bottom rotated by the drill rig. Cuttings are removed from the borehole by bringing the bucket back to the surface and emptying it. When drilling, it may be determined necessary to stabilize the borehole wall by installing a temporary casing or by using fluid, such as water or drilling mud. The determination regarding whether the drilling fluid is needed and how it is engineered, be it simply water or drilling mud, is made in the field based on direct observations of the formation and drilling tools during drilling. With this method, even if drilling mud is needed, the cuttings will typically remain primarily separated from the mud.

During the construction of the groundwater remedy well network, it is anticipated that a bucket auger will only be used if large-diameter conductor casings are required to maintain borehole integrity when installing deeper, large-diameter wells.

Hollow-stem Auger. Hollow-stem auger drilling is typically used to install smaller-diameter boreholes (up to approximately 12 to 14 inches) in unconsolidated material that is finer-grained (minimal concentrations of cobble and boulder-sized material). The method is typically used to install single-cased, smaller-diameter (2- to 4-inch-diameter casing) wells to shallow depths (fewer than 100 to 150 feet). Drilling is conducted by driving and rotating a spiral-flighted casing (auger) into the ground, whereby cuttings are moved up the borehole along the auger flights. When it has reached the appropriate depth, a well can be constructed through the inside of the auger. Typically, fluids are not added to the borehole unless required to manage borehole pressure (heaving conditions).

This method is typically not used at Topock because of the rocky lithology throughout the site, which can lead to misinterpretation of the bedrock contact, and heaving conditions that have been encountered in the past; however, it is possible that the method might prove useful for the installation of some wells such as the shallower wells near the southern end of the NTH IRZ, where the thickness of the unconsolidated material above bedrock is relatively thin and the depth to water is shallow.

Drilling Fluid. Drilling fluid, which can consist of liquids (for example, water or drilling mud) and/or gas (compressed air), will be required for the majority of drilling methods that will be used to construct the remedy well network. Drilling fluids are critical for removing cuttings from the borehole, controlling borehole pressure, and cooling the drilling tools. The primary drilling fluids used during construction will be compressed air and/or water; however, while not preferred for drilling at Topock, drilling fluid additives might be required based on field conditions. Drilling additives used will be commercially available products typically used in the water supply and environmental drilling industry and will be compliant with National Science Foundation (NSF)/ American National Standards Institute (ANSI) *Standard 60: Drinking Water Treatment Chemicals – Health Effects*. Examples of potential additives include foaming agents (Baroid Quik Foam), bentonite-based products, and fluid control additives (soda ash, Baroid Quik Gel, Quik-Trol, EZ-Mud, Penetrol, and N-Seal). The function of some example drilling additives and the example ingredients are included in Exhibit 3.2-1.

EXHIBIT 3.2-1
Example Drilling Fluid Additives
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Additive Function	Example Ingredients	Ingredient Percent/Weight	Example Trade Name
Foaming agent (cuttings removal)	Ethanol, Isopropanol	5-10% each	Quik-Foam
Filtrate control and borehole stability	Polysaccharide	60-100%	Quick-Trol
Filtrate control and clay inhibitor	Light petroleum distillate	10-30%	EZ-Mud
Viscosifier and fluid loss control	Sodium bentonite with trace silica	100%	Quik-Gel
Lost circulation material (acid soluble)	Slag wool fiber	60-100%	N-Seal

When compressed air and/or water are used as the primary drilling fluid, the total amount of additive used is typically a small percentage of the total volume of water purged or generated during the drilling process. For example, it is estimated that the average borehole could generate approximately 85,000 gallons of water when drilled at Topock using compressed air as the primary drilling fluid, of which the total volume of additive ingredient used is estimated to be less than 10 gallons. In this example, which assumes Quik-Foam will be needed, the additive ingredients represent less than 0.001 percent of the total water generated during drilling. When drilling mud is required, which uses solids like bentonite and liquid additives like those previously listed, this percentage would be higher because the total volume of water generated would be less (drilling mud is engineered to limit the volume of water that enters/exits the borehole during drilling); however, the percentage of additive relative to total volume of water generated would still be small.

The use of some drilling fluid additives (e.g., organic based additives), if not completely removed during the drilling and well development process, could alter the redox and geochemical environment in the aquifer proximate to the given borehole. This could lead to misleading laboratory results for groundwater samples collected during the time these additives persist in the aquifer. For this reason, in addition to the general objective of trying to minimize the amount of foreign material introduced to the subsurface during drilling, well construction and development, additives should be avoided to the extent possible. If additives are utilized the types and volumes used as well as the volumes of drilling fluid returned during drilling and the volume of groundwater removed during well development will be documented in field logs and associated reports, and the potential effects of the additives on groundwater sample laboratory results will be presented along with the data.

Borehole Stabilization. During drilling, as was experienced during the installation of the freshwater supply well at Site B in Arizona, field conditions might require that a borehole be stabilized to prevent an unsafe working condition or limit the amount of formation material that is removed during drilling. This is typically addressed by using the drill rig to install a temporary or permanent conductor casing in the shallower portion of the borehole, or by filling the borehole with drilling fluid (as described in the previous section) to control borehole pressure. Temporary conductor casings, which could simply be larger-diameter sections of drilling pipe, are removed when drilling is complete, whereas permanent casings are incorporated into the design of a given well construction. As was the case at Site B, if void space around the borehole that can lead to slumping of the ground surface must be stabilized, then an appropriate material like cement bentonite grout must be used to fill the void created by the unstable borehole.

Borehole Decommissioning. The majority of boreholes drilled will be used to construct well(s), though some field conditions might require a borehole to be decommissioned (backfilled) without constructing a well. For example, if a smaller-diameter pilot borehole is drilled to collect borehole data, and the well will not be constructed until a later date (for example, the drill rig that will be used to ream the borehole to a sufficient diameter is not immediately available, or potential lag time in the fabrication of special order well materials), the borehole will be decommissioned albeit only temporarily. In another case, borehole data

might determine that a well should not be constructed at a given location and that the borehole should be decommissioned permanently.

Per discussion with DTSC, the practice of temporarily decommissioning a borehole, which will require a variance to the applicable well standards, will be minimized. PG&E will coordinate with and obtain approval from DTSC for temporarily backfilling boreholes on a case-by-case basis, as determined necessary during construction of any remediation or monitoring well.

When a borehole is to be permanently decommissioned, the methods and procedures detailed for exploratory boreholes in the SOP for well and borehole decommissioning (see Well-SOP-01 in Appendix B to this C/RAWP) will be followed. For example, in accordance with the minimum standards for decommissioning a borehole in the State of California, as established by the California Department of Water Resources in the California Well Standards, because these boreholes will be drilled in areas of known or potential soil and groundwater contamination, sealing material (for example, neat cement with up to 6 percent bentonite) is required throughout the entirety of the borehole; however, prior to drilling, PG&E will seek a variance to this approach with the appropriate permitting agency (San Bernardino County or Arizona Department of Water Resources) when a borehole is only to be temporarily backfilled. For pilot boreholes that will be subsequently overdrilled for well construction, PG&E will propose to temporarily backfill the boreholes by backfilling the deepest 10 feet of the borehole with a visually distinctive, clean backfill material (e.g., filter pack sand) so that when the borehole is subsequently overdrilled the plumbness of the overdrill can be ascertained. The remainder of the borehole will then be backfilled by allowing it to either naturally collapse or with the placement of clean granular material (sand). The drilling tools (bit and casing) will be removed from the borehole in 10- to 20-foot sections (as determined by the length of drill casing joints). As each section is removed, the total depth of the borehole will be verified to determine whether it has naturally collapsed (as is typically the case in the saturated portion of the borehole); if not, the borehole will be backfilled with clean material before the next section of drill casing is removed. By temporarily backfilling boreholes that will be subsequently overdrilled for well construction, the risk of compromising the hydraulic integrity of the borehole and adjacent formation is minimized. If sealing material is used to backfill these boreholes, there is risk that a new borehole would be needed for the planned well to function properly. It is assumed that temporarily backfilled boreholes will be overdrilled within 3 to 4 months for well construction. If it is determined that a temporarily backfilled borehole will not be used for well installation, it will be overdrilled and sealed in accordance with the applicable well standards.

In accordance with the Well-SOP-01, filler and sealing materials will be installed using a tremie pipe, which may include the drill casing depending on the drilling method. As determined necessary, an additional tremie pipe installed within the drill casing will be used to install fluid materials used for backfilling and sealing (grout) so that the material is introduced near the bottom of the borehole and standing water is displaced upward. Anticipated sealing and filler materials are defined in Well-SOP-01 in Appendix B to this C/RAWP.

3.2.1.2 Data Collection during Well Construction

The boreholes drilled during the construction of the remedy well network will be used to collect a variety of data, which will be used to refine the Topock conceptual site model and finalize well design details. The need for location-specific data collection will vary from one location to another (see Section 3.2.1.3 of this C/RAWP). In general, there are two primary data needs:

1. Collecting lithologic information to determine the grain size, sorting, and stratigraphy of the geologic formation. Specifically, this information will be used to design the optimal filter-pack material and screen aperture size for the wells, as well as to select the appropriate well screen intervals within the aquifer given the purpose of an individual well (for example, selection of the intervals for injection of water with/without carbon amendment, groundwater extraction, or for groundwater monitoring).

2. Collecting borehole groundwater samples to refine understanding of local changes in water quality throughout the aquifer (for example, the distribution of Cr(VI) concentrations). Specifically, this information will be used to select the appropriate well screen intervals within the aquifer given the purpose of an individual well.

The type of data needed from a given borehole will, in part, determine what drilling method is required. For example, if lithologic information from core is needed to finalize well design details, but a borehole diameter larger than what a rotosonic rig is capable of drilling is required for well construction, a pilot borehole might initially be installed with a rotosonic drill rig, and that pilot borehole would subsequently be overdrilled with a method capable of installing a larger-diameter borehole. As data are collected from the boreholes during construction or from testing of the constructed wells (see Section 3.2.1.5 of this C/RAWP), the results will be compared to existing data comprising the conceptual site model to determine the appropriate amount of additional data required to finalize individual well designs and construct the larger remedy well network. This section details the types of data that will be collected and the collection methods. A preliminary plan for how additional data will be collected and used to finalize well design at each scheduled well location is described in Section 3.2.1.3 to this C/RAWP. This plan will be assessed on an ongoing basis to determine if more, or less, data are required.

Lithologic Logging and Soil Sample Collection. Lithologic descriptions will be logged from each borehole based on visual inspection of the retrieved core or the drill cuttings under the supervision of a California Professional Geologist. Lithologic information will be collected from continuous core (that is, unconsolidated material and/or bedrock) at well locations where understanding the stratigraphy in detail is required to finalize well design details. Lithologic information may be collected from the drill cuttings at other locations. Unconsolidated sediments will be logged in accordance with the SOP-B3 in Appendix B to this C/RAWP. The field log will document the following information for each soil boring:

- Unique soil boring or well identification
- Purpose of the soil boring (monitoring well)
- Location in relation to an easily identifiable landmark
- Names of the drilling subcontractor and logger
- Start and finish dates and times
- Drilling method
- If applicable, types of drilling fluids, volume, and depths at which they were used
- Diameters of surface casing, casing type, and methods of installation
- Depth at which saturated conditions were first encountered
- Lithologic descriptions (based on the Unified Soil Classification System)
- Sampling-interval depths
- Zones of caving or heaving
- Depth at which drilling fluid was lost and the volume lost
- Changes in drilling fluid properties
- Drilling rate
- Drilling rig reactions, such as chatter, rod drops, and bouncing

Cored bedrock boreholes will be logged with the same procedure used for previous boreholes drilled at the site (for example, the East Ravine area). At a minimum, the lithologic log for cored bedrock boreholes will include the following information:

- Depth at which drilling fluid was lost and the volume lost
- Changes in drilling fluid properties
- Drilling rate
- Fractures per foot
- Lithologic descriptions (including structures, texture, foliations, bedding, grain size, and hardness)

- Alteration and weathering
- Percent core recovery
- Core discontinuity description
- Rock quality designation

At select locations, soil samples will be collected from the unconsolidated core or drill cuttings to analyze physical properties (for example, grain size distribution), and the results of analysis will be used to finalize well design details (for example, screen slot size and filter pack material). As they are collected, soil and bedrock core will be photo-documented in the field.

Borehole Groundwater Sample Collection. Groundwater samples will be collected from the borehole during the drilling process at select locations. The results of laboratory analysis of the samples will be used to evaluate water quality at multiple intervals within the aquifer at a given location, which will be used to finalize well design for select wells. For example, borehole groundwater samples (combined with borehole lithology data) will be used to select the appropriate screen intervals at a given monitoring well location. Similarly, these data can be used to identify intervals with elevated Cr(VI) concentrations that might be targeted by a screened interval for a carbon substrate injection well along the NTH IRZ. Exhibit 3.2-2 provides a preliminary list of well locations for borehole groundwater sample collection.

EXHIBIT 3.2-2
Preliminary List of Well Locations for Borehole Groundwater Sample Collection
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Category 1 (All Locations)	Category 2 (All Locations)	Category 3 (Key Pilot Boreholes Only)
MW-A	MW-I	IRZ-1
MW-P	MW-J	IRZ-5
MW-S	MW-O	IRZ-9
MW-Z	MW-Q	IRZ-13
MW-BB	MW-T	IRZ-15
MW-DD	MW-V	IRZ-20
MW-FF	MW-W	IRZ-27
MW-10D	MW-X	IRZ-35
MW-11D	MW-AA	
MW-70BR-D	MW-CC	
MW-U	MW-GG	
MW-M	MW-HH	
MW-L	MW-II	
MW-R	RB-1	
	RB-2	
	RB-3	
	RB-4	
	RB-5	
	MW-H	
	MW-N	
	MW-Y	

Notes:

1. This preliminary list of well locations for borehole groundwater sample collection is subject to change based on observations in the field, and could result in more or less boreholes being utilized for sample collection.
2. Typically, only one borehole at a given well location (the deepest) will be utilized for borehole groundwater sample collection.
3. Refer to Section 3.2.1.3 for definition of well categories.

Borehole groundwater samples will be collected from specific intervals of select boreholes drilled within the unconsolidated aquifer. When the water table is reached, samples will be collected from the borehole approximately every 30 to 50 feet, or as significant hydrogeologic changes are identified during drilling (for example, if bedrock is encountered, a sample might be collected directly above bedrock), to assess changes in water quality with depth and qualitative changes in borehole capacity[1]. The only exception to this frequency is when borehole groundwater samples are being collected to support the design of a well that will supplement an existing well (i.e., "twinned" wells at the same location). For example, if a well is being installed to evaluate deeper water quality where a water table well already exists, samples will typically only be collected from depths deeper than the existing well screen interval(s). Alternatively, only shallower borehole groundwater samples might be collected to support the design of a well supplementing an existing deeper well.

The specific method that will be used to collect these samples will depend on the drilling method being used; however, the general approach will be similar. The borehole will be drilled to the bottom depth of the sample interval, then the drill casing will be retracted to the top depth of the interval, and the sample zone will be isolated. For example, the preferred method when drilling with a casing advance drilling method (for example, rotosonic, or rotary with casing advance) is placing a temporary well screen in the bottom of the borehole and retracting the drive casing to expose the temporary well screen. A packer attached to the temporary well casing will be used to isolate the screen from the water column in the cased borehole above. After the sampling interval is established, the sample will be collected by purging the temporary well with an electric submersible pump or equivalent that minimizes disturbance of the purged water and maximizes data quality (airlift will be the least preferred groundwater purging method for sample collection). If it is determined that this method is not practical, based on subsurface conditions (for example, heaving conditions), then the sample could be collected by simply pumping from within the drill casing using an electric submersible pump. Water quality measurements will be monitored on the pump effluent at the surface (for example, specific conductance, pH, temperature, and oxidation-reduction potential), and the temporary screen will be considered developed (ready for sample collection) once measurements are indicative of estimated aquifer conditions as compared to the water used for drilling (for example, elevated specific conductance when compared to lower specific conductance drilling water). Like past data collection efforts conducted during drilling to support well design, collected borehole groundwater samples will be analyzed onsite for Cr(VI) and Cr(T) in accordance with SOP-L01 and SOP-L03, respectively, and duplicate samples will be submitted to a certified offsite laboratory for confirmation at a frequency of approximately 10 percent (in accordance with the QAPP). Analysis for other constituents, either using the onsite or offsite laboratories, will be added as needed.

Borehole groundwater samples will not be collected during the drilling process in bedrock. Section 3.2.1.4 contains more information regarding the approach to the characterization of deeper bedrock at the MW-70 cluster location.

Borehole Geophysical Logging. Borehole geophysical logging provides information about formation mineralogy and aquifer characteristics; however, the effectiveness of geophysical logging is limited in steel-cased boreholes (boreholes drilled with rotosonic and rotary with casing advance). The determination to conduct borehole geophysical logging will be made in the field when drilling conditions are appropriate and as needed to finalize design details for the remedy well network. Examples of the types of geophysical logs that might be performed include:

- Caliper log
- Natural gamma ray log
- Electric logs (spontaneous potential, short and long normal)

[1] Borehole capacity is a qualitative measurement of aquifer yield (observing drawdown in the borehole for a given extraction rate during drilling or pumping of the open borehole), but cannot be used as a measure of permeability or transmissivity.

- Acoustic televiewer log
- Video log

Borehole geophysical logging involves lowering equipment (for example, electronic sensors and cameras) into the borehole (or well) on a cable. The equipment passively collects data while being lowered from ground surface to total depth. At the surface, the equipment in the work zone typically only includes a van or truck containing the winch and electronics required to lower the sensors and process the data.

Well Sampling. Groundwater samples will be collected from select wells to guide decisions during construction of the well network. For example, as detailed in Section 3.2.1.3, water quality samples will be collected and analyzed from key wells (referred to as Category 1) to determine proper siting of key extraction, injection, and monitoring wells. The methods and procedures for the collection of groundwater samples from wells will follow those identified in Volume 2 of the O&M Manual. Groundwater samples collected from wells will be analyzed at a certified offsite laboratory for Cr(T), Cr(VI), or other constituents, as needed.

The equipment required for well sampling will be the same as that currently used for the Topock groundwater monitoring program, and as detailed in Volume 2 of the O&M Manual. Typically, this includes one vehicle (a truck or off-highway vehicle) equipped to conduct all sampling tasks, including purge water storage. Additional vehicles are sometimes used to support the sampling.

3.2.1.3 Approach to Finalizing Well Design and/or Siting

Preliminary well designs for each remediation and monitoring well are provided in Tables 3.2-1 through 3.2-5 and include the number of screened intervals for each well location, the depth intervals to be screened, and the total depths of the wells (these tables, as well as additional well design basis information is provided in Section 3 of the Final BOD). This preliminary design information is based on general assumptions about the aquifer and the current conceptual site model. The final determination of the well design details will be made based on information collected in the field during construction and testing of the well network. Well design and/or siting will follow a structured, iterative, timely, and adaptive approach so that uncertainties inherent within the hydrogeological setting at Topock can be minimized and inform the decisions required to construct the wells to meet remedy objectives. This section presents the framework for the collection, interpretation, and communication of the data collected during well network construction and the resulting well construction decisions.

As summarized in Section 3.2.1.2, additional data will be collected during construction of the groundwater remedy well network to finalize well design and, in some cases, well siting. Based on a review of the key information required to construct the well network, each new well has been assigned to one of three categories differentiated by the types of decisions that will be made based on observations and analysis during construction. The three categories are summarized in Exhibit 3.2-3. New well locations comprising the groundwater remedy well network have been color-coded on Figure 3.2-1 to indicate the estimated category assignment. It is anticipated that the well category designations, especially for those in categories 2 and 3, will be continually assessed throughout construction of the remedy well network and will be re-designated as appropriate based on findings in the field. PG&E will update the agencies of re-designated wells via monthly progress reports as defined in Section 2 of this C/RAWP.

EXHIBIT 3.2-3
Summary of Well Categories
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Category	Is Location-specific Data Needed to Finalize Well Location(s)?	Is Location-specific Data Needed to Finalize Design?
Category 1	Yes	Yes
Category 2	No	Yes
Category 3	No	Potentially

The detailed approach to drilling, data collection, and construction of wells for each category is presented in the following subsections.

Approach to Category 1 Locations. Category 1 wells have been designated in areas where existing uncertainties in the current conceptual site model may drive final well siting and/or design, as well as the other associated remedy infrastructure (pipelines). These areas include the northern area of the NTH IRZ, the IRL injection area in the uplands, the southern freshwater injection well (FW-2) area, the western margin of the plume, and the East Ravine area. In each of these areas, an already planned monitoring well(s) have been designated as Category 1 well location(s). Data collection at these locations will be scheduled early in the construction schedule to confirm the assumptions in the basis of design for these areas prior to moving forward with the construction of other wells and remedy infrastructure. In the Upland, where multiple Category 1 locations are planned, an "east to west" approach to Category 1 well installation will generally be applied (see Exhibit 3.3-2 in Section 3.3.3 for more detail). Specifically, in response to a comment on the 90% BOD, well MW-DD will be sequenced as the last Category 1 well to be installed in the upland. This approach will minimize the potential for uncertainties in the conceptual site model to cause unnecessary disturbance (that is, avoid constructing unnecessary infrastructure). A summary of Category 1 well locations, key design assumptions that will be confirmed at each, and dependent wells associated with each is provided in Table 3.2-6. The process for data collection, communication, and associated decision making at Category 1 locations will be iterative, and more than one pilot boring and/or monitoring well may be required to confirm the location and design of adjacent remediation/monitoring wells. The process is as follows:

1. Install a pilot borehole generally through the entire thickness of the unconsolidated aquifer. This borehole will be used to collect lithologic data and borehole groundwater samples and, pending Step 2, to construct the Category 1 monitoring well.
2. Analyze pilot borehole data. Use the lithologic and water quality data to confirm the designed well location and determine what intervals of the aquifer should be screened.
    a. If the data collected from the pilot borehole indicate that key design assumptions used in the basis of design are incorrect, PG&E will organize a real-time conference call (concurrent with fieldwork) with the agencies prior to the construction of the Category 1 well. The purposes of the call will be to review the data collected, reach consensus on the appropriate next steps at the given location, and examine the potential effects these data might have on the siting of other nearby wells (potentially pending the results of Step 4). Changes in a Category 1 well location, design, or function may result from Cr(VI) concentrations in the borehole samples that deviate significantly from those projected in the basis of design or if it is determined the lithologic and/or water quality data indicate a hydrogeologic condition that deviates substantially from the site conceptual model. Alternatively, it could be determined that a well is not necessary at the Category 1 location and that the pilot borehole should be permanently decommissioned (see Step 3).
    b. If the borehole data collected confirm the key assumptions used in the basis of design, the Category 1 monitoring well will be constructed consistent with the design detailed in Table 3.2-6 as a design basis and as appropriate based on the borehole data collected. A summary of the lithologic and water quality data collected will be communicated to the agencies via monthly progress reports as defined in Section 2 of this C/RAWP.
3. Construct and develop the Category 1 well(s), or decommission the pilot borehole in accordance with the procedures detailed in Section 3.2.1.1, and implement new path forward as agreed upon with the agencies in Step 2a. A summary of final well construction information will be communicated to the agencies via monthly progress reports as defined in Section 2 of this C/RAWP.
4. Collect groundwater sample(s), as needed, from the constructed Category 1 well(s) to confirm the data collected from the pilot borehole and verify whether nearby wells are properly sited, should be moved

to meet their defined objective, or potentially whether other wells should be added or deleted to meet remedy objectives.

a. If the data collected from constructed Category 1 well(s) indicate that key design assumptions used in the basis of design are incorrect, PG&E will organize a real-time conference call (concurrent with fieldwork) with the agencies prior to constructing dependent wells and associated well infrastructure. The purpose of the call will be to review the data collected and reach consensus on the appropriate next steps for the given area.

b. If the data collected from constructed Category 1 well(s) confirm the key assumptions used in the basis of design, construction of dependent wells and associated infrastructure in the given area will move forward. A summary of the water quality data collected will be communicated to the agencies via monthly progress reports as defined in Section 2 of this C/RAWP.

5. Proceed with design and construction of nearby Category 2 and/or Category 3 wells or, if alternate siting is required, proceed with the installation of the new Category 1 pilot borehole/well for the given area.

Approach to Category 2 Locations. Category 2 wells require borehole-specific data collection to finalize well design (selection of screened intervals), but unlike Category 1, the location of the well is not anticipated to change based on the results. Category 2 wells include monitoring wells located outside of the plume where existing subsurface data is more sparse, wells that are part of the arsenic monitoring network, and the River Bank Extraction Wells (RB-1 through RB-5), where the selection of screened intervals will be dependent on borehole-specific observations (see the River Bank Extraction Wells subsection in Section 3.2.1.4). The process for data collection, communication, and associated decision making at Category 2 locations is as follows:

1. Install a pilot borehole generally through the entire thickness of the unconsolidated aquifer. This borehole will be used to collect lithologic data and borehole groundwater samples and, ultimately, to construct the Category 2 well.

2. Analyze pilot borehole data. Use the lithologic and water quality data to determine what intervals of the aquifer should be screened. PG&E will organize a real-time conference call (concurrent with fieldwork) with the agencies, as available, prior to construction of the Category 2 well. If the agency representatives are unavailable to discuss the data in a reasonable amount of time, PG&E will proceed with well construction. A summary of the lithologic and water quality data collected for the given Category 2 well will be communicated to the agencies via monthly progress reports as defined in Section 2 of this C/RAWP.

3. Construct and develop the Category 2 well(s). A summary of final well construction information will be communicated to the agencies via monthly progress reports as defined in Section 2 of this C/RAWP.

Approach to Category 3 Locations. Category 3 wells are located in areas where the conceptual site model is reasonably defined and/or will become more defined given the density of new wells that will be constructed. Category 3 wells will require a blend of borehole-specific data and/or supplemental data from adjacent boreholes and wells to finalize well design, but unlike Category 1, the location of the well is not anticipated to change. For example, due to the relatively close spacing of the IRZ wells, only certain wells may require pilot boreholes to finalize well design, particularly to the south where the aquifer is thin and the distribution of Cr(VI) is generally throughout the entire aquifer. Borehole data will be collected from pilot boreholes at an initial group of Category 3 well locations to finalize well design at these locations: IRZ-1, -5, -9, -11, -13, -15, -17, -20, -27, and -35. The design of subsequent wells will be finalized using the data collected from these locations, other predecessor locations, and/or additional pilot boreholes, as determined necessary. Similarly, freshwater injection well FW-2 and injection wells IRL-1 though IRL-4 are located in areas that will be characterized during the construction of Category 1 wells, so additional borehole-specific data (other than grain-size information for finalizing the design well screen and gravel pack specifications) is not anticipated to be critical to finalize well design. Upon analysis of the data collected

from the initial pilot boreholes (and other existing data), the need for additional pilot borings and data collection to support Category 3 well design will be evaluated based on the proximity, uniformity, and conformity of the pilot borehole data already collected.

The process for data collection, communication, and associated decision making at Category 3 wells is as follows:

1. Install Category 3 pilot borehole(s) in a given focus area (for example, pilot boreholes along the NTH IRZ), generally through the entire thickness of the unconsolidated aquifer. These borehole(s) will be used to collect lithologic data and borehole groundwater samples and, ultimately, to construct the Category 3 well. Once data collection is complete, temporarily decommission the pilot borehole in accordance with the procedures detailed in Section 3.2.1.1.
2. Evaluate data collected from the pilot borehole(s) and adjacent pilot boreholes and wells and determine whether supplemental data are needed to finalize Category 3 well design details for a given area. Install additional pilot borehole(s) at planned Category 3 locations as determined necessary.
3. Finalize Category 3 well design for a given well or group of wells. Analyze pilot borehole data and data from nearby wells for a given area to determine what intervals of the aquifer should be screened, and the design of well screen and gravel pack specifications for the Category 3 well(s) in that area. A summary of the lithologic and water quality data collected for the given Category 3 well/area will be communicated to the agencies via monthly progress reports as defined in Section 2 of this C/RAWP.
4. Install/overdrill the borehole for Category 3 well construction. For locations where a pilot borehole was installed, the pilot borehole will be overdrilled for well construction. If a pilot borehole was not installed, then drill cuttings will be used to confirm the lithologic assumptions and screen interval determinations that were finalized in Step 3 (and adjusted as necessary). A summary of final well construction information will be communicated to the agencies via monthly progress reports as defined in Section 2 of this C/RAWP.

3.2.1.4 Well Construction and Development

This section summarizes the types of wells that comprise the remedy well network, preliminary well design, key data required to finalize well design, well construction methods and materials, well development, and well surface completion and instrumentation. Additional details related to well design and purpose during remedy operation are included in Sections 3.2 and 3.6 of the Final BOD.

Well Types and Preliminary Design. This section provides a summary of the number, types, and design basis for remedy wells, as included in Sections 3.2 and 3.6 of the Final BOD. The preliminary estimates for remediation and monitoring well screen lengths and depths are summarized Tables 3.2-1 through 3.2-5, which are also included in Section 3 of the Final BOD. Generalized well design drawings are included in Appendix D of the Final BOD. Preliminary well design details including screened intervals, screen lengths, number of screens, screen/filter pack specifications, and in-well infrastructure will be finalized concurrent with construction pending the evaluation of data collected during drilling and well testing, as discussed in Section 3.2.1.3.

NTH IRZ Wells. The NTH IRZ, which is composed of 28 wells (divided among 20 locations), will act as a recirculating system in which water extracted via the four NTH IRZ Extraction Wells will be amended with carbon substrate and re-injected into the NTH IRZ line via the 24 NTH IRZ Injection Wells. Each of the wells will be constructed using up to 12-inch-nominal-diameter well casing with one or two screened intervals to target specific intervals of the unconsolidated sediments. Final determination of the screened intervals will be made based on information collected in the field during borehole installation, and it is possible that the final determination of screened intervals could result in a change to the designed number of screen intervals at a given NTH IRZ well location. In turn, a change in the number of screened intervals could result in a change in the total number of wells required at that location to accomplish the objectives of the NTH IRZ, in the associated wellhead (for example, vault design), or to down-well piping and equipment. For example, an

increase in the number of screen intervals at a given location that requires discrete control of injected carbon-amended water could result in the need to construct an additional well at that location (that is, next to the initial well) because a single well can accommodate, at most, two discrete screened intervals separated by a pneumatic packer. Alternatively, if fewer screened intervals are required, a well that was initially planned for construction may be reserved as a future provisional well. Key information that will be evaluated to finalize the design of the NTH IRZ network include the following:

- **Saturated thickness of the unconsolidated aquifer.** The design currently assumes that more screened intervals are required for wells in the northern portion of the NTH IRZ and fewer screened intervals are required in the southern portion, based on the assumption that saturated thickness of the unconsolidated aquifer thins to the south. As saturated thickness is confirmed through the installation of pilot boreholes and boreholes for well construction, the number of required screen intervals (and length of each) will be finalized.
- **Water quality within the unconsolidated aquifer.** The NTH IRZ wells are designed to inject carbon-amended water into discrete portions of the aquifer. The results of groundwater samples collected from the pilot boreholes and water quality data from the existing groundwater monitoring network (including planned Category 1 monitoring well location MW-A) will be evaluated to identify portions of the aquifer with elevated Cr(VI) concentrations relative to other intervals (qualitative changes in borehole capacity observed during borehole groundwater sample collection will also be considered, see Section 3.2.1.2). These data will be considered when selecting the screened intervals for these wells. Additionally, the northernmost extent of the NTH IRZ well network is based on the current understanding of the extent of the Cr(VI) plume in this area. The results of groundwater samples collected from the MW-A location and water quality data from the existing groundwater monitoring network in this area will be evaluated to identify whether additional wells north of IRZ-1 and MW-35 may be needed.
- **Well performance.** Following the development of a given well, the specific capacity/injectivity will be compared to assumptions used in the design. Lower-than-predicted flow or injection rates will not necessarily indicate that additional wells are required. Sustainable flow rates will be considered in the context of the conceptual site model, which will be continually updated as needed during remedy implementation and will be used to assess the potential need to replace or add wells to the NTH IRZ well network.

Thirty-one future provisional NTH IRZ wells (divided among 20 locations) are identified in the Final BOD.

River Bank Extraction Wells. Five extraction wells (RB-1 through RB-5) will be constructed along the bank of the Colorado River as the downgradient component of the Inner Recirculation Loop. The River Bank Extraction Wells will be constructed using up to 12-inch-nominal-diameter well casing with two screened intervals. Each well will be constructed with one screened interval to target the deeper portions of the aquifer, as well as a second shallow screen interval should extraction from both intervals be required in the future. Initially, groundwater will only be extracted from the lower screen, which will be isolated from the shallower screen interval with a pneumatic packer. Key information that will be evaluated to finalize the design of the River Bank Extraction Well network include:

- **Saturated thickness of the unconsolidated aquifer.** The design currently estimates lengths for two screened intervals for each of the RB Extraction Wells based on model layer thickness assumptions. As total saturated thickness is confirmed through the installation of pilot boreholes and boreholes for well construction, the length of the individual screened intervals will be finalized.
- **Water quality within the unconsolidated aquifer.** The RB Extraction Wells are designed such that the lower screen is constructed beneath the reducing rind of the Colorado River to minimize both negative hydraulic impacts to this zone and the potential for well fouling. The results of groundwater samples collected from the pilot boreholes and water quality data from the existing groundwater monitoring network will be evaluated to identify changes in water quality with depth indicative of the naturally

reduced groundwater. These changes will be considered when selecting the screened intervals for these wells.

- **Well performance.** Following the development of a given well, the specific capacity will be compared to assumptions used in the design. Lower-than-predicted flow rates will not necessarily indicate that additional wells are required. Sustainable flow rates will be considered in the context of the conceptual site model, which will be continually updated as needed during remedy implementation and used to assess the potential need to replace or add wells to the River Bank Extraction Well network.

Four future provisional RB Extraction Well locations (RB-6 through RB-9) are identified in the Final BOD.

Inner Recirculation Loop Injection Wells. Four injection wells (IRL-1 through IRL-4) will be constructed in the upland area of the site, near the western margin of the groundwater plume north of I-40, as the upgradient component of the IRL. Each of the wells will be constructed using up to 12-inch-nominal-diameter well casing with two screened intervals. Each well will be constructed with one screened interval to target the shallower portions of the aquifer, as well as a second deeper screen interval The two screened intervals will be isolated from each other with a section of blank casing and annular well seal (see Well Construction Methods and Materials below) with a pneumatic packer, as necessary. The screened intervals for wells IRL-1 and IRL-2 will be located such that the shallow screen spans approximately the upper one-third of the saturated aquifer thickness and the deep screen spans the lower two-thirds of the saturated aquifer thickness. The screened intervals for wells IRL-3 and IRL-4 will be located such that the shallow screen spans approximately the upper two-thirds of the saturated aquifer thickness and the deep screen spans the lower one-third of the saturated aquifer thickness. In each case, a blank casing section approximately 20 feet long will be installed between the shallow and deep screens so that the borehole annulus between the two screens can be sealed. The placement of the upper and lower screened intervals for wells IRL-1 through -4 are approximate and may be adjusted based on field data (that is, the blank casing section could be moved up or down to isolate a finer-grained portion of the unconsolidated aquifer, as encountered). Key information that will be evaluated to finalize the design of the IRL Injection Well network includes the following:

- **Saturated thickness of the unconsolidated aquifer.** The design currently estimates lengths for two screened intervals for each of the IRL Injection Wells based on model layer thickness assumptions. As total thickness is confirmed through the installation of pilot boreholes and boreholes for well construction, the length of the individual screened intervals will be finalized.
- **Water quality within the unconsolidated aquifer.** The IRL Injection Wells are designed such that they are located near the western margin of the groundwater plume north of I-40. Further, the upper and lower screened intervals will be constructed at depths that generally correspond with changes in naturally occurring total dissolved solids (TDS) concentrations with depth (lower TDS water is typically observed shallower in the unconsolidated aquifer in the upland area). Water quality data from the existing groundwater monitoring network will be evaluated to identify changes in water quality, with depth indicative of the naturally occurring TDS concentrations. These changes will be considered when selecting the screened intervals for these wells.
- **Well performance.** Following the development of a given well, the specific injectivity will be compared to assumptions used in the design. Specifically, the injection rates from each of the IRL Injection Wells will be compared to the nominal flow rates that were used in the design. Lower-than-predicted injection rates a specific well will not necessarily indicate that additional wells are required. Sustainable flow rates for each of the injection wells will be considered in the context of the conceptual site model, which will be continually updated as needed during remedy implementation and used to assess the potential need to replace or add wells to the IRL Injection Well network. For example, if the sustainable flow rate is less than that used in the design, then the model will be updated with the most current field data (using the update frequencies presented in Appendix B) to determine if this flow rate is expected to maintain the objectives of the given injection well in the context of the performance of the entire line of IRL Injection

Wells. The decision to add wells will only be made after this analysis, which is based on well and aquifer testing data collected during construction, is performed.

Three future provisional IRL Injection Wells (IRL-5 through IRL-7) are identified in the Final BOD.

Transwestern Bench Extraction Wells. Two extraction wells (TWB-1 and TWB-2) will be constructed northeast of the TCS where the unconsolidated aquifer extends southward following a depression in the bedrock to capture Cr(VI)-impacted groundwater. These wells are a downgradient component of the TCS recirculation loop. Each of the wells will be constructed using up to 12-inch-nominal-diameter well casing with one or two screened intervals to target specific intervals of the unconsolidated aquifer. Key information that will be evaluated to finalize the design of the TW Bench Extraction Well network includes the following:

- **Unconsolidated aquifer thickness and composition.** The design currently estimates a length for one screened interval for each of the TW Bench Extraction Wells based on model layer thickness assumptions. As is typical for extraction well design, the screened interval is placed in the lower portion of the aquifer to account for water-level drawdown during operation. As total thickness and the geologic composition of the aquifer is confirmed through the installation of pilot boreholes and boreholes for well construction, the length and depths of the individual screened interval(s) will be finalized.
- **Water quality within the unconsolidated aquifer.** The TW Bench Extraction Wells are designed to remove Cr(VI)-impacted groundwater from the unconsolidated aquifer. Therefore, the results of groundwater samples collected from pilot boreholes and the existing groundwater monitoring network will be evaluated to confirm elevated Cr(VI) concentrations with depth. The total depth of Cr(VI)-impacted groundwater will be considered when selecting the screened interval(s) for these wells such that extraction is focused at the appropriate depth.
- **Well performance.** Following the development of a given well, the specific capacity will be compared to assumptions used in the design. Lower-than-predicted flow rates will not necessarily indicate that additional wells are required. Sustainable flow rates will be considered in the context of the conceptual site model, which will be continually updated as needed during remedy implementation and used to assess the potential need to replace or add wells to the TW Bench Extraction Well network.

Two provisional TW Bench Extraction Wells are identified in the Final BOD (TWB-3 and TWB-4).

East Ravine Extraction Wells. Four extraction wells (ER-1 through ER-4) will be constructed at the eastern end of the East Ravine area to provide hydraulic capture of Cr(VI)-impacted groundwater in bedrock. In addition, an existing monitoring well (MW-70BR-225) will be converted to function as a fifth extraction well in the East Ravine bedrock (ER-6). Like the TW Bench Extraction Wells, these wells are a downgradient component of the TCS recirculation loop. Each of the wells will be constructed using 12-inch-nominal-diameter conductor casing to the top of competent bedrock. This conductor casing will be cemented in place. A 5- to 6-inch-diameter (nominal) borehole will be drilled out of the bottom of the conductor casing to total borehole depth. Depending on the condition of the bedrock encountered during drilling, a sleeve casing composed of slotted polyvinyl chloride (PVC) well screen might be placed into the borehole to prevent borehole collapse during well operation. The design of East Ravine Extraction Well network will be finalized pending the evaluation of the following key information:

- **Water quality within the bedrock.** The East Ravine Extraction Wells (ER-1 through ER-4) are designed to extract groundwater such that they hydraulically capture Cr(VI)-impacted groundwater in East Ravine area bedrock. While water quality data from the extraction well boreholes is not critical for proper well design, the vertical characterization data collected from planned monitoring well MW-70BR-D and the existing monitoring well network will be considered prior to finalizing extraction well design.
- **Well performance.** Following the development of each East Ravine Extraction Well, borehole caliper and tele-viewer logs will be conducted to assess the baseline physical borehole condition, and the specific capacity will be compared to assumptions used in the design. Specifically, the combined extraction rates

from each of the East Ravine Extraction Wells will be compared to total nominal flow rate of 5 gallons per minute (gpm) that was used in the design. Lower-than-predicted flow from a specific well will not necessarily indicate that additional wells are required. Sustainable average flow rates for the line of extraction wells will be considered in the context of the conceptual site model, which will be continually updated as needed during remedy implementation and used to assess the potential need to replace, deepen, or add wells to the East Ravine Extraction Well network. For example, if the total average sustainable flow rate is only 4.5 gpm, then the model will be updated with the most current field data (using the update frequencies presented in Appendix B) to determine if this flow rate is expected to maintain the objectives of the extraction well line, or if wells are need to be replaced, deepened, or added. The application of geophysical logging, including borehole flow testing, might be appropriate to evaluate the hydrogeologic conditions within East Ravine Extraction Well(s) prior to deciding to replace, deepen, or add a well.

Six provisional East Ravine Extraction Wells are identified in the Final BOD (ER-5 and ER-7 through ER-11).

TCS Injection Wells. Two injection wells will be constructed on the TCS to deliver carbon-amended groundwater from the TW Bench and East Ravine Extraction Wells to the unconsolidated aquifer. These wells are the upgradient component of the TCS recirculation loop. Each of the wells will be constructed using up to 12-inch-nominal-diameter well casing with one or two discrete screened intervals of the unconsolidated alluvial sediments. Key information that will be evaluated to finalize the design of the TCS Injection Well network includes the following:

- **Unconsolidated aquifer thickness and composition.** The design currently estimates a dual-screen design for the TCS Injection Wells, and the screened intervals will be selected based on the thickness and composition of the unconsolidated aquifer. While both these parameters are reasonably well-defined by characterization work conducted for the installation of existing nearby monitoring wells, this information will be confirmed during the installation of the boreholes for these wells, and the individual screened interval(s) will be finalized.
- **Water quality within the unconsolidated aquifer.** The water quality of the unconsolidated aquifer in the area of the TCS Injection Wells is well characterized by the existing monitoring well network; however, because the TCS Injection Wells are designed to inject carbon-amended groundwater to unconsolidated aquifer, in general, water quality data are not critical for proper well design. Regardless, the existing water quality data will be considered when finalizing well design.
- **Well performance.** Following the development of a given well, the specific injectivity will be compared to assumptions used in the design. Lower-than-predicted injection rates will not necessarily indicate that additional wells are required. Sustainable flow rates will be considered in the context of the conceptual site model, which will be continually updated as needed during remedy implementation and used to assess the potential need to replace or add wells to the TCS Injection Well network.

Freshwater Injection Wells. Two Freshwater Injection Wells, one in the upland area (FW-1) and another west of the TCS on the west side of Bat Cave Wash (FW-2) will be constructed outside of the plume to deliver fresh water to the aquifer and increase the hydraulic gradient across the site. Each of the wells will be constructed using up to 12-inch-nominal-diameter well casing with a single well screen interval across the majority of the unconsolidated aquifer. Key information that will be evaluated to finalize the design of the Freshwater Injection Well network includes the following:

- **Unconsolidated aquifer thickness and composition.** The design currently estimates the length for one screened interval for each of the Freshwater Injection Wells based on model layer thickness assumptions. As total thickness is confirmed through the installation of pilot boreholes and boreholes for well construction, the length of the individual screened intervals will be finalized. While the saturated thickness in the FW-1 area is reasonably well characterized, it is less so in the FW-2 area. If

sufficient saturated thickness above the bedrock surface is not present at the planned FW-2 location, an alternate location may need to be identified.

- **Water quality within the unconsolidated aquifer.** The Freshwater Injection Wells are designed to be located outside of the Cr(VI) plume. The results of groundwater samples collected from pilot boreholes and/or planned Category 1 monitoring well MW-S will be considered prior to the installation of FW-2. The water quality of the unconsolidated aquifer in the area of FW-1 is well-characterized, and IM-3 injection of treated water has been conducted in this area for many years. While the final location of FW-2 is subject to additional data collection, the location for FW-1 is unlikely to change based on additional data from nearby wells.
- **Well performance.** Following the development of a given well, the specific injectivity will be compared to assumptions used in the design. Lower-than-predicted injection rates will not necessarily indicate that additional wells are required. Sustainable flow rates will be considered in the context of the conceptual site model, which will be continually updated, as needed, during remedy implementation and used to assess the potential need to replace or add wells to the Freshwater Injection Well network.

Monitoring Wells. The existing monitoring well network will be augmented by an additional 36 monitoring well locations. The number of screened intervals that will be required at each new location is estimated in Table 3.2-5, based on the assumption for thickness of the unconsolidated aquifer in the model, or as determined by location-specific objectives (for example, MW-10D, where only one screened interval will be added above bedrock to supplement existing well MW-10). These monitoring wells will serve a variety of purposes related to monitoring the effects and progress of groundwater remedy operation. The final design of each monitoring well will depend on variables evaluated during construction, including the hydrogeologic condition at each location, well utility requirements, and constructability (see Section 3.6 of the Final BOD). While multiple screen intervals will be required at most new monitoring well locations, effort will be made to optimize final monitoring well designs so that the total number of boreholes required is minimized. It is estimated that monitoring wells will be constructed with 2-inch-nominal-diameter PVC casing and screen and that these casings will be nested in as few boreholes as practicable at each location (this is estimated to be one or two boreholes per location, but could potentially be more depending on final monitoring requirements and subsurface conditions). Key information that will be evaluated to finalize the design of the additional wells includes the following:

- **Saturated thickness of the unconsolidated aquifer.** In general, the design currently assumes that more screen intervals are required for monitoring well locations in the northern portion of the remediation project area and fewer screened intervals in the southern portion based on the assumption that saturated thickness of the unconsolidated aquifer thins to the south. As saturated thickness is confirmed through installing pilot boreholes and boreholes for well construction, the number of required screen intervals (and length of each) will be finalized.
- **Water quality within the unconsolidated aquifer.** The monitoring wells are designed to provide water quality data from discrete portions of the aquifer. For monitoring wells located within the Cr(VI) plume, the results of groundwater samples collected from the pilot boreholes and water quality data from the existing groundwater monitoring network will be evaluated to identify portions of the aquifer with elevated Cr(VI) concentrations relative to other intervals. The intervals with the elevated Cr(VI) concentrations will be considered when selecting the screened intervals for these wells. Wells designed to monitor byproducts in IRL injection areas (MW-I and MW-J) and wells designed to monitor dose response (MW-P and MW-Q) are located outside the Cr(VI) plume and do not have a chemical-specific monitoring objective. Therefore, water quality data are not critical to finalize design the design of these monitoring wells.
- **Water quality within the bedrock in the East Ravine area.** Monitoring well MW-70BR-D is designed to provide vertical characterization of Cr(VI) in bedrock at existing well location MW-70BR-225. This borehole will be drilled to evaluate approximately 60 feet deeper than the bottom of MW-70BR-225

(approximately 10 feet of separation with 50 feet of open borehole). The open portion of the MW-70BR-D borehole will initially be sampled to assess water quality. If depth-specific concentration data are determined necessary, a flow profile of the open potion of the borehole will be conducted to identify the depth(s) of water-producing fracture(s), and depth-specific samples will be collected from those depths, as appropriate.

- **Well performance.** Following the development of a given monitoring well, field water quality measurements will be evaluated to confirm that data are within the expected ranges. For example, elevated pH is an indicator of potential grout intrusion and might present the need to replace the given monitoring well.

Two provisional monitoring well locations (MW-V and MW-EE) are identified in the Final BOD; however, it is understood that the effectiveness of the monitoring network will be continuously assessed over the course of remediation and that additional wells will be installed, as needed. It is assumed that an additional 10 monitoring well locations, which might require multiple boreholes at each, could be required to supplement the monitoring well network during remedy operation as aquifer conditions change.

Well Construction Methods and Materials. The process for drilling the boreholes that will be used for well construction are detailed in Section 3.2.1.2. This section summarizes the methods and materials that will be used to construct the wells within the boreholes. Wells will be constructed in accordance with the California or Arizona well standards, as appropriate. Following construction and development of each injection and extraction well (excluding the East Ravine Extraction Wells unless determined necessary during construction), a video survey will be conducted to verify well construction details and the as-built condition of well screen, casing, and welded joints. A gyroscope survey will be conducted to verify that the well casing is plumb and straight, as determined necessary. Key elements of well construction include borehole diameter, well casing and screen installation, filter pack, and annular seal installation.

Borehole Diameter. The diameter of borehole required for extraction and injection well construction will ultimately depend on the diameter of the well casing that is selected. These wells are designed with casing up to 12 inches in nominal diameter (this does not apply to extraction wells constructed in the bedrock, which will be smaller in diameter); therefore, it is estimated that the borehole will need to be approximately 18 to 24 inches in diameter so that annular materials can be properly installed. During construction, the drilling methods and details will be continuously evaluated to minimize the diameter of the boreholes so that field efficiency is maximized and the volume of disturbed material generated is minimized.

The diameter of boreholes drilled for monitoring wells will depend on the number of casings nested in each borehole. For example, if two casings are nested in one borehole, then the borehole diameter will be up to 12 inches in diameter. If three or four casings are nested, then the borehole will be up to 24 inches in diameter; however, nesting more than two casings in one borehole presents complications for construction that will be evaluated for practicability in the field. “Telescoping” the diameter of monitoring well boreholes (that is, decreasing the borehole diameter at specific depths) might be a way to overcome the difficulties inherent in nesting multiple well casings to deeper depths and will be evaluated for applicability during construction.

As discussed in Section 3.2.1.2, borehole stabilization is a key variable for field safety and well design. If temporary or permanent conductor casings are required to stabilize the borehole or construct an effective sanitary well seal, then the borehole diameter in the uppermost part of the borehole where the conductor casing will be set could be larger than the diameter required for well casing installation alone. It is estimated that boreholes up to 32 inches in diameter could be required to install these shallow conductor casings; however, the installation of these casings will be the exception and not the rule for final well design.

Well Casing and Screen. Well casing and screen for all wells will be prefabricated offsite and installed using the drill rig. For installation, the well casing and screen assembly will be suspended at a distance above the bottom of the borehole so that none of the weight of the casing is supported from the bottom of the borehole.

Casing material for the remediation wells deeper than 150 feet will be 316L stainless steel below saturation and either 304 stainless or carbon steel above saturation to provide the required tensile strength and collapse pressure resistance for the expected installation depths (typically, the transition depth for casing material will be tens of feet above the water table). If a mix of stainless-steel and carbon-steel casings are used, it may be necessary to install a dielectric coupling between the two casing types to inhibit corrosion. Schedule 80 PVC might be selected for casing material for remediation wells shallower than 150 feet, or the same casing material used for the deeper wells might be maintained. The screened intervals for remediation wells will be comprised of continuous wire wrap 316L stainless steel. Centralizers will be installed at regular intervals along the well casing and screen assembly, approximately every 40 to 60 feet (as a minimum frequency) to allow for the proper installation of annular materials (sand pack and sealing material). In general, centralizers installed along screened sections will be located at the joints to avoid blocking portions of the screen.

Monitoring well casing and screen will be composed of flush-threaded PVC, and screen sections will be machine-slotted. Centralizers will be installed at regular intervals along the well casing and screen assembly, approximately every 40 to 60 feet (as a minimum frequency), starting from approximately 5 to 10 feet from the bottom to ensure proper installation of annular materials and, in the case of nested monitoring wells, proper separation between casings and the borehole wall.

Filter Pack. The filter pack material that is installed in the annular space adjacent the screen intervals will consist of clean, engineered granular material. The size and gradation of this material will be chosen based on review of lithologic data and will be designed in combination with the “slot” aperture of the well screen. The filter pack material will be placed using a tremie pipe, which may include the drill casing depending on the drilling method. In general, the filter pack material will begin below the screen and extend several feet above the screen to allow for settlement over time. The top of the filter pack will be measured to verify depth during emplacement and the volume of material installed will be tracked for comparison against the calculated volume of the borehole annuls. The screened interval will be surged with a surge block during filter pack emplacement to aid with settlement.

Annular Seals. Sealing material will be placed in the annulus between the well casing and the borehole wall and between well casings for nested wells to create a sanitary seal between the well screen and the ground surface (minimum thickness of 20 feet).[2] In some cases (for example, dual-screened wells where the well screens will be operated independently), annular seals might also need to be placed between well screens. Fluid sealing material will be emplaced using a tremie pipe installed within the drill casing so that the material is introduced near the bottom of the interval to be sealed and standing water is displaced upward. Like installing the filter pack, granular sealing material will be placed using a tremie pipe, which may include the drill casing depending on the drilling method. Following is a list of sealing materials that may be used at the Topock site:

- **Neat cement**. Composed entirely of Type II/V Portland cement grout with up to 6 percent bentonite powder.
- **Sand-cement grout.** Composed of Portland cement with no more than two parts sand to one part cement by weight of sand.

[2] If a well is designed so that the screened interval is exceptionally shallow and 20 feet of surface seal is not technically practicable, the surface seal depth will be maximized given the depth of the screen.

- **Concrete.** Composed of Portland cement and aggregated mixed at a ratio of at least 564 pounds of cement per cubic yard of aggregate. Aggregate used must be smaller than one-fifth of the radial thickness of the annular seal and is typically reserved for large volume/diameter borehole or well decommissioning. Concrete is typically only used in the shallowest portion of the borehole as a construction component of the wellhead protection.
- **Bentonite clay.** Composed of commercially prepared, powdered, granulated, pelletized, or chipped/crushed sodium montmorillonite clay with the largest dimension of pellet or chip being less than one-fifth the radial thickness of the annular seal. Bentonite cannot be used as a sealing material opposite zones of fractured rock, unless otherwise approved by lead agencies. Because bentonite seals may have a tendency to dry, shrink, and crack in arid and semi-arid areas where subsurface moisture levels can be low, they are not recommended for sealing the vadose zone at the Topock site. Bentonite is not a preferred material for sealing injection well screens because high injection pressures could cause the material to migrate within the borehole. Bentonite is additionally not recommended for application in high TDS environments (>5,000 parts per million) because of the adverse effects on its ability to properly swell and seal in these conditions.

According to California well standards, drilling mud or cuttings are not acceptable sealing materials.

Water used to prepare sealing materials should generally be of potable quality, compatible with the type of sealing material used, and free of contaminants and suspended matter. Manufacturers' specifications for mixture volumes and curing times will be strictly followed (typically, ASTM International [ASTM] C150, Standard Specification for Portland cement). Further, the use of any additives must comply with the requirements of ASTM C494 (Standard Specification for Chemical Admixtures for Concrete).

During installation of seal material, verification of the volume of the material placed in the well or borehole will be compared to the calculated volume of the borehole annulus, which should be at least equal to the calculated volume of void space to be sealed.

Well Development. Following construction, each well will be developed using a combination of bailing, surging, and pumping to remove fluids introduced during drilling and sediment that accumulates in the well during installation and to develop the hydraulic connection between the well screen, filter pack, and the formation. Generally, extraction and injection wells will be developed using a combination of dual-swab airlift and pumping. During select stages of pumping, purged water will be allowed to surge back into the well such that the filter pack is stressed with positive and negative hydraulic head conditions. Monitoring well development will be conducted using a combination of bailing, surging (for example, with a surge block) and pumping. Water storage tanks will be used during development, as detailed in Section 3.2.1.

Typically, development of extraction/injection wells will initially be conducted using the drill rig to airlift the well (though this is dependent on the drilling method used to construct the well). The purpose of this initial development step is to remove the majority of drilling fluid and fines from the filter pack and adjacent formation, and to settle the filter pack material prior to setting the upper well seals. Sand content, turbidity, and level of filter pack material, are the primary field measurements collected during the initial development. When stability is reached, initial development is ended and the well seal is set. After extraction/injection well construction is complete, a well service rig ("pump rig") is used to finish development using a combination of surging and/or jetting, bailing and pumping. The purpose of this phase of development is to organize the filter pack material, further remove fines, and establish efficient hydraulic connection between the well screen, filter pack, and the formation. This phase of development is iterative, and the recharge rates between these steps, sand content in the effluent during each step, and trends in the specific capacity of the well during pumping are monitored as primary indications of well development progress. Field water quality measurements will be monitored on the pump effluent at the surface (for example, specific conductance, pH, oxidation-reduction potential, etc.) during pumping. The well will be considered developed (that is, ready for subsequent hydraulic testing and/or sample collection) when turbidity measurements are low and stable (typically 50 nephelometric turbidity units or less), specific

capacity is stable, a minimum volume greater than the volume of any water introduced during drilling and well construction has been removed, and the well is yielding groundwater that exhibits water quality measurements indicative of aquifer conditions as compared to the water used for drilling.

Overall, the process for monitoring well development is simpler than for the remediation wells, primarily because of the difference in the type of screen (slotted PVC vs. wire-wrapped stainless steel) and is typically performed using a well service rig; however, some monitoring well pump development might be conducted using electric submersible pumps installed by hand. As previously detailed for the extraction and injection wells, field water quality measurements will be monitored to determine when development is complete.

Commercially available, dilute chemical additives that are typically used in constructing or rehabilitating potable water wells that might be used during well development to enhance well performance. Well development additives used will be compliant with NSF/ANSI *Standard 60: Drinking Water Treatment Chemicals – Health Effects*. The function of some example well development additives and the example ingredients are included in Exhibit 3.2-4.

Well development activities will be documented in accordance with the SOP and reported to the agencies via monthly progress reports as defined in Section 2 of the C/RAWP.

EXHIBIT 3.2-4
Example Additives that Might be Used During Well Development
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Additive Function	Example Ingredients	Ingredient Percent/Weight	Example Trade Name
Acids to remove mineral deposits	Phosphoric acid	60-85%	NuWell 120
Oxidizing agent to disinfect/degrade biofilms	Hydrogen peroxide, bleach	--	--
Dispersants	Anionic polyacrylamide	60-100%	Aqua-clear PFD, NuWell 220
Biocides to inhibit bio growth	Acetic acid	--	--
Physical agitation	Carbon dioxide, nitrogen	--	--
Chelating agents to aid acid/disinfectant penetration	Citric acid	--	--

Well Surface Completion and Instrumentation. Surface completions for constructed wells are detailed in the generalized well design drawings included in Appendix D of the Final BOD and will generally consist of subsurface well vaults, unless siting conditions require an aboveground, steel, locking wellhead monument (for example, wells installed in the channel of an active wash). Excavation to facilitate installation of the well vaults will be conducted with either hand tools or mechanical equipment (backhoe), depending on the required size of the excavation and the type of material being excavated. The subsurface well vault will be set in a concrete pad that is sized proportionally to the given well vault, and each vault will be equipped with an appropriate cover or lid. Wells inside the vault will be equipped with water-tight well seals to prevent surface water from entering the wells if the vaults fill with water. For aboveground completions, the wellhead monument completion will be placed over the casing and cap and seated in a concrete collar that extends 5 to 10 feet bgs so that the well is anchored during flow events in the wash channel.

Following construction, development, and testing (as conducted, see Section 3.2.1.5), downhole instrumentation and equipment required for a given well will be installed. For extraction and injection wells, this will include equipment such as pumps, access pipes, well maintenance infrastructure, and packers, which will be installed with a well service rig or similar equipment. The downhole equipment that will be installed in monitoring wells will only include pressure transducers or small-diameter pumps, as determined necessary, which are installed by hand.

3.2.1.5 Well Testing

Extraction and injection wells will be tested following construction and development to evaluate baseline well performance, which is necessary for tracking and troubleshooting performance degradation during remedy operation. The types of testing that will be conducted include in-well surveys (for example, video, flow logging, etc.), specific capacity/injectivity testing, water quality testing, and constant-rate extraction tests at select locations to confirm actual aquifer properties relative to the assumptions used in the groundwater model. As with data collected from the pilot boreholes to support well construction, well testing data will be collected following well construction to support decisions regarding whether adding or reducing wells is needed to properly construct the remedy well network. The results of well testing will continuously be compared to existing data that comprise the conceptual site model. Consistent with Section 4.1.1 of the O&M Manual (Volume 1) for the groundwater remedy, this section details the types of data that will be collected and the collection methods.

Following development, specific capacity and injectivity testing will be conducted at extraction and injection wells so that baseline specific capacity/injectivity can be evaluated. Typically, the testing will include evaluation of specific capacity/injectivity at flow increments of approximately 50, 100, and 150 percent of the design extraction or injection rate. These tests will typically be conducted over a 2- to 12-hour period depending on the performance of the well, and the water level in the pumping well will be monitored using pressure transducers. Field water quality measurements will be monitored on the pump effluent at the surface (for example, specific conductance, pH, and oxidation-reduction potential) during testing. Equipment for these tests will be similar to that identified for well development and include a well service rig and water storage tanks. In most cases, these tests will be conducted immediately after well development is complete, using the same equipment. Water that is purged and stored in tanks during well testing will be used for injection testing, as practicable, and this water will be pumped through a filter to remove particulate matter prior to reinjection. Injectivity testing may also include the use of fresh water. An abbreviated version of baseline specific capacity testing will be conducted at all new monitoring wells. Monitoring wells, which are not designed for target extraction rates, will be pumped at one to three different rates following development such that specific capacity information can be compared to that collected during subsequent monitoring and/or re-development events (see Section 4.2.4 of the O&M Plan (Volume 1 of the O&M Manual) regarding monitoring well acceptance standards. The use of slug test may also be appropriate to assess changes in well hydraulics over time.

Constant-rate extraction tests will be conducted to evaluate well performance and to refine the understanding of aquifer hydraulics in areas where these types of data are limited (the northern end of the floodplain, TW Bench, freshwater injection well FW-2, and uplands wells IRL-1 and IRL-4). In addition to constant-rate tests in these areas, data collected during well construction/development and specific capacity/injectivity testing might indicate that additional constant-rate tests would be beneficial in the context of estimating remedy performance. For example, if specific capacity testing indicate a significantly lower flow than that currently estimated at an extraction well, a constant-rate test might be conducted to understand if a lower extraction rate will still achieve well objectives. At the other extreme, if well capacity is much higher than that currently estimated, then data from a constant-rate test would be used to determine whether additional extraction is required to achieve well objectives. These constant-rate test data are not as important for injection wells, for which the objective is to inject a specific volume of water or carbon substrate and there is no capture metric. While excess injection capacity is not problematic for remedy operation, if injection capacity is low or marginal, then an additional well might need to be installed.

The duration of constant-rate tests are estimated to range from 6 to 12 hours when assessing well performance and up to 48 to 72 hours for tests designed to determine larger-scale aquifer hydraulics (i.e., transmissivity, specific yield, and hydraulic conductivity). Constant-rate aquifer tests will generally require the same equipment as tests detailed for the specific capacity and injectivity, but water levels several adjacent observation wells will be monitored using pressure transducers (typically, this will include wells within an approximate 500-foot radius of the pumping well, but could include wells further away, depending

on the test flow rate). For this reason, to obtain the most complete data set, constant-rate tests will typically be conducted after all of the planned wells for a given area are constructed and developed. Field water quality measurements will be monitored on the pump effluent at the surface (for example, specific conductance, pH, and oxidation-reduction potential) during constant-rate testing. Hydraulic data collected during constant-rate tests might require correction using the U.S. Geological Survey deconvolution software (Halford et al. 2012) to filter out the influence of river and barometric fluctuations.

In addition to the constant-rate testing, flow logging can be a useful element of the baseline evaluation for wells that are constructed with screen intervals greater than approximately 75 feet long. Spinner logging, the most common method of flow logging, measures the contribution of groundwater flow into the well from various depth intervals of screen. Measurements of vertical flow velocities are collected under dynamic (pumping/injection) conditions and analyzed to develop a flow profile. Other methods of flow logging that have been conducted as part of the Topock Remediation Project and that will be considered for use during well testing include hydrophysics and dye-pulse logging. Each of these methods require primary equipment similar to methods identified for well development and include a well service rig and water storage tanks.

3.2.1.6 Baseline Well Sampling

In response to 90% RTC #938 DTSC-167, this section details the plans and methods to collect initial baseline samples from all new extraction, injection, and monitoring wells[3] constructed as part of the groundwater remedy. As new wells are constructed and developed they will be added to baseline well sampling events that will be conducted on a regular frequency (i.e., initiated every 4-6 weeks) during construction. As many new wells as possible will be grouped in each event for efficiency with sampling and laboratory analysis. Baseline groundwater samples will be collected a minimum of 72 hours after well development is completed, thereby allowing the well to stabilize following the extended purge during development, before sample collection in accordance with the SOPs presented in the subsections below.

Baseline monitoring will include two samples collected to establish the baseline conditions; a third baseline sample will be collected if it is necessary to confirm the baseline condition should data from one of the first two events appear anomalous. The two baseline samples will be collected approximately one month apart; however, the time between samples might be shortened if determined necessary to ensure that the collection of these samples does not delay startup of the system. In addition to baseline sample collection at new wells, existing wells will be added to these events as determined necessary. For example, select Category 1 wells will be included in these events beyond the collection of initial baseline samples as determined necessary to inform the location and design of other remedy wells.

Groundwater Sample Collection Methods and Procedures. Sampling and field measurements will be performed in accordance with the SOPs presented in Appendix B. Required sample containers, preservation requirements, sample storage, and QC methods and requirements are described in further detail in the PG&E Program QAPP and QAPP Addendum (see Appendix C).

In continued efforts to integrate sustainability practices into remedial implementation (see Section 4 of the Final BOD), trials of alternative sampling and data collection methods were conducted at Topock to further reduce the overall sampling and project footprint and minimize potential impacts to sensitive resources (e.g., reduce trips to well sites, reduce purge water generation and management, reduce time spent at well sites, etc.).

The trial began in third quarter 2012 (September) and continued through first quarter 2013; it involved testing of two alternative sampling approaches at 18 site wells: the no-purge HydraSleeve sampling system and the minimal drawdown (low flow purging) sampling technique. Additional information about these two

[3] Sampling of existing monitoring wells to document baseline site conditions prior to remedy implementation are discussed in the Basis of Design Report, Section 2 (Baseline Site Conditions and Pre-Design Work).

approaches can be found in numerous publications and public websites including but not limited to the following:

- HydraSleeve sampling system (www.hydrasleeve.com): A joint study completed by the U.S. Army Corps of Engineers, the Air Force Center for Environmental Excellence, and the Air Force Real Property Agency in 2005 (Parsons 2005)
- Minimal drawdown (low flow purging or micro-purge) sampling technique: USEPA guidance on sampling procedures including the Groundwater Issue Paper: Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures (Puls and Barcelona 1996) and the Groundwater Sampling Guidelines for Superfund and RCRA Project Managers (Yeskis and Zavala 2002)

Trial results were compared to the current standard three-volume purge technique, and evaluated for use in monitoring of the final groundwater remedy. The 2013 annual groundwater monitoring report (CH2M HILL 2014c; available on the project website at http://dtsc-topock.com/) presented the trial results (see Recommendations section and Appendix H) along with detailed correlations between the two alternative sampling methods and the current three-volume purge method.

Based on the trial results, PG&E recommended to DTSC the use of minimal drawdown as the default sampling method for the existing groundwater monitoring and compliance monitoring programs. While minimal drawdown technique was recommended for groundwater/compliance monitoring, HydraSleeve and other grab sampling methods are also seen as useful tools for process monitoring during remedy implementation. DTSC completed review of PG&E's recommendations on June 26, 2014, and approved the use of minimal drawdown technique for wells with screen length of up to 20-foot saturated thickness in alluvial and fluvial sediments (upland and floodplain locations) (DTSC 2014). Implementation of the minimal drawdown technique at approved wells commenced in the third quarter of 2014. SOPs associated with these alternative techniques have been included in Appendix B.

Additional trials using alternative sampling techniques will be conducted at monitoring wells with 30- to 50-foot screen lengths, and at bedrock open borehole wells located in TCS or the East Ravine. Trial results have been and will continue to be evaluated and new information incorporated into the sampling and monitoring for the final remedy, as appropriate. Additional SOPs may be developed and added to the lists below, or existing SOPs may be modified and amended. The latest version of the SOPs will be available to the sampling crews at the in project files onsite during construction.

The method used for the collection of baseline samples from injection and extraction wells constructed for the groundwater remedy will ultimately be determined based on the results of the ongoing alternative sampling technique trials. During operation, these large diameter wells will be equipped with dedicated pumps and will be plumbed into the groundwater remedy; however, the infrastructure may not be installed during remedy construction when the baseline samples are collected. Given the relatively large volumes of groundwater that would have to be purged and managed if sampled using SOP-A1, alternative techniques (SOP-A18 and/or SOP-A19) are preferred.

Groundwater sampling from wells will be performed in accordance with the following SOPs, as appropriate (included in Appendix B). Additional SOPs may be added as appropriate.

- SOP-A1 – Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method
- SOP-A2 – Purging and Sampling of 1-inch-diameter Groundwater Monitoring Wells, Modified Well-Volume Method
- SOP-A3 – Purging and Sampling of Active and Inactive Water Supply Wells
- SOP-A6 – Sample Field Filtration and Preservation for Metals Analyses
- SOP-A7 – Water Level Measurements

- SOP-A8 – Field Water Quality Measurements Using a Flow-through Cell
- SOP-A9 – Calibration of Field Instruments
- SOP-A10 – Decontamination of Water Sampling Equipment
- SOP-A11 – Total Depth Measurements
- SOP-A13 – Spill Prevention, Containment, and Control Measures for Monitoring Well Sampling
- SOP-A16 – Access Routes
- SOP-A17 – Groundwater and Surface Water Mobile Integrated Sample Tracking
- SOP-A18 – Purging and Sampling of Groundwater Wells Minimal Drawdown Method
- SOP-A19 – Sampling of Groundwater Monitoring Wells Hydrasleeve No Purge Method
- SOP-A23 – Sample Handling and Custody

Groundwater Sample Laboratory Analysis and Management. Baseline groundwater samples will be analyzed at a certified laboratory in accordance with the analytes presented on Exhibit 3.2-5. The laboratory analytical suite for baseline groundwater samples collected from injection and extraction wells is consistent with the analytes listed in Exhibit 4.1-1 (Biological and Geochemical Analytical Monitoring Parameters) of the O&M Plan (Volume 1 of the O&M Manual).

The contracted analytical laboratory will provide the required sample containers for all samples including QC samples. All containers will have been cleaned and certified free of the analytes of concern for this project. No sample containers will be reused. The contracted laboratory will add preservatives, if required, prior to shipping the sample containers to the field or supply the preservative as appropriate. The laboratory markings will indicate the type of preservative in the container. The date and time of sampling and the initials of the sampler will be recorded on the pre-printed label immediately prior to collection. The waterproof labels will be placed carefully on the proper container, and if waterproof labels are unavailable, they will be secured using clear tape to protect the label. When shipping samples using a freight carrier such as Federal Express, the ice used in shipping containers will be double-bagged and laser printed labels and indelible ink pens will be used to complete sample labels to ensure that the samples arrive at the laboratory dry and appropriately marked. If a laboratory courier is used, no bagging of ice is necessary. Vital information regarding the collection of each sample will be recorded in a field logbook, field sampling form, and/or chain-of-custody (CoC) form, as appropriate. The following information for each sample will be recorded in the field logbook, field sampling form, or CoC form, whichever is appropriate:

- Sampling location and description (sketch and measured distances from reference points will be recorded if there is no established identification for the sample location)
- Sample ID
- Sampler's name
- Date and time of sampling
- Sample designation (e.g., composite, grab, etc.)
- Sample matrix
- Type and ID of sampling equipment
- Field measurement data (e.g., pH, temperature, conductivity)
- Field observations that may be relevant to the analysis or sample integrity (e.g., odor, color, and weather conditions)

- Associated QC blanks
- Shipping details (if the laboratory is providing courier service, the courier must sign and date the CoC forms; copies of the signed CoC forms should be transmitted to the office as soon as practical; if FedEx, UPS, or other courier is used, include shipping information for each shipment)
- Destination laboratory

EXHIBIT 3.2-5
Laboratory Analysis of Baseline Groundwater Samples
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Constituent	Preferred Method	Units	Monitoring Wells	Extraction Wells	Injection Wells	IRZ Injection Wells
Total Organic Carbon (TOC)	EPA 415.1	mg/L	X	X	X	X
Total Dissolved Solids (TDS)	EPA 160.1	mg/L	X	X	X	X
Title 22 Metals (Total and Dissolved)	EPA 6010B	µg/L	X	X	X	X
Hexavalent Chromium	EPA 218.6 / SM3500-Cr B	µg/L	X			
Iron and Manganese (Total and Dissolved)	EPA 6010B	µg/L	X	X	X	X
Cations: Calcium, Potassium, Magnesium, Sodium (Total)	EPA 6010B	µg/L	X	X	X	X
Anions: Chloride, Fluoride, Bromide, Nitrate, Nitrite, Sulfate	EPA 300.0A	mg/L	X	X	X	X
Sulfide	EPA 9215	mg/L		X	X	
Alkalinity as Total, Carbonate, Bicarbonate	EPA 310.1	mg/L		X	X	X
Phosphate (low detection limits ~0.10 mg/L)	EPA 300.0A	mg/L		X	X	
Total Phosphorus (low detection limits ~0.10 mg/L)	SM 4500-P B	mg/L		X	X	
Silica	SM 4500-Si D	mg/L		X	X	
Hardness as $CaCO_3$	SM 2340 C	mg/L		X	X	
Ammonia-N	SM 4500-NH3 D	mg/L		X	X	
Total Kjeldahl Nitrogen (TKN)	SM 4500-N B	mg/L		X	X	
Biochemical Oxygen Demand (BOD)	EPA 405.1	mg/L		X	X	

Notes:
µg/L = micrograms per liter
EPA = U.S. Environmental Protection Agency
mg/L = milligrams per liter

Sample coolers will be transported to the laboratory immediately after sample collection. An overnight courier may be used to transport the samples. Intermediate stops will be avoided, except for emergencies, in which case the situation will be noted in the field notebooks. The laboratory will be notified that samples are being shipped. The laboratory, upon receipt of the samples, will verify and record the adequacy of preservation and will add additional preservative, if necessary.

3.2.2 Piping and Utilities

This section describes the typical methods that are anticipated for construction of the remedy piping, stormwater drainage piping, electrical distribution systems, and communications systems. These piping and

conduit systems will connect together different components of the remedy system such as wells and building. The design contains five typical configurations for these systems:

- **Direct burial.** Pipes, conduits, and/or wires are placed in an excavated trench so they are in direct contact with the ground, earthen backfill, and/or concrete encasement. For example, pipes/ conduits in the floodplain.
- **Concrete trenches.** Typically made of precast concrete, box-like concrete trenches are placed in an excavated trench and joined to make a continuous trench, and then the pipes, conduits, and/or wires are placed in the concrete trenches. Alternatively, concrete trenches may also be cast-in-place. For example, pipes/ conduits along the TCS entrance road.
- **Trenchless technologies.** An underground hole is created to install a carrier pipe under the ground and then pipes, conduits, and/or wires pulled through the carrier pipe. For example, segment of freshwater pipe under I-40.
- **Installed above ground.** In this instance pipes, conduits, and/or wires are installed close to or above the ground surface and are often attached to other structures for support. For example, segment of freshwater pipe on the Arched Bridge.
- **Installed on pipe bridges.** Also an aboveground option, the pipes, conduits, and/or wires are installed high above the ground on bridges. For example, segment of freshwater pipe on the Arched Bridge.

Piping and utility systems are often installed sequentially from one end of the pipe to the other. However, the number and location of work sites and crews for a given pipeline will vary over time based on site-specific factors. Some of these factors are equipment availability, market rates, employee skillsets, construction schedule, the size/structure/scope of the construction contract(s), and site conditions encountered in the field. The typical methods and equipment associated with each configuration are discussed in the following sections.

3.2.2.1 Direct Burial

The steps to install this configuration include excavating a trench, installing materials in the trench, and backfilling the trench with earthen materials and/or concrete.

Excavation. The trenches will be excavated primarily with construction equipment. Soil removed from the trench, known as spoils, will be placed alongside the trench (on the ground and/or in bins) and/or loaded directly into haul vehicles. Haul vehicles may include pickup trucks, flatbed trucks, bin transport trucks, scrapers, bucket loaders, or dump trucks, all of which are typically used for this type of work. When placed next to the trench the spoil will be far enough away from the edge so as not to cause cave-in of the excavation. Where space is limited and/or spoil requires processing, spoil will be loaded into haul vehicles and transported to one or more soil storage sites. If applicable and where required, topsoil will be segregated from other soil and saved. Excavated soil that can be reused as backfill material will be segregated and stored/stockpiled onsite until backfilling. Similarly, any pavement will be segregated from the soil as required and transported offsite for recycling or disposal. Refer for the Soil Management Plan in Appendix L of this C/RAWP for more detailed information about soil management.

Methods such as sloping, benching, and/or shoring may be required to prevent the trench walls from caving in and allow construction to proceed in a safe manner and to comply with governmental regulations. Steps to prevent trench walls from collapsing are most often employed on trenches with depth greater than 4 feet. With sloping, the angle of the trench side walls are reduced from 90 degrees to near 45 degrees or flatter while benching involves cutting one or more horizontal steps into the trench walls. Shoring involves installing metal or wooden structures in the trench to support the trench walls. Shoring is usually moved as the excavation progresses. The contractor(s) will select and implement the method used to prevent trench cave-ins and that selection will meet regulatory construction safety requirements as well as limiting excavations and not over-excavating.

Hand work, that is workers using hand tools, may be required to shape or groom the trench. Hand work, as well as soft dig methods, may also be required when trenching near existing underground utilities. Soft dig techniques include hydrovacuum excavation, and air lancing. With hydrovacuuming the soil is loosened by spraying the ground with high-pressure water. The loose soil and water is then vacuumed into a truck for transport and disposal. The hydrovacuum spoils are generally placed in a containment area, allowed to dry, and moved to designated soil management areas. Air-lancing is similar to hydrovacuuming, except that high-pressure air is used to loosen the soil.

Install System Components. Construction material will be hauled to the work area, staged alongside the trenches, and installed in the trench using construction equipment and handwork. The trench bottom will be covered with a compacted bedding material, typically sand, to provide a firm rock-free layer on which to install piping and conduit. If the trench bottom itself is too soft, wet, and/or unstable to allow construction, the trench will be over-excavated and backfilled with stabilization material before placing the bedding material. Stabilization material is typically gravel, rock, crushed rock, or other gravelly soil. An alternative to stabilization is to redesign the pipe.

Lengths of pipe and conduit will be joined together, lowered into the trench, and placed on the bedding material. The lengths of pipe and conduit may be connected together either before or after being placed in the trench. Joining methods depend on the material specified and could include pushing together bell-and-spigot-type pipe ends, solvent welding, fusion welding, metal welding, mechanically restrained connections, valves, or pipe penetrations. Piping and conduits may also be placed on cradles, blocks, or other temporary supports in the trench. The joining methods will generally be in accordance with the pipe/conduit manufacturer's installation recommendations. The piping and conduit will then be covered with pipe zone material, usually concrete or compacted sand, which is designed to protect the piping/conduits from damage during backfilling. A locating wire may be attached to the top of nonmetallic pipes or conduit before placing pipe zone material. Marking materials, such as tape, tracer wire, and/or concrete, are placed on the pipe zone fill. Concrete used to encase or mark electrical conduit is generally dyed red in accordance with standard industry safety practices and project design criteria.

Pipes will be leak-tested before being placed into service. The testing will generally involve flushing the pipe, filling the pipe with water, pressurizing the pipe in one or more stages, and then measuring pressure loss over time. The testing procedures will comply with standard industry guidelines. The pipelines may be tested before, during, and/or after backfilling, and pipelines may be tested in sections and/or over the full pipe length. Water used for flushing and testing will be disposed of in accordance with applicable permits, laws, and regulations. Potential water disposal locations include IM-3, TCS evaporation ponds, and/or offsite disposal. Refer to Section 4 for water management. Electrical and communication conduits will be tested by running a mandrel between some or all manholes. The wires and conductors pulled through the conduits will be tested for continuity.

Backfill and Finish Grading. After installing the system components, the trench will be backfilled and compacted using construction equipment. Typical backfill materials are compacted select fill or concrete. Select fill is a general fill soil whose gradation meets a specified maximum particle size. Wherever the spoils stockpiled alongside the trench and/or in bins meets requirements it will be placed directly back in the trench as backfill. Or the select fill will be created by processing the spoils or other on-site soil, or importing soil. The backfill will be placed in lifts and compacted with equipment to meet project requirements. Compaction will be periodically tested as specified. The backfill is placed to create a surface that matches or is mounded slightly higher than the adjacent ground surface. The backfill soil will be graded to blend into the adjacent ground surface and stabilized. Trenches through asphalt concrete pavement (ACP) are typically topped with the same ACP.

Vaults, Valves, and Other Components. Vaults, hand holes, pull boxes, valves, anodes, and other components associated with the pipelines and conduits are typically installed as part of the backfill operation. Generally located below ground, these components are installed by excavating a hole and placing

the component in the hole on bedding and/or stabilization materials. The excavation may be created by widening the trench where the component will be installed in-line with piping or conduit. Backfill is then placed around the component as described in the previous paragraph. Although these components are discussed in the direct burial section, they may be used for other methods and facilities described in this section.

Additional Measures to Operate in Constrained Work Zones. Additional construction measures may be required to operate in locations where the primary work zones and/or access routes are of limited size due to existing facilities or other constraints. When size is limited by existing facilities, including utilities, temporary structures such as wood cribbing, underpinning, and/or shoring may be installed to temporarily reinforce or support the existing facilities. In some locations, such as the uplands, temporary "jumper" pipes, or conduits, may be installed during construction to temporarily reroute existing utilities (to include IM-3 piping). Rerouting may be needed to protect existing utilities from nearby construction activities or to clear an area into which new facilities can be installed. The jumper pipes and/or conduits will generally tie into the existing utilities at two locations, be installed on the ground surface, and be placed in a location that avoids construction activities and is protective of cultural and natural resources.

In areas such as the uplands and the flood plain, the work zones may be very narrow to protect adjacent cultural and biological resources. This may result in very little working space in which to operate equipment, stage materials, and place spoils. Measures to cope with this may include reducing trench widths to provide more usable space or prohibiting equipment/vehicles from passing through the work zone or beside the trench. If the latter measure is employed, excavation equipment would load spoils directly into a nearby haul vehicle for transport to a soil management area. A material hauling vehicle would then move into the space vacated by the spoil-hauling vehicle. The excavator would then offload backfill and/or piping materials from the vehicle and install them in the trench. After completing installation, the excavation equipment could then move forward along the pipe alignment, excavate more trench, and start the cycle again. Although these additional measures are discussed here in the direct burial section, the measures may be used for any of the construction methods described in this section.

Construction Equipment. The types and anticipated numbers of equipment typically used to construct this configuration are listed below in Exhibit 3.2-6. The activities in which each piece of equipment is typically involved is designated by an "X" in the column for a given activity.

3.2.2.2 Concrete Trench

The steps to install this configuration include excavating a trench, placing prefabricated sections of concrete trench in the excavated trench on bedding materials, backfilling around the concrete, installing piping, conduits, and/or wires in the concrete trenches, and covering the trenches with lids. Alternatively, the concrete trenches may be cast-in-place. Certain pipelines will make side-by-side use of both the prefabricated concrete trench and direct bury methods.

Excavation. The trenches will be excavated in largely the same manner as described in Section 3.2.2.1.

Install Concrete Trenches. Box-like sections of concrete trench will be placed into the excavation using construction equipment. The sections will likely be precast at an offsite location and delivered to the site. Before placing the sections, the trench bottom will be bedded and stabilized largely as described in Section 3.2.2.1. Construction equipment will be used to lift the concrete pieces and set them down in the trenches. Smaller sections will be picked and placed as a single unit. Larger sections may require that pieces be placed in trench and assembled by hand. The concrete sections and pieces may be joined mechanically or welded together and/or sealed by applying sealants to the joints after placement in the trench. The sections may be stored onsite, staged near the trench, and/or offloaded directly from haul vehicles.

The construction method will be slightly different when the concrete trenches are cast-in-place. After completing, excavation wood or metal forms will be installed in the trench to form the edges of the concrete trenches. Reinforcing steel may also be placed in the trenches. Concrete will be placed into trenches and

forms using concrete trucks or pumped using concrete pumps. The concrete will be vibrated into place, finished per specified requirements, and allowed to cure.

EXHIBIT 3.2-6
Typical Construction Equipment for Trench and Backfill
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Equipment	Excavate Trench	Install System	Backfill and F. Grading	Typical Make/Model	Estimated Number
Excavator (w/hoe-ram)	X	X	X	CAT 330	~2 per trench
Backhoe	X	X	X	CAT 430	~2 per trench
Trenching machine	X			Ditchwitch RT120	~1 per trench
Scraper (standard push)	X		X	CAT 621	~2 per trench
Scraper (twin engine)	X		X	CAT 627	~1 per trench
Bulldozer (w/rippers)	X		X	CAT D8	~1 per trench
Vacuum/soft dig truck	X			Presvac Hydrovac	~1 per trench
Dump/haul truck	X	X	X	CAT CT660	~3 per trench
Dump trailer (w/tractor truck)	X	X	X	DynaHauler	~3 per trench
Water truck	X	X	X	1,000 to 4,000 gal	~3 per trench
Articulated dump/haul truck	X	X	X	CAT 730	~2 per trench
Front end loader	X	X	X	CAT 966	~1 per trench
Walk-behind soil compactor			X	Wacker DPU 130 or DS 70	~2 per trench
Soil compactor			X	CAT 815	~1 per trench
Rough terrain/telescopic fork lift		X		SkyTrak 4290	~2 per trench
Concrete truck		X	X	McNeilus Standard Mixer	~2 per trench
Concrete pump truck w/boom		X	X	Putzmeister 28Z	~1 per trench
Boom/crane truck		X		National Crane 1400H	~1 per trench
Road grader			X	CAT 120	~1 per trench
Pipe laying machine		X		CAT PL61	~1 per trench
Pipe welding machine		X		McElroy 412 or 618	~1 per pipe material
Fuel/grease truck	X	X	X	Oilmen's AL44	~1 per trench
Mechanics truck	X	X	X	Knapheide KMT2	~1 per trench
Pickup and support trucks	X	X	X	Ford 250	~3 per trench

Note:
The equipment listed in this table are typical. The equipment actually used during construction will be selected by the construction contractor based on project-specific factors.

Install System Components. System components will be transported to and installed in the concrete trenches primarily using construction equipment and handwork. The pipes and conduits will be installed and tested in largely the same manner as described in Section 3.2.2.1. However, no pipe zone materials will be required in this method because the concrete trenches will protect the piping.

Backfill and Finish Grading. Before, during, and/or after component installation, the gap between the concrete trench and the excavation will be backfilled and compacted with construction equipment. The backfilling and finish grading will be performed in largely the same manner as described in Section 3.2.2.1. Prefabricated lids will be placed over the concrete trenches using construction equipment. The lids may be left exposed or covered with backfill.

Construction Equipment. The types and anticipated numbers of equipment typically used to construct this configuration are listed in Exhibit 3.2-7. The activities in which each piece of equipment is typically involved is designated by an "X" in the column for a given activity.

EXHIBIT 3.2-7
Typical Construction Equipment for Concrete Trench
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Equipment	Excavate Trench	Install Concrete Trench	Install System	Backfill and Finish Grading	Typical Make/Model	Estimated Number
Excavator (w/hoe-ram)	X	X	X	X	CAT 330	~2 per trench
Backhoe	X	X	X	X	CAT 430	~2 per trench
Trenching machine	X				Ditchwitch RT120	~1 per trench
Scraper (standard push)	X			X	CAT 621	~2 per trench
Scraper (twin engine)	X			X	CAT 627	~1 per trench
Bulldozer (w/rippers)	X			X	CAT D8	~1 per trench
Vacuum/soft dig truck	X				Presvac Hydrovac	~1 per trench
Dump/haul truck	X	X	X	X	CAT CT660	~3 per trench
Water truck	X		X	X	1,000 to 4,000 gal	~3 per trench
Articulated dump/haul truck	X	X	X	X	CAT 730	~2 per trench
Front end loader	X	X	X	X	CAT 966	~1 per trench
Concrete truck		X			McNeilus Standard Mixer	~1-2 per trench
Concrete pump truck w/ boom		X			Putzmeister 28Z	~1 per trench
Walk-behind soil compactors		X		X	Wacker DPU 130 or DS 70	~2 per trench
Rough terrain/telescopic forklift		X	X		SkyTrak 4290	~2 per trench
Boom/crane truck		X	X		National Crane 1400 H	~1 per trench
Crane		X			Manitowoc Grove GMK4114L	~1 per trench
Road grader				X	CAT 120	~1 per trench
Pipe laying machine			X		CAT PL61	~1 per trench
Pipe welding machine			X		McElroy 412 or 618	~1 per pipe material
Fuel/grease truck	X	X	X	X	Oilmen's AL44	~1 per trench
Mechanics truck	X	X	X	X	Knapheide KMT2	~1 per trench
Pickup and support trucks	X	X	X	X	Ford 250	~3 per trench

Note:

The equipment listed in this table are typical. The equipment actually used during construction will be selected by the construction contractor based on project-specific factors.

3.2.2.3 Trenchless Technology

Trenchless technologies such as horizontal directional drilling (HDD), horizontal-auger boring, microtunneling, and conventional tunneling may also be used to construct the remedy. Methods will be chosen based on the type of system being installed and the anticipated ground conditions. These construction techniques achieve very similar results, which is to construct a hole under the ground, install a carrier pipe in the hole, and pull the system components through the carrier pipe.

Horizontal Directional Drilling. This method consists of preparing launching and receiving sites, drilling a pilot hole, reaming, installing the pipes and utilities, and stabilizing the site.

Site Preparation. The launching and receiving sites will be prepared with construction equipment before starting drilling operations. At the launch site, a pit or an earthen platform may be constructed to provide a stable working platform for the drill rig and facilitate future pipe connections. Shoring, sloping, and or benching may be required to maintain stability of the earthen walls that form the pit. The launch pit will contain drilling mud that exits the borehole, provide work space to change bits, and facilitate future pipe connections. The ground around the launch site may be cleared and/or graded to provide adequate room to lay out materials, setup support vehicles, and perform the work. Materials that may be staged at the site include bags of (dry) drilling mud, drill steel, tools, piping, and spoil.

A pit will also be dug at the receiving site. The receiving pit will contain drilling mud that may exit the borehole, provide work space to change bits, and facilitate future pipe connections. Piping may be staged at either the launching or receiving pits. Temporary fencing and signs may be installed around the launching and receiving areas.

Drilling. A relatively small-diameter pilot hole will be drilled along the design alignment using mud rotary methods. A drilling mud slurry will be pumped into the hole as the drill bit cuts into the soil. Predominantly a mix of water, bentonite, and other drilling admixtures, this mud will carry spoil cuttings out of the hole and ultimately into a mud recycling system. The mud will also form a cake around the borehole walls that will help prevent the hole from collapsing. The recycling system will remove cuttings from the mud so the mud may be pumped back into the hole for reuse. The cuttings would be drained by the HDD contractor and managed in accordance with the Soil Management Plan presented in Appendix L to this C/RAWP. The recycling system may be truck- and/or trailer-mounted and may be augmented with pits dug into the ground. The drilling contractor will monitor progress using instrumentation in the drill rig and drill bit. The contractor will also measure mud quantity during the operation and observe the surface to look for signs that the mud is percolating upward through the soil and emerging at the ground surface.

Reaming. After reaching the receiving pit, the borehole will be enlarged by reaming. In the receiving pit, the drill bit will be swapped out for a reaming bit. The reaming bit will enlarge the borehole as it is pulled back through the pilot hole. This may require more than one pass and/or more than one bit to reach the required diameter.

Install Carrier Pipe and System Components. After the reaming is completed, a pipe will be attached to the drill pipe and pulled through the borehole by the drill rig. This may be done from either side of the hole based on site conditions. This pulled pipe may be the remedy pipe/conduit itself or it may be a carrier pipe. If the latter, the drill rig and ropes/cables will be used to pull the remedy pipes/conduits through the carrier pipe, and other equipment may assist. Eventually, the pipes/conduit ends sticking out of the hole will be connected to the rest of the pipeline on either side of the hole. These connections may be completed quite some time after the trenchless installation is complete. The connections will be made and tested in accordance with manufacturer's recommendations as described in Section 3.2.2.1.

Backfill and Finish Grading. After completing installation, the site will be left in a stable condition to support future construction operations. Drilling mud, spoil, and other materials will be removed, and the ground surface will be left in a condition that does not promote the release of fugitive dust. If the piping and conduit connections are made immediately after completing drilling, the launch and receiving pits will be backfilled.

If, however, the piping/conduit connections are made an extended time after drilling, the pits may be left open or partially backfilled and the end of the pipe marked to avoid the need to backfill an area only to re-excavate it in the future. In that case, fences, signs, regular inspections, and other measures would be considered to address any potential safety concerns.

Construction Equipment. The types and anticipated numbers of equipment typically used to implement this method are listed in Exhibit 3.2-8. The activities in which each piece of equipment is typically involved is designated by an "X" in the column for a given activity.

EXHIBIT 3.2-8
Typical Construction Equipment for Horizontal Directional Drilling
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Equipment	Site Preparation	Drilling - Reaming	Install System	Backfill and F. Grading	Typical Make/Model	Estimated Number
Excavator (w/hoe-ram)	X		X	X	CAT 330	~1 per pipe
Backhoe	X		X	X	CAT 430	~1 per pipe
Vacuum/soft dig truck	X				Prevac Hydrovac	~1 per pipe
Dump/haul truck	X			X	CAT CT660	~1 per pipe
Water truck	X	X	X	X	1,00 to 3,000 gal	~1 per pipe
Front end loader	X	X	X	X	CAT 966	~1 per pipe
Rough terrain/telescopic fork lift	X	X	X	X	SkyTrak 4290	~1 per pipe
Boom/crane truck	X	X	X	X	National Crane 1400H	~1 per pipe
Drill rig		X	X		DitchWitch JT100 Mach 1	~1 per pipe
Drill rig transport vehicle		X		X	Tractor trailers	~1 per rig
Mud recycling truck/trailer		X			American Augers MCM-4000	~1 per rig
Pipe welding machine			X		McElroy 412 or 618	~1 per pipe material
Fuel/grease truck	X	X	X	X	Oilmen's AL44	~1 per trench
Mechanics truck	X	X	X	X	Knapheide KMT2	~1 per trench
Pickup and support trucks	X	X	X	X	Ford 250	~3 per trench

Note:
The equipment listed in this table are typical. The equipment actually used during construction will be selected by the construction contractor based on project-specific factors.

Horizontal Auger Boring. This method, also called jack-and-bore, consists of preparing driving and receiving sites, boring while simultaneously advancing a casing pipe, and installing pipes and utilities in the casing/carrier pipe.

Site Preparation. The driving and receiving sites will be built with construction equipment before starting boring operations. A driving pit will be dug to allow installation of the pipe and conduit at the correct elevation and to provide a reaction surface against which the boring machine can push. The boring machine will be lifted from a haul vehicle, placed into the pit, and braced against the back wall of the drive pit. Shoring, sloping, and or benching may be required to maintain earthen wall stability in the pit. The ground around the launch pit may be cleared and/or graded to provide adequate room to layout materials, setup support vehicles, and perform the work. Materials that may be staged at the site include auger flights, tools, piping, and spoil. A pit will also be dug at the receiving site. The receiving pit will provide work space to

facilitate future pipe connections. Piping may be staged at either the launching or receiving pits. Temporary fencing and signs may be installed around the launching and receiving areas.

Boring and Casing Installation. The boring machine will advance auger flights and a steel casing pipe into the ground along the proposed pipe alignment. As the bit cuts into the ground, spoil will be removed from the hole by the auger flights. The augers and casing pipe will be advanced simultaneously into the ground as a single unit. Soil will be removed from the casing by the helical auger flights and will be removed from the drive pit using construction equipment and stockpiled. Additional lengths of pipe will be lowered into the driving pit and welded onto the carrier pipe as needed to advance the bore.

Install System Components. After boring is complete, the ends of the casing pipe will be cut and will serve as a carrier pipe for the remedy pipe/conduit. The boring machine and other equipment will use ropes, cables, or steel pipe to pull the remedy pipes/conduits through the carrier pipe. Eventually, the pipes and conduit ends sticking out of the hole will be connected to the rest of the pipelines and conduit. These connections may be made an extended period of time after the trenchless installation is complete. The connections will be made and testing performed in accordance with manufacturer's recommendations as described in Section 3.2.2.1.

Backfill and Finish Grading. After completing installation, the site will be left in a stable condition to support future construction operations. Spoil and other materials will be removed, and the ground surface will be left in a condition that does not promote the release of fugitive dust. If the piping and conduit connections are made immediately after completing boring, the drive and receiving pits will be backfilled. If, however, the piping and conduit connections are made an extended period of time after boring, the pits may be left open or partially backfilled and the end of the pipe marked to avoid the need to backfill an area only to re-excavate it in the future. In that case, fences, signs, regular inspections, and other measures would be considered to address any potential safety concerns.

Construction Equipment. The types and anticipated numbers of equipment typically used to implement this method are listed in Exhibit 3.2-9. The activities in which each piece of equipment is typically involved is designated by an "X" in the column for a given activity.

Microtunneling. Generally, this method would be used when ground conditions are not suitable for HDD or horizontal auger boring. The primary difference between this method and horizontal-auger boring is that microtunneling requires the use of a small remote-controlled tunnel boring machine (TBM) instead of an auger boring machine. Microtunneling consists of preparing launch and receiving sites, tunneling while installing a casing pipe behind the TBM, and installing pipes and utilities in the casing. The casing pipe is installed in sections and may be steel and/or precast concrete. Spoil is removed from the hole by a mud system or a conveyor belt system. Once the casing is in place, the system components are pulled through in the same manner as that for horizontal-auger boring. Except for the TBM substitution, the equipment used for this method is largely the same as discussed for horizontal auger boring.

Conventional Tunneling. Generally, this method would be used when ground conditions are not suitable for HDD, horizontal auger boring, or micro tunneling. The primary difference between this method and microtunneling is that in conventional tunneling, excavation is done by personnel in the hole using hand tools, power tools, and/or heavy equipment. Conventional tunneling consists of preparing the launch and receiving sites, tunneling while installing a casing pipe behind the excavation face, and installing pipes and utilities in the casing. A larger-diameter hole is required to allow workers to enter the hole and access the excavation face. Spoil is removed from the hole using heavy equipment, a conveyor belt system, and/or carts mounted on a light gauge rail system. The hole is supported by a continuous steel or concrete liner as the tunnel is advanced. Once the casing is in place, the system components are pulled through in the same manner as that for prefabricated utility ducts. The equipment used for this method is largely the same as discussed for horizontal auger boring except that a tunneling machine is used in place for a boring machine.

EXHIBIT 3.2-9
Typical Construction Equipment for Horizontal Auger Boring
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Equipment	Site Preparation	Boring	Install System	Backfill and F. Grading	Typical Make/Model	Estimated Number
Excavator (w/hoe-ram)	X	X	X	X	CAT 330	~1 per pipe
Backhoe	X	X	X	X	CAT 430	~1 per pipe
Vacuum/soft dig truck	X				Prevac Hydrovac	~1 per pipe
Dump/haul truck	X	X		X	CAT CT660	~1 per pipe
Water truck	X	X	X	X	1,00 to 3,000 gal	~1 per pipe
Front end loader	X	X	X	X	CAT 966	~1 per pipe
Rough terrain/extendable forklift	X	X	X	X	SkyTrak 4290	~1 per pipe
Boom/crane truck	X	X	X	X	National Crane 1400H	~1 per pipe
Auger boring machine		X	X		Robbinx ABM 72-1500	~1 per pipe
Auger boring machine transport vehicle		X		X	Tractor Trailer	~1 per rig
Crane	X	X		X	Manitowoc Grove GMK4114L	~1 per rig
Pipe welding machine			X		McElroy 412 or 618	~1 per pipe material
Fuel/grease truck	X	X	X	X	Oilmen's AL44	~1 per trench
Mechanics truck	X	X	X	X	Knapheide KMT2	~1 per trench
Pickup and support trucks	X	X	X	X	Ford 250	~3 per trench

Note:
The equipment listed in this table are typical. The equipment actually used during construction will be selected by the construction contractor based on project-specific factors.

3.2.2.4 Aboveground Piping and Utilities

Methods for installing the system components in this configuration consist of installing pipe support structures, installing the pipes, and coating and labeling the pipes. This configuration is commonly employed when pipes are routed on or inside structures.

Support Structures. Pipe supports will be attached to concrete structures such as floors, footings, pads, walls, and ceilings, or metal features such as columns, beams, or walls. Typical pipe supports will include stanchions, hanger rods, saddles, brackets, clamps, pipe racks/trays, and metal frames (for example, unistrut). Although pipe supports may be embedded in wet concrete, they will generally be installed after the concrete has cured to a sufficient strength. The supports will be attached to anchors and/or bolts that will be drilled into the concrete. When supports, such as stanchions, are placed on concrete pads or floors, a grout pad will usually be provided to level the base plate. Supports may be attached to metal using screws, welds, brackets, clamps, and/or bolts. Supports installed at high elevations will require the use of fall protection measures and/or equipment such as manlifts to meet regulatory safety requirements

Pipe/Conduit Installation. The piping and conduit will be connected and installed on the pipe supports. The pieces may be linked together either before, after, or while being placed in the pipe support. Joining methods could include pushing together bell-and-spigot-type pipe ends, solvent welding, fusion welding, metal welding, mechanically restrained connections, valves, or pipe penetrations. The joining methods will be in accordance with the pipe/conduit manufacturer's installation recommendations.

Pipes will be tested for leakage. The testing will involve flushing the pipe, filling the pipe with water, pressurizing the pipe in one or more stages, and measuring pressure loss over time. The pipelines may be tested before, during, and/or after installation and coating, and pipes may be tested in sections and/or over the full pipe length. Water used for flushing and testing will be disposed of in accordance with applicable permits, laws, and regulations. Electrical and communication conduits may be tested by running a mandrel between some or all manholes. The wires and conductors pulled through the conduits will be tested for continuity.

The installation of Pipeline B, which conveys fresh water, on the L300A (Arched) Bridge over the Colorado River is a special case. Customized roller-type pipe supports will be bolted to the bridge deck. A temporary elevated working platform will be installed to the existing deck beams to allow installation. The 12-inch-diameter pipe will be delivered to the Arizona side or the river, welded together to create 160-foot-long segments (approximate length), and hydrostatically tested. After successful testing, each segment will be lifted onto the pipe supports and welded to the other pipe segments already on the bridge. The pipe will then be pulled west towards California until there is enough room to place another segment onto the bridge and the process repeats itself. This pipeline pulling and welding process will continue until all the pipe is placed on the L300A Bridge. Fabrication, welding, and erection of the piping shall be per ASME B31.3 Code.

Coating and Labeling. Before, during, and/or after installation the piping will be painted or coated to resist corrosion, meet esthetic or architectural standards, and meet process requirements. The piping, conduit, and accessories, such as valves, will be labeled. Labelling will typically identify the purpose of the contents of the pipe, such as potable water, and the direction of flow.

Construction Equipment. The types and anticipated numbers of equipment typically used to implement this method are listed in Exhibit 3.2-10. The activities in which each piece of equipment is typically involved is designated by an "X" in the column for a given activity.

EXHIBIT 3.2-10
Typical Construction Equipment for Above-Ground Piping
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Equipment	Pipe Supports	Pipe and Conduit Installation	Coating and Labeling	Typical Make/Model	Estimated Number
Scaffolding	X	X	X	Not Applicable	~1 per pipe
Man lift/basket	X	X	X	JLG 800AJ or 3394RT	~1 per pipe
Rough terrain/extendable forklift	X	X	X	SkyTrak 4290	~1 per pipe
Boom/crane truck	X	X	X	National Crane 4290	~1 per pipe
Pipe welding machine		X		McElroy 412 or 618	~1 per pipe
Metal welding machine	X	X		Truck-mounted	~1 per pipe
Pickup and support trucks	X	X	X	Ford 250	~3 per pipe

Note:
The equipment listed in this table are typical. The equipment actually used during construction will be selected by the construction contractor based on project-specific factors.

3.2.3 Vertical Infrastructure

This section describes the typical methods and equipment that will be used to construct different elements of the vertical infrastructure associated with the remedy, which includes buildings and other aboveground facilities. Although most of the vertical infrastructure will be at the TCS, TW Bench, MW-20 Bench, or evaporation ponds, there will be some small miscellaneous vertical infrastructure at other locations such as well sites. Vertical infrastructure associated with the Construction HQ is discussed in Section 4 of this C/RAWP.

The infrastructure located inside TCS includes concrete foundations and pads, metal buildings and shade structures, concrete buildings, retaining walls, tanks (both permanent and temporary), pumps and process equipment, transformers and electrical equipment, and heating, ventilation, and air conditioning (HVAC) systems. Construction activities inside TCS will be coordinated with station personnel and will comply with TCS work rules so as to not interfere with station operations.

The infrastructure at the TW Bench includes a septic tank, trenches, concrete masonry unit buildings, fencing, and asphalt concrete pavement.

The infrastructure at the MW-20 Bench includes a storage tank with associated concrete pad; a truck-unloading concrete containment pad; a pre-engineered metal building; and associated equipment such as electrical, process, mechanical, etc.

The infrastructure at the existing evaporation ponds includes a small building, new instrumentation and control systems, and modifying pond inlet pipes. The techniques and equipment used for construction will likely be similar to those described for ground piping and vertical infrastructure.

Concrete Foundations and Pads. These elements will be built by excavating holes and trenches in the ground and using cast-in-place reinforced concrete footings. Construction equipment will be used to excavate, and the spoil will be loaded directly into haul vehicles and/or temporarily stockpiled near the excavations. Excavation in hard soil or rock may require special excavation techniques such as road mining, grinding, and/or hoe-ramming. The excavation bottom subgrade will be compacted and may be covered with a compacted layer of coarse-grained soil such as aggregate base, gravel, and/or crushed rock. Reinforcing steel, also known as rebar, will be lowered into the hole and assembled by hand. Metal and/or wood forms will be installed around the excavation to contain concrete in the above-grade portions of the footings. Concrete will be delivered to the site and placed the forms in one or more pours. Concrete pumping equipment may be used to place concrete in forms. The concrete will be vibrated into place, finished by hand, and allowed to cure. Curing could take one month or more and may require application of burlap bags, water, and/or sealant sprays. Steel components, bolts, and/or rebar may protrude from the concrete surface to provide points at which to anchor buildings.

Metal Buildings and Shade Structures. Generally, the structural framing and outer skin of the metal buildings will be prefabricated then assembled onsite. Assembly will begin with the structural framing being attached to the concrete foundations. Structural members can be welded and/or mechanically fastened together (bolted, screwed or riveted). Wall and roof skins will be attached next using mechanical fasteners or, in some case, welding the components. Electrical, plumbing, and HVAC systems will be installed concurrently as erection of the structure progresses. Equipment and piping for the remedy process systems will also be installed concurrently as the various areas are ready for the different components. Finishes, such as paint, hardware, electrical and plumbing fixtures, are generally accomplished later in the process to avoid damages to the exposed components.

Concrete Buildings. These buildings differ from the metal buildings because the structure will be built using concrete rather than steel. Construction of the concrete structure will take place by first installing forms to the shape of the finished structure, placing false work to support the concrete until it sets, and installing the reinforcing steel. Ready mix concrete will be delivered to the site and placed in the forms either by dumping directly out of the truck, or by using a concrete pump in cases where the concrete delivery truck cannot reach the forms with its chutes. Multiple setups and pours will be necessary for the concrete buildings. Once the structure is in place, electrical, plumbing, HVAC, equipment, piping and finishes will be installed in a manner similar to that for the metal buildings. Cranes will also be mounted in the ceiling of the remedy produced water conditioning plant.

Concrete Masonry Unit Buildings. These structures will be built by installing a concrete foundation, after which, walls will be built by stacking and grouting together concrete blocks having open cells or holes. Reinforcing steel will be installed in the cells, and the voids will be filled with concrete or concrete grout. At

some locations, building walls may also act as retaining walls against adjacent hillsides. The roof and other systems will be installed after installing the walls in the same manner as described for concrete buildings.

Retaining Walls. Soil retention structures, such as walls, are installed to support steep soil slopes. The slopes are made steep to create more usable space and allow for larger buildings and other structures. When providing space for buildings, the retaining walls may be incorporated into building walls. The retaining walls also may be constructed using cast-in-place concrete with the same methods of layout, excavation, forming, reinforcing, and concrete placement as described for concrete buildings and foundations, or the walls may be constructed of concrete block. Soil will be backfilled behind the retaining walls once the concrete has cured for a specified time.

Steel Tanks. Depending on size, the steel tanks may be completely prefabricated offsite and placed on the foundations as a complete unit, or the tanks may be erected in place from prefabricated or raw components. The tanks are generally cylindrical and will usually be placed on a ring-shaped cast-in-place reinforced concrete footing.

Temporary Tanks. Rectangular portable tanks, commonly known as frac tanks, will also be used. These will be placed on reinforced, cast-in-place concrete foundations designed to provide drainage and secondary containment.

Pumps and Process Equipment. Pumps and other process equipment will be installed on concrete pads. Generally, the equipment and its supports will be attached to the concrete with anchor bolts and grout pads provided to help level the equipment. Piping and electrical wiring connected to the equipment may be aboveground or buried.

Septic Tanks. A septic tank will be installed under the parking lot of the TW Bench, and two septic tanks will be installed at the CHQ. The tanks will be installed by excavating below the ground surface and placing the tanks in the excavation.

Transformers and Electrical, Instrumentation, and Communication Equipment. Transformers, cabinets, and other equipment will be installed on concrete pads. Generally, the equipment and/or its supports will be attached to the concrete with anchor bolts and grout pads provided to help level the equipment.

Conduits and raceways will be provided in the structures to carry electrical systems. The insulated electrical wiring will be pulled through conduits and raceways, whether above- or belowground, using hand holes and cable-pulling machines. The pull tension will be monitored while pulling to avoid damage to insulated wires. The wires will be tested to confirm acceptability after installation.

HVAC Equipment. In some cases, the HVAC equipment will be installed on concrete pads adjacent buildings, with pipes and ductwork penetrating the building shell.

Other Vertical Infrastructure. This category includes other miscellaneous vertical infrastructure installed at the site, such as transformers, electrical and communication panels, antennas, lighting, security devices, fencing, and a construction water tank. The techniques and equipment used for construction would be similar to those described in the sections for aboveground piping and vertical infrastructure.

Construction Equipment. The types and anticipated numbers of equipment typically used for vertical construction are listed in Exhibit 3.2-11. The activities in which each piece of equipment is typically involved is designated by an “X” in the column for a given activity.

EXHIBIT 3.2-11

Typical Construction Equipment for Vertical Construction

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Equipment	Concrete Foundations	Metal Buildings	Concrete Buildings	Retaining Walls	Tanks	Install Equipment	Typical Make/Model	Estimated Number
Excavator (w/hoe-ram)	X			X			CAT 330	~2 per bldg.
Backhoe	X			X			CAT 430	~2 per bldg
Bulldozer w/rippers	X			X			CAT D10	~2 per bldg
Vacuum/soft-dig truck	X			X			Presvac Hydrovac	~1 per bldg
Dump/haul truck	X	X	X	X	X	X	CAT CT660	~2 per bldg
Water truck	X		X	X			1,000 to 3,000 gal	~2 per bldg
Articulated dump/haul truck	X	X	X	X	X	X	CAT 730	~2 per bldg
Front-end loader	X	X	X	X	X	X	CAT 966	~1 per bldg
Walk-behind soil compactor	X			X			Wacker DPU 130 or DS 70	~2 per bldg
Soil compactor	X			X			CAT 815	~1 per bldg
Rough terrain/telescopic fork lift	X	X	X	X	X	X	SkyTrak 4290	~1 per bldg
Concrete truck	X		X	X			McNeilus Standard Mixer	~5 per bldg
Concrete pump truck w/boom	X		X	X			Putzmeister 28Z	~1 per bldg
Boom/crane truck	X	X	X	X	X	X	National Crane 1400H	~1 per bldg
Crane		X	X		X	X	Manitowoc Grove GMK4114L	~1 per bldg
Man lift/basket		X	X	X	X	X	JLG 800AJ or 3394RT	~2-3 per bldg
Scaffolding		X	X		X	X	Not Applicable	~1-2 per bldg
Pipe welding machine		X	X		X	X	McElroy 412 or 618	~1 per bldg
Fuel/grease truck	X	X	X	X	X	X	Oilmen's AL44	~1 per bldg
Mechanics truck	X	X	X	X	X	X	Knapheide KMT2	~1 per bldg
Metal welding machine		X			X	X	Truck-mounted	~2 per bldg
Pickup and support trucks	X	X	X	X	X	X	Ford 250	~3 per bldg

Note:

The equipment listed in this table are typical. The equipment actually used during construction will be selected by the construction contractor based on project-specific factors.

3.2.4 Site Access Pathways

This section describes the two types of access roads that will be installed as part of the remedy: temporary access roads used for construction and long-term access roads used to regularly operate and maintain the remedy.

3.2.4.1 Temporary Access

Temporary access roads will be provided to allow construction and startup of the remedy system. Generally, the roads will use existing paths or be constructed by clearing a new path to provide a smooth driving surface. Large rocks will be removed from the road alignment and, if necessary, vegetation will be trimmed, cut, and/or cleared. If the existing subgrade soil is soft or loose, it may be reinforced, removed and replaced, or both. Geotextiles, geogrids, steel mats, plastic mats, sand grid, and/or soil stabilizers may be used to reinforce soil. If the soil is removed and replaced, the excavated subgrade soil may be loaded directly into haul vehicles or stockpiled near the excavation for reuse. The replacement soil will generally be a coarse-grained material such as gravel, crushed rock, and/or aggregate base, built and maintained to carry the construction equipment expected on that route. The road surfacing will typically be coarse-grained soil and/or compacted native soil. In certain instances, these temporary access roads may become long-term access roads to allow operation of the remedy.

3.2.4.2 Long-term Access

Long-term access roads will be provided to allow regular O&M of remedy system components. In some locations, access roads and pipelines may share the same alignment, with the pipeline being installed adjacent to or underneath the access road.

Typically, there will be at least one way to access each well, but there will not be a dedicated route to each well. For example, the access road in the floodplain may be constructed in a loop or ring-shape configuration to allow access to/from the well from two directions. Where possible, the temporary access roads will also serve as the long-term access road to reduce the amount of disturbed area. The number of roads will be minimized to the extent practical, while still providing access to all parts of the remedy infrastructure.

Pipeline I/FW-2 Road. Improvements will be made to the road that leads into Bat Cave Wash from the west (to the west of TCS). The improvements will consist of installing new drainage structures, raising the road elevation, and providing a new road surface. This work will be accomplished with heavy construction equipment. New drainage structures, such as ditches, inlets, and pipes, will be installed by excavating below the ground surface and placing the structures in the excavation. The road will be raised by placing fill on the existing surface, cutting soil from higher portions of the road, and placing it on lower portions to create more uniform surface. The fill will likely be borrow from other excavations at the project site. The road surface will be created by spreading and compacting imported gravel on the road surface.

Floodplain Road. A new ring-shape road will be constructed in the floodplain to support construction and provide long-term access to the wells. The road may be founded on granular stabilization rock depending on the stiffness of the existing subgrade soil. The structural layers in the road will consist of gravel, aggregate base (essentially a processed mixture of sand and gravel), and geosynthetic such as geotextiles. The road materials will be placed and compacted in lifts or layers after preparing the subgrade. Depending on location, the road may be built before, during, and/or after pipeline construction.

TW Bench Area. The parking lot will be covered with ACP. The ground surface will be cut to grade, compacted, and covered with a layer of gravelly soil called aggregate base. The ACP will be placed as a hot mix on the base and allowed to cure.

In addition, a new road will be installed to provide access to the existing TW Gas Metering Station yard from the north. The footprint of the new road route will be cleared and graded, and the remaining subgrade will be compacted. The fill soil will be built up in lifts, which are loose layers of soil. Each lift will be placed, graded, moisture conditioned, and compacted. The road will be surfaced with gravel or aggregate base.

Pipeline H/IRL-4 Road. A new road will be constructed to provide access to Pipeline H. It will be installed in the same manner described above for TW Bench access road.

Moabi Regional Park Area. Access to the Construction Headquarters/Long-term Remedy O&M support area and the soil processing area will be via National Trails Highway. In addition:

- An existing access road (located south of NTH) will be used to cross the channelized, ephemeral wash that originates at the outfall from three culverts installed under the BNSF railroad track and that runs southwest to northeast adjacent to the Construction Headquarters/Long-term Remedy O&M support area. In order to ensure access to this area for long-term remedy operations, the existing access road will be improved and drainage will be engineered to divert flow through a concrete spillway.
- Existing access roads to the soil processing area, located north of NTH, will be improved to support the soil processing operations during remedy construction.

Construction Equipment. The types and anticipated numbers of equipment typically used to construct this configuration are listed in Exhibit 3.2-12. The activities in which each piece of equipment is typically involved is designated by an "X" in the column for a given activity.

EXHIBIT 3.2-12
Typical Construction Equipment for Access Construction
Groundwater Remedy Construction/Remedial Action Work Plan,
PG&E Topock Compressor Station, Needles, California

Equipment	Access Construction	Typical Make/Model	Estimated Number
Excavator (w/hoe-ram)	X	CAT 330	~1 per road
Backhoe	X	CAT 430	~1 per road
Scraper (standard push)	X	CAT 621	~2 per road
Scraper (twin engine)	X	CAT 627	~2 per road
Bulldozer (w/rippers)	X	CAT D10	~1 per road
Vacuum/soft dig truck	X	Presvac Hydrovac	~1 per road
Dump/haul truck	X	CAT CT660	~3 per road
Water truck	X	1,000 to 3,000 gal	~2 per road
Articulated dump/haul truck	X	CAT 730	~2 per road
Front-end loader	X	CAT 966	~1 per road
Soil compactor	X	CAT 815	~1 per road
Road grader	X	CAT 120	~1 per road
Fuel/grease truck	X	Oilmen's AL44	~1 per road
Mechanics truck	X	Knapheide KMT2	~1 per road
Pickup and support trucks	X	Ford 250	~1 per road

Note:
The equipment listed in this table are typical. The equipment actually used during construction will be selected by the construction contractor based on project-specific factors.

3.2.5 Commissioning

Commissioning will include functional testing and other activities are required to verify that installed equipment and other individual components are functioning as designed. The specific activities are discussed in Section 6 of this C/RAWP.

3.2.6 Construction Closeout

Construction closeout activities include the final tasks that, along with commissioning, are required for the construction contractor(s) to fulfill their contracts. It includes generating as-built documents, making final submittals, training (to be provided by vendor[s]), surveying, soil stabilization, and demobilization. Generating as-built documents includes creating record drawings that show what was actually built and surveying as-built facilities and topography. In addition to as-built documents, end-of-project submittals include the test records, quality records, final reports, lien releases, warranties and guarantees, spare parts/materials, and other documents and materials required by contract. The contractor may bring manufacturer's representatives to the site to observe construction and/or commissioning and train personnel to operate equipment.

Areas where the ground surface was disturbed by construction activities will be stabilized to reduce the chances of producing fugitive dust. Stabilization may consist of moisture conditioning and compacting the soil, and applying a layer of dust palliative/tackifier, such as SoilTac® and/or coarse-grained soil, such as gravel, to the ground surface. The contractor will make a final site survey to verify that conditions at the end of construction are keeping with requirements to match preconstruction conditions. As major field work is completed, equipment, personnel, and materials will be demobilized by removal from the site. Also, following construction completion, designated biological monitors will return to the site to document the post-construction conditions. As part of the construction closeout activities, the CHQ at Moabi Regional Park will be transitioned to support long-term O&M of the remedy, and infrastructure components that are determined to be no longer needed for long-term O&M will be deconstructed or demobilized. Certain equipment and infrastructure, including the PG&E Office Trailer, workshop building, parking shade structure, decontamination pad, utilities, and security features, will be reused for long-term O&M.

The Construction Completion Report described in Section 2.6.3.2 will be prepared as part of the construction closeout activities.

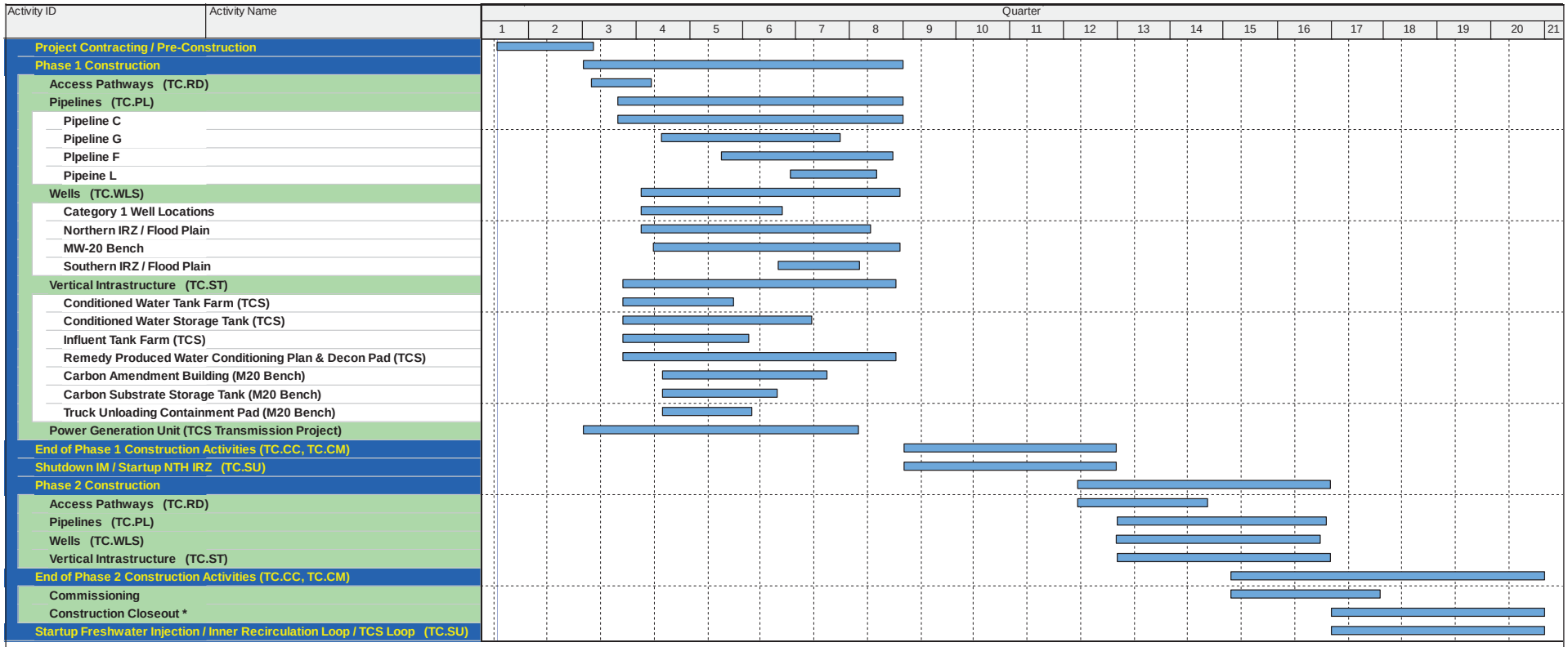
3.2.7 Startup

After functional testing is complete, remedy startup will be initiated for transition into remedy operation and maintenance. Remedy startup, including shutdown and layup of the IM, is discussed in Section 6.

3.3 Construction Sequencing

This section provides an overview of the estimated durations and logic used to develop the preliminary sequence of construction. Section 3.3.1 provides an overview of key considerations and assumptions made in developing the sequence. Sections 3.3.2 through 3.3.6 discuss construction schedule considerations for pre-construction activities, wells, piping and utilities, vertical infrastructure, and end of construction activities.

The preliminary construction sequence was developed to meet the requirements of the RCRA CACA and the CERCLA CD. Exhibit 3.3-1 illustrates the preliminary construction schedule for the groundwater remedy. A more detailed construction schedule will be prepared following approval of the final design and selection of contractors. The schedule will be regularly updated during construction and startup of the groundwater remedy. As described in Section 2.6.3, PG&E will use the monthly progress reports to communicate progress related to the schedule and PG&E will notify DTSC and DOI of a change to the schedule for performance of any activity prior to the performance of the activity, or as otherwise agreed to by PG&E, DTSC, and DOI. The following describes the sequencing development and schedule duration and constraints for key remedial infrastructure at this preliminary stage in the planning.



NOTE:

* Includes preparation and submittal of the Construction Completion Report

EXHIBIT 3.3-1

PRELIMINARY CONSTRUCTION SCHEDULE FOR THE GROUNDWATER REMEDY

CONSTRUCTION / REMEDIAL ACTION WORK PLAN

PG&E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

3.3.1 Sequencing Overview

3.3.1.1 General

The preliminary construction sequence presented herein was based on estimated construction durations and sequencing logic typical and feasible for similar projects constructed in similar site conditions. However, the exact durations and logic that will actually be used for planning and executing field activities will be based on the structure of construction contracts selected by PG&E and contractors to provide the safest and most efficient operation that meets project requirements. It is unlikely that all of the construction elements will be sequenced as described herein. It is impractical at this stage to predict exactly which elements will be constructed at any point in the future because that will depend on many variable and uncertain factors. Examples of such variables include but are not limited to equipment and personnel availability; the size/structure/scope of the construction contract(s); constraints imposed by operations at the TCS; constraints imposed by landowners, leaseholders, and other adjacent property users; and site conditions encountered in the field.

3.3.1.2 Sequencing Development

Optimal transition from the Interim Measure to the final groundwater remedy is a key factor in planning the remedy implementation, and thus a key factor in construction planning. At this stage in the design/construction process, the proposed sequencing approach is to construct the remedy in two phases. The IRZ along the NTH will be the key remedy feature constructed during the first phase, while the remaining systems (IRL, TCS recirculation loop, and injection of fresh water) will be constructed during the second phase. The phasing of construction in this manner will allow for the more rapid termination of the IM-3 operation and allow better opportunities to apply data collection during construction to evaluate system performance.

Exhibit 3.3-1 is a preliminary construction schedule, based on this phasing approach. The construction sequencing shown in Exhibit 3.3-1 was developed using a process typically used for construction projects, and in consideration of the remedy components necessary to support each construction phase. After dividing the project into major construction activities, each activity was given a unique alphanumeric identifier. Relationships, known as sequencing logic, were then used to connect the different tasks. Finally, construction durations were developed for each element based on the expected level of effort for each task, site constraints, and reasonable and typical production rates. These durations are shown as green and blue bars on Exhibit 3.3-1. This work was done using Primavera, the industry-standard software for scheduling and controlling construction projects.

3.3.1.3 Overall Project Starting Conditions

This construction sequence shown in the preliminary construction schedule starts when the groundwater remedy design is ready to construct. For purposes of sequencing, the design is considered ready to construct when the activities listed below are completed:

- Regulatory agencies have approved the final Professional Engineer-stamped design, including the C/RAWP.
- DTSC's environmental review (EIR) on the design is complete.
- Construction requirements in the C/RAWP have been put in construction and procurement documents (for example, Division 1 specifications, scopes of work, and requests for proposal). PG&E may elect to phase this item consistent with the phased sequencing approach.
- Site access agreements are in place (for example, easements, ROWs, and encroachment permits), to include lease agreements for the construction headquarters and soil processing area. PG&E may elect to phase this item consistent with the phased sequencing approach.

Duration and Calendar. The preliminary construction schedule on Exhibit 3.3-1 shows the project lasting approximately 19 to20 quarters. This duration includes time for contracting, startup, IM-3 shutdown, commissioning, and construction closeout activities that, strictly speaking, are not composed entirely of field construction activities. The estimated duration of field construction activities is projected to be approximately 14 to 15 quarters. Time on Exhibit 3.3-1 is shown in sequentially numbered quarters, as opposed to months and years, due to the uncertainty inherent in construction planning at this stage.

Phasing. Exhibit 3.3-1 illustrates the proposed sequencing approach is to construct the remedy in two phases. Phase 1 will include construction of the NTH IRZ and associated supporting infrastructure, installation of Category 1 wells, and key mobilization and site preparation activities such as construction of the CHQ. Phase 1 supporting infrastructure includes access pathways, pipelines, vertical infrastructure and monitoring wells associated with the NTH IRZ system. Following Phase 1 construction and associated functional testing, shut down of the Interim Measure and startup of the NTH IRZ will occur. During this time, some limited construction closeout (end of Phase 1) activities is expected. Phase 2 will include construction of the remaining systems (IRL, TCS recirculation loop, and injection of freshwater), and associated supporting infrastructure. Following Phase 2 construction and associated functional testing, startup of the remaining systems and construction closeout will occur. The proposed construction sequence is subject to change based on baseline data collected and analyzed, including a contingency to prioritize the installation of the River Bank Extraction Wells earlier in the sequence if warranted.

Early Starts and Concurrent Work. The preliminary construction schedule on Exhibit 3.3-1 is known as an early-start schedule because it shows the earliest possible start date for each activity based on the sequencing logic and estimated durations. As a result, Exhibit 3.3-1 shows a number of construction activities starting at nearly the same time. At first glance, this implies that a large number of field activities will commence simultaneously, and while that could in fact happen, it might not. PG&E may choose to phase the start of certain construction activities on a case-by-case basis to provide the safest and most efficient operation possible. For example, PG&E may need to stagger the start of certain tasks at the TCS to avoid interfering with critical TCS operations. This could have a ripple effect on the schedule because of the sequencing logic, but at this this stage of construction planning, it is difficult to determine exactly what the effect might be. PG&E will develop a detailed construction schedule with more solid start dates after the approval of the final design and selection of contractors.

3.3.2 Contracting and Preconstruction Activities

The first activities in the sequence include procurement/contracting, mobilization, and site preparation. These activities are early in the sequence because they are necessary to start field construction activities. These activities will overlap, and the total duration is expected to be approximately 8 months.

Construction cannot occur until qualified contractors, vendors, and suppliers are under contract to perform the work. Initial procurement and contracting is expected to begin once the design is approved and is estimated to have a total duration of approximately 5 months. It will include staffing and/or procuring a field management team, sourcing qualified construction contractors, awarding construction contracts, and procuring other services and materials. Procurement and contracting are an ongoing activity—contracts may be awarded at different times during this initial period and may be awarded during and between each construction phase, as needed, to support implementation. This approach will allow some construction to begin before the completion of all preconstruction activities. The method for selecting remedial action contractors is discussed in Section 2.3.2.

Mobilization is expected to last approximately 3 months and will include moving personnel and equipment to the site, building the CHQ, and establishing associated utilities and services for the CHQ. Section 4.2 describes mobilization in greater detail.

Site preparation will begin as mobilization is winding down and is anticipated to last approximately 1 to 2 months. It will include preparing temporary staging and work areas, including the construction water-filling

station; the soil processing and storage areas at Moabi Regional Park; installing temporary site controls (fencing, erosion control, etc.); conducting geophysical surveys to locate utilities; and demarcating sensitive areas. Site-specific sensitivity training and orientation, as well as documentation of preconstruction site conditions, will also occur during site preparation activities. Section 4.2 describes site preparation in greater detail.

Site access pathways and roads will be constructed throughout the project timeline as needed to provide access to primary work zones and support zones. The construction durations for individual pathways are included in the duration for the associated construction element. For example, the time needed to construct a road leading to the primary work zone for a well or pipeline is included in the duration for that well or pipeline.

3.3.3 Wells

Well construction and testing will be conducted throughout both Phase 1 and Phase 2 construction periods, and is expected to have a total duration of approximately 12 to 15 quarters. This duration is based on preliminary work sequencing assumptions and the assumption that a range of up to five drill rigs will be operating concurrently at any time over the given duration. In general, borehole drilling and well construction activities will begin with the Category 1 well locations and progress to Category 2 and 3 well locations (see Section 3.2.1.3), and well-testing activities will be conducted following the completion of well construction and development in a given testing area (see Section 3.2.1.5). Well drilling in Phase 1 will include Category 1 wells, and NTH IRZ remedy and monitoring wells. During Phase 2, the River Bank Extraction Wells will be sequenced to be constructed first if data shows that this is warranted. Some wells require installation of the respective pipeline to provide access to the well and for management of water generated during well development and testing. Exhibit 3.3-2 presents some of the unique schedule constraints and sequencing requirements for drilling and well construction to occur in specific areas of the site. Factors to be considered to optimize the well construction and testing schedule duration, which could result in an increase or decrease to the total estimated duration, include but are not limited to: availability of equipment; inclement weather effects; refinement to the well construction and testing scope of work based on actual field conditions; other concurrent construction activities; waste management capacity; and agency communication requirements.

3.3.4 Piping and Utilities

The total anticipated duration for pipeline construction is approximately 9-10 quarters. The estimated construction durations for the pipelines are shown on Exhibit 3.3-1. Key pipeline locations are provided on Figure 3.3-1.

The preliminary construction schedule assumes that construction of a number of pipelines could begin soon after completion of the relevant preconstruction activities (early start schedule as discussed above). As shown on Exhibit 3.3-1, during Phase 1 this includes Pipeline C. Pipeline segments could be constructed early simply because there are no or few conflicting activities that could constrain the start date. However, PG&E may choose to phase construction start on a case-by-case basis to sequence construction in the safest and most efficient manner possible and as required to coordinate with TCS operations and other constraints.

Other Phase 1 pipelines are shown to start at later dates because there are activities constraining their start times. For example, portions of Pipeline G cannot start construction until a portion of Pipeline C has been constructed in the floodplain. For purposes of estimating construction durations, the sequencing assumes that, to the extent practical, pipelines are constructed from one end to the other, pausing only when required. However, contractors could choose to construct simultaneously at several locations along the same pipeline or skip sections of pipeline. The pipeline construction durations also include time for site improvements at the well sites to include vertical infrastructure. Some of the key schedule constraints and sequencing requirements for pipelines are listed in Exhibit 3.3-3. The listed constraints are those that uniquely affect the construction sequencing and scheduling of certain work activities (for example, the

requirement for maintaining one lane of the entrance road to TCS always open affects the sequencing of Pipeline F construction).

EXHIBIT 3.3-2
Key Well Schedule Constraints
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Structure	Approx. Duration (months)	Schedule Constraints [a]
Category 1 Wells	9	Constructing access roads to MW-S and MW-BB. MW-DD will be sequenced as the last Category 1 well location to be installed in the Upland area.
NTH IRZ Area (Northern and Southern) and Floodplain Wells	17	Completing well installation and initial data collection at Category 1 well locations MW-A and MW-Z (to confirm key design assumptions) prior to the installation of other northern NTH IRZ area and floodplain wells. The access road on the floodplain and associated pipelines will be constructed before Category 2 and 3 wells on the floodplain to facilitate drill rig access. Further, advance construction of the pipelines will provide for the ability to convey water generated during well construction, development, and testing; thus limiting the associated equipment footprint. Biological surveys may identify specific locations where road construction and well drilling activities may be restricted on the floodplain for a designated time period (e.g., construction buffers around any active bird nests that may be found).[b]
Upland Area Wells	8	Completing well installation and initial data collection at Category 1 well locations MW-L, MW-M, MW-N, MW-P, MW-R, MW-U, MW-BB, MW-DD, and MW-FF (to confirm key design assumptions) prior to installing associated IRL Injection Wells 1 through 4, and associated monitoring wells. Once the IRL-4 location is confirmed, the access road and Pipeline H will be constructed before installing IRL-4, MW-Q, and MW-GG. Temporary IM-3 injection piping may be constructed before IRL-3 and FW-1 so the drilling work does not interfere with IM-3 injection activities.
Bat Cave Wash Area Wells	8	Completing well installation and initial data collection at Category 1 well location MW-S (to confirm key design assumptions) prior to installing FW-2 and associated monitoring wells and Category 1 well locations MW-10D and M11D to determine if future provisional monitoring well MW-V is required. Once the FW-2 location is confirmed, the access road will be constructed before installing FW-2, MW-HH, and MW-II. Avoiding storm events (i.e., flow in Bat Cave Wash channel) for MW-10D and MW-11D.
Topock Compressor Station Wells	2	Coordinating with the TCS such that construction of TCS-1 and TCS-2 does not interfere with their operations.
TW Bench Wells	4	Installation of TWB-1 and TWB-2 will occur after the construction of the road to the north side of the TW yard and the planned grading of the bench area associated with the construction of other remedy infrastructure. Coordinating with TW such that construction of TWB-1, TWB-2, and MW-K do not interfere with TW operations.
East Ravine Area Wells	9	Maintaining vehicle access to pipeline bridges during the construction of ER-1 through ER-4 and MW-T.
Arizona River Bank Wells	2	None

Notes:

[a] The constraints shown in this table are preliminary and could change based on variable factors.

[b] While the possibility of active bird nests is greatest within the dense vegetation of the historical and current Colorado River floodplain, it is recognized that there could also be active bird nests within the desert washes or uplands that would dictate a similar response.

EXHIBIT 3.3-3

Key Pipeline Schedule Constraints

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Pipeline	Approx. Duration (months)	Schedule Constraint [a]
All	36-45	Generally, site improvements will be made at well sites after the pipeline leading to that site has been installed. Site improvements include concrete pads, fences, gravel surfacing, shade structures, and final pipe/wire connections. The time needed to complete site improvements is included in the pipeline construction duration.
A	10	Construction of Pipeline A will be sequenced to maintain vehicle access to the IM-3 treatment plant (IM-3), for essential maintenance activities during the layup period after IM-3 is shutdown. Access to IM-3 facilities must be maintained at all times; thus, either the west access road to IM-3 or the east access road to IM-3 must be open at all times.
B	9	For planning purposes, the portion of Pipeline B within 200 feet of the Topock Marsh, between the Topock 66 Marina and HNWR-1, may not be constructed between mid-March and October 1 because that is the nesting season of the Yuma clapper rail.[b]
C	17	Construction of Pipeline C in the IRZ North/River Bank area may begin after completion of monitoring well MW-A. Construction of Pipeline C in the East Ravine area may begin after completion of monitoring well MW-70BR-D. Construction of Pipeline C on the MW-20 Bench may begin after construction support yards are established and water management structures, such as frac tanks, are installed and connected to IM-3. Biological surveys may identify specific locations on the floodplain where pipeline and road construction activities will be restricted for a designated time period.[c]
D	3	Construction of Pipeline D may begin after completion of Pipeline L because D ties into L.
E	4	Construction of Pipeline E may begin after a new road has been built to provide access to the north side of the existing gas metering station yard owned by the TW Pipeline Company.
F	10	Construction of Pipeline F may constrain vehicle access to the TCS (1 lane minimum).
G	10	Pipeline G construction may begin after completing much of Pipeline C in the IRZ North/River Bank area. Biological surveys may identify specific locations on the floodplain where pipeline and road construction activities will be restricted for a designated time period.[c]
H	7	Construction of the southern portion of Pipeline H may begin after a new access road has been built and before the IRL-4 well has been installed. The northern portion of Pipeline H may begin construction after completion of the western half of Pipeline A has been completed.
J	3	Pipeline J connects Pipelines F and B. Construction of Pipeline J may begin after completion of the portions of Pipelines F and B to which it connects.
K	5	Construction of Pipeline K may begin after completion of the remedy-produced water conditioning plant and associated decontamination pad, and portions of Pipelines L M.
L	5	Construction of Pipeline L may begin after completion of the influent tank farm, conditioned water storage tank, and foundations/piping for the conditioned water tank farm.
M	8	None identified but will coordinate with TCS in future.

Note:

[a] The constraints shown in this table are preliminary and could change based on variable factors.

[b] However, from June 1 to October 1 (i.e., the remainder of the breeding season), activities within this area may occur in a single window up to 10 days long with prior approval from BLM and USFWS.

[c] While the possibility of active bird nests is greatest within the dense vegetation of the historical and current Colorado River floodplain, it is recognized that there could also be active bird nests within the desert washes or uplands that would dictate a similar response.

3.3.5 Vertical Infrastructure

Construction of the vertical structures on TCS during Phase 2 could begin soon after completion of the preconstruction activities. These could be constructed early simply because at this time, no activities have been identified that could constrain the start date. However, PG&E may choose to phase their start on a case-by-case basis to sequence construction in the safest and most efficient manner possible and as required to coordinate with TCS operations. The total anticipated duration for TCS vertical infrastructure construction is approximately 15 to 16 months. The anticipated construction durations for each structure are shown in Exhibit 3.3-4. In addition, it is expected that TCS construction projects may be active at the same general time as the remedy construction (for example, power generation). PG&E will coordinate with TCS operations and sequence remedy construction to avoid conflict with the TCS construction projects.

Construction of the vertical structures on the MW-20 Bench during Phase 1 will likely begin after completion of Pipeline C in the MW-20 Bench area. This will be done largely to avoid congestion on the MW-20 Bench. The total anticipated duration for MW-20 Bench structure construction is approximately 9 months. The anticipated construction durations for each structure are shown in Exhibit 3.3-4.

Construction of the TW Bench operations building will likely begin in Phase 2 well after the start of field construction activities to avoid congestion created by monitoring well installation. In addition, vertical construction on the TW Bench will not start until a new road has been built to access the north side of the existing Transwestern gas pipeline metering yard.

EXHIBIT 3.3-4
Key Vertical Infrastructure Schedule Constraints
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Structure	Location	Approx. Duration (months)	Schedule Constraint [a]
Remedy-produced Water Conditioning Plant, Decontamination Pad, and Retaining Walls	TCS	15	None identified but will coordinate with TCS in future.
Conditioned Water Tank Farm	TCS	6	None identified but will coordinate with TCS in future.[b]
Conditioned Water Storage Tank	TCS	11	None identified but will coordinate with TCS in future.[b]
Influent Water Tank Farm	TCS	7	None identified but will coordinate with TCS in future.[b]
Remedy Freshwater Storage Tank	TCS	9	None identified but will coordinate with TCS in future.[b]
Carbon Substrate Storage Tank	MW-20 Bench	7	Cannot start until nearby portions of Pipeline C are built and there is more space available on the MW-20 Bench.
Carbon Amendment Building	MW-20 Bench	9	Cannot start until nearby portions of Pipeline C are built and there is more space available on the MW-20 Bench.
Truck Unloading Containment Pad	MW-20 Bench	5	Cannot start until nearby portions of Pipeline C are built and there is more space available on the MW-20 Bench.
Operations Building	TW Bench	12	Cannot start until Phase 2 when TWB-2 well installed, access provided to existing TW gas yard, and more space is available on the TW Bench.

Notes:

[a] The constraints shown in this table are preliminary and could change based on variable factors.

[b] Separate TCS construction/operations efforts may constrain sequence of work at the TCS.

3.3.6 End-of-construction Activities

Commissioning activities (also known as functional testing or shakedown) are expected to occur following construction completion for each of the key remedy systems, e.g., the IRZ along the NTH during Phase 1, and the IRL, TCS recirculation loop, and injection of fresh water during Phase 2. However, some commissioning activities could begin earlier once installation of an individual system or component is completed. This group of activities, also called functional testing, is described in more detail in Section 6.

Construction closeout activities will occur after completion of field construction activities and are expected to last approximately 12 months. This group of activities includes producing record drawings and other as-built information, submitting and obtaining approval of the Construction Completion Report, soil stabilization, and demobilization. This group of activities is described in more detail in Section 3.2.6. Some limited construction closeout activities are expected following Phase 1 construction and prior to the start of Phase 2.

Revegetation of areas affected by construction is not included in the construction schedule on Exhibit 3.3-1; a schedule for implementation of the revegetation activities will be developed separately. Revegetation will typically begin after remedy construction is complete, although may occur in specific locations after remedial construction is complete in that location. Post-construction revegetation is described in Section 6.

Startup activities will be generally concurrent with closeout activities for each phase. Startup of the NTH IRZ after Phase 1 construction is expected to last approximately 12 months. Startup of the remaining systems after Phase 2 construction is estimated to last 12 months. These activities are detailed in Section 6.2; in general, they include those activities required to start the remedy system and fine-tune remedy operations based on performance monitoring. These activities can generally start once commissioning activities are complete and the permanent remedy power supply has been established. Startup will occur concurrently with construction closeout activities.

TABLE 3.2-1
Final Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Final Injection/Extraction Rate per Model Layer (gpm)			Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Final Well Depiction	Final Well Count	Final Future Provisional Well Count	Final Well Coordinates[e]	
	Nominal	Minimum	Maximum						X	Y
IRZ-1 (Extraction)[b] (Category 3)									7615297.1	2104063.8
Layer 1	20	20	80	120	65	Dual Screen Well	1	0		
Layer 2					93					
Layer 3	20	20	80	180	124					
Layer 4					79					
IRZ-2									*7615314.7*	*2104010.3*
Layer 1	*0*	*0*	*6*	*50*	*71*	*Dual Screen Well*	*0*	*1*		
Layer 2	*0*	*0*	*6*	*70*	*93*					
Layer 3	*0*	*0*	*6*	*100*	*119*	*Dual Screen Well*	*0*	*1*		
Layer 4	*0*	*0*	*6*	*50*	*72*					
IRZ-3									*7615415.6*	*2103957.2*
Layer 1	*0*	*0*	*6*	*70*	*86*	*Dual Screen Well*	*0*	*1*		
Layer 2	*0*	*0*	*6*	*80*	*96*					
Layer 3	*0*	*0*	*6*	*90*	*109*	*Dual Screen Well*	*0*	*1*		
Layer 4	*0*	*0*	*6*	*40*	*63*					
IRZ-4									*7615392.1*	*2103849.5*
Layer 1	*0*	*0*	*6*	*70*	*90*	*Dual Screen Well*	*0*	*1*		
Layer 2	*0*	*0*	*6*	*70*	*93*					
Layer 3	*0*	*0*	*6*	*80*	*100*	*Dual Screen Well*	*0*	*1*		
Layer 4	*0*	*0*	*6*	*40*	*57*					
IRZ-5 (Extraction)[b] (Category 3)									7615445.4	2103825.7
Layer 1	40	20	80	150	93	Dual Screen Well	1	0		
Layer 2					93					
Layer 3	40	20	80	140	99					
Layer 4					56					
IRZ-6									*7615440.8*	*2103744.7*
Layer 1	*0*	*0*	*6*	*70*	*91*	*Dual Screen Well*	*0*	*1*		
Layer 2	*0*	*0*	*6*	*70*	*90*					
Layer 3	*0*	*0*	*6*	*70*	*94*	*Dual Screen Well*	*0*	*1*		
Layer 4	*0*	*0*	*6*	*40*	*54*					
IRZ-7									*7615514.9*	*2103691.9*
Layer 1	*0*	*0*	*6*	*70*	*92*	*Dual Screen Well*	*0*	*1*		
Layer 2	*0*	*0*	*6*	*60*	*87*					
Layer 3	*0*	*0*	*6*	*70*	*93*	*Dual Screen Well*	*0*	*1*		
Layer 4	*0*	*0*	*6*	*40*	*52*					

TABLE 3.2-1
Final Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Final Injection/Extraction Rate per Model Layer (gpm)			Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Final Well Depiction	Final Well Count	Final Future Provisional Well Count	Final Well Coordinates[e]	
	Nominal	Minimum	Maximum						X	Y
IRZ-8									*7615501.9*	*2103615.0*
Layer 1	*0*	*0*	*6*	*60*	*84*	*Dual Screen Well*	*0*	*1*		
Layer 2	*0*	*0*	*6*	*60*	*81*					
Layer 3	*0*	*0*	*6*	*60*	*84*	*Dual Screen Well*	*0*	*1*		
Layer 4	*0*	*0*	*6*	*40*	*51*					
IRZ-9 (Extraction)[b] (Category 3)									7615566.3	2103560.8
Layer 1	40	20	80	130	81	Dual Screen Well	1	0		
Layer 2					75					
Layer 3	40	20	80	120	80					
Layer 4					50					
IRZ-10									*7615569.3*	*2103470.4*
Layer 1	*0*	*0*	*6*	*40*	*69*	*Dual Screen Well*	*0*	*1*		
Layer 2	*0*	*0*	*6*	*40*	*65*					
Layer 3	*0*	*0*	*6*	*40*	*68*	*Dual Screen Well*	*0*	*1*		
Layer 4	*0*	*0*	*6*	*40*	*49*					
IRZ-11 (Category 3)									7615636.2	2103409.1
Layer 1	10	0	20	40	65	Dual Screen Well	1	0		
Layer 2	10	0	20	40	62					
Layer 3	10	0	20	40	66	Dual Screen Well	1	0		
Layer 4	10	0	20	40	51					
IRZ-12									*7615660.2*	*2103350.8*
Layer 1	*0*	*0*	*6*	*40*	*60*	*Dual Screen Well*	*0*	*1*		
Layer 2	*0*	*0*	*6*	*40*	*57*					
Layer 3	*0*	*0*	*6*	*40*	*59*	*Dual Screen Well*	*0*	*1*		
Layer 4	*0*	*0*	*6*	*40*	*51*					
IRZ-13 (Category 3)									7615701.7	2103307.1
Layer 1	9	0	20	40	54	Dual Screen Well	1	0		
Layer 2	9	0	20	40	52					
Layer 3	9	0	20	40	59	Dual Screen Well	1	0		
Layer 4	9	0	20	40	53					
IRZ-14									*7615736.7*	*2103202.5*
Layer 1	*0*	*0*	*6*	*40*	*55*	*Dual Screen Well*	*0*	*1*		
Layer 2	*0*	*0*	*6*	*40*	*53*					
Layer 3	*0*	*0*	*6*	*40*	*50*	*Dual Screen Well*	*0*	*1*		
Layer 4	*0*	*0*	*6*	*30*	*44*					

TABLE 3.2-1

Final Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Final Injection/Extraction Rate per Model Layer (gpm)			Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Final Well Depiction	Final Well Count	Final Future Provisional Well Count	Final Well Coordinates [e]	
	Nominal	Minimum	Maximum						X	Y
IRZ-15 (Category 3)									7615766.3	2103145.6
Layer 1	7	0	15	40	49	Dual Screen Well	1	0		
Layer 2	7	0	15	40	48					
Layer 3	7	0	15	40	48	Dual Screen Well	1	0		
Layer 4	7	0	15	30	43					
IRZ-16 (Category 3)									7615794.5	2103038.2
Layer 1	6	0	15	40	51	Dual Screen Well	1	0		
Layer 2	6	0	15	40	49					
Layer 3	6	0	15	30	42	Dual Screen Well	1	0		
Layer 4	6	0	15	20	36					
IRZ-17 (Category 3)									7615861.5	2102994.3
Layer 1	7	0	15	40	51	Dual Screen Well	1	0		
Layer 2	7	0	15	40	49					
Layer 3	7	0	15	30	39	Dual Screen Well	1	0		
Layer 4	7	0	15	20	33					
IRZ-18									*7615834.1*	*2102912.4*
Layer 1	*0*	*0*	*6*	*40*	*51*	*Dual Screen Well*	*0*	*1*		
Layer 2	*0*	*0*	*6*	*40*	*49*					
Layer 3	*0*	*0*	*6*	*20*	*30*	*Dual Screen Well*	*0*	*1*		
Layer 4	*0*	*0*	*6*	*15*	*23*					
IRZ-19 (Category 3)									7615930.4	2102847.0
Layer 1	7	0	13	35	44	Dual Screen Well	1	0		
Layer 2	7	0	13	30	41					
Layer 3	7	0	13	20	28	Dual Screen Well	1	0		
Layer 4	7	0	13	15	24					
IRZ-20 (Category 3)									7615807.6	2102769.2
Layer 1	4	0	13	35	47	Dual Screen Well	1	0		
Layer 2	4	0	13	30	42					
Layer 3	4	0	13	15	24	Dual Screen Well	1	0		
Layer 4	4	0	13	10	20					
IRZ-21 (Category 3)									7615816.0	2102691.5
Layer 1	5	0	10	40	48	Dual Screen Well	1	0		
Layer 2	5	0	10	20	29					
Layer 3	5	0	10	10	18	Dual Screen Well	1	0		
Layer 4	5	0	10	15	26					

TABLE 3.2-1
Final Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Final Injection/Extraction Rate per Model Layer (gpm)			Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Final Well Depiction	Final Well Count	Final Future Provisional Well Count	Final Well Coordinates[e]	
	Nominal	Minimum	Maximum						X	Y
IRZ-22									*7615820.0*	*2102619.3*
Layer 1	*0*	*0*	*6*	*35*	*44*	*Dual Screen Well*	*0*	*1*		
Layer 2	*0*	*0*	*6*	*15*	*27*					
Layer 3	*0*	*0*	*6*	*10*	*19*	*Dual Screen Well*	*0*	*1*		
Layer 4	*0*	*0*	*6*	*15*	*27*					
IRZ-23 (Extraction)[b] (Category 3)									7615824.9	2102534.9
Layer 1					33					
Layer 2					28	Single Screen Well (Layers 2, 3, & 4)[d]	1	0		
Layer 3	100	40	160	70	24					
Layer 4					24					
IRZ-24									*7615822.2*	*2102468.3*
Layer 1	*0*	*0*	*13*	*40*	*31*	*Dual Screen Well*	*0*	*1*		
Layer 2					*28*					
Layer 3	*0*	*0*	*13*	*40*	*26*					
Layer 4					*25*					
IRZ-25 (Category 3)									7615826.1	2102415.6
Layer 1	8	0	18	40	29	Dual Screen Well	1	0		
Layer 2					27					
Layer 3	8	0	18	40	26					
Layer 4					24					
IRZ-26									*7615818.5*	*2102313.7*
Layer 1	*0*	*0*	*13*	*40*	*28*	*Dual Screen Well*	*0*	*1*		
Layer 2					*26*					
Layer 3	*0*	*0*	*13*	*40*	*24*					
Layer 4					*24*					
IRZ-27 (Category 3)									7615801.3	2102238.9
Layer 1	8	0	18	40	27	Dual Screen Well	1	0		
Layer 2					25					
Layer 3	8	0	18	40	23					
Layer 4					24					
IRZ-28									*7615797.9*	*2102180.2*
Layer 1	*0*	*0*	*13*	*40*	*26*	*Dual Screen Well*	*0*	*1*		
Layer 2					*24*					
Layer 3	*0*	*0*	*13*	*40*	*23*					
Layer 4					*22*					

TABLE 3.2-1

Final Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Final Injection/Extraction Rate per Model Layer (gpm)			Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Final Well Depiction	Final Well Count	Final Future Provisional Well Count	Final Well Coordinates[e]	
	Nominal	Minimum	Maximum						X	Y
IRZ-29 (Category 3)									7615792.5	2102082.5
Layer 1	7	0	15	40	25	Dual Screen Well	1	0		
Layer 2					22					
Layer 3	7	0	15	35	21					
Layer 4					20					
IRZ-30									*7615780.6*	*2102010.8*
Layer 1	*0*	*0*	*13*	*40*	*26*	*Dual Screen Well*	*0*	*1*		
Layer 2					*20*					
Layer 3	*0*	*0*	*13*	*30*	*19*					
Layer 4					*18*					
IRZ-31 **(Category 3)**									7615790.6	2101947.0
Layer 1	6	0	13	35	26	Dual Screen Well	1	0		
Layer 2					16					
Layer 3	6	0	13	25	16					
Layer 4					16					
IRZ-32									*7615812.9*	*2101863.3*
Layer 1	*0*	*0*	*13*	*30*	*21*	*Dual Screen Well*	*0*	*1*		
Layer 2					*14*					
Layer 3	*0*	*0*	*13*	*20*	*14*					
Layer 4					*13*					
IRZ-33 **(Category 3)**									7615828.1	2101792.5
Layer 1	4	0	13	25	17	Dual Screen Well	1	0		
Layer 2					14					
Layer 3	4	0	13	20	14					
Layer 4					11					
IRZ-34									*7615853.9*	*2101667.0*
Layer 1	*0*	*0*	*26*	*35*	*13*	*Single Screen Well (All Layers)*	*0*	*1*		
Layer 2					*12*					
Layer 3					*12*					
Layer 4					*10*					
IRZ-35 **(Category 3)**									7615903.6	2101664.7
Layer 1	6	0	15	30	10	Single Screen Well (All Layers)	1	0		
Layer 2					10					
Layer 3					10					
Layer 4					10					

TABLE 3.2-1
Final Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Final Injection/Extraction Rate per Model Layer (gpm)			Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Final Well Depiction	Final Well Count	Final Future Provisional Well Count	Final Well Coordinates[e]	
	Nominal	Minimum	Maximum						X	Y
IRZ-36									*7615948.8*	*2101605.7*
Layer 1	*0*	*0*	*25*	*25*	*7.4*	*Single Screen Well (All Layers)*	*0*	*1*		
Layer 2					*7.6*					
Layer 3					*7.6*					
Layer 4					*7.6*					
IRZ-37 (Category 3)									7616003.9	2101554.6
Layer 1	4	0	10	20	5.7	Single Screen Well (All Layers)	1	0		
Layer 2					5.9					
Layer 3					5.9					
Layer 4					5.9					
IRZ-38									*7615965.2*	*2101400.4*
Layer 1	*0*	*0*	*25*	*15*	*5.0*	*Single Screen Well (All Layers)*	*0*	*1*		
Layer 2					*5.3*					
Layer 3					*5.3*					
Layer 4					*5.3*					
IRZ-39 (Category 3)										
Layer 1	4	0	5	10	2.8	Single Screen Well (All Layers)	1	0	7616112.5	2101375.6
Layer 2					3.1					
Layer 3					3.1					
Layer 4					3.1					
IRZ-40 (Extraction)									*7616191.5*	*2101358.0*
Layer 1	*0*	*0*	*25*	*5*	*1.7*	*Single Screen Well (All Layers)*	*0*	*1*		
Layer 2					*2.0*					
Layer 3					*2.0*					
Layer 4					*2.0*					
Extraction Total:	**300**	**200[c]**	**400[c]**	**---**	**---**	**---**	**4**	**1**	**---**	**---**
Injection Total:	**300**	**200[c]**	**400[c]**	**---**	**---**	**---**	**24**	**30**	**---**	**---**

Notes:

Gray Italics denote future provisional wells.

gpm = gallons per minute

[a] Number of wells, total screen intervals, and screen depth placement at each well location ID are for purposes of the final design submittal and may be modified during installation. One well location ID may consist of multiple wells or screens, and one well screen interval may include more than one model layer. A maximum of two discrete screen intervals will be included per individual well. Dual screen wells will consist of one well with two discreet screen intervals separated by a packer. Some well location IDs include two dual screen wells which will be installed in separate boreholes.

[b] Wells are constructed with a dedicated pump for each well screen with the intervals separated using a pneumatic packer.

[c] Individual well minimum and maximum flow rates are provided herein. However, the total aggregate extraction/injection flow rates are limited to 200 gpm at minimum flows and 400 gpm at maximum flows.

[d] Extraction well design and operation will target extraction of groundwater from all four model layers without being screened across all layers.

[e] Coordinates listed are North American Datum 1983 State Plane Ground Coordinates, Zone 5 (NAD1983, State Plane, California, V FIPS 0405) rounded to the nearest 0.1 foot. Coordinates are for purposes of the final design submittal and may be modified during installation based on field considerations.

TABLE 3.2-2
Final Remediation Well Design Parameter Summary: Inner Recirculation Loop Wells
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Final Injection/Extraction Rate per Model Layer (gpm)			Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Final Well Depiction	Final Well Count	Final Future Provisional Well Count	Final Well Coordinates[h]	
	Nominal	Minimum	Maximum						X	Y
River Bank Extraction Wells										
RB-1 (Category 2)									7615763.6	2103918.0
Layer 1				160[g]	106					
Layer 2					99					
Layer 3	25	25	170	150	104	Single Screen Well (Layers 3 & 4)[g]	1	0		
Layer 4					56					
RB-2 (Category 2)									7616012.0	2103398.0
Layer 1				70[g]	58					
Layer 2					56					
Layer 3	0	25	170	125	73	Single Screen Well (Layers 3 & 4)[g]	1	0		
Layer 4					60					
RB-3 (Category 2)									7616210.6	2103172.8
Layer 1				70[g]	56					
Layer 2					58					
Layer 3	50	25	170	100	51	Single Screen Well (Layers 3 & 4)[g]	1	0		
Layer 4					50					
RB-4 (Category 2)									7616337.5	2102908.5
Layer 1				70[g]	50					
Layer 2					55					
Layer 3	50	25	170	100	37	Single Screen Well (Layers 3 & 4)[g]	1	0		
Layer 4					50					
RB-5 (Category 2)									7616397.6	2102423.9
Layer 1				15[g]	24					
Layer 2					24					
Layer 3	25	25	170	25	16	Single Screen Well (Layers 3 & 4)[g]	1	0		
Layer 4					16					
RB-6									*TBD*	*TBD*
Layer 1				*TBD*[g]	*TBD*					
Layer 2					*TBD*					
Layer 3	*0*	*25*	*170*	*TBD*	*TBD*	*Single Screen Well (Layers 3 & 4)*[g]	*0*	*1*		
Layer 4					*TBD*					
RB-7									*TBD*	*TBD*
Layer 1				*TBD*[g]	*TBD*					
Layer 2					*TBD*					
Layer 3	*0*	*25*	*170*	*TBD*	*TBD*	*Single Screen Well (Layers 3 & 4)*[g]	*0*	*1*		
Layer 4					*TBD*					

TABLE 3.2-2
Final Remediation Well Design Parameter Summary: Inner Recirculation Loop Wells
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Final Injection/Extraction Rate per Model Layer (gpm)			Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Final Well Depiction	Final Well Count	Final Future Provisional Well Count	Final Well Coordinates[h]	
	Nominal	Minimum	Maximum						X	Y
RB-8									*TBD*	*TBD*
Layer 1				*TBD*[g]	*TBD*					
Layer 2					*TBD*					
Layer 3	*0*	*25*	*170*	*TBD*	*TBD*	*Single Screen Well (Layers 3 & 4)*[g]	*0*	*1*		
Layer 4					*TBD*					
RB-9									*TBD*	*TBD*
Layer 1				*TBD*[g]	*TBD*					
Layer 2					*TBD*					
Layer 3	*0*	*25*	*170*	*TBD*	*TBD*	*Single Screen Well (Layers 3 & 4)*[g]	*0*	*1*		
Layer 4					*TBD*					
Inner Recirculation Loop Injection Wells[b]										
IRL-1 (Category 3)									7614392.1	2103402.9
Layer 1	0			80	62					
Layer 2		35	200		71					
Layer 3	75			170	74	Dual Screen Well	1	0		
Layer 4					64					
IRL-2 (Category 3)									7614133.3	2103058.4
Layer 1	0			74	62					
Layer 2		35	200		63	Dual Screen Well	1	0		
Layer 3	75			160	65					
Layer 4					64					
IRL-3 (Category 3)									7613976.1	2102799.3
Layer 1					55					
Layer 2	100	35	200	140	55	Dual Screen Well	1	0		
Layer 3					59					
Layer 4				71	61					
IRL-4 (Category 3)									7613953.8	2102380.7
Layer 1					46					
Layer 2	200	35	200	115	46	Dual Screen Well	1	0		
Layer 3					49					
Layer 4				56	51					
IRL-5									*TBD*	*TBD*
Layer 1					*TBD*					
Layer 2	*0*	*35*	*200*	*TBD*	*TBD*	*TBD*	*0*	*1*		
Layer 3					*TBD*					
Layer 4					*TBD*					

TABLE 3.2-2
Final Remediation Well Design Parameter Summary: Inner Recirculation Loop Wells
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Final Injection/Extraction Rate per Model Layer (gpm)			Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Final Well Depiction	Final Well Count	Final Future Provisional Well Count	Final Well Coordinates[h]	
	Nominal	Minimum	Maximum						X	Y
IRL-6[f]									*TBD*	*TBD*
Layer 1	*0*	*35*	*200*	*TBD*	*TBD*	*TBD*	*0*	*1*		
Layer 2					*TBD*					
Layer 3					*TBD*					
Layer 4					*TBD*					
IRL-7[f]									*TBD*	*TBD*
Layer 1	*0*	*35*	*200*	*TBD*	*TBD*	*TBD*	*0*	*1*		
Layer 2					*TBD*					
Layer 3					*TBD*					
Layer 4					*TBD*					
Extraction Total:	**150**	**0**[c]	**500**[c]	---	---		**5**	**4**	---	---
Injection Total:	**450**[d]	**150**[d,e]	**900**[d,e]	---	---		**4**	**3**	---	---

Notes:

Gray Italics denote future provisional wells.

gpm = gallons per minute

[a] Number of wells, total screen intervals, and screen depth placement at each well location ID are for purposes of the final design submittal and may be modified during installation.

[b] The final nominal scenario assumes IRL-1 and IRL-2 will receive River Bank Extraction Well water (carbon-amended if Cr[VI] concentrations in the River Bank Extraction Wells exceed the clean-up goal); and IRL-3 and IRL-4 will receive fresh water. However, injection wells IRL-1 through IRL-4 (and future provisional wells IRL-5 through IRL-7, if constructed) will be constructed for flexibility to inject either/both fresh water or/and River Bank Extraction Well water during the lifetime of the remedy. IRL-1 and IRL-2 will be installed as dual-screen wells with the shallow screen (upper one-third of the saturated interval) separated from the deep screen (lower two-thirds of the saturated interval) with a pneumatic packer. The final nominal scenario assumes injection of River Bank Extraction Well water into the deep screen only at IRL-1 and IRL-2. IRL-3 and IRL-4 will be installed with both a shallow screen (upper two-thirds of the saturated interval) and deep screen (lower one-third of the saturated interval). IRL-3 and IRL-4 will be designed to accommodate a pneumatic packer for potential future isolation of the shallow and deep screened intervals; however, under the final nominal scenario, only fresh water will be injected into IRL-3 and IRL-4 and the shallow and deep screens in these wells will not be isolated.

[c] Individual extraction well minimum and maximum flow rates are provided herein. However, the minimum and maximum aggregate flow rates from the entire extraction well network are estimated to be 0 gpm and 500 gpm, respectively.

[d] Injection flow rate includes 300 gpm of fresh water for the nominal flow, up to 150 gpm of fresh water for the minimum flow, and up to 900 gpm of fresh water for the maximum flow, as needed.

[e] Individual injection well minimum and maximum flow rates are provided herein. However, the minimum and maximum aggregate flow rates for the entire injection well network are estimated to be 150 gpm and 900 gpm, respectively.

[f] Future provisional well IRL-6 or IRL-7 may alternatively be considered as an extraction well with extracted groundwater re-injected into other IRL Injection Wells.

[g] River Bank Extraction Wells will be installed with a second shallow screen interval for potential future use which will be isolated from the deeper screen interval with a pneumatic packer.

[h] Coordinates listed are North American Datum 1983 State Plane Ground Coordinates, Zone 5 (NAD1983, State Plane, California, V FIPS 0405) rounded to the nearest 0.1 foot. Coordinates are for purposes of the final design submittal and may be modified during installation based on field considerations.

TABLE 3.2-3

Final Remediation Well Design Parameter Summary: TCS Recirculation Loop Wells

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Final Injection/Extraction Rate per Model Layer (gpm)			Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Final Well Depiction	Final Well Count	Final Future Provisional Well Count	Final Well Coordinates[e]	
	Nominal	Minimum	Maximum						X	Y
Transwestern Bench Extraction Wells										
TWB-1 (Category 3)									7615903.0	2100962.5
Layer 1					11					
Layer 2					11					
Layer 3	13	1	15	20	11	Single Screen Well (Layers 3 & 4)[d]	1	0		
Layer 4					11					
TWB-2 (Category 3)									7615993.88	2100972.00
Layer 1					8.3					
Layer 2					8.7					
Layer 3	9	1	15	15	8.7	Single Screen Well (Layers 3 & 4)[d]	1	0		
Layer 4					8.7					
TWB-3									*7615776.6*	*2101143.4*
Layer 1					*12*					
Layer 2					*13*					
Layer 3	*0*	*1*	*15*	*25*	*13*	*Single Screen Well (Layers 3 & 4)[d]*	*0*	*1*		
Layer 4					*13*					
TWB-4									*7616088.1*	*2100858.5*
Layer 1					*5.5*					
Layer 2					*5.9*					
Layer 3	*0*	*1*	*15*	*20*	*5.9*	*Single Screen Well (Layers 3 & 4)[d]*	*0*	*1*		
Layer 4					*5.9*					

TABLE 3.2-3

Final Remediation Well Design Parameter Summary: TCS Recirculation Loop Wells

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Final Injection/Extraction Rate per Model Layer (gpm)			Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Final Well Depiction	Final Well Count	Final Future Provisional Well Count	Final Well Coordinates[e]	
	Nominal	Minimum	Maximum						X	Y
East Ravine Extraction Wells[b]										
ER-1 **(Category 3)**									7616511.0	2101089.3
Layer 1	0.5			90	30	Single Screen Well or Open Bore	1	0		
Layer 2					20					
Layer 3					20					
Layer 4					20					
ER-2 **(Category 3)**									7616666.3	2100998.8
Layer 1	0.5			90	30	Single Screen Well or Open Bore	1	0		
Layer 2					20					
Layer 3					20					
Layer 4					20					
		2 Total	4 Total							
ER-3 **(Category 3)**									7616855.5	2100897.9
Layer 1	0.5			90	30	Single Screen Well or Open Bore	1	0		
Layer 2					20					
Layer 3					20					
Layer 4					20					
ER-4 **(Category 3)**									7616934.6	2100761.3
Layer 1	0.5			90	30	Single Screen Well or Open Bore	1	0		
Layer 2					20					
Layer 3					20					
Layer 4					20					
ER-5									*7616995.3*	*2100677.9*
Layer 1	*0*	*0.5*	*1*	*90*	*30*	*Single Screen Well or Open Bore*	*0*	*1*		
Layer 2					*20*					
Layer 3					*20*					
Layer 4					*20*					
ER-6 **(Category 3)**									7615840.0	2100512.0
Layer 1	3	1	5	90	29	Single Screen Well or Open Bore	1	0		
Layer 2					20					
Layer 3					20					
Layer 4					20					
ER-7									*TBD*	*TBD*
Layer 1	*0*	*0.5*	*1*	*TBD*	*TBD*	*Single Screen Well or Open Bore*	*0*	*1*		
Layer 2					*TBD*					
Layer 3					*TBD*					
Layer 4					*TBD*					

TABLE 3.2-3

Final Remediation Well Design Parameter Summary: TCS Recirculation Loop Wells

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Final Injection/Extraction Rate per Model Layer (gpm)			Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Final Well Depiction	Final Well Count	Final Future Provisional Well Count	Final Well Coordinates[e]	
	Nominal	Minimum	Maximum						X	Y
ER-8									*TBD*	*TBD*
Layer 1	*0*	*0.5*	*1*	*TBD*	*TBD*	*Single Screen Well or Open Bore*	*0*	*1*		
Layer 2					*TBD*					
Layer 3					*TBD*					
Layer 4					*TBD*					
ER-9									*TBD*	*TBD*
Layer 1	*0*	*0.5*	*1*	*TBD*	*TBD*	*Single Screen Well or Open Bore*	*0*	*1*		
Layer 2					*TBD*					
Layer 3					*TBD*					
Layer 4					*TBD*					
ER-10									*TBD*	*TBD*
Layer 1	*0*	*0.5*	*1*	*TBD*	*TBD*	*Single Screen Well or Open Bore*	*0*	*1*		
Layer 2					*TBD*					
Layer 3					*TBD*					
Layer 4					*TBD*					
ER-11									*TBD*	*TBD*
Layer 1	*0*	*0.5*	*1*	*TBD*	*TBD*	*Single Screen Well or Open Bore*	*0*	*1*		
Layer 2					*TBD*					
Layer 3					*TBD*					
Layer 4					*TBD*					
TCS Injection Wells										
TCS-1 (Category 3)									7615167.7	2101171.4
Layer 1	6.75	2	20	50	37	Dual Screen Well	1	0		
Layer 2					21					
Layer 3	6.75	2	20	40	21					
Layer 4					25					
TCS-2 (Category 3)									7615149.1	2100899.7
Layer 1	6.75	2	20	40	27	Dual Screen Well	1	0		
Layer 2					26					
Layer 3	6.75	2	20	40	27					
Layer 4					17					
Extraction Total:	**27**	**10[c]**	**75[c]**	**---**	**---**	**---**	**7**	**8**	**---**	**---**
Injection Total:	**27**	**10[c]**	**75[c]**	**---**	**---**	**---**	**2**	**0**	**---**	**---**

Notes:

Gray Italics denote future provisional wells.

gpm = gallons per minute

[a] Number of wells, total screen intervals, and screen depth placement at each well location ID are for purposes of the final design submittal and may be modified during installation. One well location ID may consist of multiple screens, and one well screen interval may include more than one model layer. A maximum of two discrete screen intervals will be included per individual well. Dual screen wells will consist of one well with two discrete screen intervals separated by a packer.

[b] East Ravine Extraction Wells are not expected to produce significant water, and automated pump cycling will be required.

TABLE 3.2-3

Final Remediation Well Design Parameter Summary: TCS Recirculation Loop Wells

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Final Injection/Extraction Rate per Model Layer (gpm)			Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Final Well Depiction	Final Well Count	Final Future Provisional Well Count	Final Well Coordinates [e]	
	Nominal	Minimum	Maximum						X	Y

[c] Individual well minimum and maximum flow rates are provided herein. However, the total aggregate minimum and maximum extraction/injection flow rates are limited to 10 gpm and 75 gpm, respectively.

[d] Extraction well design and operation will target extraction of groundwater from all four model layers without being screened across all layers.

[e] Coordinates listed are North American Datum 1983 State Plane Ground Coordinates, Zone 5 (NAD1983, State Plane, California, V FIPS 0405) rounded to the nearest 0.1 foot. Coordinates are for purposes of the final design submittal and may be modified during installation based on field considerations.

TABLE 3.2-4

Final Remediation Well Design Parameter Summary: Freshwater Injection Wells

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Final Injection/Extraction Rate per Model Layer (gpm)[b]			Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Final Well Depiction	Final Well Count	Final Future Provisional Well Count	Final Well Coordinates[c]	
	Nominal	Minimum	Maximum						X	Y
FW-1 (Category 3)									7613297.3	2102955.40
Layer 1	100	50	200	250	57	Single Screen Well (All Layers)	1			
Layer 2					57					
Layer 3					56					
Layer 4					78					
FW-2 (Category 3)									7614682.7	2100511.5
Layer 1	50	25	100	60	15	Single Screen Well (All Layers)	1			
Layer 2					15					
Layer 3					15					
Layer 4					15					
Total:	**150**	**75**	**300**	**---**	**---**	**---**	**2**		**---**	**---**

Notes:

gpm = gallons per minute

[a] Number of wells, total screen intervals, and screen depth placement at each well location ID are for purposes of final design submittal and may be modified during installation. One well screen interval may include more than one model layer. A maximum of two discrete screen intervals will be included per individual well.

[b] Well testing will be conducted to assess specific injectivity per Section 4 of the O&M Plan (Final BOD Appendix L, O&M Manual, Volume 1).

[c] Coordinates listed are North American Datum 1983 State Plane Ground Coordinates, Zone 5 (NAD1983, State Plane, California, V FIPS 0405) rounded to the nearest 0.1 foot. Coordinates are for purposes of the final design submittal and may be modified during installation based on field considerations.

TABLE 3.2-5

Estimated Construction of Proposed Groundwater Monitoring Wells

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Monitoring Category/ Location ID	Projected Depth to Groundwater (ft bgs)	Projected Saturated Thickness Above Bedrock (ft)	Projected Depth to Bedrock (ft bgs)	Number of Intervals to be Monitored[a]	Length of Interval(s) to be Monitored (ft)[a]	Estimated Depths to be Monitored (ft bgs)[a]			
Northern NTH IRZ Extraction Monitoring Well									
MW-A **(Category 1)**	13	357	370	4	10-20	50 to 70	150 to 170	240 to 260	320 to 340
MW-B **(Category 3)**	17	327	344	4	10-20	50 to 70	140 to 160	230 to 250	300 to 320
NTH IRZ Dose Response Monitoring Well									
MW-C **(Category 3)**	22	197	219	4	10-20	30 to 50	80 to 100	130 to 150	180 to 200
MW-D **(Category 3)**	18	157	175	3	10-20	40 to 60	90 to 110	140 to 160	
MW-E **(Category 3)**	36	100	136	2	10-20	50 to 70	105 to 125		
MW-F **(Category 3)**	54	81	135	2	10-20	70 to 90	105 to 125		
MW-G **(Category 3)**	57	30	87	1	10-20	65 to 85			
NTH IRZ Downgradient Well and River Bank Extraction Monitoring Well									
MW-H **(Category 3)**	14	183	197	4	10-20	30 to 50	80 to 100	120 to 140	170 to 190
MW-W **(Category 2)**	16	27	43	1	10-20	20 to 40			
NTH IRZ River Bank Extraction Monitoring Well									
MW-O **(Category 2)**	1	253	254	4	10-20	30 to 50	90 to 110	150 to 170	210 to 230
MW-X **(Category 2)**	1	325	326	4	10-20	30 to 50	110 to 130	190 to 210	270 to 290
MW-Y **(Category 2)**	1	325	326	4	10-20	30 to 50	110 to 130	190 to 210	270 to 290
Slant wells[b,c]	0	262	262	2	10-20	160 to 180	220 to 240		
IRL Downgradient Monitoring Well									
MW-M **(Category 1)**	59	169	228	4	10-20	70 to 90	110 to 130	155 to 175	195 to 215
MW-R **(Category 1)**	100	185	285	4	10-20	115 to 135	160 to 180	205 to 225	250 to 270

TABLE 3.2-5

Estimated Construction of Proposed Groundwater Monitoring Wells

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Monitoring Category/ Location ID	Projected Depth to Groundwater (ft bgs)	Projected Saturated Thickness Above Bedrock (ft)	Projected Depth to Bedrock (ft bgs)	Number of Intervals to be Monitored[a]	Length of Interval(s) to be Monitored (ft)[a]	Estimated Depths to be Monitored (ft bgs)[a]			
IRL Dose Response Monitoring Well									
MW-P **(Category 1)**	51	275	326	4	20-50	55 to 105	120 to 170	190 to 240	265 to 315
MW-Q **(Category 3)**	105	195	300	4	20-50	70 to 120	130 to 180	190 to 240	250 to 300
IRL Byproduct Monitoring Well									
MW-I **(Category 2)**	67	278	345	4	20-50	65 to 115	135 to 185	200 to 250	280 to 330
MW-J **(Category 2)**	118	218	336	4	20-50	110 to 160	170 to 220	230 to 280	285 to 335
TCS Loop Transwestern Bench Extraction Monitoring Well									
MW-K **(Category 3)**	94	24	117	1	10-20	95 to 115			
East Ravine Extraction Monitoring Well									
MW-T **(Category 3)**	51	TBD	TBD	2	TBD	TBD			
MW-70BR-D **(Category 1)**	99	0	69	1	50	235 to 285			
Freshwater Injection Observation Well									
MW-S **(Category 1)**	90	68	158	2	20-50	90 to 120	130 to 160		
Compliance Monitoring Well - Inside Plume									
MW-L **(Category 1)**	76	177	253	4	10-20	90 to 110	140 to 160	180 to 200	220 to 240
MW-N **(Category 3)**	109	131	240	3	10-20	130 to 150	170 to 190	210 to 230	
MW-10D **(Category 1)**	95	105	200	1	10-20	170 to 190			
MW-11D **(Category 1)**	66	126	192	1	10-20	150 to 170			

TABLE 3.2-5

Estimated Construction of Proposed Groundwater Monitoring Wells

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Monitoring Category/ Location ID	Projected Depth to Groundwater (ft bgs)	Projected Saturated Thickness Above Bedrock (ft)	Projected Depth to Bedrock (ft bgs)	Number of Intervals to be Monitored[a]	Length of Interval(s) to be Monitored (ft)[a]	Estimated Depths to be Monitored (ft bgs)[a]			
Compliance Monitoring Well - Outside Plume									
MW-U **(Category 1)**	144	164	308	2	10-20	170 to 190	250 to 270		
MW-V [b]	96	89	185	1	10-20	130 to 150			
MW-Z **(Category 1)**	24	388	412	4	10-20	60 to 80	160 to 180	260 to 280	360 to 380
Arsenic Monitoring Well									
MW-AA **(Category 2)**	41	282	323	3	20-50	70 to 120	170 to 220	270-320	
MW-BB **(Category 1)**	73	261	334	3	20-50	90 to 140	170 to 220	270-320	
MW-CC **(Category 2)**	65	260	325	3	20-50	90 to 140	170 to 220	270-320	
MW-DD **(Category 1)**	105	230	335	2	20-50	120 to 170	220 to 270		
MW-EE [b]	105	228	333	2	20-50	120 to 170	220 to 270		
MW-FF **(Category 1)**	105	201	306	2	20-50	120 to 170	220 to 270		
MW-GG **(Category 2)**	111	199	310	2	20-50	120 to 170	220 to 270		
MW-HH **(Category 2)**	86	90	176	2	20-50	85 to 125	135-175		
MW-II **(Category 2)**	83	93	176	2	20-50	85 to 125	135-175		

Notes:

[a] The screened intervals as shown are preliminary, and are based on assumptions in the current site conceptual model (primarily the total projected thickness of the unconsolidated aquifer) as well as the specific purpose of the proposed monitoring location. The number, length, and depths of the monitoring intervals for each location will be finalized concurrent with fieldwork. These decisions will be based on additional information collected during construction of the remedy well network. As requested by DTSC, at least three monitoring intervals (shallow-middle-deep) will be utilized to monitor portions of the aquifer that are 250 feet in thickness or greater.

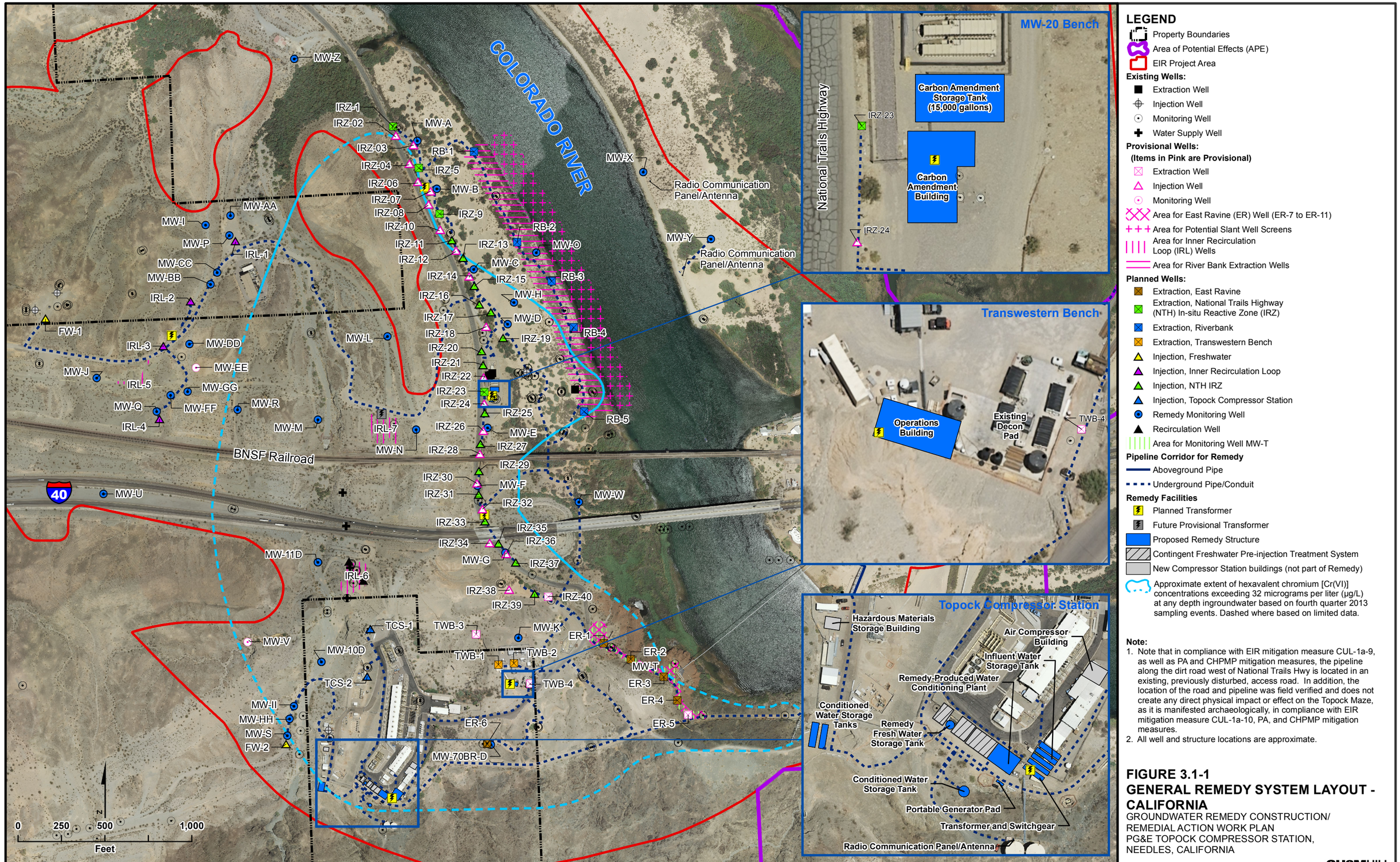
[b] Future provisional monitoring well location

[c] Final number of slant well screens and lengths will depend on well design and borehole angle

TBD = To Be Determined

TABLE 3.2-6
Summary of Category 1 Well Information
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Category 1 Well Location	Key Design Assumption Being Confirmed at Category 1 Well Locations	Dependent Well Locations
MW-A	Northern margin of the groundwater plume is defined and the northern extent of the NTH IRZ and RB Extraction Wells are adequate	Northern IRZ and River Bank Extraction Wells
MW-Z	Northern margin of the groundwater plume is defined and the northern extent of the NTH IRZ and RB Extraction Wells are adequate	Northern IRZ and River Bank Extraction Wells
MW-P	Near the western margin of the groundwater plume	IRL-1, MW-I, MW-AA
MW-S	Outside the western margin of the groundwater plume Saturated thickness above bedrock is adequate for injection well operation	FW-2, MW-HH, MW-II
MW-BB	Near the western margin of the groundwater plume	IRL-2
MW-DD	Near the western margin of the groundwater plume	IRL-3 and MW-EE
MW-FF	Near the western margin of the groundwater plume	IRL-4, MW-Q, MW-J, MW-GG,
MW-L	The western margin of the groundwater plume is adequately defined	Upland area wells
MW-M	The western margin of the groundwater plume is adequately defined	Upland area wells
MW-R	The western margin of the groundwater plume is adequately defined	Upland area wells
MW-U	The western margin of the groundwater plume is adequately defined	Upland area wells
MW-10D	The western margin of the groundwater plume is adequately defined	MW-V
MW-11D	The western margin of the groundwater plume is adequately defined	MW-V
MW-70BR-D	East Ravine Extraction Wells will function properly at the designed total depth; this will not affect East Ravine Extraction Well siting but could affect design (i.e., depth)	ER-1 through ER-4, ER-6 (potentially), MW-T



LEGEND

- Property Boundaries
- Area of Potential Effects (APE)
- EIR Project Area

Existing Wells:

- Extraction Well
- Injection Well
- Monitoring Well
- Water Supply Well

Provisional Wells:

(Items in Pink are Provisional)

- Extraction Well
- Injection Well
- Monitoring Well
- Area for East Ravine (ER) Well (ER-7 to ER-11)
- Area for Potential Slant Well Screens
- Area for Inner Recirculation Loop (IRL) Wells
- Area for River Bank Extraction Wells

Planned Wells:

- Extraction, East Ravine
- Extraction, National Trails Highway (NTH) In-situ Reactive Zone (IRZ)
- Extraction, Riverbank
- Extraction, Transwestern Bench
- Injection, Freshwater
- Injection, Inner Recirculation Loop
- Injection, NTH IRZ
- Injection, Topock Compressor Station
- Remedy Monitoring Well
- Recirculation Well
- Area for Monitoring Well MW-T

Pipeline Corridor for Remedy

- Aboveground Pipe
- Underground Pipe/Conduit

Remedy Facilities

- Planned Transformer
- Future Provisional Transformer
- Proposed Remedy Structure
- Contingent Freshwater Pre-injection Treatment System
- New Compressor Station buildings (not part of Remedy)
- Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

Note:

1. Note that in compliance with EIR mitigation measure CUL-1a-9, as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Hwy is located in an existing, previously disturbed, access road. In addition, the location of the road and pipeline was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10, PA, and CHPMP mitigation measures.
2. All well and structure locations are approximate.

FIGURE 3.1-1
GENERAL REMEDY SYSTEM LAYOUT - CALIFORNIA

GROUNDWATER REMEDY CONSTRUCTION/
REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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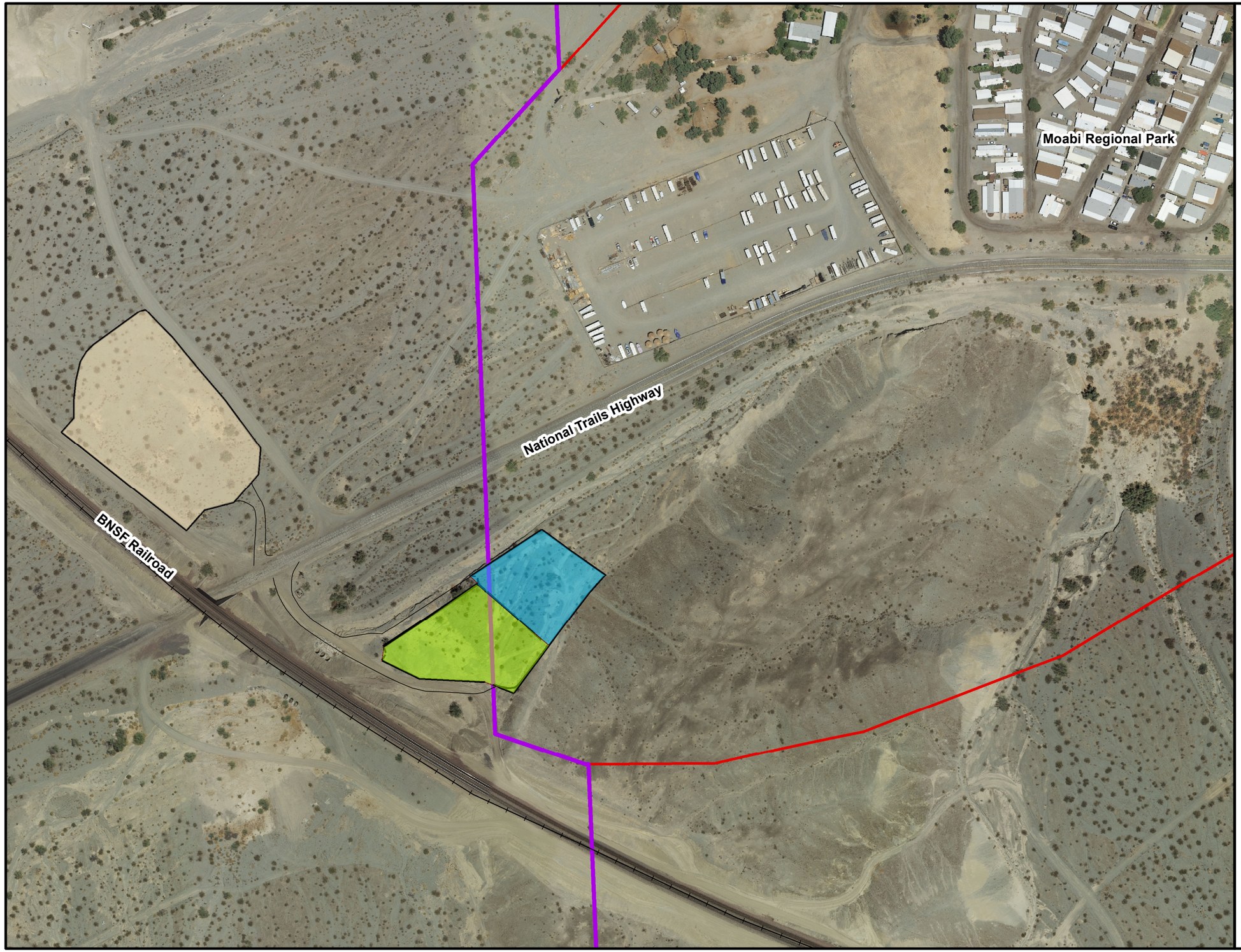
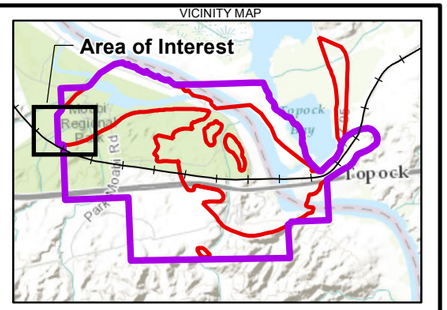


VICINITY MAP



LEGEND

- Long-term Remedy Support Area (0.8 Acres Approximate)
- Soil Processing Area (2.56 Acres Approximate)
- Temporary Construction Laydown Area (1.05 Acres Approximate)
- Area of Potential Effects (APE)
- EIR Project Area

Notes:

1. Descriptions of activities/functions anticipated for the construction support areas are included in the Construction/Remedial Action Work Plan.
2. Descriptions of activities/functions anticipated for the long-term remedy support areas are included in Section 3.5 of the BOD, and the O&M Manual.

N

0 90 180 360 Feet

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS

FIGURE 3.1-2
GENERAL REMEDY SYSTEM LAYOUT - MOABI REGIONAL PARK
GROUNDWATER REMEDY CONSTRUCTION/ REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

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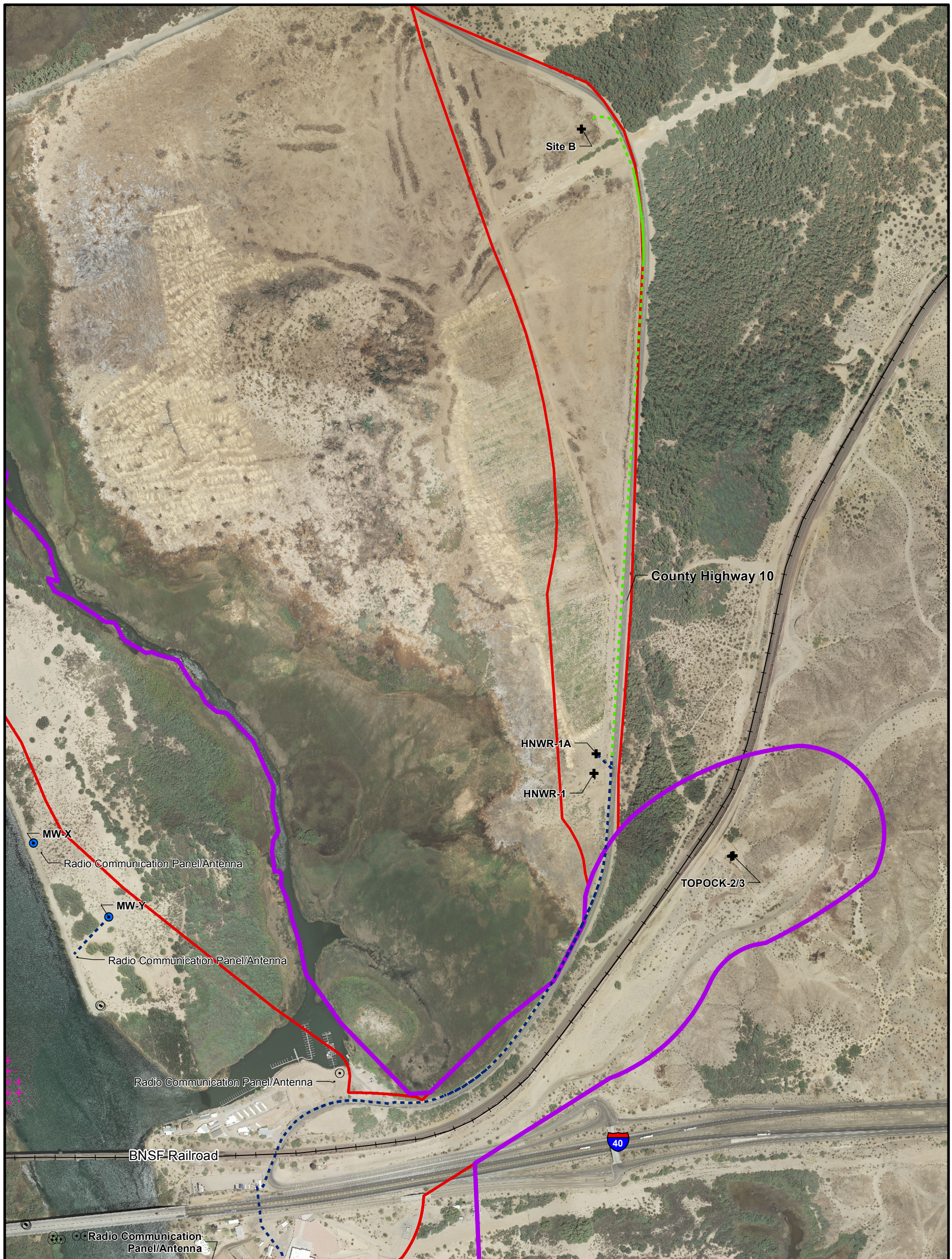

FIGURE 3.1-3
GENERAL REMEDY SYSTEM LAYOUT - ARIZONA
GROUNDWATER REMEDY CONSTRUCTION/ REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

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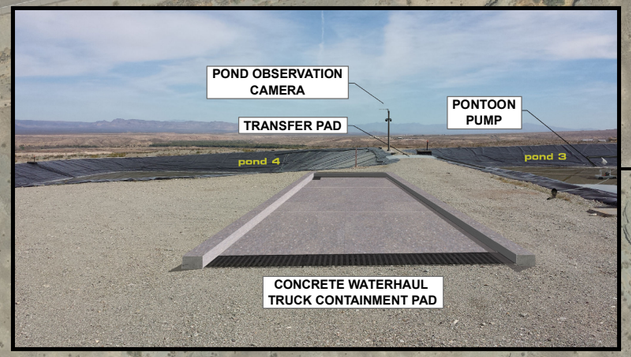


NYLON GUY WIRES

PONTOON PUMP (TYP)

POND 4

AGITATOR (TYP)

CONCRETE WATERHAUL TRUCK CONTAINMENT PAD

POND OBSERVATION CAMERA

POND 3

PONTOON PUMP (TYP)

AGITATOR (TYP)

POND 2

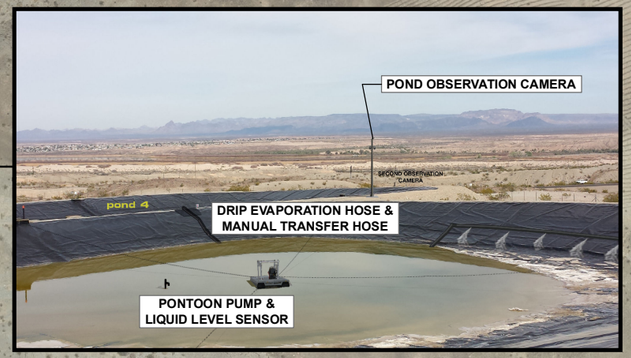
UTILITY BUILDING

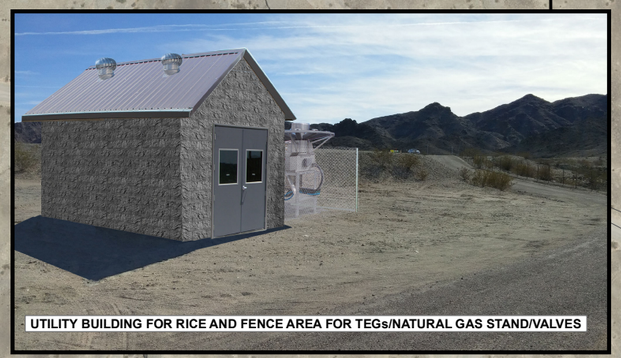
THERMOELECTRIC GENERATORS

POND 1

INSTRUMENTAL MOTOR OPERATED VALVE (TYP)

GAS SUPPLY




UTILITY BUILDING FOR RICE AND FENCE AREA FOR TEGs/NATURAL GAS STAND/VALVES



L-300B

L-300B

LEGEND

- Underground Gas Supply Pipe
- Proposed Remedy Structure

Notes:

1. All remedy structure locations are approximate.

N

0 100 200 400 Feet

FIGURE 3.1-4
GENERAL REMEDY SYSTEM LAYOUT - TCS EVAPORATION PONDS
GROUNDWATER REMEDY CONSTRUCTION/
REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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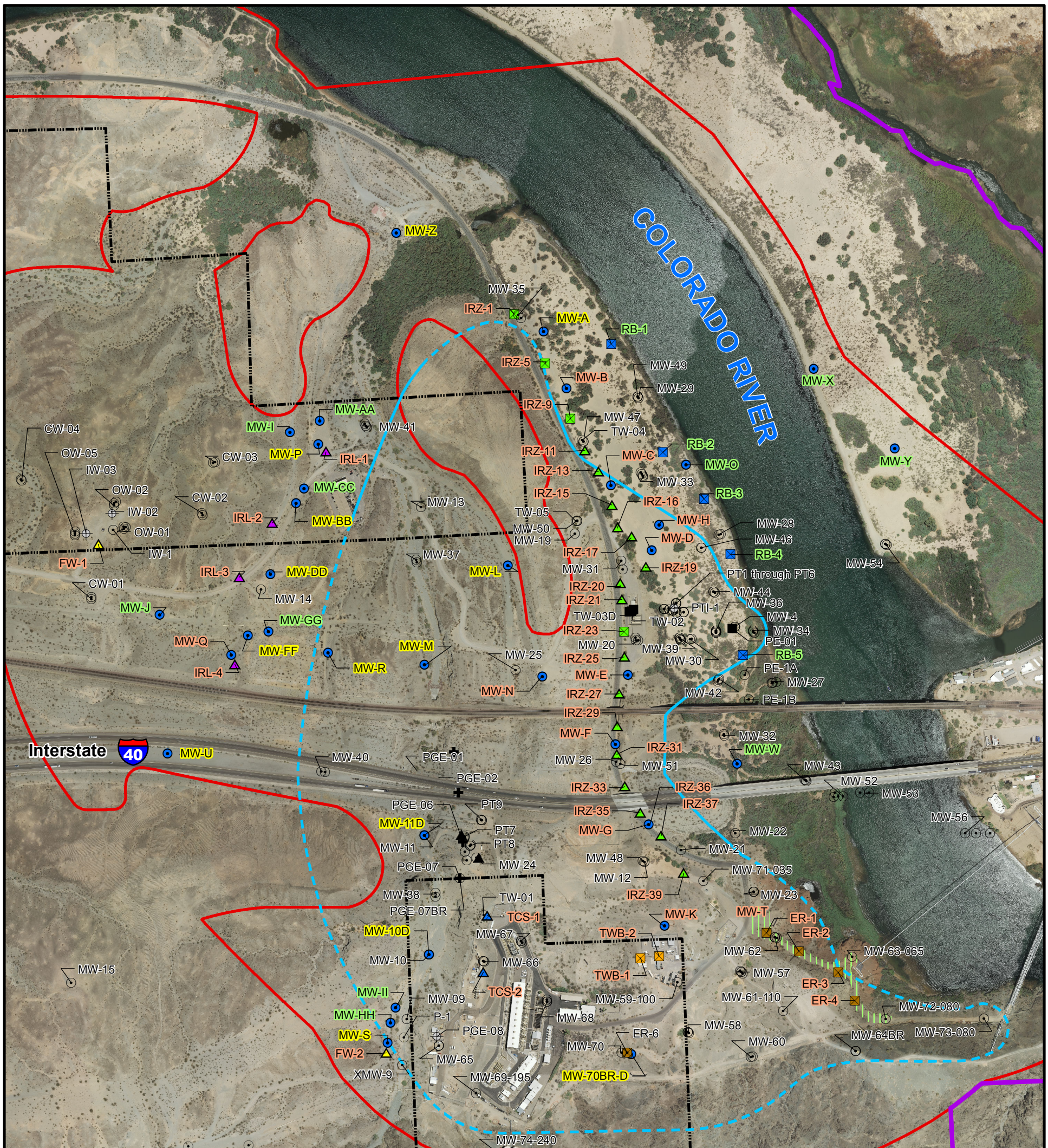


LEGEND

- Property Boundaries
- Area of Potential Effects (APE)
- EIR Project Area

Existing Wells:

- Extraction Well
- Injection Well
- Monitoring Well
- Water Supply Well

Well Category Highlighting:
Yellow Highlighting for Well Category 1
Green Highlighting for Well Category 2
Orange Highlighting for Well Category 3

Planned Wells:

- Extraction, East Ravine
- Extraction, National Trails Highway (NTH) In-situ Reactive Zone (IRZ)
- Extraction, Riverbank
- Extraction, Transwestern Bench
- Injection, Freshwater
- Injection, Inner Recirculation Loop
- Injection, NTH IRZ
- Injection, Topock Compressor Station
- Remedy Monitoring Well
- Recirculation Well
- Area for Monitoring Well MW-T

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

Note:
All well and structure locations are approximate.

0 220 440 880 Feet

N

FIGURE 3.2-1
ESTIMATED APPROACH TO WELL NETWORK CONSTRUCTION
GROUNDWATER REMEDY CONSTRUCTION/ REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

CH2MHILL

Path: R:\PGEAlliance\Topock\MapFiles\2015\CRAWP\CRAWP_Fig321.mxd

FOR CONTINUATION SEE INSET BELOW

NATIONAL TRAIL HWY

MOHAVE COUNTY HIGHWAY 10

COLORADO RIVER

BNSF RAILROAD

RAILROAD

NATIONAL TRAIL HWY

PG&E TOPOCK
COMPRESSOR STATION
APPROX. BOUNDARY

ARCH BRIDGE

COLORADO RIVER

PIPE 300 ACCESS ROAD

TCS MAIN ACCESS ROAD

INSET

PIPELINE SEGMENT MAP

1" = 300'

0 300 600

SCALE: 1"=300'

LEGEND

- ABOVE GROUND PIPE
- UNDERGROUND PIPE
- BORE AND JACK PIPE
- ON EXISTING BRIDGE

- PIPELINE "A"
- PIPELINE "B"
- PIPELINE "C"
- PIPELINE "D"
- PIPELINE "E"
- PIPELINE "F"
- PIPELINE "G"
- PIPELINE "H"
- PIPELINE "I"
- PIPELINE "J"
- PIPELINE "K"
- PIPELINE "L"
- PIPELINE "M"
- PIPELINE "N"
- PIPELINE "T"
- FRESHWATER PIPE (TO BE USED WHEN PRE-TREATMENT IS REQUIRED)

FIGURE 3.3-1
KEY PIPELINE MAP
GROUNDWATER REMEDY CONSTRUCTION/REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

SECTION 4

Site Management Plan

This section contains the site management plan required by CD SOW Section 3.2 and describes overall procedures and practices to be followed during construction and startup of the groundwater remedy. Procedures and practices described herein include coordination with other project or site activities; mobilization and site preparation; site access and security; protocols for visitors and monitors; waste management, environmental controls, and BMPs during construction to manage waste materials, construction footprint, dust, and erosion.

4.1 Coordination with Other Project or Site Activities

Construction of the groundwater remedy will occur over an approximately 2- to 3-year period, followed by approximately 1 year of construction closeout, and the remedy will be constructed within an approximately 35-acre area owned by a variety of land owners in both California and Arizona. Remedial infrastructure is planned on federal lands, as well as non-federal lands, including lands owned by BNSF Railway, Kinder Morgan, the FMIT, and private property owners in the Topock Marina area. In addition, infrastructure is planned on county roadways or their ROWs (San Bernardino County, Mohave County), as well as roadways/ROWs of Caltrans and ADOT. Remedy pipelines will also cross other foreign utilities' ROWs (for example, Southwest Gas, Kinder Morgan, SoCal Gas, Transwestern Pipeline, Frontier Communications, Mohave Electric Coop, Needles Electric, and Southwest Water). As such, it is important that construction of the groundwater remedy be well-coordinated with other neighboring project or site activities.

As described in the Final BOD, PG&E is in the process of obtaining access agreements and/or other approvals, permits, and agreements with the appropriate entities that own the land where groundwater remedial infrastructure will be constructed or temporary support facilities will be located. It is anticipated that those agreements, approvals, and permits will outline specific requirements for coordinating construction with existing transportation and utility entities and landowners, and PG&E will comply with the terms of those agreements. PG&E will also obtain necessary permits and approvals for lane closure of public roads or construction within state or county ROWs and road and railway crossings or crossing of the Colorado River on the Arch Bridge. Access agreement, permits, and approvals are expected to include provisions regarding communications, coordinating schedules for construction with landowners, minimizing disturbance, ensuring safety, and performing restoration following construction.

Coordination of construction activities with other PG&E operations and activities will be performed throughout the construction. Key components of the coordination will be associated with TCS operations, IM operations, and Soil RFI/RI activities. The discussion of coordination with other project or site activities in this section meets the requirement of CD Paragraph 13.b.3: Schedule for developing and submitting other required remedial action plans.

4.1.1 Coordination with TCS Operations

The TCS compresses natural gas for transportation through pipelines to PG&E's customers in northern and central California. TCS facilities include natural gas pipelines; TCS fenced operational structures, including the compressor building, cooling towers, offices, warehouse, vehicle garage, maintenance buildings, storage buildings, and aboveground tanks; four evaporation ponds connected to the TCS via a wastewater pipeline; and supporting roads, water, and power. Pipeline facilities include two 34-inch pipelines, two pipeline bridges across the Colorado River, valves, and cathodic protection.

Groundwater remedial facilities to be constructed on the TCS parcel include structures, pipelines, and wells. Structures to be located on the TCS parcel include:

- Remedy-produced Water Conditioning Plant
- Conditioned Water Storage Tanks and Secondary Containment
- Influent Water Storage Tanks and Secondary Containment
- Freshwater Storage Tank
- Decontamination Pad (occupies the same footprint as the Contingent Freshwater Pre-injection Treatment Building)
- TW Bench Operations Building

In addition to the groundwater remedy infrastructure to be built on the TCS parcel, construction will occur along the access road to the TCS, in areas immediately surrounding the TCS parcel (including the Arched Bridge over the Colorado River), and at the TCS evaporation ponds.

Key coordination issues with the TCS staff will include scheduling construction activities to minimize disturbance to TCS operations, communications, space considerations, safety, coordination of shared utilities (water, power, wastewater), and design compatibility. Construction activities that occur in PG&E's gas pipeline ROWs will be coordinated with PG&E Gas Operations. Many of these issues were considered during design but will also require coordination during construction.

4.1.2 Coordination with Ongoing IM-3 Activities

PG&E has been implementing an interim measure at the Topock site since March 2004 for the purpose of stabilizing the groundwater contamination until implementation of the groundwater remedy. The IM, currently designated as IM No. 3 or IM-3, consists of groundwater extraction for hydraulic control of the plume boundaries in the Colorado River floodplain and management of extracted groundwater. The location of existing primary IM-3 components, including facilities, pipelines, and extraction, injection, and monitoring wells, are shown on Figure 4.1-1 and include the following:

- Groundwater extraction by extraction wells in the floodplain area of the site. There are five extraction wells (TW-2S, TW-2D, TW-3D, and PE-1).
- Transport of extracted groundwater to an aboveground treatment plant via underground pipelines.
- Treatment of groundwater in the aboveground treatment plant. The groundwater treatment system is a continuous, multi-step process involving reduction of Cr(VI) to Cr(III); precipitation and removal of Cr(III) precipitate solids by clarification and microfiltration; and lowering the naturally occurring TDS using reverse osmosis.
- Transport of treated groundwater to an injection well field via aboveground pipeline.
- Injection of treated groundwater into the alluvial aquifer. There are currently two injection wells (IW-02 and IW-03).
- Brine storage tanks and other facilities on the MW-20 Bench, including truck access and loading areas, containment structures, parking areas, fencing, piping, pumps, motors, valves, electrical power and control panels, instrumentation, security system, lighting, and other ancillary equipment.
- Monitoring wells from which data are required and identified well pairs to evaluate the performance of the IM.

During much of the period under which the groundwater remedy will be constructed, the IM-3 system will be operational, and the groundwater remedy construction must minimize interference with the existing IM-3 wells, pipelines, treatment plant, and MW-20 Bench facilities and access to those facilities. For example, portions of the remedy piping corridor and the construction area for remediation wells FW-1, IRL-1 and IRL-3 will occupy the same corridor as the IM-3 piping; therefore, the construction must be done with care so as

to not damage the IM infrastructure in the corridor. The construction project will coordinate with IM-3 to install temporary or jumper piping around planned remedy infrastructure during construction to allow for continued IM-3 operation, as necessary.

The IM-3 treatment and injection system will be used during the construction period as one of several methods to manage water generated from construction and testing of new wells and pipelines.

After the DTSC has determined that PG&E may cease IM-3 operations, the IM-3 treatment plant will be placed in standby mode. The lay-up of the IM-3 system is described in Appendix F to this C/RAWP. IM-3 decommissioning activities will be implemented after receipt of approval for IM-3 decommissioning by DTSC, with concurrence from the DOI, in accordance with Exhibit A to the 2012 Settlement Agreement between DTSC and the FMIT.

4.1.3 Coordination with Soil RCRA Facility Investigation/Remedial Action Activities

PG&E is implementing site investigation and remediation activities associated with identified soil investigation areas under both RCRA and CERCLA. Currently, there are 35 identified soil investigation areas within and surrounding the TCS associated with past TCS operations. PG&E is conducting additional investigation activities at the soil investigation areas, targeting completion in 2016. Soil investigation activities are expected to include drilling and soil sampling, potential plant or other biota sampling, equipment staging and decontamination, and investigation-derived waste management.[4] Much effort was put into integrating the soil information into the remedy design and coordinating with the current soil investigation program to minimize duplication and disturbance.

Since remedy infrastructure are located in or near the soil investigation areas, the construction of the groundwater remedy will be managed to control exposure to and control of potential contaminants at the soil investigation areas. Section 4.4 presents site controls and procedures for health and safety, personnel air monitoring, soil management, and decontamination for areas where groundwater remedy facilities will intersect with soil contamination areas. The Soil Management Plan in Appendix L to this C/RAWP includes existing information on locations of soil investigation areas, as well as known or potential contaminants in those areas. Additional characterization data collected during the soil investigation program and the baseline soil sampling program will be used during groundwater remedy construction to inform and adjust controls and procedures as needed. Figure 4.1-2 and Exhibit 4.1-1 identify the overlap between groundwater remedial infrastructure and soil investigation areas.

EXHIBIT 4.1-1
Soil RCRA Facility Investigation/Remedial Investigation SWMUs, AOCs, and Undesignated Areas
Construction/Remedial Action Work Plan for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California

Soil Investigation Areas		Overlaps or Is within 20 feet of Groundwater Remedy Infrastructure? (Y/N)—List type of infrastructure
Located Outside the Topock Compressor Station Fence Line		
SWMU 1	Former Percolation Bed	Yes - pipes
AOC 1	Area Around Former Percolation Bed	Yes – wells, pipes
AOC 4	Debris Ravine	Yes – pipes
AOC 9	Southeast Fence Line (Outside Visitor Parking Area)	Yes – pipes
AOC 10	East Ravine	Yes – pipes, wells
AOC 11	Topographic Low Areas	Yes – pipes, wells, building

[4] At this time, it is not anticipated that the soil investigation areas will move through the site characterization and remedy selection process such that remedial action will occur at the soil investigation areas at roughly the same time as groundwater remedy construction.

EXHIBIT 4.1-1

Soil RCRA Facility Investigation/Remedial Investigation SWMUs, AOCs, and Undesignated Areas

Construction/Remedial Action Work Plan for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California

	Soil Investigation Areas	Overlaps or Is within 20 feet of Groundwater Remedy Infrastructure? (Y/N)—List type of infrastructure
AOC 12	Fill Area	Yes – pipe, wells
AOC 14	Railroad Debris Site	No
AOC 27	MW 24 Bench	Yes – well, pipes
AOC 28	Pipeline Drip legs	Yes – pipes, wells
AOC 29	IM-3 Treatment Plant	No
AOC 30	MW 20 Bench	Yes – pipes, wells, building, tanks
AOC 31	Former Teapot Dome Oil Pit	No
UA 1	Potential Pipe Disposal Area	No
UA 2	Former 300B Pipeline Liquids Tank	No
Located Inside the Topock Compressor Station Fence Line		
SWMU 5	Sludge-Drying Beds	Yes - pipes
SWMU 6	Chromate Reduction Tank	Yes - pipes
SWMU 8	Process Pump Tank	No
SWMU 9	Transfer Sump	Yes - pipes
SWMU 11	Former Sulfuric Acid Tanks	No
AOC 5	Cooling Tower A	No
AOC 6	Cooling Tower B	No
AOC 7	Hazardous Materials Storage Area	Yes – pipes, tanks
AOC 8	Paint Locker	Yes – pipes, tanks
AOC 13	Unpaved Areas within the Compressor Station	Yes – pipes, wells, buildings
AOC 15	Auxiliary Jacket Water Cooling Pumps	No
AOC 16	Sandblast Shelter	No
AOC 17	Onsite Septic System	Yes – pipes
AOC 18	Combined Hazardous Waste Transference Pipelines	Yes – pipes
AOC 19	Former Cooling Liquid Mixing Area and Former Hotwell	No
AOC 20	Industrial Floor Drains	No
AOC 21	Round Depression near Sludge-drying Bed	Yes - pipes
AOC 22	Unidentified Three-sided Structure	Yes – pipes
AOC 23	Former Water Conditioning Building	No
AOC 24	Stained Area and Former American Petroleum Institute Oil/Water Separator	No
AOC 25	Compressor and Generator Engine Basements	No
AOC 26	Former Scrubber Oil Sump	No
AOC 32	Oil Storage Tanks and Waste Oil Sump	No
AOC 33	Potential Former Burn Area near AOC 17	Yes – pipes
Unit 4.3	Oil/Water Holding Tank	Yes - pipes
Unit 4.4	Oil Water Separator	No
Unit 4.5	Portable Waste Oil Storage Tank	No
Perimeter Area		Yes – pipes, wells
Storm Drain System		Yes – pipes

4.2 Preconstruction Activities

This section presents the preparation activities that will be conducted prior to the beginning of construction, including project initiation with the agencies and stakeholders (including Tribes), mobilization of construction facilities and staff, work area preparation and demarcation, and documentation of preconstruction work area conditions. In addition, this section presents plans for establishing the water source and power supply to support construction.

4.2.1 Project Initiation Meeting

Consistent with other phases of work conducted at the Topock site, PG&E will invite agency representatives and other stakeholders (including representatives of Tribes involved with the Topock project) to the site for a project initiation meeting. This meeting will be scheduled to occur prior to the start of primary construction activities. During the meeting, PG&E will present an overview of the activities that will be conducted as part of this C/RAWP, discuss various cultural and biological sensitivities associated with the project, introduce key project team members (including subcontractors), identify requirements for site visitors, describe applicable site safety and communication protocols, and review plans for project communications with the agency and stakeholders during work.

4.2.2 Mobilization

Mobilization of people and equipment to the site will include the setup of two primary yard areas located in the western area of Moabi Regional Park to support the remedy construction for approximately 2 to 3-year period, followed by approximately 1 year of construction closeout,:

- **The main construction yard (also known as the Construction Headquarters [CHQ]).** The CHQ will serve as the central work/meeting space for all site workers/contractors and visitors, and will be a primary area for the staging of equipment (drill rigs, excavators, backhoes, cranes, etc.) and supplies (pipes, valves, transformers, well materials, etc.). Supporting activities at the CHQ include establishing required utilities, restroom facilities, safety and security measures, and office space.
- **The soil staging/processing area**. This area is where soil and material displaced during construction activities will be brought for staging, processing and potential reuse at the project site. Imported material for use in construction may also be temporarily staged here.

The location of these areas is shown on Figure 4.2-1. As shown on this figure and as further detailed on Figure 4.2-2, the CHQ comprises two areas: the temporary construction laydown area and the long-term remedy support area. Figure 4.2-2A is a photo simulation of the new remedy support buildings and other structures located at the CHQ and the temporary construction laydown area consisting of construction trailers and laydown yard. After construction is complete, PG&E proposes to reduce the CHQ area to the smaller long-term remedy support area, which will serve as the primary yard supporting a smaller team during the O&M of the remedy, which is expected to last for approximately 30 years, followed by approximately 10 years of long-term monitoring and up to 20 years of additional arsenic monitoring.

Figure 4.2-2B is a photo simulation of the temporary soil processing area consisting of the general soil processing and staging area and the screened material storage area.

Additional notes regarding the proposed conceptual layout and use of these support areas are listed below:

- The footprint for the CHQ has been designed to simultaneously support multiple contractors and their respective employees, equipment, tools, materials, and supplies.
- The portion of the CHQ identified as the temporary construction laydown area includes features that will be removed after the construction is completed. These features will include portable office trailers, tool storage containers, construction materials, and construction equipment.

- The active equipment in the soil staging/processing area is expected to only be needed during the construction of the remedy. After the construction is complete, this area may be used as a location for storage of stockpiles of clean soils. Clean soils may also be used in this location as fill material at the landowner's request.
- Utility features for the CHQ will include the use of power, water, and sewer services. After the layout and features becomes firm, PG&E will work with the City of Needles to determine the power supply details and with the BLM and San Bernardino County for water supply and sewer management details and the availability of those services for the CHQ.

4.2.3 Site Preparation and Demarcation

Site preparation and demarcation activities include demarcating work area limits, identifying biologically and/or culturally sensitive areas, identifying subsurface utilities and other existing constraints, documenting preconstruction site conditions, and establishing access routes and work areas that will minimize impacts to these features to the extent possible. This work will be conducted in accordance with EIR Mitigation Measure CUL-1a-8n, as presented in Section 2.14 of the CIMP, Protocols for Protective Measures for Archaeological/Historical Sites during Construction; Section 6.6.3 of the CHPMP, Avoidance Measures/Management Thresholds; Section 3.4 of the PBA, General Project Management Measures CDFW avoidance and mitigation measures, and the protocol for compliance with EIR MM BIO-1 and ARAR #32.

Site preparation and demarcation activities will be conducted for areas where construction-related activities occur and include the following types:

- **Primary Work Zones.** These zones are defined as the immediate area where actual construction will occur for a given component of remedy infrastructure. For example, the primary work zone for the construction of a well will consist of a defined area around the well location, while the zone for the construction of a pipeline will consist of an area on one or both sides along the length of the pipeline. To the extent feasible, primary work zones will be limited to previously disturbed areas (that is, minimizing use of undisturbed areas and those potentially exposed to differential compaction).
- **Support Zones (Staging Areas).** Most of the staging areas will be located adjacent to or near primary work zones to support construction. Staging areas are existing open areas (that is, minimizing use of undisturbed areas and those potentially exposed to differential compaction) that can be used to minimize the size of the primary work zones by centrally placing temporary facilities, such as portable toilets and breaks areas, and for laydown of construction equipment, materials, supplies, and tools. Displaced soil, material (asphalt), and water generated in the primary work zones might also be temporarily staged in a staging areas en route to the designed storage or disposition area so that the size of the primary work zones can be minimized. Staging area will also be used to coordinate transportation activities—for example, a staging area for the management of wastewater generated during well construction and development on the floodplain—will be set up at the centrally located MW-20 Bench. This central wastewater management area will include a series of portable frac tanks for temporary storage of wastewater, a truck haul station for hauling of wastewater, and pumping facilities to pump the wastewater to the IM-3 treatment plant, as appropriate, thereby limiting the need for these activities in the primary work zones on the floodplain.
- **Access Routes.** These pathways consist of existing and new routes that are required for workers, equipment, and materials to access the primary work zones and staging areas.

The location of access routes and staging areas are depicted on Figure 4.2-3. Primary work zones will be co-located with planned remedy infrastructure and are not specifically indicated on Figure 4.2-3. The precise boundaries of primary work zones, staging areas, and access routes will be identified and demarcated in the field prior to construction, with participation from qualified archaeological monitor(s) and biologist(s) to exclude the locations and boundaries of known biological resources, archaeological and historical resources, and other cultural sites requiring protective measures to the maximum extent practicable. These

demarcations are temporary by nature and will be precisely demarcated in the field to minimize the total area needed to support a given construction activity. The demarcation process for each of these areas will be implemented as needed as field work is conducted in a given area.

Twenty-seven areas are identified on Figure 4.2-3 for use during groundwater remedy construction. In response to DTSC and DOI direction to examine and consider Tribal inputs on use of areas, and to provide detailed descriptions of the proposed use and justification for the necessity for use of the proposed use of certain areas, PG&E prepared the Technical Memorandum *Proposed Use of Certain Areas for Construction, Staging, and Soil Storage at PG&E Topock Compressor Station* which is included in this C/RAWP as Appendix W. Based on the evaluation in Appendix W and input provided by Tribes, DTSC and DOI imposed specific conditions on the use of certain areas in the final design directives dated October 19, 2015. Table 4.2-1 summarizes the proposed uses and agencies' imposed conditions at each of the areas during groundwater remedy construction and decommissioning of IM-3.Tribal monitors will be invited to participate in/or observe the demarcation of work areas. If warranted, protective measures may be employed on or around archaeological or historical sites to protect the resource from disturbance. These measures may include, but are not limited to, protective coverings of soil or riprap, onsite personnel to prevent access to sensitive areas, use of flagging, blaze-orange mesh fencing secured to steel posts, bollards, natural barriers of rocks or piled brush, cables suspended between secure posts, K-rails, and/or signage (for example, "This Area Closed" or "Exclusion Zone: Keep Out"). Such measures will be temporary (only as needed during construction) and will, to the extent practicable, not call undue attention to the nature of the resource being protected.

In accordance with Occupational Safety and Health Administration requirements and the Health and Safety Plan, exclusion zones, contaminant reduction zones, and support zones will be established for primary work zones in potentially contaminated areas. BMPs will be implemented as appropriate within the primary work zones or staging areas, including the placement of plastic sheeting or other covering on the ground to minimize potential impacts from construction materials and equipment (both active and idle). Other site preparation activities will include construction staking, installing erosion and sedimentation controls and other temporary environmental controls in accordance with the BMP Plan (see Appendix M to this C/RAWP), delineating access/haul routes between primary work areas and staging areas posting of signage, planning and setup of work observation locations, site orientation, setting up health and safety equipment, and similar activities.

4.2.4 Documentation of Preconstruction Site Conditions

Site preparation will include documentation of preconstruction site conditions, including utility surveys, photographic documentation, and baseline soil sampling. In addition, PG&E may, at its discretion, perform a pre-construction aerial survey of the construction area. Also, in conformance the PBA, the BIAMP, and other requirements, a qualified biologist will conduct pre-construction surveys for special status wildlife species and nesting birds.

4.2.4.1 Aboveground and Underground Utility Survey

A survey of aboveground and underground utilities will be conducted within all work areas prior to beginning site preparation and construction activities. These surveys, which may be conducted at different times during construction as work in a given area is initiated, will include the following activities at a minimum:

- Site-specific reconnaissance, which will include a visual inspection of work areas and review of available site utility plans and as-built documentation.
- Notification to the one-call notification center that supports the Southern California area (Underground Service Alert or "Dig Alert") and Arizona (Blue Stake or "Arizona 811") to identify utilities that operate within the respective work areas. These notifications will also be used to notify a given utility owner of planned field work to determine if a stand-by field representative is required for field oversight.

- Surface geophysical survey of the work areas to supplement and confirm the information obtained from the one-call notification. These surveys will utilize various remote sensing tools to identify underground features. The geophysical methods that may be used, as determined appropriate in the field, include electromagnetic locators, radio frequency locators, magnetic locators, metal detection, and ground-penetrating radar.

In addition, proposed locations of field work will be reviewed with PG&E and landowners, leaseholders, and/or utility companies with personnel knowledgeable regarding the locations of the existing utilities, and in conformance with land use agreements. Prior to field work and as determined necessary by the utility owner, all known or suspected utilities that are identified through the activities above will be exposed by hand or with soft excavation equipment (for example, hydrovacuum excavation). The appropriate exposure method will be selected in consultation with the owner of the feature (as appropriate) and may be dependent upon the type of feature being investigated. Those utility services that will require lockout/tagout, shut off, or relocation to carry out the work will be identified in cooperation with the utility owner. Lockout/tagout will be performed only by qualified personnel.

4.2.4.2 Photograph Documentation

Photographs will be taken to document the preconstruction site conditions of the work areas and will be referenced when assessing requirements for post-construction site conditions, and biological restoration. See photo documentation requirements in the CIMP (CUL-1a-8e), the PBA, HNWR Habitat Restoration Plan (Appendix G), the Aesthetics and Visual Resources Protection and Revegetation Plan (Appendix N), and the Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (Appendix O).

4.2.4.3 Baseline Soil Sampling

To document baseline soil conditions prior to groundwater remedy implementation, soil samples will be collected and analyzed in accordance with the Baseline Soil Sampling and Analysis Plan. The Sampling and Analysis Plan also includes the collection of data to assist with the management of materials displaced during construction activities in accordance with the Revised Management Protocol for Handling and Disposition of Displaced Site Material (PG&E 2015). The Sampling and Analysis Plan is included in Appendix A, and the Revised Management Protocol is Appendix B, of the Soil Management Plan (see Appendix L of this C/RAWP).

4.2.5 Construction Water Supply

A construction water supply will be established to support field work. Example uses for construction water include dust control, equipment decontamination, process water for well construction and development, hydrostatic testing of constructed pipelines, and other activities. Potential sources of water include:

- **Existing TCS water supply system.** This supply will be accessed by a temporary storage and distribution system so interference with TCS operations is minimized. The existing water supply pipe will be tapped and a temporary aboveground pipe (1- to 2-inch-diameter high-density polyethylene pipe) will convey water from the tap to a temporary freshwater storage tank staged in the vicinity of the turnout area outside east of the PG&E TCS entry gate.
- **Existing freshwater supply well in Arizona (HNWR-1A).** This supply will be accessed either at the wellhead (typically, to support construction in Arizona) or through Pipeline B once constructed. Water will be pumped from the well using either a temporary pump/power supply (generator) or using the remedy equipment and power supply once constructed.
- **Treated water from IM-3.** Excess treated water from IM-3 will be accessed by the existing IM-3 storage and distribution system, or utilizing a temporary storage and supply system. This option will only be pursued following PG&E's evaluation of the potential TDS impacts associated with the use of IM-3 treated water for dust suppression during remedy construction control, and agency acceptance of that evaluation.

- **Existing water supply for Moabi Regional Park.** This water supply is included as a contingency and will only be accessed as determined necessary and as authorized by the landowner. A water supply station will be established in the CHQ area using a temporary storage and distribution system.
- **Other commercially available supplies.** Water will be obtained, as necessary, from commercially available supplies including, but not limited to, Golden Shores Water Company and City of Needles. Water will be transported to the site via water truck.

Primary construction water supply tanks (typically 12,000-gallon overhead fill tank) will be staged near the given water source. Typically, water trucks will be used to convey water from the water sources to the work areas to support field work and wetdown vehicle traffic routes, as determined necessary to suppress dust; however, a temporary network of aboveground distribution pipes (1- to 2-inch-diameter high-density polyethylene pipe) may be employed to convey water to the appropriate work areas, where feasible, to minimize the disturbance associated with water truck traffic. Secondary construction water tanks will be placed in the primary work zones or adjacent staging areas in California and Arizona to support construction in a given work area, as determined necessary, and will be removed once work in that area is complete.

4.2.6 Construction Power and Lighting

In general, construction power will be supplied by portable generators, whenever utility power is not readily available near the point of use. With the exception of security lighting at Moabi Regional Park in the CHQ area, which might be supplemented for the CHQ, temporary lighting will be supplied by portable generators and light plants, as needed. While night work is not planned as part of routine construction activities, it may be determined that limited circumstances require the continuation of work into the nighttime because it cannot be disrupted or suspended (for example, special conditions during drilling or concrete pouring). For these special circumstances, nighttime construction lighting will be used in accordance with EIR Mitigation Measure CUL-1a-7, which includes protocols for nighttime lighting, as discussed in Section 4.6 of this C/RAWP.

4.3 Site Management Practices

This section provides details related to general site management including site access and security, site visitation protocols, and transportation routes and protocols.

4.3.1 Site Access and Security

Site access and security provisions during construction include preserving access to the project area, engineering controls for safeguarding equipment and constructed facilities, inspections, and notification and reporting. Land management and ownership considerations affect site access and security. A portion of the groundwater remedy will be constructed on land owned by PG&E. However, most of the land in the project area is owned by the United States and managed by federal agencies. Portions of these federal lands are also used by other entities, such as the Caltrans, ADOT, San Bernardino County, Mohave County, and various utility companies through leases, easements, and ROWs. The rest of the land in the project area is owned by private or governmental parties, including BNSF, the FMIT, and other owners of smaller parcels in Arizona. Provisions for site access and security of the groundwater remediation system will be coordinated with these entities, as necessary. Details of site access and security will be defined in the final agreements with land owners, land managers, lease holders, and utility companies.

In conformance with EIR Mitigation Measure CUL-1a-2 and the PA, protocols have been developed to preserve Tribal members' access to, and use of, the project area for religious, spiritual, or other cultural purposes, to the extent that PG&E has the authority to facilitate such access. The protocols are contained in the Access Plan, provided as Appendix P to this C/RAWP. Tribal access issues and procedures vary according to land ownership: federal property, private parcels not owned by PG&E, and PG&E-owned property. PG&E is committed to accommodate Tribal access requests in accordance with these procedures, in consideration of landowner requirements, health and safety concerns, and to ensure noninterference with approved

remediation activities and TCS operations. On PG&E-owned property, for safety and security purposes, a PG&E escort is required for Tribal representatives, and Tribal access must be consistent with PG&E safety requirements and must not interfere with approved remediation activities or TCS operations.

In addition, site visitors (including federal and state agency personnel and interested stakeholders) will be accommodated throughout the duration of the construction phase. Procedures for visitors associated with the project—such as regulators, landowners, and leaseholders of land or facilities entering work areas (access routes, primary work zones, and staging areas), utility companies, stakeholders, and Tribal monitors—are described in Section 4.3.2.

In conformance with EIR Mitigation Measure CUL-1a-3b and for protection of the groundwater remedy infrastructure and facilities, a Site Security Plan has been developed and is provided as Appendix Q. The Site Security Plan outlines PG&E security plans and protocols, including physical security measures, inspections, notification, and reporting. Security for remedial facilities inside the compressor station will be provided for by the existing TCS security system. Construction contractors will establish and enforce their own separate security measures for safeguarding their equipment, materials, and constructed facilities. The Health and Safety Plan also outlines security measures that will be followed for all work activities, including hazardous materials and waste storage (as necessary).

Engineering controls are anticipated to be established to safeguard equipment, materials, and constructed remedial facilities and to protect the health and safety of personnel, the public, and the surrounding environment in accordance with the Site Security Plan. During construction, PG&E will establish a fenced CHQ area that will be equipped with security features consistent with PG&E's current security standards, such as perimeter fencing with gates equipped with chains and locks, security alarm system, lighting and cameras. Separately, satellite staging areas will be established for use by construction contractors, in areas approved by PG&E, for storage of equipment and supplies. Some of the satellite staging areas may be fenced and locked and may also include cameras and alarms. A subset of the staging areas discussed during the 60% comment resolution process will be used during construction; the proposed areas are presented in Figure 4.2-3 (the numbering scheme used during 60% comment resolution was retained on this figure for ease of referencing).

The contractor/contractors may elect to install additional security measures; these measures will be coordinated with and approved by PG&E or their responsible representative. Lighting for security of construction equipment and materials will be temporary and will be minimized to the extent feasible in conformance with Mitigation Measure CUL-1a-7.

Protocols for protective measures for archaeological/historic sites during construction are provided in the CIMP and CHPMP. Protective measures may include, but are not limited to, protective coverings of soil or riprap, onsite personnel to prevent access to sensitive areas, use of flagging, blaze-orange mesh fencing secured to steel posts, bollards, natural barriers of rocks or piled brush, cables suspended between secure posts, and/or signage (for example, "This Area Closed" or "Exclusion Zone: Keep Out"). These measures will be temporary (only as needed during construction) and will, to the extent practicable, not call undue attention to the nature of the resource being protected. In accordance with the Site Security Plan, inspections will be performed to increase observation of potential intrusions during construction other impact significant cultural resources. Should a designated inspector observe disturbance to the environment, notification will be provided to DTSC, DOI, and the corresponding landowner/land manager.

4.3.2 Protocols for Visitors and Monitors

Safety for visitors and monitors is a high priority for this project; therefore, prior to entering the construction site, visitors and monitors associated with the active construction must check in at the CHQ, which serves as the point of contact location, and must be properly attired for safety. At the CHQ, visitors will sign the visitors' log and meet the designated PG&E representative for the site visit. First-time visitors will be provided with cultural resources awareness and site safety orientation and, if appropriate, biological

resources awareness training, prior to further work at the site. Visitors will complete a signoff form before entering the site for the first time acknowledging understanding of the site access requirements. Repeat visitors will be asked to renew their understanding of the site access requirements annually. A master list of companies and utilities and their employees and individuals who have signed the signoff form will be kept at the CHQ and will be verified when each person arrives at the site.

Visitors to the site will meet the designated PG&E representative to verify that he/she is aware of the visit and obtain instructions on access restrictions or considerations related to the purpose of the visit. To ensure safety for vehicular traffic on NTH during the busy construction period, PG&E may arrange for transportation of visitors and monitors to the construction site or might otherwise organize consolidation of travel vehicles associated with the purpose of the visit. Visitors will not travel around the site without an escort unless the Site Operations Manager or his designee permits otherwise. Visitors will be told not to enter restricted areas unless an archaeological or biological monitor is present. Because PG&E anticipates that Tribal monitors and agency observers are likely to be onsite to observe much of the construction work, PG&E will arrange appropriate safe viewing locations for site observers. Upon arrival to the site, PG&E will establish a protocol for observers to communicate and check in with PG&E's construction team.

To minimize interference with ongoing TCS operations during remedy construction, access to the TCS will be limited to essential construction personnel and visitors/monitors needing to observe the construction work.

Consistent with EIR Mitigation Measure CUL-1a-8l, as formulated in Section 2.12 of the CIMP, Protocols for Tribal Monitors to Observe Ground Disturbing Activities; and in the sections "Tribal and Archaeological Monitoring Protocol" in the PA and CHPMP, PG&E will notify the Tribes of planned ground-disturbing activities and other scientific surveying being conducted in anticipation of construction activities. This provides the opportunity for Tribes to send Tribal monitors to the site to observe these activities, if they wish. While onsite, Tribal monitors will have the opportunity to discuss concerns directly with the PG&E project team while the activities are proceeding, as well as reporting their observations and any issues of concern directly to the Tribe(s) that they represent.

After a schedule for field activities has been established and communicated, each Tribal monitor can choose their arrival and departure times at the work site. Scheduled project activities will not be delayed if a notified monitor does not arrive at the time that the work is scheduled. If the field activity schedule changes, the Tribes will be notified as soon as practicable. It is the responsibility of monitors to report to and maintain ongoing communication with their respective Tribe(s). Each Tribal monitor will prepare a Daily Monitoring Log, which will be signed by the monitor and PG&E's Site Operations Manager (or designee), and will be submitted to PG&E at the end of each day. PG&E will provide a copy to the Tribe(s) upon request. Monitoring of ground-disturbing activities will be in accordance with this protocol, as well as with the "Tribal and Archaeological Monitoring Protocol" of the PA (BLM et al. 2010).

The safety requirements identified in the "Tribal and Archaeological Monitoring Protocol" of the PA will apply at all times, as well as the requirement for all monitors to check in to the CHQ or designated location at the start of work each day. Monitors will be expected to actively participate to enhance the safety of themselves and the other workers onsite by communicating with PG&E's Site Operations Manager (or designee) if any safety concerns are identified. Due to safety considerations at the construction site, monitors will be prohibited from conducting any monitoring within designated construction exclusion areas inside the primary work zones, unless otherwise authorized by PG&E. Such zones will be clearly delineated to the Tribal and archaeological monitors by PG&E's Site Operations Manager (or designee). In these situations, PG&E will provide alternative methods for accommodating monitors including, but not limited to, high-powered binoculars, spotting scopes, or other vision enhancement tools or alternative viewing platforms will occur.

4.3.3 Transportation Routes and Traffic Control

Figure 4.2-3 illustrates the proposed traffic routes, along with the primary truck inspection station, and check-in points for trucks. Traffic routes will be updated as needed throughout the construction planning process and, where possible, existing unpaved access roads will be used and maintained for different stages of construction to limit the potential for differential compaction of undisturbed areas. Figure 4.2-3 shows access routes in the project area; note that public roadways outside the EIR project area or APE will also be used for the groundwater remedy construction.

Day-to-day routine construction vehicle and heavy equipment traffic will typically be routed between the CHQ (Area 4 on Figure 4.2-3) and a given construction area using the routes shown on Figure 4.2-3. Non-routine traffic entering the project site will check in at a designated check-in location prior to entering the site. The check-in location will typically be the CHQ but may, at times, be another location including the turnout north of the I-40 freeway ramps (staging area 9), MW-20 Bench along the NTH (staging area 18), the TW Bench near the TCS entrance gate (staging area 23), or other locations that have been identified as staging areas. Depending on level of activity, there may be a separate check-in location established for work in Arizona at one of the staging areas near County Highway 10 or I-40. At the truck check-in/inspection station, trucks will undergo a cursory mechanical inspection to identify readily apparent potential safety concerns and confirm that documentation is complete. In addition, prior to entering work areas, trucks will be visually inspected for fuel or oil leaks, appropriate sound suppression devices, as well as inspection of load (for example, empty containers will be inspected for cleanliness and haul vehicles will be verified covered). Construction traffic will be routed in and out of primary work zones and staging areas through stabilized construction entrances/exits to reduce the potential for tracking of mud and dirt onto private or public roads.

After check in, arrangements will be made for meeting the specific contact person for the specific load at the designated work area. To control onsite traffic and minimize disruptions to existing operations (including but not limited to operations at Moabi Regional Park, operations by property owners/land managers/utility companies/BNSF Railroad, and operations related to IM-3) and activities (by Moabi Regional Park residents and/or recreational users of the area) —depending on the quantity and type of equipment/materials— designated onsite trucks may be used to shuttle materials from the check-in point to individual staging areas/construction zones. This approach of using designated vehicles may also apply to transporting personnel to and from the construction zones. Personnel vehicles will typically be parked at the CHQ.

Within the TCS, vehicles are required to maintain appropriate speeds for safety and dust control. While on public roads (including NTH and IM-3 access road), project-related vehicles will follow the posted speed limits and apply defensive driving techniques for traffic safety.

It is anticipated that lane closures will be required for portions of the following activities, at a minimum:

- The construction of some portions of the freshwater pipe in Arizona will require temporary single-lane closures along Arizona County Highway 10.
- The construction of portions of the NTH IRZ will require single-lane closures along NTH near the MW-20 Bench.
- Portions of the unpaved IM-3 access road will be temporarily closed for the construction of the remedy infrastructure in the uplands area of the site.

Traffic control plans, which will include the plan for use of temporary signage and delineators, will be prepared by the individual construction contractors for their work and reviewed by PG&E's construction management team. Traffic control plans will be prepared for submittal to San Bernardino and Mohave Counties as part of the encroachment permitting process, and traffic control measures will be designed in accordance with applicable state and federal highway temporary traffic control guidelines.

4.4 Safety, Air Monitoring, and Decontamination

Consistent with PG&E commitment to worker safety and minimizing migration of contaminants due to construction activities, the following address health and safety, air monitoring, and decontamination procedures for construction of the groundwater remedy, focused primarily on those locations at the site where construction activities may encounter contaminated soil or groundwater.

4.4.1 Health and Safety

A Construction Health and Safety Plan is included in Appendix D, for construction activities specifying how workers will be protected during the construction activities, and includes training requirements, establishment of work zones, hazard control, exposure monitoring and protection, medical surveillance, and emergency planning, in conformance with EIR Mitigation Measure HAZ-2, as well as applicable requirement of the California Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Response (HAZWOPER) regulations of Title 8 of the California Code of Regulations (CCR) Section 5192, as well as the U.S. Occupational Safety and Health Administration requirements in 29 Code of Federal Regulations (CFR) 1910 and 1926.

4.4.2 Air and Meteorological Monitoring

Construction of the groundwater remedy will include construction activities within the boundaries of soil investigation areas, both inside and outside of the TCS fence line. During construction activities within soil investigation areas, air monitoring may be conducted to assess air quality within and adjacent to work areas and work perimeters. Air monitoring for construction activities within soil investigation areas may be performed to assess worker exposure to airborne contaminants and to document that construction activities do not result in the migration of soil contaminants by air beyond the work area boundaries. Results of air monitoring will be used to evaluate and adjust engineering control measures to prevent airborne contaminants from migrating outside the work area and to evaluate levels of personal protective equipment.

Air and meteorological monitoring will be performed for construction activities within the boundaries of soil investigation areas that overlap with or are located within 20 feet of groundwater remedy infrastructure, as identified in Exhibit 4.1-1.

The air and meteorological monitoring program for construction activities within the boundaries of the soil investigation areas may include baseline monitoring, perimeter air monitoring, and meteorological monitoring. Personal monitoring within the construction areas will is not described below, but will be performed in conformance with the Construction Health and Safety Plan (Appendix D). Monitoring parameters will depend on the location for construction and the contaminants of concern from available soil data at that location, including data that may be available at the time of groundwater remedy construction from implementation of the Soil RCRA Facility Investigation/Remedial Investigation Work Plan (CH2M HILL 2013).

4.4.2.1 Perimeter Air Monitoring

Perimeter air monitoring will be used to evaluate the ongoing effectiveness of the dust control program, to guide modifications to field activities and engineering control measures, if necessary, and to document that construction activities do not result in the migration of soil contaminants by air beyond the work area boundaries. Both direct-read, real-time dust monitoring and air sampling may be conducted during construction activities within soil investigation areas. Portable battery-operated dust monitors and air sampling pumps would be set up at the perimeter of the construction zones based on wind direction and location of site work. The monitors would be installed if activities have the potential to create significant visible dust or if extensive trenching or other soil disturbance is performed. The monitors would be removed immediately after activities are completed.

The results of the perimeter air monitoring, in consideration of baseline monitoring performed prior to construction activities within soil investigation areas or other risk-based action levels, will be used to adjust work activities such as the use of dust suppression, altering the pace of excavation or work activities, modifying work practices to minimize dust or other emissions, or temporarily halting work activities until conditions are more favorable.

4.4.2.2 Meteorological Monitoring

Weather conditions can play an important role when determining potential dust migration pathways. The meteorological monitoring program will consist of an anemometer capable of reading wind speed and direction, a thermometer, a hygrometer, and a rain gauge interfaced with a data logger. Meteorological weather stations that may be used would be temporary, portable, battery-operated units, and set up on tripods. Meteorological monitoring parameters to evaluate upwind, downwind, and crosswind ambient air monitoring locations may include:

- **Wind Direction:** The wind direction indicates the direction from which the wind is blowing and which direction dust will migrate. The observed wind directions will be used to designate samples as upwind, downwind, or crosswind relative to the construction zone.
- **Wind Speed:** The wind speed is a major determinant of the travel distance and travel time of dust.
- **Maximum Observed Wind Speed:** The maximum observable wind speed will be recorded and an action level will be set, at which, work will cease at the construction zones.
- **Rainfall:** The amount of precipitation can affect the concentration of dust suspended in the air surrounding the construction zones.
- **Temperature (daily high and low):** The temperature at the construction zones can affect the concentration of dust suspended in the air surrounding these areas.
- **Humidity:** The humidity level can affect the concentration of dust remaining suspended in the air surrounding the construction zones.

4.4.3 Equipment Decontamination

Construction vehicles, equipment, and drill rigs will be cleaned before mobilization to the site, between work areas as necessary and before leaving site. BMPs will be implemented to keep materials, vehicles, equipment, and rigs clean to minimize potential impact to the ground surface and the tracking of mud and dirt out of the primary work zones and onto public or private roads. Such measures may include, but are not limited to, dry brush methods to remove mud or dirt and air dry, and/or wet methods such as steam cleaning or pressure washing with water/detergents (see Standard Operating Procedure [SOP]-B5 in Appendix B for additional information on decontamination procedures).

Decontamination operations will occur within the given primary work zone and/or at one of three designated decontamination pads designated for remedy use, which are (1) within the TCS fence line next to the remedy-produced water conditioning plant (to be constructed); (2) at the TW Bench (existing); and (3) at the CHQ in Moabi Regional Park (to be constructed). Where a designated decontamination pad is not available and/or not conveniently located, a temporary equipment decontamination facility will be constructed to properly decontaminate equipment by mechanical means as well as with the use of high-pressure, low-volume hot water when necessary. Decontamination rinse water will be captured and routed to temporary storage tanks and will be managed in accordance with the Waste Management Plan, provided as Appendix R to this C/RAWP. Sediments collected from the decontamination facility will be transferred to the designated waste management areas.

Equipment that comes into contact with contaminated groundwater (for example, downhole drilling tools or water sampling equipment) will be decontaminated between drilling and sampling locations, as appropriate, to prevent cross contamination.

Some construction activities will occur in areas with potential soil contamination such as an AOC or a SWMU. Vehicles, equipment, and rigs that enter an AOC or a SWMU will be decontaminated before exiting and entering uncontaminated areas. In this case, temporary equipment decontamination facilities (also known as contaminant reduction zones) will be within the primary work zone; the location will be selected to prevent equipment from being exposed to additional or other contamination. This area will be demarcated to limit access to essential personnel involved with the decontamination process. Decontamination of personnel, as necessary, is addressed in the Health and Safety Plan, provided as Appendix D to this C/RAWP.

4.5 Waste Management Plan

The Waste Management Plan, provided as Appendix R to this C/RAWP, discusses expected wastes to be generated during startup and construction of the final groundwater remedy at the site. The Waste Management Plan presents procedures for the characterization, storage, onsite management, transportation, and disposal of waste. Wastes generated from construction and startup activities will be managed onsite in compliance with the EIR mitigation measures, as adopted in the MMRP, and the ARARs established in the ROD (DOI 2010) and will be disposed of offsite in a manner consistent with applicable local, state, and federal laws and regulations.

Wastes to be generated from decommissioning of the interim measure are addressed in the IM-3 Decommissioning Plan (Appendix F), and wastes generated during O&M of the groundwater remedy are addressed in the O&M Manual that is Appendix L of the Final BOD (CH2M HILL 2015b).

4.5.1 Expected Waste Streams

Expected waste streams from remedy construction and startup activities and their estimated quantities are described in this section.

4.5.1.1 Wastewater

Expected wastewater streams include:

- **Wastewater generated from well installation, development, and testing/sampling.** The current estimated total volume of wastewater generated over the entire construction period is 25 million gallons. It is expected that some of this wastewater stream will be trucked or conveyed to temporary staging areas (for example, the MW-20 Bench) and subsequently disposed onsite at the existing IM-3 treatment plant and TCS evaporation ponds. In addition, water from well testing/sampling will be injected into an appropriate well (through a filter to remove particulate matter) of similar aquifer water quality subject to availability and in accordance with the substantive requirements. Excess or hazardous wastewater will be transported offsite for treatment/disposal.
- **Remedy-produced water generated during remedy startup such as backwashing of wells.** This wastewater stream will be transported onsite via piping or trucking to the remedy-produced water conditioning plant (inside the TCS), conditioned by removing solids and pH adjustment, and transported via piping to the IRZ wells for re-injection. The estimated total volume of remedy-produced water is 7.6 million gallons per year (see Final BOD, Section 3.4, Remedy-produced Water Management). No offsite transportation is anticipated for this waste stream.
- **Miscellaneous wastewater streams (for example, equipment decontamination, rainfall that collects in secondary containment areas).** These waste streams will be managed onsite via IM-3 and/or TCS evaporation ponds. During startup, these waste streams may be managed by piping or trucking to the remedy-produced water conditioning plant (inside the TCS), the IRZ wells. Excess wastewater will be transported offsite for disposal.

- **Water from hydrotesting of conveyance piping system.** It is anticipated that this water will be generally clean and therefore suitable for reuse in testing, dust control, backfill moisture control, and other similar onsite uses.

4.5.1.2 Displaced Site Material

Expected solid waste streams due to displaced site material include:

- **Displaced soil (for example, well drilling, installation of pipe trenches/access roads).** Displaced soil will be managed in accordance with the Soil Management Plan, provided as Appendix L to this C/RAWP. After accounting for onsite processing and reuse of soils, approximately 11,000 cubic yards of clean soil will remain onsite. The clean soil will include approximately 3,000 cubic yards of drill cuttings and 8,000 cubic yards of soil generated by other construction activities. Approximately 4,000 cubic yards of non-hazardous soil which includes 3,000 cubic yards of drill cuttings and 1,000 cubic yards generated by other construction activities, will be disposed offsite. In addition, approximately 800 cubic yards of excavated bedrock is expected to be removed for the construction of remedial facilities inside the TCS. Excavated bedrock will be managed in a manner similar to oversized rocks in displaced soil. Based on contaminant concentrations at soil investigation areas near TCS, soil to be generated from construction activities is not expected to be characterized as hazardous waste.

4.5.1.3 Construction Waste

Expected solid waste streams from general construction activities include:

- **General construction waste**. These general construction waste streams will be transported offsite for recycling or disposal.
  - Concrete and asphalt pavement rubble (from construction within roads, TCS)
  - Construction and demolition debris (lumber, gypsum wallboard, glass, metal, roofing material, carpeting, plastic pipe, etc.)
  - Used personal protective equipment
  - Miscellaneous waste (trash, paper bags, cardboard boxes, office debris, etc.)
  - Empty drums/cans, unused chemicals/paints, used oil, used solvents, oily solids, and used fuel filters/parts from equipment maintenance, etc.
  - Universal waste (batteries, electronic devices, lamps, aerosol cans, and mercury-containing equipment)
  - Sampling equipment such as calibration gas cylinders

4.5.1.4 Other Waste

Other expected solid waste streams include:

- **Sanitary waste**. This waste stream will be handled by portable toilets, with the exception of the temporary facilities that may be able to tie into existing sanitary systems such as the TCS and the planned CHQ at Moabi Regional Park.
- **Precipitated solids/sludge and spent filters generated from the remedy-produced water conditioning process**. The amount of precipitated solids and sludge is estimated to be 1.6 tons (dry weight) per year, based on 7.6 million gallons per year of remedy-produced water, using 25 percent caustic to neutralize the first flush of well rehabilitation water. The amount of spent filters is estimated to be 0.45 tons (dry weight) per year. These waste streams will be transported offsite for disposal.

4.5.2 Waste Characterization and Classification

Waste material with the potential to be hazardous wastes will be characterized per the procedures outlined below. Once the characteristics or profile of a waste stream is established, PG&E will continue to use the same waste profile unless a process change indicates that the waste stream should be recharacterized.

4.5.2.1 Liquid Wastes

Liquids will be classified as hazardous waste if they exhibit hazardous waste characteristics. Characterization will be conducted as appropriate as defined in the following sections. Three expected liquid wastes at the site include liquid with a pH of 2.0 or below or 12.5 or above; dissolved chromium concentration equal to or greater than 5 parts per million; and/or dissolved arsenic concentration equal to or greater than 5 parts per million. Liquids will be evaluated for the presence of metals having hazardous waste toxicity characteristic levels specified in 22 CCR 66261.24 using the following approach:

- For liquid wastes containing less than 0.5 percent filterable solids, the filtered liquid will be analyzed for total metals and the results compared with the RCRA toxicity characteristic (TC) limits in 22 CCR 66261.24(a)(1) and the soluble threshold limit concentrations (STLC) in 22 CCR 66261.24(a)(2). If a constituent exceeds the RCRA TC limit, the waste will be classified as RCRA hazardous. If no constituents exceed the RCRA TC limit, but one or more constituents exceed the STLC, the waste will be classified as non-RCRA hazardous. If neither limit is exceeded, the waste will be classified as non-hazardous.
- For liquid wastes containing 0.5 percent or more filterable solids, the filtered solids will be analyzed using the toxicity characteristic leaching procedure (TCLP), and the results compared with the RCRA TC limits. If a TC limit is exceeded, the waste will be classified as RCRA hazardous. If no TC limits are exceeded, the waste will be analyzed using the California Waste Extraction Test (WET), and the results will be compared with the STLCs. If one or more STLCs is exceeded, the waste will be classified as non-RCRA hazardous. If neither limit is exceeded, the waste will be classified as non-hazardous.

4.5.2.2 Solid Wastes

Solid wastes will be analyzed for total metals expressed in milligrams per kilogram, and the results will be evaluated as follows:

1. If the total constituent concentration exceeds the total threshold limit concentration in 22 CCR 66261.24(a)(2), material will be classified as a non-RCRA hazardous waste. Additional evaluation of the STLC, as described in Step 3, will not be performed.
2. If the total constituent concentration exceeds the numeric value of the RCRA TC level by 20 times or more, the TCLP will be performed. If the constituent concentration in the TCLP leachate exceeds the TC level, the material will be classified as a RCRA hazardous waste. Additional evaluation of the STLC, as described in Step 3, will not be performed.
3. If the material has not been classified as hazardous waste in Steps 1 or 2, the total constituent concentration will be compared to the STLC. If the total constituent concentration exceeds the numeric value of the STLC by 10 times or more, the WET will be performed. If the constituent concentration in the WET exceeds the STLC, the material will be classified as a non-RCRA hazardous waste.

If the material has not been classified as a hazardous waste in Steps 1, 2, or 3, it will be classified as non-hazardous waste.

4.5.2.3 Miscellaneous Wastes

Miscellaneous waste such as trash, paper bags, and cardboard boxes will be disposed of as non-hazardous solid waste unless affected by potentially contaminated material or water. Potentially contaminated miscellaneous waste will be combined with other hazardous waste. Empty, used 55-gallon drums that formerly contained hazardous materials will be labeled with the word “empty” and the date emptied and will be returned to the original chemical supplier or turned over to a drum reconditioner. Containers

managed as empty will meet the requirements of 22 CCR 66261.7. Drums being reconditioned will be removed from the site within 1 year.

Characterization and classification of additional, miscellaneous construction waste streams is provided in the Waste Management Plan in Appendix R to this C/RAWP.

4.5.3 Management of Waste

4.5.3.1 General Waste Management Procedures

Waste materials will be managed onsite in demarcated waste management areas. Waste management areas are identified in Figure 4.5-1. Within the waste management areas, hazardous wastes will be segregated from non-hazardous wastes. Additionally, incompatible hazardous wastes (for example, flammable and corrosives wastes) will be segregated. Wastes of the same matrix, contamination, and source may be aggregated to facilitate accumulation and disposal. Lined roll-off boxes will be used to contain solid wastes. Liquid wastes will be contained in drums, totes, or portable tanks. Cleaning and decontamination wastewater will be contained in portable tanks within secondary containment near the point of origin while the water is characterized for onsite management or offsite disposal. Incidental trash, such as wooden pallets and food and beverage containers, will be contained in dumpsters located in staging areas near temporary facilities. Universal waste will be stored in containers or packages that will remain closed; are structurally sound; are adequate to prevent breakage; are compatible with contents of batteries, lamps, or thermostats; and lack evidence of leakage, spillage, or damage that could cause leakage under reasonably foreseeable conditions. When possible, containerized wastes will be direct-loaded onto a truck and removed from the site from the point of generation (for example, potentially during rehabilitation event at well site).

Non-RCRA and RCRA hazardous wastes will be removed from the site within 90 days from the date of generation. The date of generation is the day that a waste is first placed in a container or stockpiled. The accumulation start date for containers is documented on the hazardous waste label. A log or other record will be used to document the accumulation start date for stockpiles and tanks. Labeling of waste containers (tanks) will be in accordance with 22 CCR Division 4.5 Chapter 12 and 49 CFR 172, 173, and 178. Universal waste will be labeled as universal waste plus the type of universal waste (for example, “Universal Waste – Batteries”); it will be accumulated onsite up to 1 year, and not more than 5,000 kilograms will be accumulated at one time. Universal waste will be sent to a permitted recycling facility. Waste accumulation and equipment storage areas will be inspected daily for labeling, malfunctions, deterioration, discharges, and leaks that could result in a release. Deficiencies observed or noted during inspection will be corrected immediately, and corrective measures will be documented and maintained onsite.

4.5.3.2 Onsite Management of Construction Water

Wastewater will be generated during construction activities from well installation, development, and testing/sampling. Other miscellaneous wastewater streams will be generated from equipment and vehicle decontamination, as well as water from hydrotesting of conveyance piping and rainfall collected in secondary containment areas. Consistent with water conservation and sustainability practices, onsite reuse and disposal of wastewater generated during construction will be maximized. Onsite options are described below. Water that is not managed onsite will be transported offsite to a permitted facility.

Management at IM-3 and the TCS Ponds. ARARs for the operation of IM-3 (treatment and injection facilities) authorize the disposal of groundwater generated during well installation, well development, and aquifer testing, as well as purged groundwater and water generated while rinsing field equipment during sampling events for the area-wide groundwater monitoring program.

The lined evaporation ponds receive cooling tower blowdown water and evaporate it as part of normal TCS operations. Solids are removed from the ponds periodically. The ponds operate under Waste Discharge Requirements issued by the California Regional Water Quality Control Board. Discharge of construction water to the ponds will require coordinating capacity with the TCS operations and authorization by the Regional Water Quality Control Board.

Onsite Reuse. Water from hydrostatic testing of conveyance piping may be reused onsite in a manner that complies with the State Water Resources Control Board Water Quality Order No. 2003-003-DWQ, Statewide General Waste Discharge Requirements for Discharges To Land With A Low Threat To Water Quality. The permit states that *"The discharge of water main, water storage tank, water hydrant pipeline flushing, or hydrostatic testing water from tanks or pipelines that have been used to store or convey any medium other than potable water is prohibited, unless the Discharger has demonstrated to the Regional Board that all residual pollutant concentrations have been reduced to levels below Regional Board Basin Plan groundwater quality objectives."*(Paragraph 7 on page 4). The water generated from hydrostatic testing will be low-volume discharges with minimal pollutant concentrations and will not be reused in a manner that results in a discharge to waters of the United States or waters of the state. The volume and date of each reuse event will be recorded.

Injection at Individual Wells during Well Testing. Following well installation and development, wells may be tested to evaluate its maximum injection flow rate. This hydraulic testing involves extracting water from the well, storing the water in portable tanks, then injecting the water back into the aquifer at the same or nearby well through a filter to remove particulate matter. Because chemical additives will not be used during these well testing activities, the water will be injected without additional characterization.

4.5.4 Waste Transportation and Offsite Disposal

After the wastes are containerized and labeled, those wastes ready for offsite disposal will be loaded onto trucks for transport to preapproved disposal facilities. A designated transportation and disposal coordinator will be onsite during transportation and disposal activities. This individual will be responsible for coordinating and overseeing these activities.

As truck loading is completed, the containers and trucks will be inspected and brushed as necessary to remove loose materials if the truck is transporting hazardous waste. Each load on a truck will be inspected by the driver to ensure that the load is secure. Hazardous waste labels on non-bulk containers will be verified to be accurate and complete, and non-bulk containers will be labeled with the appropriate USDOT hazard class label. Appropriate documentation to include waste manifests or shipping papers will be completed, checked, and kept onsite. A truck log with loading and transportation information will be maintained. Transport vehicles will proceed to the designated disposal facilities in accordance with local, state, and federal transportation requirements.

4.5.4.1 Disposal Facilities

Disposal facilities that receive CERCLA waste (wastes that contain CERCLA hazardous substances, pollutants, or contaminants) will be in compliance with the CERCLA Off-Site Rule (42 United States Code [U.S.C.] 9621(d)(3) and 40 CFR 300.440). Wastes designated as RCRA or non-RCRA hazardous wastes, or non-hazardous waste will be transported to and disposed of at an appropriately permitted facility. In accordance with the requirements of the Remedial Design/Remedial Action Consent Decree (DOI 2013), prior to the first shipment of waste material offsite, and annually thereafter, PG&E will demonstrate to DOI's satisfaction that USEPA has determined that the proposed receiving facility is operating in compliance with 42 U.S.C. 9621(d)(3) and 40 CFR 300.440. If PG&E knows or has reason to know the facility no longer meets the criteria of 40 CFR 300.440(b), PG&E will inform DOI, propose an alternate receiving facility prior to any subsequent shipments, and demonstrate to DOI's satisfaction that USEPA has determined that the alternate receiving facility is operating in compliance with 42 U.S.C. 9621(d)(3) and 40 CFR 300.440. The waste material will be stored onsite in accordance with the Waste Management Plan until approval is received and the waste material is transported offsite. If the waste management facility is out of state, prior to the first shipment of waste material, PG&E will provide written notice for disposal of waste material at the listed facilities to the appropriate state environmental official in each receiving facility's state and the DOI Project Manager and will comply with state law with regard to providing any further notifications. Additionally, PG&E will notify the state environmental official referenced above and the DOI Project Manager of any

major changes in the shipment plan, such as a decision to ship the waste material to a different out-of-state facility.

PG&E proposes use of the following potential disposal facilities for the project as well as others, subject to the communication and approval processes under the CD outlined above:

Chemical Waste Management – Kettleman Hills Facility – Landfill
35251 Old Skyline Road
Kettleman City, CA 93239

US Ecology Inc. - Landfill
Highway 95 (12 miles South of Beatty, NV)
Beatty, NV 89003

Clean Harbors Button Willow – Landfill
2500 West Lokern Road
Button Willow, CA 9320

4.6 Best Management Practices Plan

The following describes BMPs for the construction of the groundwater remedy.

4.6.1 Stormwater-related BMPs

A BMP plan, prepared to meet the substantive requirements of applicable federal, state, and local permit and regulatory requirements for stormwater discharges associated with construction and land disturbance activities, as well as EIR Mitigation Measure HYDRO-1, is provided as Appendix M. Appendix M includes BMPs, as well as requirements for visual inspection, monitoring, reporting, working training and education, and recordkeeping. BMPs will be used for varying activities and varying locations and durations depending on specific activities

Storm water related BMPs addressed in Appendix M include:

- Erosion control BMPs, including preservation of existing vegetation, geotextiles and road maintenance
- Sediment control BMPs, including silt fences, gravel bag berms and straw bale barriers
- Waste and Materials Management Control, including stockpile management, and waste management
- Non-stormwater BMPs, including vehicle and equipment fueling and maintenance
- Good housekeeping BMPs.

4.6.2 Other Site Controls and Avoidance, Mitigation, and Management Measures

4.6.2.1 Dust Control

To comply with EIR Mitigation Measures AIR-1a, AIR-1b, AIR-1c and AIR-1e, fugitive dust emission control measures will be used during construction: wind erosion control will be applied as necessary to prevent nuisance dust and minimize the movement of sediment disturbed during construction.

- Use periodical watering for short-term stabilization of disturbed surface areas, including haul roads, to minimize visible fugitive dust emissions during dust episodes. A water truck also will be used to control dust on disturbed surfaces during visible dusting episodes. Water application rates will be optimized to the greatest practical extent while still maintaining dust control but controlling runoff from affected material. Water may be applied as a pre-wetting step in addition to use during construction activities.
- Cover loaded haul vehicles while operating on publicly maintained roads.
- Stabilize graded site surfaces using soil binders, as necessary, upon completion of grading when subsequent development is delayed or expected to be delayed more than 30 days, except when such delay is caused by precipitation that dampens the disturbed surface sufficiently to eliminate visible

fugitive dust emissions. Commercial dust control and soil stabilization products are typically polymer- or plant-based slurries such as Soiltac or similar products.

- Cleanup project-related track out or spills on publicly maintained paved surfaces within 24 hours.
- Curtail or reduce nonessential earthmoving activity under high-wind conditions (greater than 25 miles per hour), or develop a plan to control dust during high-wind conditions.

4.6.2.2 Control Measures in Soil Investigation Areas

To comply with EIR Mitigation Measures HAZ-2a, HAZ-2b, and HAZ-2c, the following procedures will be followed for construction activities in soil investigation areas:

- Vehicle movement will be controlled to avoid traveling in areas where contaminated soils are known to be present, and speeds will be limited to 15 miles per hour or slower to limit generation of dust. Measures such as wetting of surfaces will be employed to prevent dust generation by vehicular traffic or other dust-generating work activities.
- Pre-mobilization planning will be used to review the likelihood of encountering contaminated soils, and procedures in the Hazardous Materials Business Plan, Construction Health and Safety Plan, the Soil Management Plan, SOPs, and the Waste Management Plan will be followed. The pre-mobilization planning will ensure that the contingencies for handling contaminated soils are in place prior to implementing the field operations.
- Should evidence of contaminated soil be identified during ground-disturbing activities (for example, noxious odors, discolored soil), work the area will immediately cease until soil samples can be collected and analyzed for the presence of contaminants. Potentially contaminated soils encountered in situ will be isolated—and appropriate dust and erosion control measures will be applied—to minimize the potential for migration until laboratory results are received. Contaminated soil will be managed and disposed of in accordance with the Construction Health and Safety Plan and the Soil Management Plan.

4.6.3 Noise and Vibration

Compliance measures and protocols related to noise and vibration are included in the EIR MMRP and the CIMP. For convenience and brevity, the compliance measures and protocols to be implemented before, during, and after construction through the start of O&M are compiled in Exhibit 4.6-1.

EXHIBIT 4.6-1
Protocols to Reduce Auditory and Vibration Impacts from Construction Activities
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Noise Protocols	Timing/Schedule
1. PG&E will designate disturbance coordinators for noise concerns arising from construction.	Before construction
2. Verify location of planned construction activities that may occur within the noise buffers (i.e., 1,850 feet and 5,830 feet from the mobile home park at Moabi Regional Park, and 330 feet and 735 feet from the mobile home park at the Topock Marina in Arizona and private residences in Topock Marina area for daytime and nighttime noise, respectively), and determine through-noise measurements if temporary noise barriers must be erected, as required by NOISE-2c.	Before construction
3. If noise monitoring during construction is required by the CIMP, noise monitoring locations will be selected in the field by a qualified acoustical consultant (INCE Board Certified or Professional Engineer in Acoustics) in coordination with the Tribes. The EIR MMRP requires that noise measurements be conducted at the nearest noise-sensitive land use relative to the construction activities. Noise measurements will be in accordance with the Topock Sound Measurement Protocol in the Final BOD. The qualified acoustical consultant will use a sound level meter for the noise measurements that meets the standards of ANSI (Section S14 1979, Type 1 of Type 2).	Before construction

EXHIBIT 4.6-1

Protocols to Reduce Auditory and Vibration Impacts from Construction Activities

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Noise Protocols	Timing/Schedule
4. PG&E disturbance coordinators will post contact information in a conspicuous location near construction areas so that it is clearly visible to nearby noise sensitive receptors (i.e., mobile home parks at Moabi Regional Park and the Topock Marina, and private residences in Topock Marina area) most likely to be disturbed. In addition, mailing of the same information will be sent to nearby noise sensitive receptors and Interested Tribes. The disturbance coordinator will contact nearby noise-sensitive receptors, advising them of the construction schedule. The disturbance coordinators also will alert Interested Tribes to project activities that would generate new noise in the Topock Cultural Area at least annually.	Before and during construction
5. If the qualified acoustical consultant, after taking noise measurements at the nearest noise-sensitive land use relative to the construction activities, finds that the relevant noise thresholds are exceeded, temporary noise barriers will be erected.	During construction
6. Maintain construction equipment according to manufacturer guidelines. Equipment will be fitted with the best available noise-suppression devices. Applicable impact tools will be shrouded or shielded, and intake or exhaust ports on power equipment will be muffled or shielded.	During construction
7. Construction equipment will not be allowed to idle for extended periods of time (more than 15 minutes) when not being used for construction.	During construction
8. Should a concern about the actual noise generated by remedy construction arise, the PG&E disturbance coordinator will thoroughly investigate and resolve the issue appropriately. A qualified acoustical consultant will evaluate reoccurring disturbances for compliance with applicable standards. Noise measurements will be in accordance with sound measurement protocol in the Final BOD. Noise complaints and resolutions will be recorded, tracked, and reported to DTSC in quarterly compliance reports.	Before, during, and after construction
Vibration Protocols	**Timing/Schedule**
1. PG&E will designate disturbance coordinators for vibration concerns arising from construction.	Before construction
2. PG&E disturbance coordinators will post contact information in a conspicuous location near construction areas so that it is clearly visible to nearby vibration sensitive receptors (i.e., mobile home parks at Moabi Regional Park and the Topock Marina, and private residences in Topock Marina area). The coordinator will manage complaints resulting from the construction noise. Reoccurring disturbances will be evaluated by a qualified acoustical consultant to ensure compliance with applicable standards. The disturbance coordinator will contact nearby vibration-sensitive receptors, advising them of the construction schedule. Vibration complaints and their resolutions will be recorded, tracked, and reported to DTSC in the quarterly compliance reports.	Before, during, and after construction
3. Construct new wells a minimum of 45 feet from vibration-sensitive receptors (i.e., mobile home parks at Moabi Regional Park and the Topock Marina, and private residences in Topock Marina area). Avoid constructing wells within 30 feet of vibration- sensitive land uses located in California and 275 feet of vibration- sensitive land uses located in Arizona (i.e., mobile home parks at Moabi Regional Park and the Topock Marina, and private residences in Topock Marina area).	During construction

Sources: EIR MMRP, CIMP

Figures 4.6-1 and 4.6-2 show identified noise-sensitive receptors at the project site in California and Arizona, respectively, as well as noise monitoring buffer zones for daytime and nighttime noise. Construction activities occurring within these buffer zones will plan for monitoring and mitigation in accordance with the EIR MMRP and the CIMP.

As mentioned in Item 5 of Exhibit 4.6-1, temporary noise barriers will be erected if the relevant noise thresholds are exceeded breaking the line of sight between the source and receptor where noise levels exceed applicable standards. Typical noise barriers that could be used during construction to mitigate noise concerns are dumpsters, bins, tanks, soil berms, and/or soil stockpiles. In the unlikely event that engineered acoustical barriers such as temporary panels or blankets are required during construction, they will comply

with requirements of the EIR Mitigation Measure NOISE-2c. Placement, orientation, size, and density of acoustical barriers will be specified by a qualified acoustical consultant.

4.6.4 Lighting

4.6.4.1 Nighttime Construction Lighting

The protocol for nighttime lighting, in conformance with EIR Mitigation Measure CUL-1a-7 is provided in Appendix P, Cultural Resources Protocols, to this C/RAWP. The first step will be to determine whether nighttime construction work is required. Nighttime construction-related activities will be limited to work that cannot be disrupted or suspended until the following day, such as, but not limited to, well drilling and development or decommissioning activities. If nighttime construction is required, the following principles will be applied:

- Identify the active area for construction and the applicable lighting standards. Only areas of active construction may be illuminated.
- Obtain portable lighting (including solar-powered). Lights must include shielding/shrouding (for example, downward-facing fixtures with cutoff shields to reduce light diffusion). No permanent poles will be installed for nighttime lighting.
- Install the minimum lighting feasible to maintain adequate night lighting for safety at the lowest allowable height. Orient the lights such that offsite visibility of light sources, glare, and construction activities is limited.
- Assign a responsible member of the construction crew, such as foreman or crew boss, to extinguish the lighting as soon as the nighttime construction work is completed.

4.6.4.2 Emergency Lighting System

The emergency lighting system will:

- Provide emergency illumination in appropriate spaces, as required by code to provide life safety, property, and equipment protection.
- Provide adequate lighting levels to maintain safe building egress and critical process/plant functions.

4.6.4.3 Explosion-proof Luminaires

A room or space listed as a hazardous atmosphere area will have explosion-proof-type luminaires UL-listed for installation in the hazardous area classifications, as required by Article 500 of the National Electric Code.

4.6.4.4 Lighting Standards

The following lighting standards will apply during remedy construction through the start of O&M, as discussed in the Final BOD:

- Construction Industry 29 CFR 1926.56 (lighting safety requirements)
- General Industry 29 CFR 1910.120 (HAZWOPER) (lighting safety requirements)
- San Bernardino County Code Title 8, 83.07.040 Glare and Outdoor Lighting - Mountain and Desert Regions
- Mohave County Outdoor Light Control Ordinance 87-1

4.6.5 Aesthetic/Biological Resource-related Site Management and Compliance Measures

Compliance measures and BMPs related to aesthetic and biological resources are included in numerous preexisting documents and directives, including:

- PBA for the TCS final groundwater remedy (CH2M HILL 2014a; see Appendix U) containing:
  - General project management measures
  - Management measures for potential southwestern willow flycatcher habitat
  - Management measures for potential western yellow-billed cuckoo habitat
  - Management measures for potential Agassiz's desert tortoise habitat
  - Management measures for potential Morafkai's desert tortoise habitat
  - Management measures for potential Yuma clapper rail habitat
  - Management measures for work in or near the mainstream Colorado River, as well as the backwater areas of Moabi Regional Park and the Topock Marina
- Final Bird Impact Avoidance and Minimization Plan, provided as Appendix S to this C/RAWP, which contains general avoidance and minimization measures, as well as species-specific mitigation measures for southwestern willow flycatcher and Yuma clapper rail similar to those in the PBA.
- The MMRP for the TCS groundwater remediation project (DTSC 2011a), containing mitigation measures (EIR Mitigation Measures BIO-2a and BIO-2b) for special-status birds and desert tortoise, as well as mitigation measures for vegetation removal, preservation, and revegetation (BIO-1, AES-1, and AES-2) during construction.
- The protocol for PG&E compliance with EIR MMRP BIO-1 and ARAR #32 for work activities near or within jurisdictional wetland and waters containing wetlands avoidance measures and management practices before, during, and after construction.
- Avoidance and Minimization Measures for California Department of Fish and Wildlife (CDFW) Jurisdictional Washes as documented in correspondence with CDFW: Attachment to Letter from Chris Hayes/CDFW to Yvonne Meeks/PG&E, Confirmation of Application of the CERCLA 121(e)(1) Permit Exemption to Pacific Gas and Electric Company's Soil and Groundwater Investigation and Remediation Project, dated March 6, 2013

Collectively, these documents and directives provide procedures and avoidance measures to be followed before, during, and after construction. Reporting and communications associated with these compliance measures are included in Section 2 of this C/RAWP. Habitat restoration for HNWR lands, riparian habitats, and aesthetics and visual resources is discussed in Section 6, and the restoration plans that will govern restoration of the project area are included as Appendices G, N, O, and V to this C/RAWP.

In addition to the compliance measures and BMPs in preexisting documents and directives discussed above, BMPs will be implemented during construction to protect wildlife from incurring injuries within open trenches, boreholes, or pipes that are stored in work areas. Options to accomplish this objective include:

- Limiting the size of trenches that may be left open overnight or longer
- Covering trenches and boreholes such as with metal plates
- Isolating the trenches/excavations from surrounding areas using mesh-fabric fence whose base is partially buried or otherwise keyed into the ground
- Creating exit points at open trenches using planks or dirt ramps at intervals along the trenches
- Wildlife inspection of trenches or open pipe by a biologist or qualified designee (as defined by PG&E) prior to resuming construction work following an overnight or longer period of inactivity

4.6.6 Cultural/Archaeological/Historical Resource-related Site Management and Compliance Measures

Compliance measures and BMPs related to cultural and archaeological/historical resources are included in numerous existing documents and directives, including:

- The PA Among the Bureau of Land Management, Arizona State Historic Preservation Officer, California State Historic Preservation Officer and the Advisory Council on Historic Preservation for the Topock Remediation Project in San Bernardino County, California and Mohave County, Arizona (BLM 2010), with provisions applicable during construction and associated with avoidance measures; construction monitoring; accommodations of Tribal activities; treatment of cultural, historical, and archaeological properties; and procedures for discoveries.
- The CHPMP (BLM 2012), provided as Appendix I to this C/RAWP, with provisions applicable during construction and associated with avoidance measures; site controls; construction monitoring; accommodations of Tribal activities; treatment of cultural, historical, and archaeological properties; and procedures for discoveries.
- CIMP, provided as Appendix H, to this C/RAWP, with protocols applicable before, during, and after construction and associated with Tribal communications; treatment of archaeological materials; repatriation of clean soils; accommodation of Tribal ceremonies; Tribal monitoring; protective measures for archaeological/historical sites; and inspection of remediation facilities and/or staging areas; and reporting discoveries of cultural importance.
- The certified EIR and adopted MMRP (DTSC 2011a-b), with provisions applicable during construction associated with mitigation measures to minimize impacts to cultural, archaeological, and historical resources to the extent feasible.
- Management Measures for Geoarchaeological Resources, provided as Appendix T to this C/RAWP, with procedures for monitoring and avoidance of excavations in defined areas.
- Management Measures for Paleontological Resources, provided as Appendix J to this C/RAWP, with requirements for training, monitoring, and surveying of paleontological resources during ground-disturbing activities, as well as recovery, documentation, preparation, and repository for fossils recovered during the project.

Collectively, these documents and directives provide procedures and avoidance measures to be followed before, during, and after construction. Reporting and communications associated with these compliance measures are included in Section 2.

TABLE 4.2-1

Proposed Use of Certain Areas During Groundwater Remedy Construction and/or IM-3 Decommissioning

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Area No.[1]	Groundwater Remedy Construction	IM-3 Decommissioning
Moabi Regional Park Area (California)		
4	This area will serve as the Construction Headquarters during construction	This is a potential support area during the decommissioning of IM-3.
5	This area will be used for soil processing during construction	Soil storage (if needed)
Upland Area (California)		
IM-3 Treatment Plant	The IM-3 Treatment Plant will be used during remedy construction for communication and coordination. However, this area will continue to be an operating facility during remedy construction with limited available space as access to work areas must be maintained. During remedy start-up and until the commencement of IM-3 decommissioning, access will be maintained for maintenance activities during lay-up of IM-3.	This area will be a primary work zone during the decommissioning of IM-3 treatment plant.
6	This area will be a primary work zone during construction of wells IRL-1, MW-AA, and MW-P and the associated vaults, piping, and instrumentation. In addition, it will be used for essential staging activities during the construction of remedial facilities within the access road, including pipeline A, wells MW-BB, MW-CC, and IRL-3, and associated vaults, piping, and instrumentation. Due to its central location, temporary facilities will be placed in this area for the duration of construction of remedy infrastructure in the upland area. Portable toilets will not be placed within this area, and the area will not be used for long-term storage of soil or other material.	This area will be used for essential staging activities during the decommissioning of IM-3 Portable toilets will not be placed within this area, and the area will not be used for long-term storage of soil or other material.
7	This area will be a support zone during construction of wells IRL-1, MW-AA, and MW-P and the associated vaults, piping, and instrumentation. In addition, it will be used for essential staging activities during the construction of remedial facilities within the access road, including pipeline A, wells MW-BB, MW-CC, and IRL-3, and associated vaults, piping, and instrumentation. Similar to Area 6, due to its central location, temporary facilities will be placed in this area for the duration of construction of remedy infrastructure in the upland area. Portable toilets will not be placed within this area, and the area will not be used for long-term storage of soil or other material.	This area will be used for essential staging activities during the decommissioning of IM-3. Portable toilets will not be placed within this area, and the area will not be used for long-term storage of soil or other material.
8	This area will be a primary work zone as well as a staging area for the duration of construction of remedy infrastructure in the upland area.	This area will be a primary work zone for the decommissioning of IM-3 related pipelines, conduits, and vaults.
12	This area will be a primary work zone and staging area for laydown of construction equipment, materials, supplies, and tools, as well as temporary placement of displaced soils during the construction of remediation well FW-1 and associated vaults/piping/conduits. During remedy construction, access will be maintained for O&M of the IM-3 injection well field. Also, until the commencement of IM-3 decommissioning, access will be maintained for the maintenance of the injection well field during lay-up of IM-3.	This area will be a primary work zone for the decommissioning of IM-3 related wells and associated vaults/piping/conduits.

TABLE 4.2-1

Proposed Use of Certain Areas During Groundwater Remedy Construction and/or IM-3 Decommissioning

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Area No.[1]	Groundwater Remedy Construction	IM-3 Decommissioning
13	This area will be a staging area for laydown of construction equipment, materials, supplies, and tools, as well as temporary placement of displaced soils for the duration of construction of remedy infrastructure in the upland area. In addition, this area has and will continue to serve as a critical vehicle turnaround area for traffic along the existing access road.	This area is not proposed for use as a staging area during IM-3 decommissioning. Note that this area will continue to serve as a vehicle turnaround area.
16	Similar to Area 8, this area will be used as a staging area for the duration of construction of remedy infrastructure in the upland area.	This area will be a primary work zone for the decommissioning of IM-3 related pipelines, conduits, and vaults.
17	This area will be a primary work zone during construction of pipeline A. In addition, this area has and will continue to be used as a vehicle turnaround area for traffic along the existing access road.	This area will be a primary work zone for the decommissioning of IM-3 related pipelines, conduits, and vaults. In addition, this area will continue to be used as a vehicle turnaround area for traffic along the existing access road.
19	This area will be a primary work zone during construction of pipeline A, and monitoring well MW-N. In addition, this area has and will continue to be used as a turn around and/or parking areas for vehicle traffic along the existing access road.	This area will be a primary work zone for the decommissioning of IM-3 related pipelines, conduits, and vaults. In addition, this area will continue to be used as a vehicle turnaround area for traffic along the existing access road.
MW-20 Bench and Vicinity (California)		
14	This area will be a primary work zone during construction of well MW-Z. In addition, it will be a staging area during construction of the NTH IRZ, and for the duration of construction of remedy infrastructure in the project area.	This is a potential staging area during the decommissioning of IM-3.
15	This area has been identified as a location for planting of native plants, if needed, to mitigate potential impacts to plants that may occur during remedy construction in the upland. If use for mitigation planting, access to this area will also be needed for monitoring and maintenance of the plants.	This area is not proposed for use for IM-3 decommissioning.
18 (MW-20 Bench)	This is a primary work zone during construction of the carbon amendment facilities on the MW-20 Bench. This area will also be a staging area during construction of the NTH IRZ and other remedy infrastructure. During construction, access for O&M activities of the IM-3 related infrastructure on the MW-20 Bench must be maintained. Until the commencement of IM-3 decommissioning, access will also be needed for maintenance activities during lay-up of IM-3.	This is a primary work zone for the decommissioning of IM-3 related wells, pipelines, conduits, and vaults.
Near I-40 On/Off Ramp (California)		
9	This area will be used for staging for the duration of remedy construction.	This is a potential staging area during IM-3 decommissioning.
10	Subject to concurrence from Caltrans, this area may be used for staging for the duration of remedy construction.	This is a potential staging area during IM-3 decommissioning.
PG&E Topock Compressor Station and Vicinity (California)		

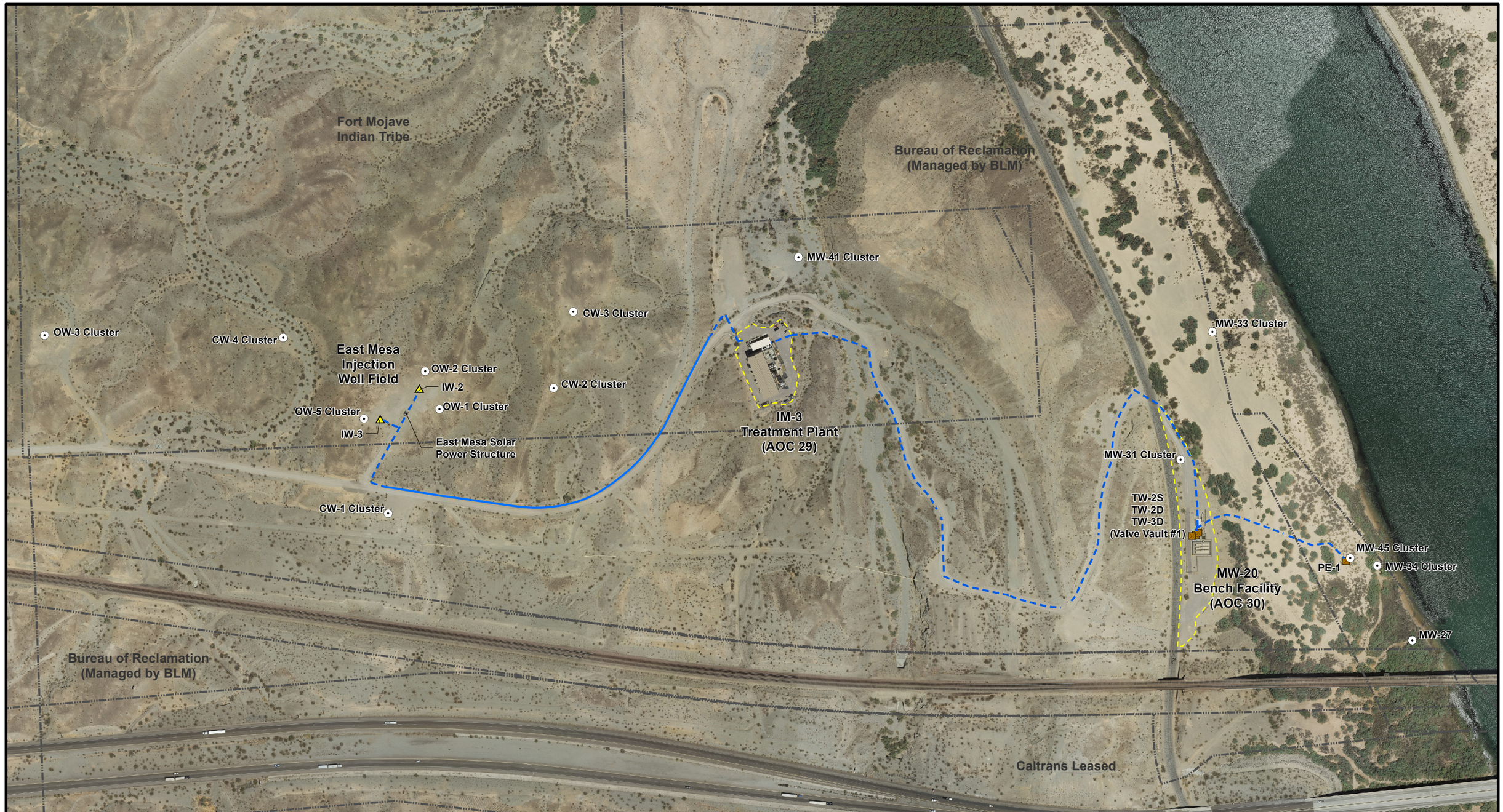
TABLE 4.2-1

Proposed Use of Certain Areas During Groundwater Remedy Construction and/or IM-3 Decommissioning

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

Area No.[1]	Groundwater Remedy Construction	IM-3 Decommissioning
11	This is a primary work zone for the construction of remedy infrastructure located at the TCS ponds. When used for staging during remedy construction, the area will be limited to the western side of the fenced area.	This is a potential staging area during IM-3 decommissioning.
20	This area is not currently proposed for use during remedy construction. If it is later determined that the future provisional well IRL-6 needs to be installed, this area will need to be used as a primary work zone to install the well and associated vaults/piping/ conduits. In addition, this area will be used to monitor the existing wells on the MW-24 Bench.	This area is not proposed for use during IM-3 decommissioning.
21 (TCS)	This area will be a primary work zone during construction of remedy infrastructure on TCS. It will also be used as a staging area for the duration of remedy construction. The TCS will continue to be an operating facility during remedy construction with limited available space as access to work area must be maintained.	This is a potential staging area for IM-3 decommissioning.
22	This area will be a primary work zone during construction of pipeline F along the TCS entrance road.	This area is not proposed for use during IM-3 decommissioning.
23 (TW Bench)	This area is a primary work zone during construction of remedy infrastructure on the TW Bench. It will also be used as a staging area for the duration of construction of pipeline F along the TCS entrance road and other remedy infrastructure.	This area will be a staging area during IM-3 decommissioning.
24	This area is a primary work zone during construction of remedy infrastructure in the topographic low area.	This is a potential staging area during IM-3 decommissioning.
25	This flat area is where construction vehicles and water trucks will obtain construction water for use during remedy construction. This area will be used for limited staging of construction materials/equipment and temporary parking of construction related vehicles for the duration of remedy construction. Working areas will be demarcated and protective barriers used to safeguard the Route 66 sign.	This is a potential staging area during IM-3 decommissioning.
Arizona		
26-29	These areas will be used for staging for the duration of remedy construction.	These areas are not proposed for use during IM-3 decommissioning.

Note:
[1] As identified in Figure 4.2-3



LEGEND

- Monitoring Well
- Extraction Well
- Injection Well
- IM-3 Pipeline (underground where dashed)
- Area of Concern (AOC) Boundary
- Property Boundary

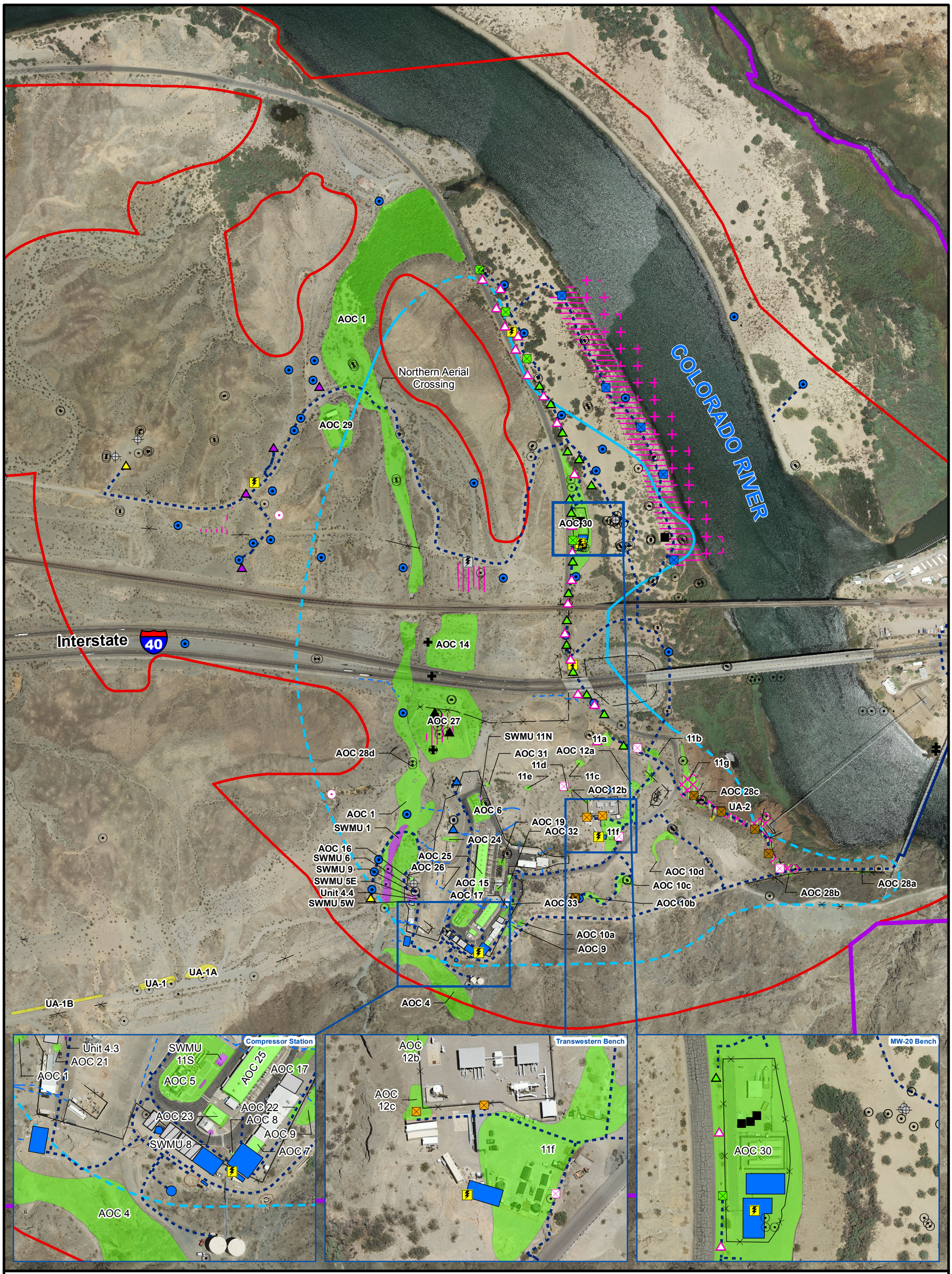
N

0 150 300 600 Feet

FIGURE 4.1-1
LOCATION OF IM-3 COMPONENTS
GROUNDWATER REMEDY CONSTRUCTION/
REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Document Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CRAWP\FIG411_IM3System_Photos.mxd



LEGEND

Existing Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- Water Supply Well

Provisional Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- Area for East Ravine (ER) Wells (ER-7 to ER-11)
- Area for Potential Slant Well Screens
- Area for Inner Recirculation Loop (IRL) Wells
- Area for River Bank Extraction Wells

Planned Wells:
- Extraction, East Ravine
- Extraction, National Trails Highway (NTH) In-situ Reactive Zone (IRZ)
- Extraction, Riverbank
- Extraction, Transwestern Bench
- Injection, Freshwater
- Injection, Inner Recirculation Loop
- Injection, NTH IRZ
- Injection, Topock Compressor Station
- Remedy Monitoring Well
- Recirculation Well
- Area for Monitoring Well (MW-T)

Transformers
- Planned Transformer
- Future Provisional Transformer

- Site Fence Boundary
- Stormwater Piping Below Ground
- Stormwater Piping Above Ground

Pipeline Corridor for Remedy
- Aboveground Pipe
- Underground Pipe/Conduit
- Area of Potential Effects (APE)
- EIR Project Area

Work Areas
- Solid Waste Management Unit (SWMU)
- Area of Concern (AOC)
- Other

Remedy Facilities
- Proposed Remedy Structure
- Contingent Freshwater Pre-injection Treatment System

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

Notes:
1. All wells and remedy structure locations are approximate.
2. AOC 13 consists of the current and former unpaved areas within the fence line.AOC 18 consists of the hazardous waste transference pipelines and cooling tower blowdown pipelines.

N

0 550

Feet

FIGURE 4.1-2
MAP OF SOLID WASTE MANAGMENT UNITS (SWMUS) AND AREAS OF CONCERN (AOCS)
GROUNDWATER REMEDY CONSTRUCTION/
REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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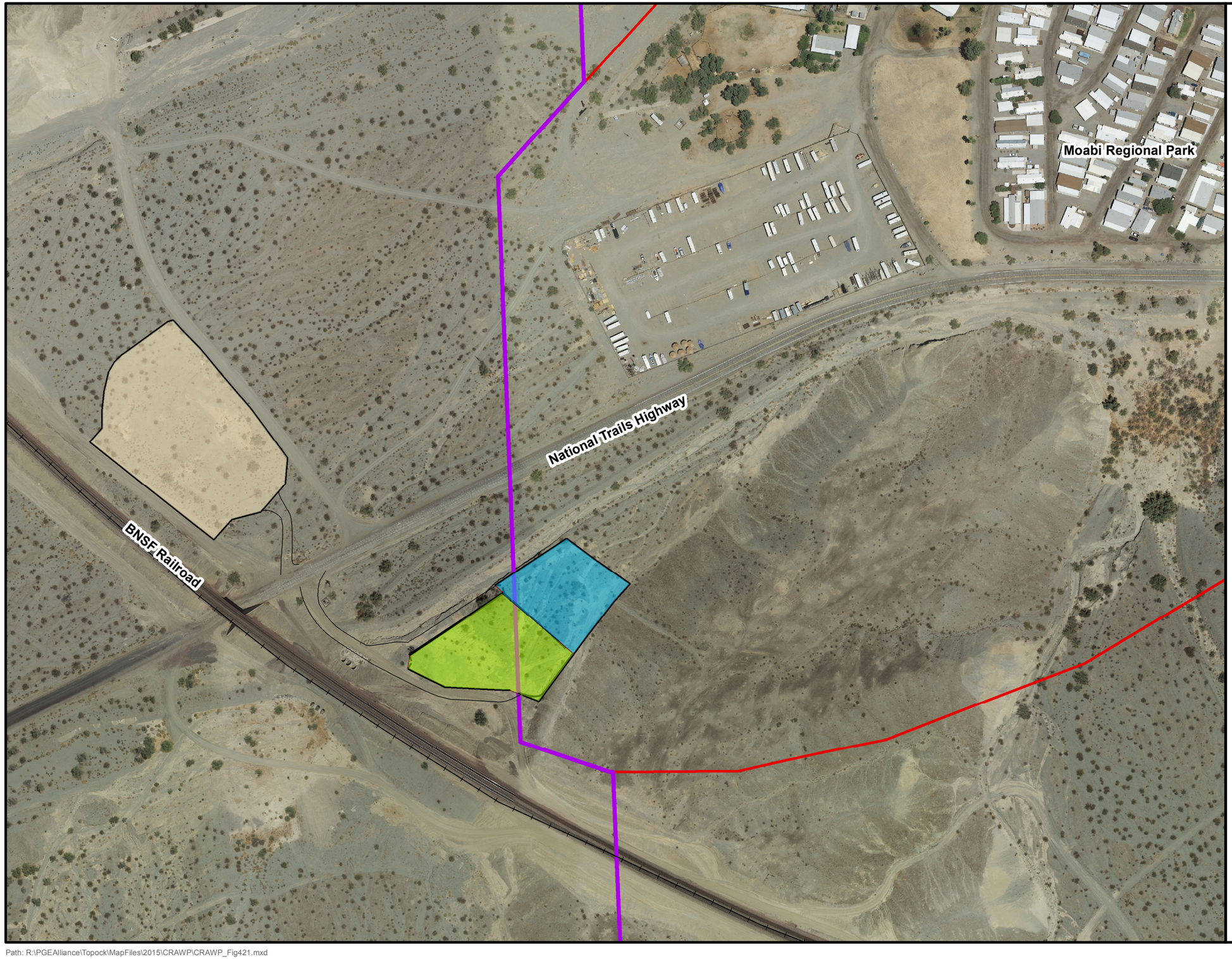
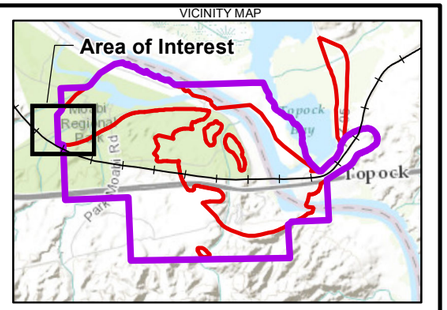


VICINITY MAP



LEGEND

- Long-term Remedy Support Area (0.8 Acres Approximate)
- Soil Processing Area (2.56 Acres Approximate)
- Temporary Construction Laydown Area (1.05 Acres Approximate)
- Area of Potential Effects (APE)
- EIR Project Area

Notes:

1. Descriptions of activities/functions anticipated for the construction support areas are included in the Construction/Remedial Action Work Plan.
2. Descriptions of activities/functions anticipated for the long-term remedy support areas are included in Section 3.5 of the BOD, and the O&M Manual.

N

0 90 180 360 Feet

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FIGURE 4.2-1
LOCATIONS OF CONSTRUCTION FACILITIES IN MOABI REGIONAL PARK

GROUNDWATER REMEDY CONSTRUCTION/
REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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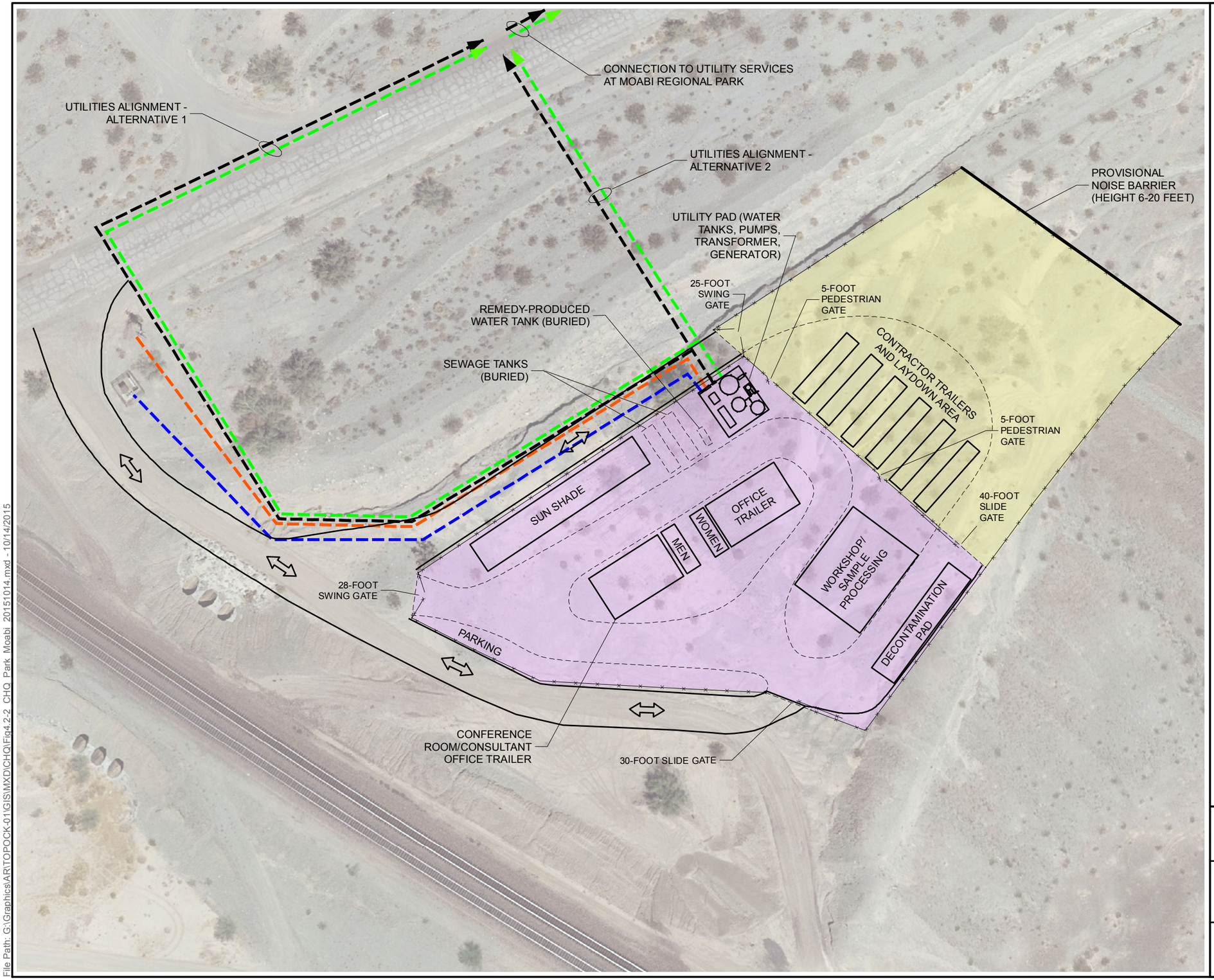

Legend

- Future Potential Fire Water Connections
- Future Potential Sanitary Sewer Connections
- Future Potential Water Connection
- Anticipated Electrical and Telecom Connection*
- Fenceline
- Temporary Construction Laydown Area (1.05 acres approx.)
- Long Term Remedy Support Area (0.8 acres approx.)

Notes:

1. All remedy structure locations are approximate.
2. Descriptions of activities/functions anticipated for the construction support areas are included in the Construction/Remedial Action Work Plan.
3. Descriptions of activities/functions anticipated for the long-term remedy support areas are included in Section 3.5 of the BOD and the O&M Manual.
4. Temporary storage/conex boxes (not shown) may be used within the fenced Construction Headquarters.

* Final locations will be determined by Needles

N

0 60 120 180

1 " = 60 '

PACIFIC GAS AND ELECTRIC COMPANY
TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
GROUNDWATER REMEDY CONSTRUCTION/REMEDIAL ACTION WORK PLAN

CONSTRUCTION HEADQUARTERS SPATIAL PLANNING

ARCADIS

FIGURE
4.2-2

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Notes:

1. **The layout shown is for conceptual visualization purposes and may be modified as necessary.**
2. **Other areas not shown.**

PACIFIC GAS AND ELECTRIC COMPANY
TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
GROUNDWATER REMEDY CONSTRUCTION/REMEDIAL ACTION WORK PLAN

PHOTO SIMULATION OF NEW REMEDY SUPPORT FACILITY IN MOABI REGIONAL PARK

ARCADIS

FIGURE 4.2-2A

City: Div/Group: Created By: Last Saved By: tyarbrough
Project (Project #)
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Note: Soil storage may also occur at the soil processing area.

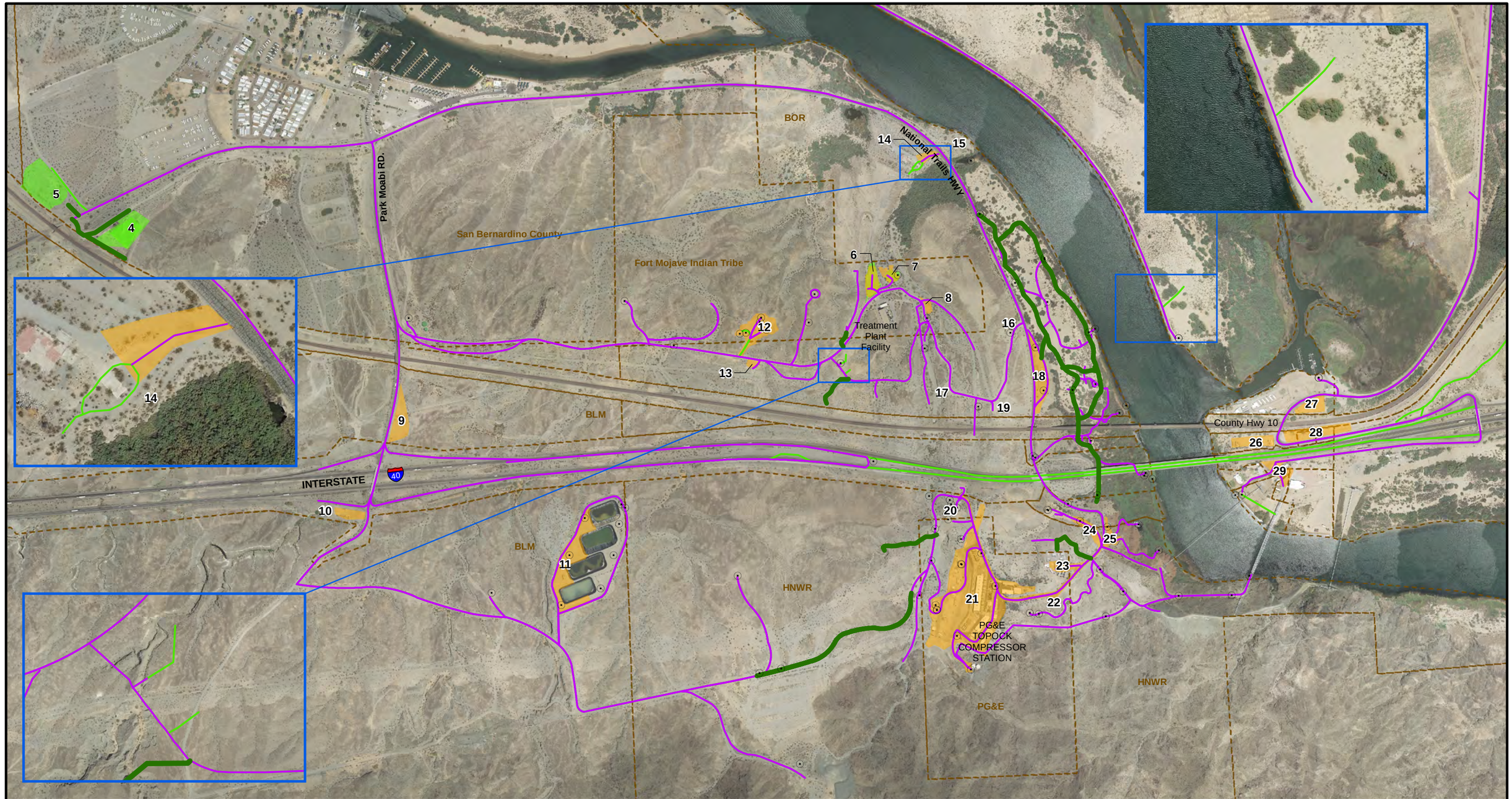
PACIFIC GAS AND ELECTRIC COMPANY
TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA
GROUNDWATER REMEDY CONSTRUCTION/REMEDIAL ACTION WORK PLAN

PHOTO SIMULATION OF TEMPORARY SOIL PROCESSING AREA IN MOABI REGIONAL PARK

ARCADIS

FIGURE
4.2-2B

CITY: Novi DIV: ENV DB: TRY PIC: PM: TM: TR: PROJECT NUMBER: COORDINATE SYSTEM: NAD 1983 StatePlane California V FIPS 0405 Feet
D:\GIS\Project Files\Toprock4B_Layout.mxd PLOTTED: 10/7/2015 1:03:43 PM BY: TYarbrough



LEGEND

- Existing Access Route (will continue to be used for remedial activities)
- Existing Route (proposed to be used as is for access to remedial activities)
- Roads to be improved or constructed for groundwater remedy
- Proposed Soil Processing (Area #5) and Construction Headquarter (Area #4) for Remediation Project
- Proposed Staging Areas for Remediation Project

Notes:

1. Area #3 will not be used as the Construction Headquarter (CHQ). The CHQ will be moved to Area #4.
2. Area #4 will be used as the primary truck inspection area. Areas #9, 18, and 23 or other staging areas might also be used depending on the specific construction activity.
3. Decontamination pads will be located in Area #4 (Construction Headquarters), Area #21 (Topock Compressor Station), and Area #23 (Transwestern Bench).
4. Areas #15, 16, 17, 19, and 20 will not be used as staging areas. Areas #16, 17, and 19 may be part of the primary work zones for remedy infrastructure along the access road.
5. Area #20 may be part of the primary work zone for installation of future provisional well IRL-6 (if determined to be needed in the future) and associated piping/concrete/vault.
6. Public roadways outside of the EIR project area and the APE can also be used for remedy implementation.

N

0 900

Feet

FIGURE 4.2-3
CONSTRUCTION SITE PLAN AND ACCESS ROUTES

GROUNDWATER REMEDY CONSTRUCTION/
REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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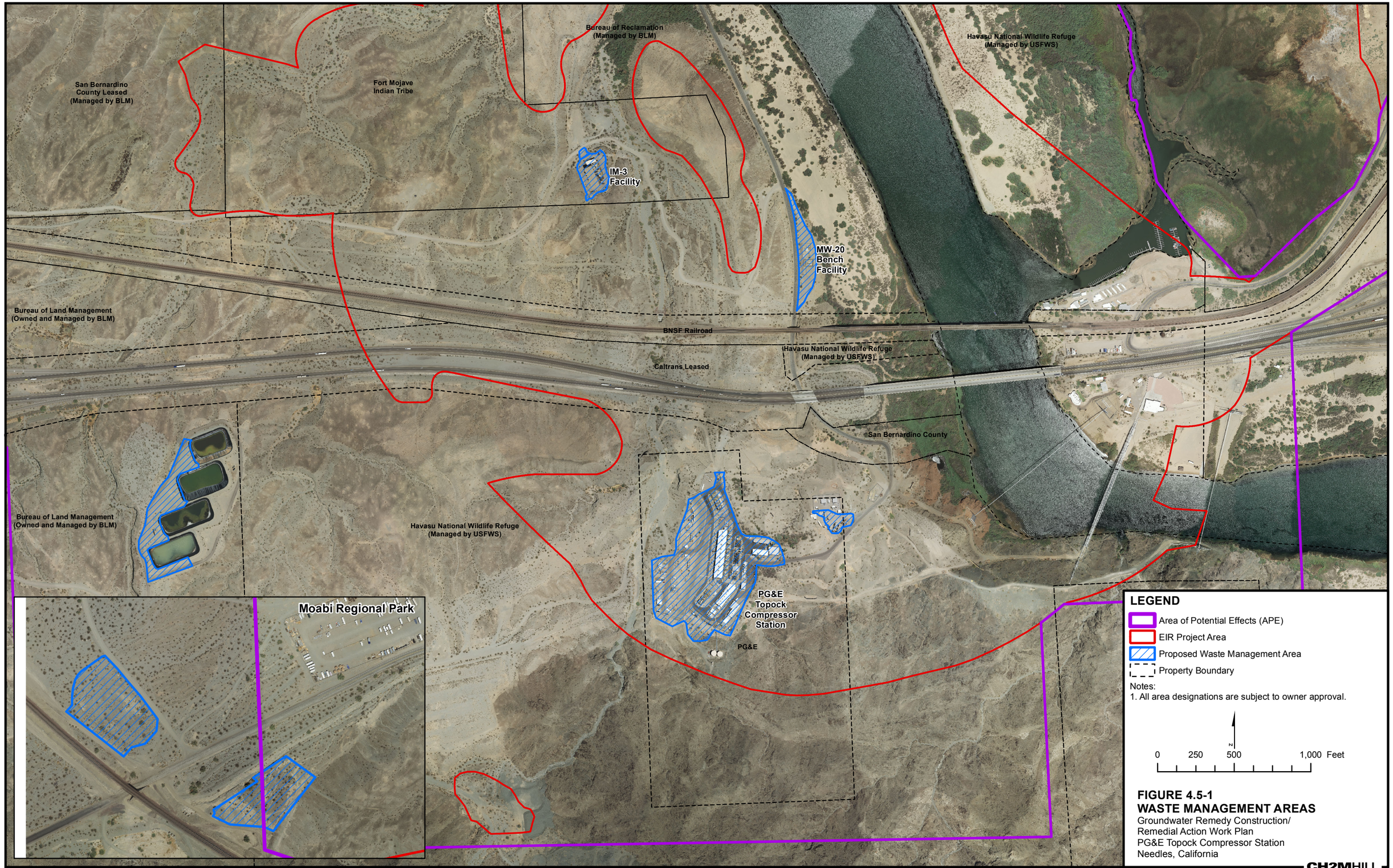

FIGURE 4.5-1
WASTE MANAGEMENT AREAS
Groundwater Remedy Construction/
Remedial Action Work Plan
PG&E Topock Compressor Station
Needles, California

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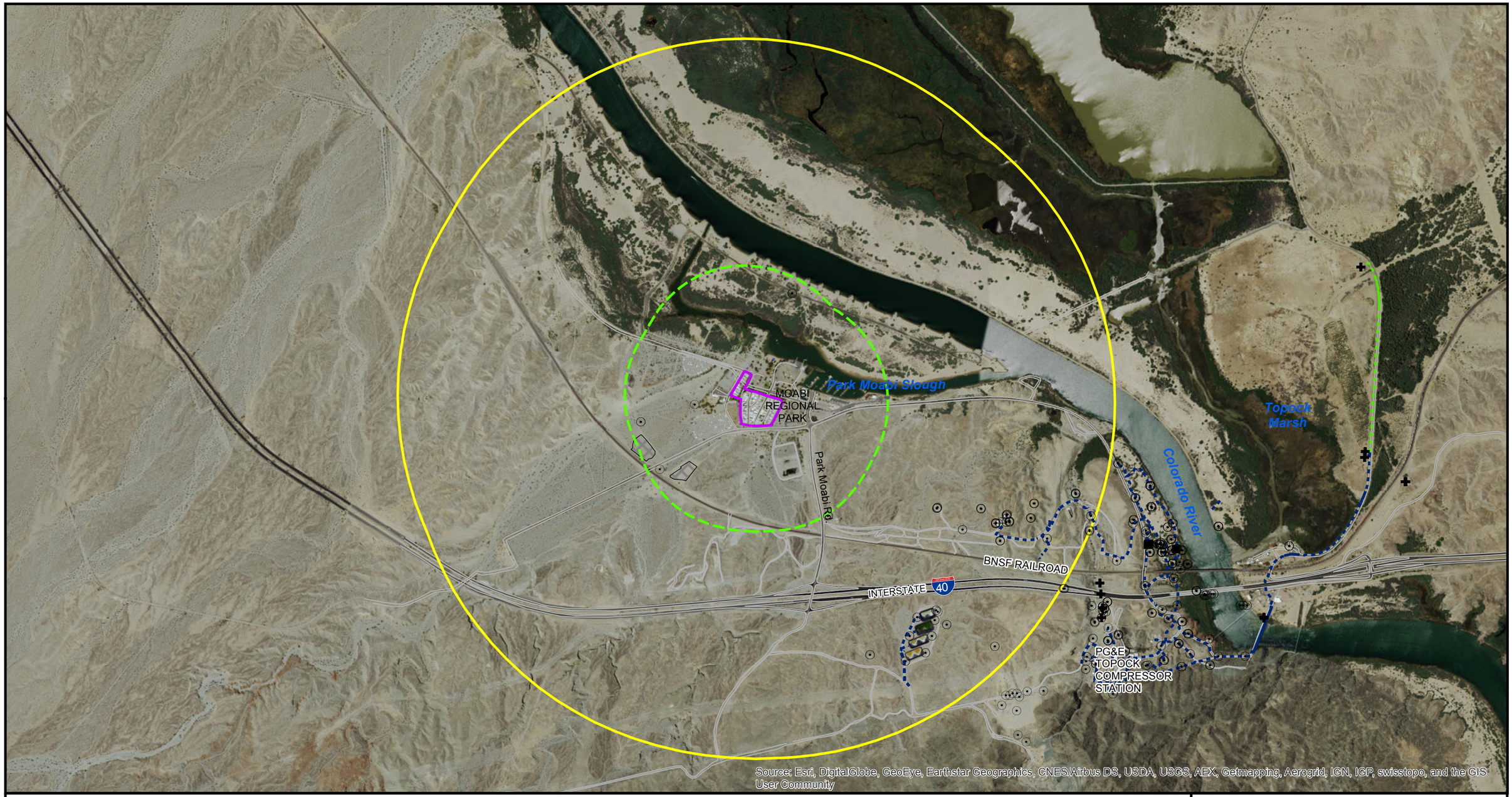

LEGEND

- Extraction Well
- Injection Well
- Monitoring Well
- Water Supply Well
- Aboveground Pipe
- Underground Pipe/Conduit
- Future Provisional/Contingent Fresh Water Pipe
- 5,830' Noise Monitoring Buffer for Construction Activities between 10PM and 7AM
- 1,850' Noise Monitoring Buffer for Construction Activities conducted between 7AM and 10PM
- Noise Sensitive Receptor
- Moabi Regional Park Facilities

Note:
Proposed noise monitoring locations will be the boundary of the noise receptors facing the project-related construction activities. The precise monitoring locations will be determined in the field by a qualified acoustical consultant. In accordance with the CIMP protocol CUL-1a-8h, noise monitoring locations will be selected in coordination with the Tribes prior to construction.

N

0 750 1,500 3,000
Feet

FIGURE 4.6-1
PROPOSED NOISE MONITORING LOCATIONS RELATED TO PROJECT-RELATED CONSTRUCTION ACTIVITIES IN CALIFORNIA
EIR MITIGATION MEASURE NOISE-2C
GROUNDWATER REMEDY CONSTRUCTION/
REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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LEGEND

- Extraction Well
- Injection Well
- Monitoring Well
- Water Supply Well
- Aboveground Pipe
- Underground Pipe/Conduit
- RailRoad
- 735' Noise Monitoring Buffer for Construction Activities between 10PM and 7AM
- 330' Noise Monitoring Buffer for Construction Activities conducted between 7AM and 10PM
- Noise Monitoring Station
- Proposed Staging Areas

Note:
Proposed noise monitoring locations will be the boundary of the noise receptors facing the project-related construction activities. The precise monitoring locations will be determined in the field by a qualified acoustical consultant. In accordance with the CIMP protocol CUL-1a-8h, noise monitoring locations will be selected in coordination with the Tribes prior to construction.

N

0 145 290 580
Feet

FIGURE 4.6-2
PROPOSED NOISE MONITORING LOCATIONS RELATED TO PROJECT-RELATED CONSTRUCTION IN ARIZONA EIR MITIGATION MEASURE NOISE-2C
GROUNDWATER REMEDY CONSTRUCTION/
REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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SECTION 5

Construction Contingency Plan/Procedures

This section presents the contingency plan and procedures to implement the plan during the construction and startup of the groundwater remedy, as required by the CACA (Attachment C, Item E7) (DTSC 1996) and the CD (Paragraph 13.b.6, and Appendix C, Sections 2.2.6 and 3) (DOI 2013). Contingency planning is being conducted as a part of the construction planning process to anticipate potential risks, organize plans, and develop methods/ procedures to mitigate these risks.

5.1 Contingency Plans Required by the CACA and the CD

Pursuant to the CACA and CD requirements, this C/RAWP identifies and addresses potential failure modes related to (1) changes to the design and/or specifications due to issues that may arise during construction, and (2) unforeseen events that prevent the construction of the groundwater remedy (e.g., earthquakes, flooding, and fires).

The objective of the contingency planning process is to outline possible failures that could cause unacceptable conditions if not mitigated during the construction and startup of the groundwater remedy. Mitigation measures are focused on these issues first and foremost. The planning process also identified conditions that, while not unacceptable, are issues that PG&E will strive to avoid or minimize (e.g., releases of hazardous substances).

The following types of unacceptable conditions have been identified if failures are not mitigated:

- Approved design rendered noncompliant with codes, regulations, and/or engineering standard of practice.
- Noncompliant with the EIR, ARARs, PA, CHPMP, PBA, etc.
- Significant delay in schedule
- Significant increase in cost

The mitigation measures described in this section are taken to minimize or eliminate the likelihood of these unacceptable conditions or to lessen their effects. In general, causes of potential failures during construction are mitigated through: (1) chartering a team committed to implementing the project in an effective manner that is safe, sustainable, and respectful, (2) establishing site procedures and BMPs, including workers' education programs to ensure that the work is implemented properly, as discussed in Section 4 of this C/RAWP, and (3) implementing an approach to groundwater remedy well network construction (detailed in Section 3.2.1.3) that is designed to minimize or lessen the effects of the risk associated with discovery of groundwater or hydrogeologic conditions that differ from those assumed for design. Causes of potential failures during startup are mitigated through the design and the O&M planning phases. The mitigations are documented in the O&M Contingency Plan (O&M Manual, Volume 3).

Tables 5.1-1 and 5.1-2 summarizes the contingency plans for changes to the design and/or specifications due to issues that may arise during construction, and unforeseen events that could prevent the construction of the groundwater remedy (e.g., earthquakes, flooding, and fires). In addition, several tables from the O&M Contingency Plan addressing contingency plans during startup are included herein for convenience.

5.2 Contingency Plan Required by DTSC

Per DTSC direction (Response to Comment [RTC] #21 DTSC-2 on the 60% BOD Report), a contingent arsenic treatment system is included in the final design as part of the O&M Contingency Plan (Volume 3 of the O&M Manual, Section 2.3 and Appendix B). If the contingent system were to be constructed, the construction activities would be addressed under this C/RAWP. Construction approaches for this contingent system are anticipated to be similar to that of the remedy-produced water conditioning plant discussed in Section 3.2.

5.3 Contingency Plan from Comment Resolution at 60% Design

In response to comments on the 60% design documents (RTC #757 DTSC-239, RTC #341), a contingent system is included in the final design (O&M Contingency Plan, Section 2.2 and Appendix A) to remove scale-forming ions from remedy-produced water prior to injecting. If the contingent system were to be constructed, the construction activities would be addressed under this C/RAWP. Construction approaches for this contingent system are anticipated to be similar to that of tanks and process systems discussed in Section 3.2 of this C/RAWP.

5.4 Contingency Plan from Comment Resolution at 90% Design

In response to comments received on the 90% design documents (RTCs #135, 267, and 300), a contingency to tie-in the existing Topock-2/-3 wells is included in the final design (O&M Manual Volume 3, Contingency Plan, Table 2.3-1) to supplement the source of freshwater supply for the remedy. In addition, in response to 90% RTC #248, a contingency is included in the final design to use fresh water in the TCS Recirculation Loop should yields from the Transwestern Bench Extraction Wells and East Ravine Extraction Wells be insufficient to promote treatment in this area (Contingency Plan, Table 2.1-1, TCS Recirculation Loop).

Further, a contingency is also added to prioritize the installation of the River Bank Extraction Wells earlier in the construction sequence if warranted, based on baseline data collected and analyzed (Contingency Plan, Table 2.1-1, Inner Recirculation Loop section. This contingency may also include possible carbon amendment and injection of extracted groundwater into the NTH IRZ.

If the above contingencies were to be constructed, the construction activities would be addressed under this C/RAWP.

Failure mode effect analyses for the startup of the in situ remediation system, the remedy-produced water conditioning system, the remedy SCADA, and the power distribution system have been conducted as part of contingencies planning for O&M and have been documented in the Contingency Plan (Volume 3 of the O&M Manual). The failure mode effect analyses tables from the Contingency Plan are included in this section for the convenience of the reader.

TABLE 5.1-1

Failure Mode Effect Analysis Matrix – Contingencies to Address Changes to the Design/Specifications due to Issues that May Arise during Construction and Startup

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

	Failure Mode	Likely Causes for Failure	Effects of Failure If Not Mitigated	Mitigation after Failures Had Occurred to Lessen Their Effects
Failure Modes Associated with Construction	Discovery of site conditions that differ from those assumed for design	• Lack of site-specific subsurface data during design (e.g., certain groundwater quality data, certain hydrogeologic data, supplemental geotechnical data, soil conditions)	• Approved design rendered noncompliant with codes/ regulations and/ or engineering standard of practice • Planned well locations and/or constructions fail to meet the project objectives • Schedule delay • Increase cost	• Implement communication protocol outlined in Table 2.3-1 to obtain approval for design changes. • Implement approved design changes as appropriate.
	Discovery of soil contamination at or near target depth of pipe trench(es)	N/A	• Potential damage to remedy infrastructure during potential future soil remediation • Potential negative effects on potential future soil remediation efforts (e.g., delay due to lack of access to the contamination)	• Conduct additional soil sampling and potentially remediation within the footprint of the pipe trench(es). Discussions with agencies, stakeholders, and Tribes will occur prior to any remediation activities.
	Discovery of human remains or burials	N/A	• Noncompliant with PA, CHPMP, CIMP, EIR, and ARARs if work activities were to continue without implementing the identified mitigations • Schedule delay • Increase cost	• Suspend work in the immediate vicinity of the discovery (not less than 5 meters and not to exceed 50 meters from the discovered remains). • Implement communication protocol outlined in Table 2.3-1.
	Discovery of previously unidentified potentially significant cultural, historical, and/or paleontological resources	N/A	• Noncompliant with PA, CHPMP, CIMP, EIR, and ARARs if work activities were to continue without implementing the identified mitigations • Schedule delay • Increase cost	• Suspend work in the immediate vicinity of the discovery (not less than 5 meters and not to exceed 50 meters from the discovered remains). • Implement communication protocol outlined in Table 2.3-1.
	Discovery of active bird nests in work zones	• Non-transient, protected species moving into the project area	• Noncompliant with PBA and Bird Avoidance Plan if work activities were to continue without implementing the identified mitigations • Schedule delay • Increase cost	• Suspend work in the immediate vicinity of the discovery at recommended distance as described in Table 6-1 or 6-2 of the Bird Avoidance Plan
	Discovery of active desert tortoise burrows in work zones	• Desert tortoise moving into the project area	• Noncompliant with PBA if work activities were to continue without implementing the identified mitigations • Schedule delay • Increase cost	• Suspend work in the immediate vicinity of the discovery. • Consult with Agencies.

TABLE 5.1-1

Failure Mode Effect Analysis Matrix – Contingencies to Address Changes to the Design/Specifications due to Issues that May Arise during Construction and Startup

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

	Failure Mode	Likely Causes for Failure	Effects of Failure If Not Mitigated	Mitigation after Failures Had Occurred to Lessen Their Effects
Failure Modes Associated with Startup	Failure mode effect analyses for the startup of the in situ remediation system, the remedy-produced water conditioning system, the remedy SCADA, and the power distribution system have been conducted as part of contingencies planning for O&M and have been documented in the O&M Contingency Plan (Volume 3 of the O&M Manual). The failure mode effect analyses tables from the O&M Contingency Plan are included in this section for the convenience of the reader.			

TABLE 5.1-2

Failure Mode Effect Analysis Matrix – Contingencies to Address Potential Failure Modes Related to Unforeseen Events during Construction and Startup

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

	Failure Mode	Likely Causes for Failure	Effects of Failure If Not Mitigated	Mitigation taken or to be taken to Minimize or Eliminate the Likelihood of Failures, or lessen Their Effects	Mitigation after Failures Had Occurred to lessen Their Effects
Failure Modes Associated with Construction and Start-up	Major breakdown includes emergency situations such as fires, incidents that result in hospitalization or death, acts of God (e.g., earthquake, flood), etc.	• Acts of God • Human Error • Construction and startup activities	• Construction cannot proceed • Schedule delay • Increase cost	• Establish emergency response plan(s) • See failure mode effect analyses from the O&M Contingency Plan (included in this section for the convenience of the reader).	• Implement communication protocol outlined in Table 2.3-1. • Implement emergency response plan(s).
	Releases[a] of EPCRA-listed extremely hazardous substances and CERCLA-listed hazardous substances to the environment that are subject to reporting under EPCRA Section 304.	• Various construction and startup activities	• Noncompliant with various federal and state regulations	• Implement BMPs specified in the Site Management Plan to eliminate or minimize opportunity for releases.	• Implement communication protocol outlined in Table 2.3-1.
	Releases[a] of CERCLA-listed hazardous substances to the environment that are reportable under CERCLA Section 103.	• Various construction and startup activities	• Noncompliant with various federal and state regulations	• Implement BMPs specified in the Site Management Plan to eliminate or minimize opportunity for releases.	• Implement communication protocol outlined in Table 2.3-1.
	Releases[a] of hazardous materials to the environment reportable under CHSC 25501 and 19 CCR 2703.	• Various construction and startup activities	• Noncompliant with various federal and state regulations	• Implement BMPs specified in the Site Management Plan to eliminate or minimize opportunity for releases.	• Implement communication protocol outlined in Table 2.3-1.
	Release of oil to navigable waters of the US or adjacent shorelines in quantity that causes a sheen on the water or a violation of applicable water quality standards. Release of a quantity of oil to waters of the State, or release of 1 barrel (42 gallons) or more to a location on land where it could potentially enter waters of the State.	• Various construction and startup activities	• Noncompliant with various federal and state regulations	• Implement BMPs specified in the Site Management Plan to eliminate or minimize opportunity for releases.	• Implement communication protocol outlined in Table 2.3-1.
	Release of hazardous waste or hazardous waste constituents that could threaten human health or the environment outside the facility.	• Various construction and startup activities	• Noncompliant with various federal and state regulations	• Implement BMPs specified in the Site Management Plan to eliminate or minimize opportunity for releases.	• Implement communication protocol outlined in Table 2.3-1.

TABLE 5.1-2

Failure Mode Effect Analysis Matrix – Contingencies to Address Potential Failure Modes Related to Unforeseen Events during Construction and Startup

Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California

	Failure Mode	Likely Causes for Failure	Effects of Failure If Not Mitigated	Mitigation taken or to be taken to Minimize or Eliminate the Likelihood of Failures, or lessen Their Effects	Mitigation after Failures Had Occurred to lessen Their Effects
	Release of USDOT-regulated hazardous material during transportation[b] reportable under 49 CFR 171.15(b).	• Various construction and startup activities	• Noncompliant with various federal and state regulations	• Implement BMPs specified in the Site Management Plan to eliminate or minimize opportunity for releases.	• Implement communication protocol outlined in Table 2.3-1.

Notes:

[a] Excludes permitted discharge of materials and release of hazardous materials/waste into secondary containment areas that is not released to the environment.

[b] Transportation includes loading, offloading, and storage of a USDOT-regulated vehicle/trailer.

Failure Mode Effect Analysis Tables from O&M Manual Volume 3, Contingency Plan

TABLE 2.1-1
Failure Mode Effect Analysis Matrix - In-Situ Remediation System
Groundwater Remedy Operation and Maintenance Manual
Volume 3: Contingency Plan
PG&E Topock Compressor Station, Needles, California

Potential Failure and Effect without Mitigation	Potential Cause	Mitigation - Design	Mitigation - Operations				Severity (1 Low - 5 High)	Likelihood (1 Low - 5 High)	Severity x Likelihood	Type of Unacceptable Condition					Notes
			Mitigation	Observable Condition		Action if Cause Occurs				A. Unacceptable Remedy Performance	B. Significant Schedule Increase	C. Significant Cost Increase	D. Change to Impact	E. H&S or Compliance NOV (other than related to remedy performance)	
				Remedy SCADA	Human										
Conveyance (General)															
Release from conveyance pipeline. Effect Without Mitigation: Potential release of water with Cr(VI), carbon substrate, and/or well/pipeline maintenance chemicals.	Differential thermal expansion or settlement, deterioration, vandalism, puncture; pressure exceedance; fabrication failure.	Overall pipeline design for durability over project lifetime; secondary containment (double-wall pipe or concrete trench box) with appropriately-designed leak detection systems (see Appendix C - Design Criteria, Section C.5.1 - Piping); redundant/spare pipe installed (or spare space provided for additional pipe); pipe installed within concrete trench box or direct buried without stacking to facilitate access.	Flow monitoring	Alarm conditions - secondary containment sump alarms; out-of-range process alarms (i.e., pipeline flows or pressures)	Observe leak	Stop pipeline operation, switch to spare pipeline and/or repair /replace pipeline, resume operation.	4	1	4					X	Type E unacceptable condition associated with potential environmental release.
Conveyance fouling/clogging. Effect without Mitigation: Potentially insufficient capacity to support remedy.	Solids buildup (i.e., scaling, biofouling).	Overall system/pipeline design to minimize solids buildup; clean-in-place system and cleanouts for pipeline maintenance (see Operations and Maintenance Plan, Section 5 - Pipeline Maintenance); redundant/spare pipe installed (or spare space provided for additional pipe); pipe installed within concrete trench box or direct buried without stacking to facilitate access.	Pipeline pressure/flow monitoring	Pipeline pressure/flow monitoring and data-logging	Significant increase in pipeline pressure or decrease in flow; observed clogging	Stop pipeline operation, switch to spare pipeline and/or clean/repair /replace pipeline, resume operation.	2	3	6						
Pipeline maintenance chemical/fluid release to wells. Effect without Mitigation: Release of chemicals, solids, etc. into wells and groundwater.	Valving between wells and conveyance not closed during pipeline maintenance.	Clean-in-place system programmed to require automated wellhead valves to be closed prior to operation.	Operator training; wellhead/pipeline inspection during maintenance	Well pressure/flow monitoring and data-logging; wellhead valve position monitoring	Loss of pipeline maintenance solution; observed well flows during pipeline maintenance	Well rehab (Operations and Maintenance Plan, Section 4 - Well Maintenance)	2	2	4						

TABLE 2.1-1
Failure Mode Effect Analysis Matrix - In-Situ Remediation System
Groundwater Remedy Operation and Maintenance Manual
Volume 3: Contingency Plan
PG&E Topock Compressor Station, Needles, California

Potential Failure and Effect without Mitigation	Potential Cause	Mitigation - Design	Mitigation - Operations				Severity (1 Low - 5 High)	Likelihood (1 Low - 5 High)	Severity x Likelihood	Type of Unacceptable Condition					Notes
			Mitigation	Observable Condition		Action if Cause Occurs				A. Unacceptable Remedy Performance	B. Significant Schedule Increase	C. Significant Cost Increase	D. Change to Impact	E. H&S or Compliance NOV (other than related to remedy performance)	
				Remedy SCADA	Human										
Remediation Wells (General) - see also Table 2.2-1, Failure Mode Effect Analysis Matrix - Remedy-produced Water Management System															
Extraction well failure. Effect without Mitigation: The well will not be able to contribute to meeting extraction rate/remedy goals.	Capacity declines over time due to fouling or other well issues.	See Appendix C - Design Criteria (Remediation Well Design and Field Construction Approach) and Operations and Maintenance Plan, Section 4 - Well Maintenance - Extraction wells designed to optimize performance - Extraction wells designed to facilitate periodic well rehab - Remedy operations to minimize substrate and remedial by-product concentrations at extraction wells to minimize fouling	Remediation/monitoring well performance monitoring; periodic well rehab (Operations and Maintenance Plan, Section 4 - Well Maintenance)	Well water level/flow monitoring and data-logging	Insufficient capacity of produced water based on remediation/ monitoring well performance monitoring and evaluation	If well maintenance efforts ineffective - stop well operation, repair or replace, resume operation.	2	3	6						
	Well collapse or casing/screen failure (from deterioration, corrosion, etc.), vandalism, accidental damage, etc.	See Appendix C - Design Criteria (Remediation Well Design and Field Construction Approach) - Overall well design for durability over project lifetime - materials selection for resistance against corrosion, deterioration, and damage during routine operation and well rehab - Wells secured within vaults for protection	Visual well inspections	Alarm condition - out-of-range well operation	Observe damage	Stop well operation, repair or replace, resume operation.	2	1	2						
Injection well failure. Effect without Mitigation: The well will not be able to contribute to meeting injection rate/remedy goals.	Capacity declines over time.	See Appendix C - Design Criteria (Remediation Well Design and Field Construction Approach) and Operations and Maintenance Plan, Section 4 - Well Maintenance - Injection wells designed to optimize performance - drop tubes to minimize air entrainment - Injection wells designed to facilitate routine backwashing and periodic well rehab	Remediation/monitoring well performance monitoring; periodic well backwashing and rehab (Operations and Maintenance Plan, Section 4 - Well Maintenance)	Well water level/pressure/flow monitoring and data-logging	Insufficient capacity of injected water based on remediation/ monitoring well performance monitoring and evaluation	If well maintenance efforts ineffective - stop well operation, repair or replace, resume operation.	2	3	6						
	Well collapse or casing/screen failure (from deterioration, corrosion, etc.), vandalism, accidental damage, etc.	See Appendix C - Design Criteria (Remediation Well Design and Field Construction Approach) - Overall well design for durability over project lifetime - materials selection for resistance against corrosion, deterioration, and damage during routine operation and well rehab - Wells secured within vaults for protection	Visual well inspections	Alarm condition - out-of-range well operation	Observe damage	Stop well operation, repair or replace, resume operation.	2	1	2						
Release from wellhead, piping, or vault. Effect Without Mitigation: Potential release of water with Cr(VI), carbon substrate, and/or well/pipeline maintenance chemicals.	Differential thermal expansion, deterioration, vandalism, puncture; pressure exceedance; fabrication failure.	Overall wellhead design for durability over project lifetime; wells secured within vaults for protection; leak detection level switch in vault sump to alarm/stop well operation	Visual well/vault inspections	Alarm condition - well vault sump level switch; out-of-range well operation	Observe leak	Stop well operation, repair, resume operation.	4	1	4					X	Type E unacceptable condition associated with potential environmental release.
	Injection well overflows.	Downwell pressure transducer to shut off well if excessive water level/pressure increase; leak detection level switch in vault sump to alarm/stop well operation; overall injection system designed for flow/pressure balancing across network to minimize potential for well overflow	Visual well/vault inspections; preventative well maintenance (Operations and Maintenance Plan, Section 4 - Well Maintenance)	Alarm condition - well vault sump level switch; out-of-range well operation	Observe leak	Stop well operation, make repairs (as necessary), troubleshoot injection well capacity issues, as necessary - rehab/redevelop well (Operations and Maintenance Plan, Section 4 - Well Maintenance)	4	1	4					X	
Remediation well equipment, valving, instrumentation failure (other than above). Effect without Mitigation: Potential well damage or undesired operation.	Mechanical or electrical failure; general wear and tear; temperature.	Valves/instruments designed to fail in safest position; redundant controls/alarms; well casing relief valves to protect injection wells in case of excess pressure; common equipment/onsite spares for wells to facilitate troubleshooting	Preventative maintenance schedule; visual well/vault inspections	Alarm condition - well vault sump level switch; out-of-range well operation	Observe leak or out-of-range well operation	Stop well operation, repair, resume operation.	2	2	4						

TABLE 2.1-1
Failure Mode Effect Analysis Matrix - In-Situ Remediation System
Groundwater Remedy Operation and Maintenance Manual
Volume 3: Contingency Plan
PG&E Topock Compressor Station, Needles, California

Potential Failure and Effect without Mitigation	Potential Cause	Mitigation - Design	Mitigation - Operations				Severity (1 Low - 5 High)	Likelihood (1 Low - 5 High)	Severity x Likelihood	Type of Unacceptable Condition					Notes
			Mitigation	Observable Condition		Action if Cause Occurs				A. Unacceptable Remedy Performance	B. Significant Schedule Increase	C. Significant Cost Increase	D. Change to Impact	E. H&S or Compliance NOV (other than related to remedy performance)	
				Remedy SCADA	Human										
Carbon Amendment System (MW-20 Bench)															
General carbon amendment system failure. Effect without Mitigation: Unable to operate parts or all of groundwater recirculation and carbon amendment systems to support remedy.	Equipment, valving, instrumentation failure	Valves/instruments that can result in a release if a fail-safe return is not provided are designed to fail in safest position; redundant controls/alarms; common equipment/onsite spares to facilitate troubleshooting; secondary containment at bench systems.	Visual inspections and preventative maintenance schedule	Alarm condition - out-of-range system operation; sump level alarm	Observed failure condition	Stop system operation, repair, resume operation.	3	2	6						
Carbon substrate storage and/or feed system failure. Effect without Mitigation: Potential release of flammable liquid; unable to amend recirculated groundwater with carbon substrate; potential over-dosing of carbon substrate to injection wells.	Human error	See Appendix C - Design Criteria, C.5.7 - Fire Protection Equipment and Final Basis of Design Report, Section 3.2.1.1 - Description of NTH IRZ (Organic Carbon Substrate Amendment System [MW-20 Bench]) - System designed in accordance with all applicable codes for flammable liquids - Overall system design for durability over project lifetime, including materials selection for compatibility, corrosion control, impact/damage protection - Storage tank has impact-resistant construction and double-wall construction with integral interstitial zone for leak detection monitoring - Instrumentation to include: tank interstitial space fluid level sensors, primary tank level transmitter with manual gauging port for operator verification, primary tank fluid temperature sensor, visible beacon/audible alarm within bench areas to notify operators of high level during tank filling, pipeline secondary containment leak detection system - Double-wall tank and piping systems with additional secondary containment in process/filling area - Valves/instruments designed to fail in safest position - Redundant controls/alarms - Fire extinguishers to be located at bench system in accordance with applicable codes - Security fencing/traffic bollards	Visual inspections and preventative maintenance schedule; operator training	Alarm condition - leak detection/ secondary containment alarm; tank overfill alarm; out-of-range system operation (i.e., over- or under-dosing)	Observe failure condition	Stop system operation, repair, replace, or otherwise resolve failure, resume system operation; manual carbon substrate dosing at system or individual wells, if necessary	5	2	10			X		X	Type C/E unacceptable conditions associated with potential cost/H&S issues with flammable liquid storage and handling.
	Physical impact from vehicles														
	Equipment, valving, instrument failure														
	Corrosion, puncture, deterioration, accidental damage														
	Vandalism														

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Potential Failure and Effect without Mitigation	Potential Cause	Mitigation - Design	Mitigation - Operations				Severity (1 Low - 5 High)	Likelihood (1 Low - 5 High)	Severity x Likelihood	Type of Unacceptable Condition					Notes
			Mitigation	Observable Condition		Action if Cause Occurs				A. Unacceptable Remedy Performance	B. Significant Schedule Increase	C. Significant Cost Increase	D. Change to Impact	E. H&S or Compliance NOV (other than related to remedy performance)	
				Remedy SCADA	Human										
NTH IRZ															
IRZ is not effective at removing Cr(VI) from groundwater as designed. Effect without Mitigation: Potential schedule/cost increase or other issues with achieving RAOs as designed.	More rapid utilization of carbon substrate after injection than anticipated.	Design included pilot testing, predictive simulations/modeling, and additional design efforts; system designed with flexibility for range of operating flow rates and carbon substrate types and dosing strategies; future provisional wells have been included in the design, if needed; flexibility retained in the design to adjust locations of provisional wells; manual carbon substrate dosing can target individual wells if needed to supplement IRZ-wide dosing; River Bank Extraction Wells are designed to capture downgradient Cr(VI), TOC, and/or byproducts, as needed; system designed with flexibility to re-direct extracted water from TCS Recirculation Loop to NTH IRZ (if system is flow limited)	See Sampling and Monitoring Plan, Decision Rules/Operational Framework (Figures 2.2-2 and 2.2-3) for IRZ performance troubleshooting and operational adaptability philosophy to be conducted based on remedial performance monitoring/evaluation and using the designed system flexibility - operational adjustments may include flow rates, carbon substrate type and dosing strategy, number and location of operating wells, injection of water from the TCS Recirculation Loop into the NTH IRZ (if system is flow limited), etc. River Bank Extraction Wells, Inner Recirculation Loop Injection Wells, and Freshwater Injection Wells may be slowed or shut down to slow groundwater flow rate during NTH IRZ troubleshooting.		See Sampling and Monitoring Plan and Operations and Maintenance Plan for summary of remedy monitoring and how data will be evaluated/applied to remedy system optimization	If operational adjustments outlined in Sampling and Monitoring Plan, Decision Rules/Operational Framework (Figures 2.2-2 and 2.2-3) are not successful in establishing IRZ effectiveness - additional extraction/injection wells or water sources (if system is flow limited) will be considered	4	2	8	X	X	X	X		Unacceptable conditions associated with potential increased level of effort required to achieve remedy performance objectives.
	Well spacing or screen placement is inadequate.						4	2	8	X	X	X	X		
	Recalcitrant mass in immobile porespace.						4	2	8	X	X	X	X		
	Unexpected hydrogeologic conditions (e.g., preferential flow paths allow water to pass through IRZ without adequate treatment).						4	3	12	X	X	X	X		
	Extraction/injection flow limited.						4	2	8	X	X	X	X		
Extraction of organic carbon and/or significant byproducts. Effect without Mitigation: Potential to increase well/pipeline maintenance required to meet remedy goals.	Carbon substrate dosing greater than required.					If operational adjustments outlined in Sampling and Monitoring Plan, Decision Rules/Operational Framework (Figures 2.2-2 and 2.2-3) are not successful in managing organic carbon or by-product concentrations at extraction wells - additional wells or water sources (if system is flow limited) will be considered; treatment of riverbank extracted groundwater prior to re-injection will be considered.	4	2	8			X			
	By-product generation greater than expected/attenuation slower than expected						4	2	8			X			

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Potential Failure and Effect without Mitigation	Potential Cause	Mitigation - Design	Mitigation - Operations: Mitigation	Mitigation - Operations: Observable Condition: Remedy SCADA	Mitigation - Operations: Observable Condition: Human	Mitigation - Operations: Action if Cause Occurs	Severity (1 Low - 5 High)	Likelihood (1 Low - 5 High)	Severity x Likelihood	Type of Unacceptable Condition: A. Unacceptable Remedy Performance	B. Significant Schedule Increase	C. Significant Cost Increase	D. Change to Impact	E. H&S or Compliance NOV (other than related to remedy performance)	Notes
Inner Recirculation Loop - see also Table 2.3-1, Failure Mode Effect Analysis Matrix - Freshwater Supply															
Unacceptable migration of Cr(VI) or byproducts. Effect without Mitigation: Potential for Cr(VI) or byproducts to enter the Colorado River; potential plume expansion.	Unexpected hydrogeologic conditions.	Design included pilot testing, predictive simulations/modeling, and additional design efforts; system designed with flexibility for range of operating flow rates and carbon substrate type and dosing strategy; Inner Recirculation Loop Injection Wells designed for flexibility to inject freshwater and/or riverbank extracted groundwater[1]; future provisional wells have been included in the design, if needed; flexibility retained in the design to adjust locations of provisional wells	See Sampling and Monitoring Plan, Decision Rules/Operational Framework (Figures 2.2-4 and 2.2-5) for IRL performance troubleshooting and operational adaptability philosophy to be conducted based on remedial performance monitoring/evaluation and using the designed system flexibility - operational adjustments may include flow rates, carbon substrate type and dosing strategy, number and location of operating wells, injection of freshwater and/or riverbank extracted groundwater into Inner Recirculation Loop Injection Wells[1], etc.		See Sampling and Monitoring Plan and Operations and Maintenance Plan for summary of remedy monitoring and how data will be evaluated/applied to remedy system optimization	If operational adjustments outlined in Sampling and Monitoring Plan, Decision Rules/Operational Framework (Figures 2.2-4 and 2.2-5) are not successful in establishing adequate plume control or plume flushing - additional extraction/injection wells (including wells to the south of RB-5), River Bank Extraction Well pumping from shallow zones, or additional water sources (if system is flow limited) will be considered, as needed, to limit new large-capacity extraction wells; additional mitigation measures, including potential treatment of riverbank extracted groundwater prior to re-injection, will be considered; construction sequence may also be changed to prioritize installation of River Bank Extraction Wells (with possible carbon amendment and injection of extraction groundwater into the NTH IRZ), if needed	4	3	12	X		X	X		Unacceptable conditions associated with potential increased level of effort required to achieve remedy performance objectives.
	Well spacing or screen placement is inadequate.						4	2	8	X		X	X		
	New large-capacity wells (e.g., water supply wells) are installed near the site (e.g., at Park Moabi or elsewhere along the Colorado River).						4	2	8	X		X	X		
Flushing of plume through NTH IRZ not as effective as designed. Effect without Mitigation: Potential schedule delay.	Unexpected hydrogeologic conditions.						4	3	12		X	X	X		
	Well spacing or screen placement is inadequate.						4	2	8	X		X	X		
	Lack of adequate supply of injection water (e.g., River Bank Extraction Well produced water contains unacceptably high concentrations of byproducts/other constituents).						4	2	8		X	X	X		
Natural reducing rind near river is negatively-impacted by pumping resulting in inadequate reducing buffer in floodplain. Effect without Mitigation: Could affect ability to rely on MNA for residual contamination when active remediation ends.	Oxic water from the river being pulled into floodplain by extraction wells near the river	Design included pilot testing, predictive simulations/modeling, and additional design efforts; system designed with flexibility for range of operating flow rates; River Bank Extraction Well pumping planned for deeper zones only				If operational adjustments are not successful in adequately maintaining the natural reducing rind - assess potentially required remedy modifications	2	2	4						

TABLE 2.1-1
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Potential Failure and Effect without Mitigation	Potential Cause	Mitigation - Design	Mitigation - Operations: Mitigation	Mitigation - Operations: Observable Condition: Remedy SCADA	Mitigation - Operations: Observable Condition: Human	Mitigation - Operations: Action if Cause Occurs	Severity (1 Low - 5 High)	Likelihood (1 Low - 5 High)	Severity x Likelihood	Type of Unacceptable Condition: A. Unacceptable Remedy Performance	B. Significant Schedule Increase	C. Significant Cost Increase	D. Change to Impact	E. H&S or Compliance NOV (other than related to remedy performance)	Notes
TCS Recirculation Loop															
Transwestern Bench Extraction Well network does not provide adequate volume or mass removal. Effect without Mitigation: Potential schedule delay as impacted water near TCS not treated as rapidly as planned.	Unexpected hydrogeologic conditions.	Design included pilot testing, predictive simulations/modeling, and additional design efforts; system designed with flexibility for range of operating flow rates and carbon substrate type and dosing strategy; future provisional wells have been included in the design, if needed; flexibility retained in the design to adjust locations of provisional wells; River Bank Extraction Wells are designed to capture downgradient Cr(VI), TOC, and/or byproducts, as needed; system designed with flexibility to re-direct extracted water from TCS Recirculation Loop to NTH IRZ (if system is limited by ability to inject into TCS Injection Wells)	See Sampling and Monitoring Plan, Decision Rules/Operational Framework (Figures 2.2-6 to 2.2-8) for TCS Recirculation Loop performance troubleshooting and operational adaptability philosophy to be conducted based on remedial performance monitoring/evaluation and using the designed system flexibility - operational adjustments may include flow rates, carbon substrate type and dosing strategy, number and location of operating wells, etc.; Transwestern Bench and East Ravine extracted groundwater may be injected into NTH IRZ (if system is limited by ability to inject into TCS Injection Wells).		See Sampling and Monitoring Plan and Operations and Maintenance Plan for summary of remedy monitoring and how data will be evaluated/applied to remedy system optimization	If operational adjustments outlined in Sampling and Monitoring Plan, Decision Rules/Operational Framework (Figures 2.2-6 to 2.2-8) are not successful in achieving design objectives - additional extraction/injection wells or water sources (if system is flow limited) will be considered, including the use of fresh water to supplement injections into the TCS Injection Wells - a plan for constructing arsenic monitoring wells and establishing baseline arsenic conditions including prior carbon injections in the area would be required prior to injecting fresh water into the TCS Injection Wells.	4	3	12		X	X	X		
	Well spacing or screen placement is inadequate.						4	2	8		X	X	X		
	Extraction/injection flow limited.						4	2	8		X	X	X		
East Ravine Extraction Well network does not provide capture of targeted groundwater, as designed. Effect without Mitigation: Potential expansion of plume or Cr(VI) release to Colorado River.	Unexpected hydrogeologic conditions.						4	3	12	X	X	X	X		Unacceptable conditions associated with potential increased level of effort required to achieve remedy performance objectives.
	Well spacing or screen placement is inadequate.						4	2	8	X	X	X	X		
	Extraction/injection flow limited.						4	2	8	X	X	X	X		
Cr(VI) treatment by TCS Injection Well network not as effective as designed. Effect without Mitigation: Potential schedule delay.	Unexpected hydrogeologic conditions.						4	3	12		X	X	X		
	More rapid utilization of carbon substrate after injection than anticipated.						4	2	8		X	X	X		
	Well spacing or screen placement is inadequate.						4	2	8		X	X	X		
	Extraction/injection flow limited.						4	2	8		X	X	X		

TABLE 2.1-1
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Potential Failure and Effect without Mitigation	Potential Cause	Mitigation - Design	Mitigation - Operations: Mitigation	Mitigation - Operations: Observable Condition: Remedy SCADA	Mitigation - Operations: Observable Condition: Human	Mitigation - Operations: Action if Cause Occurs	Severity (1 Low - 5 High)	Likelihood (1 Low - 5 High)	Severity x Likelihood	Type of Unacceptable Condition: A. Unacceptable Remedy Performance	B. Significant Schedule Increase	C. Significant Cost Increase	D. Change to Impact	E. H&S or Compliance NOV (other than related to remedy performance)	Notes
Freshwater Injection System - see also Table 2.3-1, Failure Mode Effect Analysis Matrix - Freshwater Supply															
Flushing of plume through NTH IRZ not as effective as designed. Effect without Mitigation: Potential schedule delay.	Unexpected hydrogeologic conditions.	Design included pilot testing, predictive simulations/modeling, and additional design efforts; system designed with flexibility for range of operating flow rates	See Sampling and Monitoring Plan, Figure 2.2-9 Freshwater Injection System Decision Rules/Operational Framework for freshwater injection performance troubleshooting and operational adaptability philosophy to be conducted based on remedial performance monitoring/evaluation and using the designed system flexibility - operational adjustments may include flow rates, number and location of operating wells, etc.; TCS injections may be adjusted or shut down if FW-02 is not operating as intended		See Sampling and Monitoring Plan and Operations and Maintenance Plan for summary of remedy monitoring and how data will be evaluated/applied to remedy system optimization	If operational adjustments outlined in Sampling and Monitoring Plan, Figure 2.2-9 Freshwater Injection System Decision Rules/Operational Framework are not successful in achieving design objectives - additional injection wells will be considered	4	3	12		X	X	X		Unacceptable conditions associated with potential increased level of effort required to achieve remedy performance objectives.
	Well or screen placement is inadequate.						4	2	8		X	X	X		
	Lack of adequate supply of injection water.						4	2	8		X	X	X		
Insufficient FW-02 performance to maintain control of southwestern plume margin. Effect without Mitigation: Potential plume expansion.	Unexpected hydrogeologic conditions.						4	3	12	X					
	Well or screen placement is inadequate.						4	2	8	X					
	Lack of adequate supply of injection water.						4	2	8	X					
Analytical data collected from freshwater arsenic monitoring wells located 225 feet from freshwater injection locations indicate arrival of arsenic plume above the 10 µg/L water quality objective. Effect without Mitigation: Per the California State Water Resources Control Board (SWRCB) letter to DTSC (SWRCB 2013), PG&E is required to cease injection of untreated water and either 1) add pre-treatment or 2) use a freshwater source without arsenic if data collected from freshwater arsenic monitoring wells located 225 feet from freshwater injection locations indicate arrival of arsenic plume above the 10 µg/L water quality objective. Modeling calculations will be re-assessed and these or other actions may also be considered for implementation if data collected from freshwater arsenic monitoring wells located 150 feet from freshwater injection locations indicate arrival of the leading edge of the arsenic plume above the 10 µg/L water quality objective.	Unexpected hydrogeologic/ geochemical conditions.	Design included pilot testing, predictive simulations/modeling and additional design efforts; system designed with flexibility for range of operating flow rates	Sampling of freshwater arsenic monitoring wells located 150 feet from freshwater injection locations. If data from these wells indicate arrival of the leading edge of the arsenic plume above the 10 µg/L water quality objective, modeling calculations will be re-assessed and operational adjustments may include flow rates, number and location of Inner Recirculation Loop Injection Wells operating with fresh water versus riverbank extracted groundwater[1], aeration of fresh water prior to injection to reduce arsenic mobility, etc. (see Sampling and Monitoring Plan, Section 2.2.4)		See Sampling and Monitoring Plan and Operations and Maintenance Plan for summary of remedy monitoring and how data will be evaluated/applied to remedy system optimization	If operational adjustments/interim actions discussed in Sampling and Monitoring Plan, Section 2.2.4 are not successful in achieving design objectives - implementation of the freshwater pre-injection treatment system (see also Section 2.3) for freshwater arsenic treatment and/or additional/alternative freshwater sources will be implemented per the SWRCB letter to DTSC (SWRCB 2013).	4	2	8		X	X			Type B/C unacceptable condition associated with potential schedule/cost increases.

TABLE 2.1-1
Failure Mode Effect Analysis Matrix - In-Situ Remediation System
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Potential Failure and Effect without Mitigation	Potential Cause	Mitigation - Design	Mitigation - Operations			Severity (1 Low - 5 High)	Likelihood (1 Low - 5 High)	Severity x Likelihood	Type of Unacceptable Condition					Notes
			Mitigation	Observable Condition		Action if Cause Occurs									
				Remedy SCADA	Human										
In-Situ Remediation System (General)															
Aerial or vertical extent of Cr(VI) plume greater than currently defined. Effect without Mitigation: Potential expansion of remedy footprint.	Inadequate characterization of Cr(VI) in groundwater	Groundwater characterization efforts to date indicate it is unlikely that significant Cr(VI) concentrations exist outside of currently-defined plume footprint. Remedy system design includes some flexibility to expand outside of planned footprint, if needed. See Chapter 5 of the Construction/Remedial Action Work Plan for the Construction Contingency Plan/Procedures.	Installation of remediation and monitoring wells will be conducted in a step-wise manner with a focus on first gathering lithologic data, then water quality data, before finalizing well locations/well screen intervals and installing wells. Well construction will also consider previous well data to ensure the latest data is used in the well installation process.			Assess potentially required remedy modifications, including system expansion	4	2	8			X	X		Unacceptable conditions associated with potential cost increase/additional CEQA analysis required due to expansion of remedy footprint.
Cr(III) re-oxidation to Cr(VI) after in-situ treatment. Effect without Mitigation: Potential issues with achieving RAOs as designed.	Unexpected high availability of reactive MnO_2 surfaces along groundwater flow path.	Design included pilot testing, predictive simulations/modeling, and additional design efforts that indicated significant re-oxidation of Cr(III) to Cr(VI) is unlikely	See Sampling and Monitoring Plan, Decision Rules/Operational Framework (Figures 2.2-2 to 2.2-9) for remedy performance troubleshooting and operational adaptability philosophy to be conducted based on remedial performance monitoring/evaluation and using the designed system flexibility such as adjusting operational flow rates, organic carbon dosing strategy, etc.		See Sampling and Monitoring Plan and Operations and Maintenance Plan for summary of remedy monitoring and how data will be evaluated/applied to remedy system optimization	Assess potentially required remedy modifications	1 to 4	1	1 to 4	X	X	X	X		Unacceptable conditions associated with potential increased level of effort required to achieve remedy performance objectives.
Changes in aquifer pH not adequately buffered. Effect without Mitigation: Potential issues with achieving RAOs as designed.	Inadequate groundwater and/or biogeochemical characterization	Design included pilot testing and predictive simulations/modeling that indicated significant change in pH is unlikely				Assess potentially required remedy modifications	1 to 3	1	1 to 3						
In-situ remedy byproduct (arsenic) concentrations do not sufficiently attenuate. Effect without Mitigation: Potential issues with achieving RAOs as designed.		Design included pilot testing, predictive simulations/modeling, and additional design efforts that indicate sufficient byproduct attenuation following remedy operation				Assess potentially required remedy modifications, including potential treatment of extracted riverbank groundwater prior to re-injection	1 to 3	1	1 to 3						
In-situ remedy byproduct (manganese) concentrations do not sufficiently attenuate. Effect without Mitigation: Potential issues with achieving RAOs as designed.							1 to 3	1	1 to 3						
In-situ remedy byproduct (iron) concentrations do not sufficiently attenuate. Effect without Mitigation: Potential issues with achieving RAOs as designed.							1 to 3	1	1 to 3						

TABLE 2.1-1
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Potential Failure and Effect without Mitigation	Potential Cause	Mitigation - Design	Mitigation - Operations			Severity (1 Low - 5 High)	Likelihood (1 Low - 5 High)	Severity x Likelihood	Type of Unacceptable Condition					Notes
			Mitigation	Observable Condition		Action if Cause Occurs									
				Remedy SCADA	Human				A. Unacceptable Remedy Performance	B. Significant Schedule Increase	C. Significant Cost Increase	D. Change to Impact	E. H&S or Compliance NOV (other than related to remedy performance)	
Natural Disaster														
Seismic damage. Effect without Mitigation: Damage to remedy infrastructure may cause shutdown of parts or all of remedy.	Earthquake	See Appendix C - Design Criteria, C.3.5 - Seismic Loads - Structures will be designed in accordance with applicable seismic codes		Alarm conditions will shut system down if significant damage	Observed failure condition	Stop system operation, inspect system, repair/replace system infrastructure (as needed), resume system operation	varies	1	varies		X	X			Type B/C unacceptable condition associated with potential schedule/cost increases.
Flooding. Effect without Mitigation: Damage to remedy infrastructure may cause shutdown of parts or all of remedy; potential loss of access.	Rising water levels in Colorado River and/or extreme rain events	Remedy infrastructure located outside of ordinary high water mark and 100-year floodplain to the extent possible; system can be operated/shutdown remotely if access limited	Preventative system shutdown or other action if flood conditions predicted	Alarm conditions will shut system down if significant flooding (sump levels)/ damage	Observed failure condition		varies	1	varies		X	X			Type B/C unacceptable condition associated with potential schedule/cost increases.
Fire damage. Effect without Mitigation: Damage to remedy infrastructure may cause shutdown of parts or all of remedy.	Wildfires/vegetation fires; Compressor station or gas pipeline explosion	System can be operated/shutdown remotely if access limited	Routine vegetation clearing/housekeeping in remedy facility areas; preventative system shutdown or other actions if fires in area	Alarm conditions will shut system down if significant damage	Observed failure condition		varies	1	varies		X	X			Type B/C unacceptable condition associated with potential schedule/cost increases.
Freezing conditions. Effect without Mitigation: Potential damage to remedy infrastructure may cause shutdown of parts or all of remedy.	Cold temperatures	Site conditions/temperatures unlikely to be cold enough to cause issues.	Preventative system shutdown and system/pipeline draining if freezing temperatures predicted	Alarm conditions will shut system down if significant freezing/ damage	Observed failure condition		1	1	1						
Wind-blow dust damage. Effect without Mitigation: Potential damage to remedy infrastructure may cause shutdown of parts or all of remedy.	Dust, sands, etc. blown by high desert winds	Most remedy infrastructure located within enclosed buildings or vaults.	Preventative maintenance and visual inspection schedule to observe damage	Alarm conditions will shut system down if equipment failure due to dust damage	Observed damage or failure condition		1	2	2						

Abbreviations:
PLC - process logic controller
DOI - United States Department of the Interior
DTSC - Department of Toxic Substances Control
EIR - environmental impact report
H&S - health and safety
NOV - notice of violation
RAO - remedial action objective
TW - Transwestern
IRZ - In-Situ Reactive Zone
NTH - National Trails Highway
TCS - Topock Compressor Station
IRL - Inner Recirculation Loop
MNA - monitored natural attenuation
Cr(VI) - hexavalent chromium
Cr(III) - trivalent chromium
MnO_2 - manganese dioxide
P/V - pressure/vacuum
SWRCB - State Water Resources Control Board
TOC - total organic carbon

Notes:
1. Under the nominal operational scenario, riverbank extracted groundwater will be injected into the lower two-thirds of the saturated interval at IRL-1 and IRL-2. Changes in the wells and/or intervals into which riverbank extracted groundwater is injected will first be discussed with the DTSC and DOI.

TABLE 2.2-1
Failure Mode Effect Analysis Matrix — Remedy-produced Water Management System
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PG&E Topock Compressor Station, Needles, California

Potential Failure and Effect without Mitigation	Potential Cause	Mitigation - Design	Mitigation - Operations				Severity (1 Low - 5 High)	Likelihood (1 Low - 5 High)	Severity x Likelihood	Type of Unacceptable Condition					Notes
			Mitigation	Observable Condition		Action if Cause Occurs				A. Unacceptable Remedy Performance	B. Significant Schedule Increase	C. Significant Cost Increase	D. Significant Change to Impacts (Additional CEQA Analysis)	E. H&S or Compliance NOV (other than related to remedy performance)	
				Remedy SCADA	Human										
1. Conditioning System Capacity Insufficient [2,3] Effect without Mitigation: Some water will not be able to be conditioned or re-used/ disposed on-site.	a. Generate more water that must be managed in a single backwash event – Short- term capacity condition	Plant designed for 35 gpm capacity and safety factor applied in sizing storage tanks	Temporarily decrease backwash frequency which would cause an increase in water level in the injection well	Influent flow measurements	N/A	Adjust operations to reduce backwash Investigate root cause and re-evaluate well O&M procedures	1	1	1						In cases resulting in loss of well performance, see the SOPs in the O&M Manual for diagnostic and maintenance procedures.[4]
	b. Wells need more maintenance then anticipated – Long-term capacity condition	Plant designed for 35 gpm capacity and safety factor applied in sizing storage tanks. Process is divided into 2 sides (Remedy A-side and Freshwater B-side) to allow for flexibility in managing conditioned water.	Investigate root cause, re-evaluate well operations, and maintenance procedures (see Section 4). If needed, evaluate the need and methods to increase plant capacity.	Flow transmitters, High well operating level	N/A	Adjust operations to reduce backwash Investigate root cause and re-evaluate well O&M procedures	3	2	6						See Note [1]. Severity depends on downtime and cost.
	c. Excessive load of solids on filters. Frequent filter change-outs	Install tanks to settle solids and turbidity analyzers on conditioned water tanks. Design coarse, then fine filter and standby filters on each train and instrumentation to measure pressure across the filters.	Conduct jar testing for alternative coagulants, to improve settling in tanks. Normal operation is flow through 2-stage filters. Standby filters put into service if operating filter is fouled. Stock spare filters on site	Quick increase in differential pressure across cartridge filters Alarms	Scheduled inspections, check water chemistry for scaling conditions	Well sampling to evaluate influent solids concentrations; Replace cartridges. If scaling, change pH target or add antiscalant	2	1	2						In cases resulting in loss of well performance, see the O&M Manual, Volume 1, Section 4 for diagnostic and maintenance procedures.[4]
	d. Grit build-up in tank	Design capability to pump solids from these tanks to phase separators. Design capability to use vac truck to remove solids.	Operators to monitor solids level	N/A	Operators to monitor solids level	Operators to hose down solids so they'll pump out, or remove by vac truck	1	1	1						
	e. Phase separator bins cannot be removed due to problems with hauling contractor and solids fill up in system. Plant capacity limited or stopped.	N/A	Have backup destination for disposal planned	N/A	N/A	Store full bins on site or at other PG&E facilities	1	1	1						

TABLE 2.2-1
Failure Mode Effect Analysis Matrix — Remedy-produced Water Management System
Groundwater Remedy Operation and Maintenance Manual
Volume 3: Contingency Plan
PG&E Topock Compressor Station, Needles, California

Potential Failure and Effect without Mitigation	Potential Cause	Mitigation - Design	Mitigation - Operations				Severity (1 Low - 5 High)	Likelihood (1 Low - 5 High)	Severity x Likelihood	Type of Unacceptable Condition					Notes
			Mitigation	Observable Condition		Action if Cause Occurs				A. Unacceptable Remedy Performance	B. Significant Schedule Increase	C. Significant Cost Increase	D. Significant Change to Impacts (Additional CEQA Analysis)	E. H&S or Compliance NOV (other than related to remedy performance)	
				Remedy SCADA	Human										
	f. IRZ and other on-site reuse/disposal options do not have the capacity to take all treated water – Short term condition	N/A	Storage	N/A	N/A	Adjust operations	2	1	2						
	g. IRZ and other on-site reuse/disposal options do not have the capacity to take all treated water – Long term condition	N/A	Evaluate alternative re-use options	N/A	N/A	Trucking	3	1	3						.
	h. More wells or higher flow rates are needed to achieve RAOs, which produces more water to manage	Reserve space for additional storage and/or conditioning equipment	N/A	N/A	N/A	N/A	2	1	2						See Note 3.
2. Poor Quality Water to Wells: High or low pH Effect without Mitigation: Out of Spec Water may cause increased well or formation fouling or geochemical changes releasing minerals which could affect IRZ performance or plume composition. Excessive pH either high or low could reduce or change microorganism populations, which in turn could also reduce IRZ performance.	a. Tank eductor failure, and poor mixing of conditioning chemicals	Install redundant tank eductors	N/A	N/A	If chemical addition loses effectiveness at altering pH. Will do periodic visual inspections of educators	Repair or replace	1	1	1						
	b. pH Analyzer Failure	Install analyzers on influent and conditioned water tanks	Periodic calibration and system inspections	High and low alarm	Scheduled inspections and monitoring with handheld meter	N/A	1	1	1						
3. Poor Quality Water to Wells: High Suspended Solids Effect without Mitigation: Increase potential for well fouling which could result in increased well maintenance	Cartridge filter rupture or operator not install cartridge	Install turbidity analyzers on conditioned water tanks	Injection well performance monitoring SOP and RPWC System SOPs.[4] Normal operation is flow through 2-stage filters. Standby filter put into service if operating filter is fouled	Alarms on analyzers	Equipment inspections	Follow well maintenance procedures (Section 4), replace cartridges	2	1	2						

TABLE 2.2-1
Failure Mode Effect Analysis Matrix — Remedy-produced Water Management System
Groundwater Remedy Operation and Maintenance Manual
Volume 3: Contingency Plan
PG&E Topock Compressor Station, Needles, California

Potential Failure and Effect without Mitigation	Potential Cause	Mitigation - Design	Mitigation - Operations: Mitigation	Observable Condition: Remedy SCADA	Observable Condition: Human	Action if Cause Occurs	Severity (1 Low - 5 High)	Likelihood (1 Low - 5 High)	Severity x Likelihood	Type of Unacceptable Condition: A. Unacceptable Remedy Performance	B. Significant Schedule Increase	C. Significant Cost Increase	D. Significant Change to Impacts (Additional CEQA Analysis)	E. H&S or Compliance NOV (other than related to remedy performance)	Notes
4. Poor Quality Water to Wells: Presence of scaling ions: (Ca, Mg, Mn, Fe, etc.) or high pH water Effect without Mitigation: Scaling in pipelines and wells	Presence of ions in well water	Reserve space to add conditioning units, if needed. These contingent units are described in Section 2.2 of this Contingency Plan. Pipe blowoffs and cleanouts are included in the pipelines. May need to add anti-scalants continuously or use other chemical cleaners.	Monitor effluent quality and injection well performance (see additional information in the Notes column).	N/A	N/A	Follow well maintenance procedures (Section 4)	2	2	4						System is not designed for removing dissolved metals. Modify conditioning process if dissolved ions and metals pose or are causing declining well performance. Addition of conditioning methods may be required if pH increase is not effective in removing constituents. More frequent rehabs or backwash at wells that are fouling due to poor effluent water quality.
5. Equipment Failure Effect Without Mitigation: Leak, contamination, personnel exposure	a. Pipe rupture	Select piping material that is appropriate for the liquid being conveyed and is rated for the anticipated operating pressure.	N/A	N/A	Visual	Follow SOPs,[4] and perform repair	2	1	2						
	b. Tank Failure	Install tank vents, barriers to prevent vehicle impact, seismic supports, coatings, corrosion protection system, and secondary containment for tanks	Preventive maintenance	N/A	Visual	Follow SOPs,[4] and perform repair	2	1	2						
	c. Pump Failure	Mech. seals, drainage for leaks and drips, evaluate seal flush system destination, evaluate cavitation potential on low suction head pumps.	Preventive maintenance	Run fail indication	N/A	Follow SOPs[4] for pump and seals, and perform repair	1	1	1						
	d. Filter failure	Install instrumentation to measure pressure across the filters and alarm. Install 2-stage filters (coarse and fine). Set vessel pressure rating to contain “deadhead” pump condition.	Preventive maintenance	Increased pressure across filters	N/A	Follow SOPs,[4] and perform repair/ replace cartridges	1	1	1						
	e. Eductor failure	Install multiple tank eductors. Monitor vacuum on educator to evaluate erosion or fouling.	Preventive maintenance and inspection. Do routine maintenance and adjust procedures and equipment accordingly.	N/A	Visual inspections/ maintenance	Follow SOPs[4] and perform repair/ replace educators.	1	1	1						

TABLE 2.2-1
Failure Mode Effect Analysis Matrix — Remedy-produced Water Management System
Groundwater Remedy Operation and Maintenance Manual
Volume 3: Contingency Plan
PG&E Topock Compressor Station, Needles, California

			Mitigation - Operations							Type of Unacceptable Condition					
				Observable Condition											
Potential Failure and Effect without Mitigation	Potential Cause	Mitigation - Design	Mitigation	Remedy SCADA	Human	Action if Cause Occurs	Severity (1 Low - 5 High)	Likelihood (1 Low - 5 High)	Severity x Likelihood	A. Unacceptable Remedy Performance	B. Significant Schedule Increase	C. Significant Cost Increase	D. Significant Change to Impacts (Additional CEQA Analysis)	E. H&S or Compliance NOV (other than related to remedy performance)	Notes
6. Freezing Effect without mitigation: No fluid flow	Low ambient temperature	Install heat trace for some chemical piping and storage tanks.	Drain system. Other responses include heat tape, wrapping lines with cloth or rags, or placing heat lamps.	N/A	Weather forecast and anticipated outage schedule.	Upgrade freeze protection or change chemical strength or type	2	1	2						Not been a problem historically at TCS or IM-3
7. Spills Effect without Mitigation: Exposure and contamination of soil	Equipment or pipe failure	Provide adequate secondary containment	SOP[4] and training and alarms (also in HMBP, BMPs, SWPPP)	Alarm for pump running and no flow. Secondary containment level alarms	Visual inspections	Drain system, pump to influent storage tanks. Repair leak.	2	1	2						
8. Unexpected constituents/ material by-product in conditioned water Effect without Mitigation: Carry over contaminant to cooling tower or injection wells	a. Not following RPWC SOPs[4]	N/A	Follow the Operation and Maintenance Manual and SOPs	N/A	N/A	Reinforce/training	1	1	1						Examples include, iron, manganese, silica, calcium, magnesium, and biological materials
	b. Unexpected material enters system	N/A	Investigate root cause, re-evaluate well operations, and maintenance procedures (see Section 4)	N/A	N/A	Revise SOPs[4] or process as needed, could modify monitoring procedures.	2	1	2						
9. Lightning Strike Effect without mitigation: Damage to plant may cause shutdown of system. May cause release of produced water or conditioning chemicals	Lightning	Provide lightning protection and adequate secondary containment for tanks and equipment	Maintain appropriate spare parts to minimize downtime. If necessary, can truck offsite or stop backwashing to mitigate downtime of conditioning system.	N/A	Add inspections into SOPs[4] to watch for leaks or overfilling after a strike	Inspect and assess site for damage / mechanical integrity or repair. If necessary, can truck offsite or stop backwashing until repair is done.	2	1	2						
10. Seismic Damage Effect without Mitigation: Damage to plant may cause shutdown of system	Earthquake	Design in accordance with structural design criteria in 90% Basis of Design Report, Appendix C. Provide adequate secondary containment for tanks and equipment	If necessary, can truck offsite or stop backwashing to mitigate downtime of conditioning system.	N/A	N/A	Inspect and assess site for damage / mechanical integrity or repair. If necessary, can truck offsite or stop backwashing until repair is done.	3	1	3						
11. Fire Effect without Mitigation: Damage to plant may cause shutdown of system	Fire	Fire hydrant in proximity of building. Provide adequate secondary containment for equipment and tanks.	Fire water/pumps at station. If necessary, can truck offsite or stop backwashing to mitigate downtime of conditioning system.	N/A	N/A	Contact Fire Dept. Inspect, assess damage, begin repairs, startup. If necessary, can truck offsite or stop backwashing until repair is done.	2	1	2						

TABLE 2.2-1
Failure Mode Effect Analysis Matrix — Remedy-produced Water Management System
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PG&E Topock Compressor Station, Needles, California

			Mitigation - Operations							Type of Unacceptable Condition					
				Observable Condition											
Potential Failure and Effect without Mitigation	**Potential Cause**	**Mitigation - Design**	**Mitigation**	**Remedy SCADA**	**Human**	**Action if Cause Occurs**	**Severity (1 Low - 5 High)**	**Likelihood (1 Low - 5 High)**	**Severity x Likelihood**	**A. Unacceptable Remedy Performance**	**B. Significant Schedule Increase**	**C. Significant Cost Increase**	**D. Significant Change to Impacts (Additional CEQA Analysis)**	**E. H&S or Compliance NOV (other than related to remedy performance)**	**Notes**
12. System is damaged due to vandalism Effect without Mitigation: Damage to wells could result in increased trucking or well repair/ replacement. Plant is off-line for weeks to months while being re-built.	Vandalism	Facilities within the TCS will be secured by current TCS security system. Controls built into the system (alarms, containment, automatic cutoffs and shutdowns) are designed to help mitigate uncontrolled releases or discharges following several types of due to vandalism	Periodic inspections of all equipment inside and outside conditioning system and wells. TCS access control and security will help protect plant.	N/A	N/A	Inspect and assess site for damage / mechanical integrity or repair.	2	1	2						

Notes:

[1] Anticipated annual remedy-produced water volume is 7.6 million gallons (MG) per year. With provisional wells this volume could increase to 10 MG per year. The automated backwashing and conditioning system has been designed to accommodate this range of anticipated volume of wastewater. If the system functions as designed, the amount of trucking needed during O&M would be minimal, and within the range analyzed in the certified EIR (DTSC 2011; see Section 3.5.3, page 3-26).

[2] Current estimated annual flow is 7.6 MG; with provisional wells could be 10 MG/yr. Peak design flow is 35 gpm (18.4 MG/yr.).

[3] Space is reserved to allow for increase storage and system conditioning capacity if needed.

[4] Standard Operating Procedures are presented in O&M Manual Volume 1, Operation and Maintenance Plan, Appendix B.

Acronyms and Abbreviations:

ARAR = Applicable or Relevant and Appropriate Requirements
BMP = Best Management Practices
EIR = Environmental Impact Report
H&S = Health & Safety
HMBP = Hazardous Materials Business Plan
IM-3 = Interim Measure No. 3
NOV = Notice of Violation
N/A = Not Applicable
O&M = Operation and Maintenance
RAO = Remedial Action Objective
RPWC = Remedy-Produced Water Conditioning
SCADA = Supervisory Control and Data Acquisition
SOP = Standard Operating Procedure
SWPPP = Storm Water Pollution Prevention Plan
TCS = Topock Compressor Station

TABLE 2.3-1
Failure Mode Effect Analysis Matrix — Freshwater Supply
Groundwater Remedy Operation and Maintenance Manual
Volume 3: Contingency Plan
PG&E Topock Compressor Station, Needles, California

	Failure Mode	Likely Causes for Failure	Effects of Failure	Operational Actions	Possible Contingency Measures
Failure Modes Associated with HNWR-1A Source	Well yield declines below the minimum required for optimal remedy operation[1]	• Pump failure • Extraction well fouling • Excessive drawdown due to competing water users	• Delay in reaching Remedial Action Objectives	• Replace pump • Rehab well • Replace well • Bring HNWR-1 online	• Supplement flow with water from Topock 2/3 or bring Site B well online. Blend Site B water with water from Topock-2/3 and/or HNWR-1/1A. Potentially implement a contingent arsenic treatment system per State Water Resources Control Board letter (SWRCB 2013)[2].
	Quality of water in freshwater well declines over time	• Pumping draws in saline water from below or geochemically reduced water containing iron and manganese	• Could result in shutting down remedial action if water quality is not suitable for injection	• Isolate the upper well screen interval from the lower screen interval (e.g., using an in-well packer) • Aerate freshwater prior to injection (note that this option requires a small amount of piping changes and addition of fittings) • Increase riverbank extraction (note that this option could only be used to offset a marginal reduction in freshwater supply)	• Supplement flow with water from Topock 2/3 or bring Site B well on line. • Potentially implement a contingent arsenic treatment system per State Water Resources Control Board letter (SWRCB 2013)[2]
	Freshwater pumping causes adverse effects on water quality or capacity in nearby wells	• Over pumping of aquifer in areas with marginal groundwater quality / transmissivity	• Could result in shutting down remedial action if affected water users cannot be made whole	• None	• Bring Site B well on line. Blend Site B water with water from Topock-2/3 and/or HNWR-1/1A. Potentially implement a contingent arsenic treatment system per State Water Resources Control Board letter (SWRCB 2013)[2]

Notes:

[1] PG&E provided a response to a two-part question regarding the potential effects of a prolonged drought on Arizona water supply and the remedy process via an email from Yvonne Meeks/PG&E to Doug Bonamici/Colorado River Indian Tribes, titled Re; February TWG Action Item and dated March 24, 2015. The questions and responses are stated as follows:

"1.) Are you saying severe drought will not adversely affect remedy flow characteristics as it operates, and,

PG&E Response: That's correct, PG&E professional judgment is that potential future drought conditions would not be expected to significantly impact the remedy flow characteristics as it operates, and therefore the remedy performance or simulated timeframes. The remedy doesn't depend on local precipitation for its function.

2) That a prolonged drought is unlikely to reduce/impair the availability of Arizona freshwater supply so much that it would jeopardize the remedy process?

PG&E Response: Again correct, as long as there is flow in the Colorado River, then the remedy is expected function as designed (including the availability of freshwater from Arizona). The aquifer on both sides of the river Topock is fed by the Colorado River and the river is

TABLE 2.3-1
Failure Mode Effect Analysis Matrix — Freshwater Supply
Groundwater Remedy Operation and Maintenance Manual
Volume 3: Contingency Plan
PG&E Topock Compressor Station, Needles, California

Failure Mode	Likely Causes for Failure	Effects of Failure	Operational Actions	Possible Contingency Measures

highly controlled by the dams upstream. So as long as there is some water flowing in the Colorado River, there would be adequate water in the aquifer to support the pumping associated with the remedy.

Although it has never happened, in an extreme drought there could possibly be curtailments on water usage in the Colorado River basin. That could cause PG&E, along with other water users, to have to reduce pumping – although we have water rights well in excess of planned pumping needs. A reduction in pumping would not result in a failure of the remedy. The natural hydraulic gradient would continue to move the plume through the IRZ even in the absence of pumping, just at a slower rate."

[2] The referenced letter provides the SWRCB's findings and conditions for allowing injection of fresh water containing naturally occurring arsenic above the maximum contaminant level (MCL) without pre-treatment. The letter requires that if the leading edge of the arsenic plume above the 10 parts per billion [μg/L] water quality objective extends more than 150 feet away from injection locations, PG&E must immediately reassess its modeling calculations and quickly identify interim actions it can take to limit the migration of the arsenic plume. The letter further directs the cessation of the injection of untreated fresh water if the arsenic concentration caused by injection of fresh water is detected above the water quality objective (10 μg/L) at 225 feet from the injection locations. The letter states that at this point, DTSC should either (i) require pretreatment to remove arsenic prior to injection or (ii) require another source of fresh water in order to meet the water quality objective.

TABLE 2.4-1
Failure Mode Effect Analysis Matrix — Power Supply
Groundwater Remedy Operation and Maintenance Manual
Volume 3: Contingency Plan
PG&E Topock Compressor Station, Needles, California

Potential Failure and Effect without Mitigation	Potential Cause	Mitigation – Design	Mitigation - Operations				Severity (1 Low - 5 High)	Likelihood (1 Low - 5 High)	Severity x Likelihood	Type of Unacceptable Condition					Notes
			Mitigation	Observable Condition		Action if Cause Occurs				A. Unacceptable Remedy Performance	B. Significant Schedule Increase	C. Significant Cost Increase	D. Significant Change to Impacts (e.g., Additional CEQA Analysis)	E. H&S or Compliance NOV (other than related to remedy	
				Remedy SCADA	Human										
1. Utility or generated power supply failure Effect Without Mitigation: Loss of equipment function and eventual loss of control system functionality. May prohibit systematic shutdown of processes	Raptor entanglement, lightning strike on line, high wind, post insulator destroyed by gunshot, traffic collision with pole, or external customer causes distribution circuit trip	Uninterruptible Power Supplies (UPS) for control circuits	Maintain site security.	N/A	N/A	Repair, replace	1	2	2						
	Generator mechanical, electrical, or controller failure	Interconnection to other source(s) of generated electrical power, connection point for dedicated portable generator (note that a portable, rental backup generator of similar make and model of the existing generator [Isuzu Model 6WG1X] will be mobilized onsite as needed during project implementation to provide power).	N/A	N/A	N/A	Repair, replace	2	1	2						
2. Electrical distribution equipment failure Effect Without Mitigation: Loss of power downstream of failed equipment. May prohibit systematic shutdown of processes	Manufacturing defects, age, and heat exposure, or ingress of dirt/sand into electrical equipment	Use utility-grade equipment, rated for installation environment. Utilize common equipment styles for quick replacement	Periodic electrical testing, including transformer dissolved gas analysis	N/A	N/A	Repair, replace	3	1	3						
3. Damage from direct or nearby lightning strikes Effect Without Mitigation: Loss of power downstream of failed equipment. May prohibit systematic shutdown of processes	If power is from utility: Connection to utility overhead lines which attract lightning	Use of Surge Protective Devices	Periodic inspection of SPD indicators	N/A	N/A	Repair, replace	3	1	3						
	Direct strike on equipment	None	None	Loss of Power Detected	Charred Enclosure	Repair, replace	3	2	6						
4. Cable damage/fault/failure Effect Without Mitigation: Loss of power downstream of failed equipment. May prohibit systematic shutdown of processes	Digging near underground lines, rodents in termination cabinets, over temperature leading to insulation failure	Protect power cabling in raceway and enclosures. Minimize sun exposure to insulation systems and size circuits conservatively	Keep enclosure doors closed, use proper bolt torques	Loss of Power Detected	N/A	Repair, replace	3	1	3						
5. Externally caused equipment failure Effect Without Mitigation: Loss of power downstream of failed equipment. May prohibit systematic shutdown of processes	Vandalism, theft, force majeure	Provide secure, robust, and lockable system enclosures	Inspect accessible equipment for damage	N/A	Inspect accessible equipment for damage	Repair, replace	3	1	3						

TABLE 2.4-1
Failure Mode Effect Analysis Matrix — Power Supply
Groundwater Remedy Operation and Maintenance Manual
Volume 3: Contingency Plan
PG&E Topock Compressor Station, Needles, California

			Mitigation - Operations							Type of Unacceptable Condition					
				Observable Condition											
Potential Failure and Effect without Mitigation	Potential Cause	Mitigation – Design	Mitigation	Remedy SCADA	Human	Action if Cause Occurs	Severity (1 Low - 5 High)	Likelihood (1 Low - 5 High)	Severity x Likelihood	A. Unacceptable Remedy Performance	B. Significant Schedule Increase	C. Significant Cost Increase	D. Significant Change to Impacts (e.g., Additional CEQA Analysis)	E. H&S or Compliance NOV (other than related to remedy	Notes

Notes:
ARAR = applicable or relevant and appropriate requirement
H&S = health and safety
N/A = not applicable
NOV = Notice of Violation
PLC = programmable logic controller

TABLE 2.5-1
Failure Mode Effect Analysis Matrix — Remedy SCADA, Control Systems, and Instruments
Groundwater Remedy Operation and Maintenance Manual
Volume 3: Contingency Plan
PG&E Topock Compressor Station, Needles, California

Potential Failure and Effect without Mitigation	Potential Cause	Mitigation - Design	Mitigation - Operations: Mitigation	Mitigation - Operations: Observable Condition: Remedy SCADA	Mitigation - Operations: Observable Condition: Human	Mitigation - Operations: Action if Cause Occurs	Severity (1 Low – 5 High)	Likelihood (1 Low – 5 High)	Severity x Likelihood	Type of Unacceptable Condition: A. Unacceptable Remedy Performance	B. Significant Schedule Increase	C. Significant Cost Increase	D. Significant Change to Impacts (e.g., Additional CEQA Analysis	E. H&S or Compliance NOV (other than related to remedy	Notes
1. PLC hardware failure Effect Without Mitigation: Lose ability to send/ receive control signals from control room. Lose ability to collect data.	a. Over-temperature	Keep cooled, design includes shade or active cooling where required for equipment longevity.	Keep spares on-site in stock	Remedy SCADA monitors communication and PLC health, and alarms in failure event	Failure may result in unchanged or frozen process variable	Repair, replace	1	3	3						Would be fixed before would cause RAO or schedule issues
	b. Dust/Rainfall/Spray from washdown or pipe break	Design utilizes industrial-grade equipment, housing in National Electrical Manufacturers Association (NEMA)-rated enclosures appropriate for environment. For open enclosures include filters.													Would be fixed before would cause RAO or schedule issues
	c. Power supply irregularity (lightning, shifting generator power, utility's overvoltage, harmonics, temporary power loss)	UPS provided for each PLC.													Would be fixed before would cause RAO or schedule issues
2. Cabling or termination damage/failure Effect Without Mitigation: Lose ability to send/ receive control signals from control room. Lose ability to collect data.	Mechanical damage by backhoe or shovel for underground circuits, traffic or vandalism for above-ground circuits, or temperature changes loosen terminations	Provide conduit for mechanical protection of circuits, route fiber optic cables in protected areas of panels, monitor communications, detection tape, rigid conduit, concrete cap, pipe markers.	Use proper torque on cable terminations	Remedy SCADA monitors communications network, alarms in failure event	Routine patrols of utility corridors and facilities	Repair, replace	1	2	2						

TABLE 2.5-1
Failure Mode Effect Analysis Matrix — Remedy SCADA, Control Systems, and Instruments
Groundwater Remedy Operation and Maintenance Manual
Volume 3: Contingency Plan
PG&E Topock Compressor Station, Needles, California

			Mitigation - Operations							Type of Unacceptable Condition					
				Observable Condition											
Potential Failure and Effect without Mitigation	**Potential Cause**	**Mitigation - Design**	**Mitigation**	**Remedy SCADA**	**Human**	**Action if Cause Occurs**	**Severity (1 Low – 5 High)**	**Likelihood (1 Low – 5 High)**	**Severity x Likelihood**	**A. Unacceptable Remedy Performance**	**B. Significant Schedule Increase**	**C. Significant Cost Increase**	**D. Significant Change to Impacts (e.g., Additional CEQA Analysis**	**E. H&S or Compliance NOV (other than related to remedy**	**Notes**
3. Field instrumentation damage/failure Effect Without Mitigation: Lose ability to receive accurate control signals from control room or at local controllers. Diminished process data accuracy.	a. Thermal or physical damage to instrument or aging of internal parts or circuits, drifting of instrument output signal(s)	Provide sun protection and mechanical protection where instruments are vulnerable to damage	Calibrate instruments according to manufacturer's recommended schedules	Reduced control system and process performance	Test critical alarms as part of O&M procedure and field verification (e.g., water levels)	Adjust, repair, replace	1	1	1						For severities upon loss of critical instrumentation, see Process FMEAs.
	b. Power supply irregularity (lightning, shifting generator power, utility's overvoltage, harmonics, temporary power loss)	Connect externally powered instruments to UPS-fed circuits	Routine testing of battery capacity or regular replacement	Erroneous alarms, reduced control system and process performance	N/A	Repair, replace	1	1	1						
4. SCADA controls software failure: Effect without Mitigation: Control system commands lock themselves into last state	Software bug, OS or applications software	Use HMI software suited for size of system, rigorous testing of applications software prior to and during startup	Keep backup files onsite and offsite for all OS and application software programs	N/A	Loss of real-time monitoring and/or control	Reboot system, potential reload of software	2	2	4						
5. Valve fails in non-safe state. Effect without Mitigation: Water or chemical may flow not per design.	a. Power failure	Valves that are important to fail in safe position will be designed or configured with a fail-safe mode or passive valves (checks), alarm at PLC	N/A	Detection of undesirable process condition	N/A	Repair, replace	2	2	4						
	b. Electrically actuated valves - power loss at valve	Program to fail to safe position	N/A	Objectionable flow condition	N/A	Repair, replace	2	2	4						

TABLE 2.5-1
Failure Mode Effect Analysis Matrix — Remedy SCADA, Control Systems, and Instruments
Groundwater Remedy Operation and Maintenance Manual
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PG&E Topock Compressor Station, Needles, California

Potential Failure and Effect without Mitigation	Potential Cause	Mitigation - Design	Mitigation - Operations				Severity (1 Low – 5 High)	Likelihood (1 Low – 5 High)	Severity x Likelihood	Type of Unacceptable Condition					Notes
			Mitigation	Observable Condition		Action if Cause Occurs				A. Unacceptable Remedy Performance	B. Significant Schedule Increase	C. Significant Cost Increase	D. Significant Change to Impacts (e.g., Additional CEQA Analysis	E. H&S or Compliance NOV (other than related to remedy	
				Remedy SCADA	Human										
6. Radio Communication interruption Effect Without Mitigation: Lose ability to send/ receive control signals from control room. Lose ability to collect data.	Vegetation or other obstruction in radio path	Antennas on towers with clear line of sight, use appropriate carrier frequency for link, program communications heartbeat	Vegetation management	Communication loss for radio link	N/A	Clear obstruction	1	2	2						
7. Externally caused SCADA equipment failure Effect Without Mitigation: Lose ability to send/ receive control signals from control room. Lose ability to collect data.	Vandalism, theft, force majeure	Provide secure and robust system enclosures, bollards where required, installations above flood plain	Periodic inspections of all equipment inside and outside conditioning system and wells. TCS access control will help protect plant.	Loss of equipment functionality	Visibly damaged or missing equipment	Repair, replace	1	1	1						
8. pH probe or other analytical probe/device fouling Effect Without Mitigation: Lose ability to monitor pH/parameter. Lose ability to collect data.	Contact with process liquid over time	Make pH probes or other devices accessible to operators	Routine inspection of cleaning of pH probes or devices	N/A	Rapid loss of calibration, visual fouling	Clean and re-calibrate	1	1	1						
9. Cyber-security: Software security, remote access security, or operating system update errors. Effect Without Mitigation: Lose ability to send/ receive control signals from control room. Lose ability to collect data.	Not keeping software up to date, remote hack	Design in site access security, and remote access security, password protected access	Maintain software license, password protection	N/A	N/A		2	1	2						

TABLE 2.5-1
Failure Mode Effect Analysis Matrix — Remedy SCADA, Control Systems, and Instruments
Groundwater Remedy Operation and Maintenance Manual
Volume 3: Contingency Plan
PG&E Topock Compressor Station, Needles, California

			Mitigation - Operations							Type of Unacceptable Condition					
				Observable Condition											
Potential Failure and Effect without Mitigation	**Potential Cause**	**Mitigation - Design**	**Mitigation**	**Remedy SCADA**	**Human**	**Action if Cause Occurs**	**Severity (1 Low – 5 High)**	**Likelihood (1 Low – 5 High)**	**Severity x Likelihood**	**A. Unacceptable Remedy Performance**	**B. Significant Schedule Increase**	**C. Significant Cost Increase**	**D. Significant Change to Impacts (e.g., Additional CEQA Analysis**	**E. H&S or Compliance NOV (other than related to remedy**	**Notes**
10. Remedy SCADA does not get alarms Effect Without Mitigation: Systems are shut down	Loss of communications which results in loss of status, control, and alarms.	Design includes layers of protection against such consequences. Such a failure would result in an alarm indicating loss of communication. See control scheme for the PLC in Appendix E of the 90% BOD Report, Section Number 26 79 15.	Periodic verification of SCADA/PLC communications	No communication	No communication		3	1	3						

Notes:
ARAR = applicable or relevant and appropriate requirement
BOD = Basis of Design
CEQA = California Environmental Quality Act
H&S = health and safety
FMEA = Failure Mode Effects Analysis
N/A = not applicable
NOV = Notice of Violation
O&M = operation and maintenance
OS = operating system
PLC = programmable logic controller
RAO = remedial action objective
SCADA = supervisory control and data acquisition
TCS = Topock Compressor Station
UPS = uninterruptible power supply

TABLE 2.6-1
Failure Mode Effect Analysis Matrix — Enhanced Evaporation at TCS Evaporation Ponds
Groundwater Remedy Operation and Maintenance Manual
Volume 3: Contingency Plan
PG&E Topock Compressor Station, Needles, California

	Failure Mode	Likely Causes for Failure	Effects of Failure	Operational Actions	Possible Contingency Measures
Failure Modes Associated with Evaporation Ponds	Discharge rate will cause ponds to exceed capacity	• Compressor station wastewater discharge needs are high • Remedial waste water production rates are high	• Potential overflow of evaporation ponds	• Utilize portable pumps to transfer water to ponds with available capacity • Storage water in temporary tanks • Truck water offsite • Identify operational adjustments at compressor station to reduce station waste water generation	• Add drip system to Pond 1 and/or 2
	Flow rates through drip evaporation system decline	• Pump failure • Build-up in the circulation piping • Clogging of the circulation pipe perforations	• Potential overflow of evaporation ponds	• Rehab pump • Replace pump • Flush pipe or perform mechanical cleaning • Inspect and clean perforations	• Add drip system to Pond 1 and/or 2

SECTION 6

Post-construction and Startup Activities

Construction of the groundwater remedy will end with functional testing, construction closeout, post-construction revegetation, and transition to operation and maintenance. As described in Section 3, construction closeout will include record drawings, final submittals and reports from construction contractors (including site photos), site cleanup, vendor training, demobilization, and stabilizing areas of soil disturbance. The remaining end of construction activities—namely functional testing, post-construction revegetation, and commissioning and startup of the remedial systems—are described herein.

6.1 Post-construction Revegetation

After the remedy construction is complete, the revegetation of the areas affected by construction will begin. Revegetation efforts for the Topock Program will be conducted at two specific periods related to the final groundwater remedy. The first period will be immediately after completion of the remedy construction. The second period will be in future, after the groundwater remedy has achieved the groundwater RAOs, and the system has been decommissioned and removed. The activities discussed in this section will begin immediately following remedy construction, and the intent will be to offset loss of habitat incurred during construction, as represented by the loss of mature plants and trees. The revegetation efforts related to the future final decommissioning and removal of remedy system will be provided at a future date when adequate information related to the site conditions is known.

In general, the revegetation approach will be informed by the preconstruction condition, as documented through ground photographic records, topographic/aerial maps, disturbed area map, archaeological surveys, historical resource surveys, and biological surveys. The goal is to restore the areas affected by construction as close as possible to preconstruction conditions.

6.1.1 Revegetation Activities Concurrent with Construction

The revegetation activities summarized here are based upon the different plans that have been prepared to address different sensitive habitats or areas and that are provided in various appendices of this C/RAWP. These plans include the HNWR Habitat Restoration Plan (Appendix G to this C/RAWP), the Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (Appendix O), the Aesthetics and Visual Resources Protection and Revegetation Plan (Appendix N), and the Mitigation and Monitoring Plan for Culturally Significant Plants (Appendix A of the CIMP [which is Appendix H of this C/RAWP]).

These various plans describe the overall program restoration and revegetation approach for the period that begins with the completion of the remedy construction and extends through the operation phase of the remedy project up to the decommissioning and removal phases. Specific information related to the actual project impacts, as well as generalized locations for restoration activities, are presented in the restoration plans for the HNWR, riparian vegetation, and other sensitive habitats. However, the specific information related to precisely how the plantings will occur within each restoration area was provided on January 26, 2015 to the agencies for review in a technical memorandum entitled *Preliminary Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California* (CH2M HILL 2015a). Agency review comments were addressed and incorporated into the finalized technical memorandum that is included in this C/RAWP as Appendix V. For each restoration area to be used, the technical memorandum includes information about the number of replacement plants by species, plant size and container type, planting locations, and irrigation system design.

It should be recognized that much of the actual remedy construction footprint will be required for continued access to allow for ongoing system O&M and for sampling of the final groundwater remedy system. For this reason, revegetation activities to offset construction impacts is almost entirely planned to occur on adjacent

or nearby habitats to the construction footprint. This will minimize having to disturb restoration plantings when future removal and restoration activities are needed.

6.1.1.1 Avoidance and Minimization of Plant Impacts during Design and Construction

Throughout the design process, efforts have been made to locate remedy facilities along roadways, pipeline ROWs, and other previously disturbed areas to avoid impacts to vegetation. Construction areas, as well as staging and storage areas, also have been located in previously disturbed and/or developed areas to minimize and avoid impacts to vegetation and other sensitive resources. To further minimize impacts, a biologist will conduct preconstruction surveys, and areas of native vegetation and sensitive habitats in the immediate vicinity of the construction areas will be identified and clearly marked with flagging, fencing, and/or signage. Construction workers also will be provided with environmental awareness training regarding biological resources, including sensitive species and habitats.

Implementation of the project will not be able to avoid impacts to all mature plants and trees. However, the field implementation and approach will be first to avoid mature vegetation or to preserve them in place, wherever feasible. Where the impact cannot be avoided, design and construction implementation will preferentially seek to avoid impacts to woody perennial native trees, such as blue palo verde and honey mesquite, because these species are considered more valuable in terms of aesthetics and habitat for local wildlife species.

Impacts to mature vegetation will include both temporary and permanent impacts. Temporary impacts would occur in areas where some vegetation clearing is needed to provide work space for construction activities that are associated with installation Remedy facilities. In these areas, plants such as arrow weed, salt cedar and, to a limited extent, creosote bush, will either be trimmed or flattened, but the root systems of the plants will be left intact whenever feasible. Both arrow weed and salt cedar are adapted to frequent disturbance and will readily resprout if the root systems remain intact. Creosote bush will also naturally recover as long as the root system is not significantly disturbed. Trimming of trees is another temporary impact that may occur during construction; however, trimming alone is not considered as habitat loss.

Permanent impacts to mature plants will occur in areas where the root systems of the plants are significantly disturbed as a result of installation of remedy facilities. Permanent impacts may also occur at those locations where vegetation will be removed to create access roadways that will be used throughout the operation phase of the project for routine monitoring, inspection, and maintenance activities. With the exception of some of the creosote bushes common throughout the project area, the majority of the vegetation impacts will occur to arrow weed and salt cedar on the historical floodplain lying above the 100-year flood elevation below the NTH and the MW-20 Bench.

An inventory of the habitat losses at the final design stage is part of the HNWR and riparian restoration plans and is presented in maps and in tabular format within each plan.

6.1.1.2 Approaches for Restoration and Revegetation

The various restoration plans provide information on the different options that will be employed for mitigating plant impacts that cannot be otherwise avoided. These plans include techniques to save plants by salvaging plants, when feasible, and replanting them in a pre-designated location. When the trees are too large to be reliably transplanted, the lost trees will be replaced with new trees of the same species grown in containers within a commercial plant nursery from locally collected seeds, if available. The revegetation plans in this C/RAWP do not; however, include techniques for establishment of herbaceous vegetation because those approaches would not mirror existing conditions in this arid ecosystem and were considered unlikely to be successful.

6.1.1.3 Success Criteria, Monitoring, and Adaptive Management

Due to the fact that replacement saplings do not provide the same habitat value as mature trees, a mitigation ratio of 3:1 will be used to offset impacts to riparian trees. Replacement trees will be propagated

from locally collected seeds and grown in a nursery for one year prior to planting in selected mitigation sites, if available. The success criteria for mitigation plantings will be a final minimum plant replacement ratio of 2.25:1 (75 percent overall survival rate) of mitigation plantings at the end of a minimum 5-year monitoring period.

Monitoring will continue for a minimum of 5 years following mitigation plantings. In the event that mortality rates or trends in declining vigor of the mitigation plantings result in less than a minimum of a final 2.25:1 mitigation ratio, additional saplings will be planted. Replacement plantings will be monitored for 5 years from the time of the initial planting to ensure that the mitigation success criteria have been met.

To account for anticipated mortality rates that may be as high as 50 percent for desert mitigation plantings, the initial replanting will include twice as many saplings as required by the mitigation ratios. This initial higher planting ratio is intended to compensate for expected sapling mortality over time and ensure that the final mitigation ratios are obtained. For example, if three palo verde trees will be removed during construction they would be replaced at a 3:1 ratio with seedlings grown from locally sourced seeds. The initial mitigation would therefore require nine replacement plantings. The success criteria would be 75 percent overall survival of these plantings after 5 years, resulting in a final mitigation ratio of 2.25:1 or survival of 6.75 (rounds to 7) out of nine initial plantings.

Adaptive management involves learning from experience and modifying subsequent behavior in light of that experience. Data may be collected and analyzed throughout the monitoring period, and the results can be used to modify (adapt) restoration approaches, as appropriate, to ensure successful establishment of transplanted species and the desired density and cover of plants. Maintenance and adaptive management will focus on weed control, irrigation modification, herbivory protection, and mortality rates.

6.1.1.4 Weed Control

Weedy species, such as Russian thistle (*Salsola tragus*), Sahara mustard *(Brassica tournefortii*), and salt cedar (*Tamarix ramosissima*), can significantly affect growth and survival of transplants. Transplant and seed sites will be relatively weed-free and will be monitored regularly for weed infestations. It is much easier to prevent the establishment of weeds in an area than it is to eradicate weed populations once they have become established. Monitoring for weed seedlings of Russian thistle, Sahara mustard, and salt cedar will be done early in the growing season (March to April) to allow for treatment and removal of weedy species before flowering and seed dispersal. In addition, young weed seedlings can be removed by hand, thereby avoiding the need for more intensive mechanical or chemical treatments.

6.1.1.5 Irrigation Modification

The objective is to obtain the maximum survival rate of transplanted trees and shrubs; therefore, it may be necessary to modify the irrigation schedule and/or amount of water during the revegetation period. While irrigation will only be used during the initial establishment period, the condition of the plants will be monitored throughout the monitoring period of 5 years. If after the initial watering, plants show a notable decline in vigor, it may be necessary to increase the amount and/or timing of irrigation to prevent mortality and increase vigor. Care will be taken not to overwater the plants.

6.1.1.6 Herbivory Protection

Tree and shrub protectors will be maintained until the plants are large enough to withstand herbivory or before the growth of the plant is impacted by the protector. PG&E will be responsible for removing the tree and shrub protectors.

6.1.1.7 Photo-monitoring

Photo-monitoring stations will be established by a qualified vegetation ecologist or landscape architect in areas where vegetation impacts will occur to document preconstruction conditions. Photo points also will be used to monitor the natural recovery of plant species and to monitor the mitigation areas. The methods and

procedures to be used are adapted from the U.S. Department of Agriculture's Photo Point Monitoring Handbook (Hall 2002).

6.2 Functional Testing, Startup, and Transition to Operation and Maintenance

This section discusses activities from the functional testing at the end of construction to the start of remedy O&M and the methodologies proposed to be used for functional testing, remedy startup (including shutdown and layup of the IM), and the transition from startup to O&M. This section is intended to meet the requirements of CD Paragraph 13(b)(5) (Methodology for Implementing the Operations and Maintenance Plan).

6.2.1 Functional Testing

Pursuant to CERCLA 40 CFR 300.435(f)(2), the groundwater remedy becomes operational and functional either 1 year after construction is complete, or when the groundwater remedy is determined by DOI to be functioning properly and performing as designed—whichever is earlier. The "functional testing" period is often referred to as "commissioning" or "shakedown," which is the period when the construction team makes minor adjustments as necessary to ensure the system or components are operating and functioning as designed. For the purposes of this C/RAWP, the term "functional testing" will be used. DOI may grant extensions to the 1-year period, as appropriate. Criteria for assessments of are being developed in coordination with DTSC and DOI.

The following provides a general overview of functional testing activities. These activities are grouped and presented below according to the type of infrastructure/system with which they are associated (e.g., remediation wells, remedy water conveyance systems, process systems, and monitoring wells). Additional testing procedures will typically be provided by vendors or construction contractors as part of their submittals to PG&E for review and acceptance. Where applicable, requirements for these testing procedures are included in the technical specifications (Appendix E of the Final BOD).

The types of activities and associated footprint (areas of activity, resources, etc.) anticipated for functional testing will be similar to that for construction. However, while most of the functional testing activities will occur onsite, certain remedy components will also be tested prior to being delivered to the site (e.g., specialty weld joints, motors, pumps, etc.)

6.2.1.1 Remediation Wells

Functional testing for remediation wells will be implemented both during development (following construction) and post-development. During development, wells will be evaluated for potential construction and/or efficiency issues by monitoring parameters such as turbidity and specific capacity. In general, trends in specific capacity observed during well development (i.e., during pumping) can be an early indicator of sustainable well capacity and refinement of local hydrogeologic conditions. Post-development functional testing may include downhole video surveys and specific capacity/injectivity testing. Additional detail on these types of testing is provided in Section 3.2.1.5 of this C/RAWP and in Section 4.1 of Volume 1 of the O&M Manual. The remediation wells also include down-well components (e.g., submersible pumps, check valves, etc.) that should be tested per the technical specifications, provided in Appendix E of the Final BOD, and the manufacturer's recommendations.

6.2.1.2 Remedy Water Conveyance Systems

Functional testing for remedy water conveyance systems will include leakage testing. Before being placed into service, piping will be hydostatically leak-tested according to the procedures summarized in Section 3.2.2 of this C/RAWP and detailed in the technical specifications (Appendix E of the Final BOD, Section 40 80 01 – Process Piping Leakage Testing). Valves may be tested during pipeline testing or as a separate step (Appendix E of the Final BOD, Section 40 27 02 – Process Valves and Operators). Prior to final

acceptance, following assembly and testing, pipelines will also be flushed with water to remove accumulated construction debris/other foreign matter to the extent practicable per the technical specifications (Appendix E of the Final BOD, Section 22 10 01 – Plumbing Piping and Accessories).

Remedy water conveyance systems also include instrumentation and control components installed at the well vaults/well meter vaults and, in some cases, water transfer/recirculation pumps and/or water storage tanks. These components will be tested per the technical specifications, provided in Appendix E of the Final BOD, and the manufacturer's recommendations. Relevant technical specifications are listed below:

- Section 40 90 00 – Instrumentation and Control for Process Systems
- Section 44 42 56.10 – Horizontal End Suction Centrifugal Pumps
- Section 33 16 13.14 – Frac Tanks
- Section 43 40 13 – Steel Storage Tank

Certain components (e.g., tanks, pumps, etc.) may be tested prior to being delivered to the site.

6.2.1.3 Process Systems

Process systems include vertical infrastructure—aboveground process piping, pumps, tanks, and other process equipment—installed at the TCS, TW Bench, and MW-20 Bench. Functional testing for aboveground process piping will include pressure/leakage testing. Before being placed into service, piping will be leak-tested using hydrostatic or pneumatic methods according to the procedures detailed in the technical specifications (Appendix E of the Final BOD, Section 40 80 01 – Process Piping Leakage Testing and Section 40 50 20 – Aboveground Piping). Valves may be tested during pipe testing or as a separate step (see also Appendix E of the Final BOD, Section 40 27 02 – Process Valves and Operators).

Functional testing for process system equipment, including pumps (e.g., alignment/vibration testing), tanks (e.g., leak testing), filters, and instrumentation and control components, will be conducted per the technical specifications, provided in Appendix E of the Final BOD, and the manufacturer's recommendations. Relevant technical specifications are listed below:

- Section 44 44 13.01 – Chemical Metering Pumps
- Section 44 42 56.15 – Air-Operated Diaphragm Pumps
- Section 43 40 13 – Steel Storage Tank
- Section 43 40 02 – High Density Polyethylene Tank
- Section 33 16 13.14 – Frac Tanks
- Section 44 43 13.16 – Cartridge Filters
- Section 40 90 00 – Instrumentation and Control for Process Systems)

Certain components (e.g., tanks, pumps, etc.) may be tested prior to being delivered to the site.

To assist the reader with understanding and visualization of functional testing activities, an example of how the remedy-produced water conditioning plant may be functionally tested is described below:

- First, freshwater will be used to test the functionality of mechanical, electrical, and controls equipment by subsystem. No remedy-produced water or treatment chemicals will be introduced in this phase. Subsystems will include the Influent Tank Farm, A-side Filter System, B-side Filter System, Acid System, Caustic System, Coagulant System, Seal Water System, A-Side Conditioned Water Tank Farm, B-Side Conditioned Water Storage Tank, and TCS Truck Fill Station. Equipment (duty and standby) within each subsystem will be tested. This phase will include completing loop checks of instrumentation and control equipment, ensuring that a signal is properly sent to field instrumentation for each programmable logic controller (PLC) output designed, and ensuring that a signal is received at the PLC for each PLC input designed.
- After subsystems are functioning as intended, the entire system will be tested with freshwater. No remedy-produced water or treatment chemicals will be introduced in this phase. The primary objective

of this step is to ensure all subsystems function together for the batch and conditioning processing modes. Functional testing of the batch processing mode will be conducted on the A-side process equipment, and functional testing of the continuous processing mode will be conducted on the A-side and B-side process equipment. Equipment (duty and standby) within each subsystem will be tested. Set points will be temporarily adjusted during clean water startup of the batch processing mode to test functionality of the chemical feed systems with the influent tanks. The system will be tested using the process design nominal and maximum flow rates. Process alarms and alarm actions will be simulated for their proper annunciation, process interaction, resetting, and process restarting.

- After freshwater startup of the full entire system is complete, the system will be functionally tested using remedy-produced water and treatment chemicals. This phase initially will consist of testing items that could not be simulated with freshwater, such as the liquid-phase separators and chemical feed systems (with true set points). Functional testing will continue with testing of the batch processing mode on the A-side process equipment and the continuous processing mode on the A-side and B-side process equipment. Equipment (duty and standby) within each subsystem will be tested. Process samples will be collected at various sample ports built into the system during this phase. Samples will be collected and in accordance with the Sampling and Monitoring Plan in Volume 1 of the O&M Manual.

6.2.1.4 Monitoring Wells

Monitoring wells will not be subject to the same functional testing procedures as the remediation wells due to their differing performance objectives (i.e., ability to yield representative water quality data [monitoring wells] versus sustain a design flow rate [remediation wells]). In general, representative groundwater samples can still be collected from low-flowing wells and, because the flow metric is less essential for monitoring wells, rigorous specific capacity testing has not been specified.

Functional testing for newly installed monitoring wells will occur primarily following construction and development. Monitoring wells will be sounded to verify total depth and to determine whether there are obstructions that could prevent successful sample collection. In addition, as described previously in Section 3.2.1.4, field water parameter measurements (e.g., turbidity and pH) collected post-development will be evaluated for indications that the well screen or casing might be compromised by collapse or grout intrusion. If there is evidence of downhole issues, video surveying may be performed as a second resort to evaluate well casing and screen integrity. In addition, well protection features (e.g., well seal, well vault/ protective monument casing, and concrete pad/collar) will be inspected to ensure that they are in place and adequate to prevent damage or contamination.

6.2.2 Remedy Startup, Including Shutdown and Layup of IM-3

After functional testing is completed, the following steps will be conducted (these are consistent with Article V(B) of the Settlement Agreement between DTSC and FMIT [DTSC 2012] and Article 9(a) of the Settlement Agreement between PG&E and FMIT [PG&E 2012]):

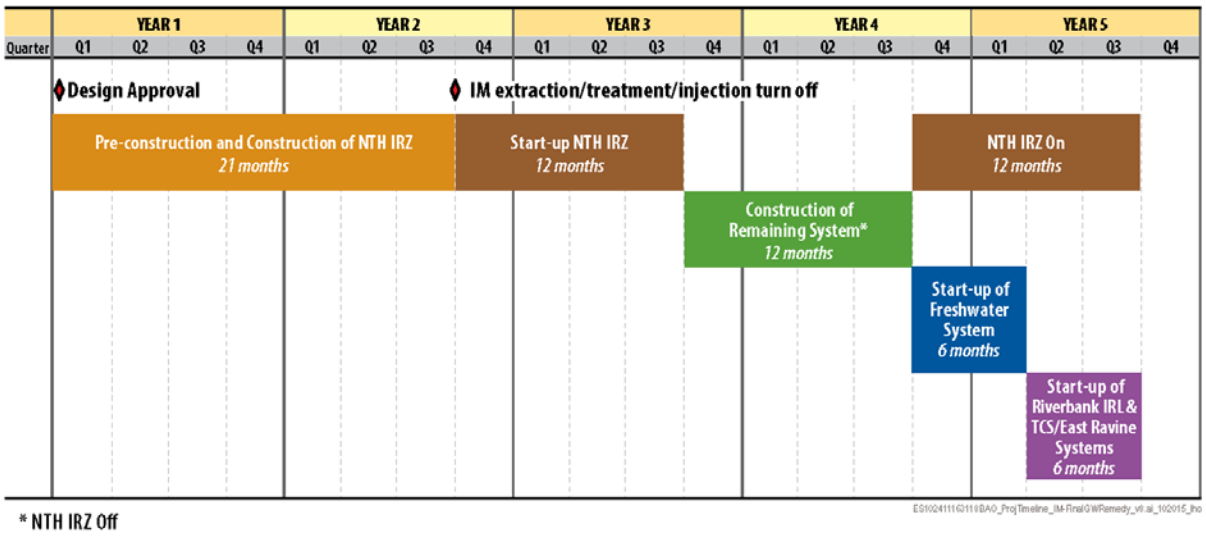
- The IM-3 system will be turned off when the groundwater remedy equipment and facilities are in place and ready for startup. For the first phase of construction, the remedy equipment and facilities will include the wells for the IRZ along the NTH, monitoring wells associated with the NTH, high priority monitoring wells (e.g., Category 1), the carbon storage and amendment facility at the MW-20 Bench, the remedy-produced water conditioning plant, power supply, construction support facilities like the CHQ, and associated pipelines, controls, and electrical and mechanical systems needed to operate these wells and facilities. A contingency to prioritize installation of River Bank Extraction Wells is included in this first phase based on baseline data collected and analyzed. PG&E will notify DTSC and the Tribe when the IM-3 system is ready to be turned off per the above-stated conditions. Upon DTSC concurrence that the system is ready to be turned off, PG&E will turn off the IM-3 system, and this date will be the “startup date.”

- Procedures for shutting down IM-3 are included in the existing IM-3 Treatment and Extraction System O&M Plan (CH2M HILL 2006). Procedures for preparing IM-3 for layup and activities during layup are presented in the IM-3 Decommissioning, Removal, and Restoration Work Plan, included in Appendix F of this C/RAWP.

- Once the IM-3 system is shut down, PG&E will implement the following remedy startup steps as presented in the 100% BOD Report (the rationale for this step-wise startup strategy is discussed in detail in Section 7.3 of the 100% BOD) (see also Exhibit 6.2-1):

  - The NTH IRZ carbon substrate injections will begin, and the NTH IRZ cutoff line will be established. This step could be completed 6 to 12 months after startup to allow for incremental startup of the injection wells, water level measurements, flow balancing, and system adjustments, as necessary.

EXHIBIT 6.2-1
Projected Timeline for Implementation of Proposed Transition Plan
Groundwater Remedy Construction/Remedial Action Work Plan, PG&E Topock Compressor Station, Needles, California



- Once the NTH IRZ is established and baseline data collected and analyzed, the carbon substrate injections will be turned off and the second phase of construction begins. The remaining remedy equipment and facilities will include wells associated with the freshwater and the IRL and TCS/East Ravine Recirculation Loop systems, lower priority monitoring wells (e.g., Categories 2 and 3), remaining O&M supporting facilities, and associated pipelines, controls, and electrical and mechanical systems needed to operate these wells.

- Once the second phase of construction is complete, the freshwater injection system[5] will be brought online to begin enhancing the riverward gradient to enhance migration of the Cr(VI)-impacted groundwater toward the IRZ wall. This step could take 3 to 6 months to allow for incremental startup of the injection wells, water level measurements, flow balancing, and system adjustments, as necessary.

- Subsequently, the IRL will next be initiated (i.e., startup of RB Extraction Wells and IRL Injection Wells). This step could take 3 to 6 months to allow for incremental startup of the extraction and injection wells, flow balancing, and system adjustments, as necessary. In addition, if groundwater captured by the RB

[5] The final (100% design) nominal scenario assumes IRL-1 and IRL-2 (northern IRL Injection Wells) will receive RB Extraction Well water (amended with carbon if Cr(VI) concentrations in the RB Extraction Wells exceed the cleanup goal) to the lower two-thirds of the saturated interval; and IRL-3 and IRL-4 (southern IRL Injection Wells) will receive fresh water.

Extraction Wells requires carbon amendment before re-injection, operation of the carbon substrate amendment system components will also be required.

- Simultaneously to the startup of the IRL, the startup of the TCS recirculation loop (i.e., the East Ravine Extraction Wells, TW Bench Extraction Wells, and TCS Injection Wells) will be initiated. This step could take 3 to 6 months to allow for incremental startup of the injection wells, water level measurements, flow balancing, and system adjustments, as necessary.

Startup and O&M activities for the different remedy components are detailed in Volume 1 of the O&M Manual. The types of activities and associated footprint (areas of activity, resources, etc.) anticipated for system startup will be similar to that described in the O&M Manual (Volumes 1 and 2) for routine O&M and remedy monitoring. However, in general, site visits are anticipated to occur slightly more frequently during initial startup as remediation wells and systems are brought online incrementally to facilitate flow balancing and the optimization of injection/extraction rates across the system.

During initial startup, carbon substrate dosing may also be adjusted incrementally until the target nominal injection concentration, or otherwise optimal concentration, is achieved to establish a microbial population and evaluate substrate distribution in an incremental fashion. Additionally, there may be a greater need for troubleshooting and operational adjustments at this phase. Aquifer conditions—e.g., flow/hydraulic gradients and geochemistry—are also anticipated to change most rapidly during startup (i.e., the first one to 2 years of remedy operation). The Sampling and Monitoring Program (Volume 2 of the O&M Manual) accounts for this, and higher monitoring/sampling frequencies are typically specified for the first year or two of operation or until system operations are verified.

Detailed SOPs for conducting start-up activities for individual remedy components are presented in Appendix B. These SOPs include:

- IRZ-SOP-01 – MW-20 Bench system startup
- FWS-SOP-01 for the freshwater supply conveyance and storage operations – System startup and shutdown
- RTP-SOP-01 for Remedy-produced Water Conditioning Plant operations – System “hot” startup and shutdown

6.2.2.1 Remedy Operation and Maintenance

Pursuant to Article 9(a) of the Settlement Agreement between DTSC and FMIT (DTSC 2012), and Exhibit A to that agreement (“Additional Settlement Terms – Criteria for Decommissioning of IM-3”), the groundwater remedy will have reached full operational status when the start-up steps have been completed. At that point, PG&E will perform the following steps:

- Provide DTSC, DOI, and the Tribes with written notice that the remedy has reached full operational status. The date of this notice will be the “full operational status date.”
- At the end of each calendar quarter following the full operational status date, prepare and submit to DTSC and DOI quarterly progress reports on the extent to which the data regarding remedy performance are adequate to make a determination of Plume Control, for the purpose of making a determination that IM-3 may be decommissioned (for criteria for approval of IM-3 Decommissioning, see the IM-3 Decommissioning, Removal, and Restoration Work Plan included in Appendix F of this C/RAWP or Section 7.4 of the Final BOD).

In addition, pursuant to Exhibit A to the Settlement Agreement between DTSC and the FMIT (DTSC 2012), DTSC’s determination of Plume Control will be consistent with the ability to achieve the criteria for DTSC’s determination that the overall groundwater remedy is operating properly and successfully (OPS), and must be made concurrent with or after DTSC’s OPS determination, unless DTSC in its lawful discretion, decides

that decommissioning of IM-3 can occur prior to DTSC's OPS determination; and DOI must concur with DTSC's decision to decommission IM-3.

Exhibit A of the Settlement Agreement between DTSC and the FMIT (DTSC 2012) also defines "Operating Properly and Successfully" for purposes of the overall groundwater remedy is defined as follows: (1) the remedy is operating as designed, (2) the information obtained from remedy operation indicates that the remedy is protective of human health and the environment, and c) the remedy is likely to be able to achieve the cleanup levels or performance goals delineated in the DTSC (DTSC 2011) and the ROD (DOI 2010) for the groundwater remedy at the PG&E Topock Site. Criteria for assessments of OPS are being developed in coordination with DTSC and DOI.

Procedures for the operation of various remedy components and supporting facilities included in the O&M Plan, Volume 1 of the O&M Manual, and for the collection of data regarding remedy performance included in the Sampling and Monitoring Plan, Volume 2 of the O&M Manual will be implemented. In addition, the Contingency Plan (Volume 3), the Soil Management Plan (Volume 4), and the Health and Safety Plan (Volume 5) will also be followed.

SECTION 7

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Appendix A
Construction Quality Assurance Project Plan

Final

Construction Quality Assurance Project Plan for the Final Groundwater Remedy

PG&E Topock Compressor Station Needles, California

Prepared for

Pacific Gas & Electric Company

November 2015

CH2MHILL®

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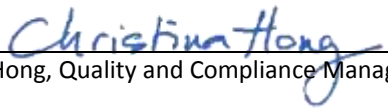
Approvals

Approved by  Date: November 18, 2015

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Acronyms and Abbreviations

ACHP	Advisory Council on Historic Preservation
ACI	American Concrete Institute
ANSI	American National Standards Institute
AOC	Area of Concern
APE	Area of Potential Effects
ARAR	applicable or relevant and appropriate requirement
ASME	American Society of Mechanical Engineers
ASNT	American Society for Nondestructive Testing
ASQ	American Society for Quality
ASTM	ASTM International (formerly American Society for Testing and Materials)
AWS	American Welding Society
BLM	U.S. Bureau of Land Management
BOR	U.S. Bureau of Reclamation
CACA	Corrective Action Consent Agreement (1996)
CD	Consent Decree
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIMP	Cultural Impact Mitigation Program
CMQ/OE	Certified Manager of Quality/Organizational Excellence
CQA	Certified Quality Auditor
CQAPP	Construction Quality Assurance Project Plan
CQCP	Contractor Quality Control Plan
CQE	Certified Quality Engineer
C/RAWP	Construction/Remedial Action Work Plan
CWG	Consultative Working Group
DFOW	definable feature of work
DOI	U.S. Department of the Interior
DOT	U.S. Department of Transportation
DTSC	California Department of Toxic Substances Control
EIR	Environmental Impact Report
IRZ	In-situ Reactive Zone
ISO	International Organization for Standardization
ITP	Inspection and Testing Plan

MMRP	Mitigation Monitoring and Reporting Program
NCR	nonconformance report
NHPA	National Historic Preservation Act
PA	Programmatic Agreement
PG&E	Pacific Gas and Electric Company
PMO	Program Management Office
psi	pounds per square inch
QA	quality assurance
QC	quality control
QSR	Quality Surveillance Report
RCA	root cause analysis
RFI	Request for Information
SHPO	State Historic Preservation Officer
USFWS	U.S. Fish and Wildlife Service

Definitions of Terms

The following definitions apply to this Construction Quality Assurance Project Plan:

- **Area of Potential Effects (APE):** The area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any are present. The APE for the Topock site is contained within what the Fort Mojave and other Native American Tribes have identified as a larger area of traditional and cultural importance.
- **Audit:** A documented activity performed in accordance with written procedures or checklists to verify, by examination and evaluation of objective evidence and performance-based activities, that applicable elements of the quality assurance (QA) program have been developed, documented, and effectively implemented in accordance with specified requirements.
- **Auditor:** An individual who performs any portion of an audit, including lead auditors, technical specialists, and others such as management representatives and auditors-in-training.
- **Corrective Action:** Actions taken to correct an identified nonconformance or deficiency and to prevent future recurrence.
- **Corrective Action Report:** The document in which the condition is identified, and corrective action and verification of completion are documented.
- **Deficiency:** Failure to develop, document, or effectively implement any applicable element of the QA program.
- **Design Change Request:** A document that is prepared when the scope of work is changed. Sources of change include the following:
  - **Internal**: Changes that do not result in a contract modification and therefore can be handled internally by Pacific Gas and Electric Company (PG&E). These may include design changes to improve functionality, reduce costs, or for use of standard materials; schedule changes for staff workload balancing, task sequencing, and work processes; increased level of effort resulting from unexpected additions to the level of work when executing a task; or quality deviations among PG&E and subcontractor organizations.
  - **External:** These may include Requests for Information (RFIs) or changes in resources; contractor-initiated changes relating to construction technique, value engineering, presumed error, or scope addition; PG&E-initiated changes such as scope addition, criteria change, construction technique, and value engineering; schedule changes; externally driven design changes to improve functionality, reduce costs, or for use of standard materials; missed scope; regulatory changes such as code revisions, regulatory changes, or permit conditions that can affect the project; field or construction changes as a result of a field issue, such as changed or unforeseen conditions, scheduling, local code change, or scope additions; PG&E direction resulting in a design change; and stakeholders' programmatic and/or technical requests.
- **Document Control:** Establishes the controls and defines the process for ensuring that documents are identified, prepared, reviewed, approved, revised, and made available for use. Document control, and any associated document management system, focuses primarily on gathering, organizing, and managing official project documents and records. After the records are turned over for document control, they are "controlled," meaning that they are in final form and are ready to be distributed.
- **Engineer of Record:** Engineer of Record is a registered professional who takes responsibility for the design and associated drawings and documents. The Engineer of Record may act in a supervisory or

oversight role, taking responsibility for the validity of work performed by other (nonregistered) members of the design team after suitable review and validation.

- **Federal Agencies:** In the context of the groundwater remedy, this refers to the U.S. Department of the Interior, Bureau of Land Management, U.S. Fish and Wildlife Service, and U.S. Bureau of Reclamation.
- **Groundwater Environmental Impact Report (EIR) Project Area:** The area within which remedial activities will be occurring that have the potential, directly or ultimately, to result in physical changes to the environment. The Groundwater EIR Project Area was delineated during the development of the Programmatic EIR and Addendum.
- **Hold Point:** See Witness Point.
- **Inspection:** Examination, by visual check or by measurement using monitoring devices, of executed work to ensure compliance with specified requirements.
- **Inspector:** Personnel performing inspection activities with the necessary expertise in the area to be inspected.
- **Internal Audits:** Audits of those portions of the organization's QA program retained under its direct control and within its organizational structure.
- **Nonconforming Product:** Nonconforming product includes the following:
  - Defective, damaged, or wrongly supplied material or equipment
  - Incorrectly stored equipment or material (stored in a way that might affect its quality)
  - Work activities executed incorporating material or installed equipment that has not been approved
  - Work activities found not to be in accordance with design requirements and /or not addressed within a reasonable time after inspection
  - Work activities found not to be in accordance with design requirements and that, if continued, will lead to a major defect requiring extensive remedial work
  - Damaged or incorrectly constructed or installed items
  - Work activities implemented based on drawings, method statements, and specifications that have not been checked and approved
- **Observation:** A statement of fact regarding the potential for a noncompliance that could lead to a more serious problem if not identified and/or corrected, but that does not constitute a lack of compliance with established requirements.
- **Official Record:** The complete and accurate evidence of a business action or business transaction. Records include documents, papers, reports, photographs, electronic transmissions, emails, databases, videos, CD-ROMs, machine-readable materials, and any other documentary materials, regardless of physical form or characteristics, that are created, received, or maintained in connection with business activities and serve as evidence of the company's functions, policies, decisions, procedures, obligations, and/or operations. Records may be originals or reproduced copies.
- **Oversight:** Overall process for monitoring and evaluating compliance of construction activities with regulations, industry standards, and management expectations, as well as reporting on the status and progress of a project. This includes the organizational freedom to identify problems, recommend and provide solutions, and verify implementation of the solution. Oversight provides independent evaluation to assess compliance with regulations, commitments, procedures, and management expectations; evaluates the performance of organizations and programs against industry standards; and assesses the effectiveness of procedures and programs.

- **Owner's Representative:** An Owner's Representative is either an employee of the company or a designated official representative of the Owner (e.g., architect, engineer, or contractor) to oversee a project.
- **Preventive Action:** Action taken to eliminate the cause of a potential nonconformance or deficiency.
- **Quality Assurance (QA):** Established elements and programs that provide the background to give adequate confidence that all quality requirements from the construction contract are satisfied. Many of these elements and programs are included as part of the project delivery process. The construction contractor is responsible for the construction work; the QA Officer assures quality of construction.
- **Quality Assurance Audit Finding:** A documented statement of fact concerning a noncompliance or deviation from established requirements.
- **Quality Control (QC):** A process implemented at the discipline and project level that includes those checks and reviews deemed most appropriate for a specific discipline and project. Its purpose is to subject each deliverable to rigorous scrutiny at the initial, intermediate, and final stages of development. QC is the responsibility of the person(s) actually performing the work.
- **Quality Plan:** A document specifying which procedures and associated resources should be applied by the responsible individuals at a specified time for the project.
- **Record:** A document stating results achieved or providing evidence of activities performed.
- **Request for Information (RFI):** A document generated by the contractor when a question or inconsistency arises with regard to the contract documents that requires input from the Design Engineer.
- **Root Cause:** The cause of an event which, if adequately addressed, will prevent a recurrence of that same event.
- **Site:** The geographic area necessary to implement the corrective action/remedial action, consistent with the requirements of the Corrective Action Consent Agreement and Consent Decree, respectively. This area is generally depicted on Figure 1-1 of this CQAPP.
- **Stop Work Order:** The order issued to the Construction Manager to stop further processing, delivery, installation, or operation until the nonconformance, deficiency, or unsatisfactory condition has been identified and addressed.
- **Surveillance:** Monitoring or observing an item, activity, task, or process, to verify that it conforms to specified requirements. This process includes the terms monitoring, observations, walkdowns, and source verification.
- **Testing:** Verification that certain material or executed work satisfies specified requirements through the use of specific equipment or methods that monitor the physical characteristics and/or chemical properties of a material or executed item.
- **Witness Point:** A point at which authorized personnel may witness a certain test or measurement. Subsequent work may proceed without authorized personnel being present. A witness point is a routine activity that is offered to observe the fabrication/construction process and to ensure that effective QC has taken place. At a witness point, QA may or may not comment on the test or measurement. QA may request additional activities or, if it has been agreed upon in advance, QA could stop the activity if it is not in accordance with the requisition requirements or to the satisfaction of the witness.

SECTION 1

Introduction

This section provides a brief project description and information regarding the Pacific Gas and Electric Company (PG&E) Topock Compressor Station groundwater remedy and current project schedule; cultural, historic, and biological resources; and key stakeholders. This section also provides an overview of the quality program and defines the objective and scope of this Construction Quality Assurance Project Plan (CQAPP). This information provides the framework within which this CQAPP was developed.

1.1 Project Description

PG&E is implementing a selected remedy for chromium contamination in groundwater at the PG&E Topock Compressor Station located in eastern San Bernardino County, California. The selected groundwater remedy addresses existing chromium contamination from past discharges of wastewater in the Former Percolation Bed (Solid Waste Management Unit [SWMU] 1]) and the area around the Former Percolation Bed within Bat Cave Wash (Area of Concern [AOC] 1) near the Compressor Station. The remedy also addresses groundwater within the East Ravine (AOC 10) and under the Compressor Station. Figure 1-1 presents the general remedy layout.

Remedial activities at the Topock site are being performed in conformance with the requirements of Resource Conservation and Recovery Act corrective action pursuant to a Corrective Action Consent Agreement (CACA) entered into by PG&E and the California Department of Toxic Substances Control (DTSC) in 1996 (DTSC 1996).

The 2005 Administrative Consent Agreement between PG&E and federal agencies (U.S. Department of the Interior [DOI], Bureau of Land Management [BLM], U.S. Fish and Wildlife Service [USFWS], and U.S. Bureau of Reclamation [BOR]), executed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), incorporated the CACA by reference and addressed requirements up to and including the Record of Decision, executed on January 20, 2011.

Most recently, PG&E and the United States executed a Remedial Design/Remedial Action Consent Decree (CD), on behalf of DOI, under CERCLA in 2012, which was approved by the U.S. District Court for the Central District of California in November 2013 (DOI 2013). This CD involves related requirements from the remedial design to the completion of the remedial action.

The CACA and CD specify requirements for development of a Construction Quality Plan, the elements of which are included in this document:

- **1996 CACA:** The agreement indicates a requirement that the Owner/Operator develop and implement a complete construction quality assurance (QA) program to ensure that the corrective measure will meet or exceed all design criteria, plans, and specifications.
- **2013 Remedial Design/Remedial Action CD:** This document states that PG&E must prepare a CQAPP as part of the pre-final/final design that will describe the QA approach during construction, including:
  - Construction QA objectives, specific quality control (QC) requirements, and performance standards to be followed during implementation of remedial actions
  - Identification of a QA official, independent of the construction contractor, to conduct a QA program during the construction phase of the project
  - Identification of responsibilities and authority of all organizations and key personnel involved in the design and construction of the site remediation
  - Description of the construction QA personnel qualifications

- Description of inspection activities, observations, and tests to be conducted, along with their schedules and scope

This CQAPP is required to be included in the *Construction/Remedial Action Work Plan for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California* (hereafter referred to as the Construction/Remedial Action Work Plan or C/RAWP) (CH2M HILL 2015).

1.1.1 Groundwater Remedy

The groundwater cleanup method selected by DTSC and DOI is known as in situ treatment with fresh water flushing. This in situ process starts by injection of a food-grade material (such as grain alcohol) into affected groundwater to stimulate the growth of naturally occurring bacteria within the soil. The growth cycle of the bacteria creates conditions that convert hexavalent chromium to trivalent chromium, a naturally abundant substance that is not harmful to humans, animals, or the environment. Once converted, trivalent chromium leaves the groundwater and becomes part of the surrounding soil. This cleanup technology is well proven and has been applied at numerous sites throughout the United States.

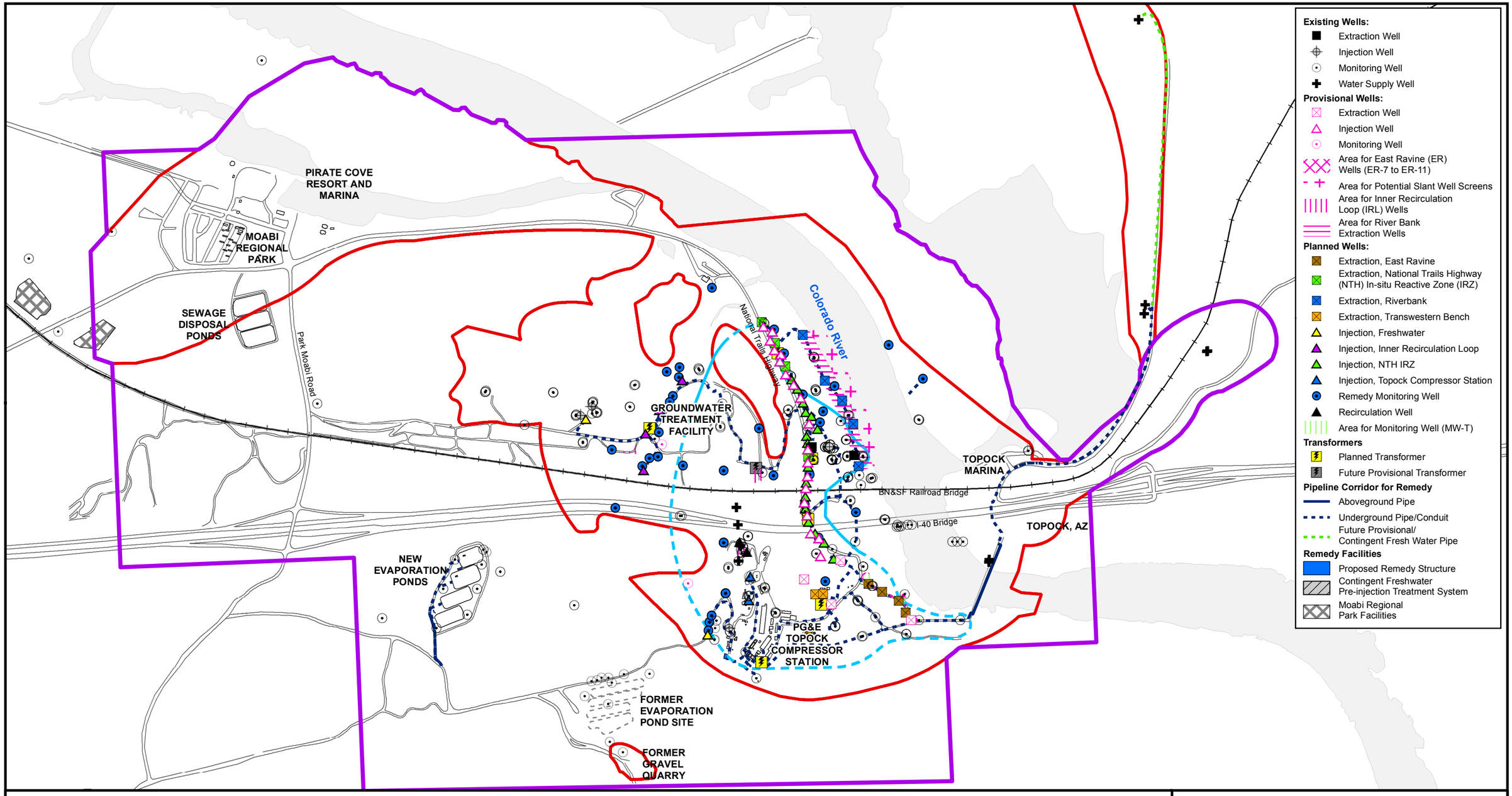
The groundwater remedy includes the following tasks:

- Construction of an In-situ Reactive Zone (IRZ) along National Trails Highway (NTH) using a line of wells that may be used as both injection and extraction wells to circulate groundwater and distribute an organic carbon source to promote bacteriological reduction of the hexavalent chromium to trivalent chromium.
- Flushing via a combination of fresh water injection and injection of carbon-amended water in wells upgradient of the plume.
- Extraction wells near the Colorado River to provide hydraulic capture of the plume, clean up the floodplain downgradient of the IRZ, and enhance the flow of contaminated groundwater through the IRZ line.
- Bedrock extraction wells in the eastern (downgradient) end of the East Ravine to provide hydraulic capture of contaminated groundwater in bedrock. Extracted water will be treated and managed using the same active treatment system that will be used to treat and manage contaminated groundwater extracted from the alluvial aquifer.
- Institutional controls to restrict surface land uses and prevent the use of groundwater.
- Monitored natural attenuation as a long-term component to address residual chromium that may remain in recalcitrant portions of the aquifer after enhanced in situ treatment and optimized system performance.

1.1.2 Cultural, Historic, and Biological Resources

The Topock site lies within a larger geographic area considered sacred by the Fort Mojave and other Native American tribes. Moreover, properties on and near the site are eligible for, or listed on, the National Register of Historic Places and include Native American cultural resources and elements of the historic built environment.

A large portion of the site and surrounding area is the Havasu National Wildlife Refuge. The USFWS and BOR *Lower Colorado River National Wildlife Refuges Comprehensive Management Plan* calls for protection of endangered and threatened species and the marsh and wetland habitat, as well as habitat for migratory, wintering, and nongame avian species (USFWS and BOR 1994). Portions of the Topock site also are located in a Riparian and Cultural Area of Critical Environmental Concern and the Topock-Needles Special Cultural Resource Management Area as defined in the BLM's Resource Management Plan (BLM 2007).



LEGEND

Area of Potential Effects (APE)

EIR Project Area

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

Notes:

1. The locations of pipelines and existing infrastructure are approximate. The figure is not intended to be a comprehensive depiction of all existing infrastructure in the APE.
2. Note that in compliance with EIR mitigation measure CUL-1a-9 as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Highway is located in an existing, previously disturbed, access road. In addition, the location of the road and the pipeline was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10 and PA and CHPMP mitigation measures.

N

0 375 750 1,500 Feet

FIGURE 1-1
GROUNDWATER REMEDY PROJECT AREA AND SYSTEM LAYOUT

CONSTRUCTION QUALITY
ASSURANCE PROJECT PLAN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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1.1.3 Public Participation and Key Stakeholders

Community outreach plans (DTSC 2013, and DOI 2012) provide the framework for informing and involving the stakeholder community in the Topock site cleanup process. These plans present the overall outreach strategy and describe the specific outreach activities that DTSC will implement through both formal and informal forums (e.g., public meetings, briefings, and site tours). Written documentation (e.g., reports, fact sheets, and public notices) and progress on cleanup are accessible through a variety of venues (e.g., information repositories, websites, site visits, and face-to-face meetings). These forums and mechanisms for communication as well as those described in the Communication Framework (see Section 2 of the C/RAWP) will be used, as appropriate, to provide status updates concerning the CQAPP and related actions executed during construction.

The key stakeholders include the following:

- **Federal Government:** Federal agencies include the DOI, BLM, BOR, USFWS, the Advisory Council on Historic Preservation (ACHP), and the U.S. Environmental Protection Agency (USEPA). DTSC and DOI coordinate their oversight activities in accordance with their Memorandum of Understanding (DOI and DTSC 2011). The federal agencies actively participate in the Consultative Working Group (CWG).
- **State and Local Governments:** The State of California and local governments, including the Regional Water Quality Control Board, Colorado River Basin Region, the Colorado River Board of California, and San Bernardino County, as well as the Metropolitan Water District of Southern California, have local resources that are affected or could be affected by former activities and the remedial project. DTSC also works closely with its counterpart in Arizona, the Arizona Department of Environmental Quality. Other State of Arizona and local governments, including Mohave County, are also key stakeholders. Additionally, both the California State Historic Preservation Officer (SHPO) and the Arizona SHPO are involved in the remedial project. Many of these agencies participate in the CWG.
- **Tribal Governments:** The following nine federally recognized Native American Tribes have ties to the area in which the groundwater remedy will be implemented: the Chemehuevi Indian Tribe, Cocopah Tribe of Arizona, Colorado River Indian Tribes, Fort Mojave Indian Tribe, Havasupai Indian Tribe, Hualapai Indian Tribe, Quechan Tribe of the Fort Yuma Indian Reservation, Twenty-Nine Palms Band of Mission Indians, and Yavapai-Prescott Tribe. The Fort Mojave Indian Tribe also owns a parcel of land in this area. The federal government has a trust responsibility to these tribes and has consulted with the tribes, including on a government-to-government basis, throughout the remedy process. The BLM also represents the federal agencies for purposes of consulting with the Tribes, pursuant to Section 106 of the National Historic Preservation Act (NHPA), and other federal laws and Executive Orders concerning potential adverse effects on cultural and historic properties that may result from the remedy.

Pursuant to the NHPA and its implementing regulations (36 Code of Federal Regulations 800), the BLM, the USFWS, the SHPOs of California and Arizona, the ACHP, and PG&E entered into a Programmatic Agreement (PA) for the project in 2010 (BLM 2010). The Hualapai Tribe signed the PA as an Invited Signatory on July 20, 2011. The BLM also completed and is implementing a Cultural and Historic Properties Management Plan, an overarching treatment plan for the project, on January 19, 2012.

As a state agency, DTSC respects the sovereignty of tribal governments and “has solicited comments from tribal members throughout the CEQA review and administrative decision-making process” for the project (DTSC 2011). During the California Environmental Quality Act (CEQA) process to study the project, six tribes “substantially participated in the various administrative processes surrounding remediation of the site with DTSC, PG&E, and DOI, including throughout development of the final remedy” (DTSC 2011). The Environmental Impact Report (EIR) defines these six Tribes as the “Interested Tribes,” which are “the Chemehuevi Indian Tribe, Cocopah Indian Tribe, Colorado River Indian Tribes, Fort Mojave Indian Tribe, Fort Yuma-Quechan Indian Tribe, and Hualapai Indian Tribe” (DTSC 2011). The term “Interested Tribes” is used

throughout the EIR and the mitigation measures required for the project through DTSC's adoption of the Mitigation Monitoring and Reporting Program (MMRP).

The MMRP includes mitigation measures intended to reduce the severity of the project's impacts, including the impacts on the Topock Cultural Area, which the EIR defines as the Topock Maze and "the area surrounding the Topock Maze" (DTSC 2011). One of the mitigation measures addressing potential impacts to the Topock Cultural Area requires that PG&E submit a Cultural Impact Mitigation Program (CIMP) as part of the final design of the project. PG&E completed the CIMP and submitted it to DTSC in May 2014 for DTSC's review and approval. DTSC is undertaking additional environmental review pursuant to CEQA to inform its decision on additional project approvals.

The Area of Potential Effects (APE) for the Topock site is contained within what the Fort Mojave Indian Tribe and other Native American Tribes have identified as a larger area of traditional and cultural importance. The Tribes believe that the environmental, cultural, and spiritual resources may not be physically perceptible. DTSC concluded that the 779.2-acre project site "appears to qualify as a historic resource under CEQA as an area that is significant in the social and cultural annals of California" (DTSC 2011). The BLM also has determined that a traditional cultural property or property of traditional religious and cultural significance that is eligible for listing on the National Register of Historic Places exists in the area of the Topock project, within the current APE, consisting of 1,600 acres of surface area and a section of the Colorado River.

1.2 Quality Program Overview

PG&E's approach to management of the quality of the groundwater remedy construction project includes a combination of QC performed by the contractor and QA performed by an independent party. This CQAPP details the systems and controls that PG&E has put in place to ensure that the quality of the project meets the requirements specified in the C/RAWP, drawings, specifications, and contract documents. PG&E provides definition and overall management of the quality approach to be followed by its contractors and consultants. The quality of the Topock remediation construction will be ensured through an integrated system of QA and QC. The QA Manager is responsible for the day-to-day coordination of QA and QC measures in the field.

This CQAPP is included as an appendix to the Construction/Remedial Action Work Plan and was developed in accordance with the 1996 CACA (Attachment 6, Section E.4) and 2013 Remedial Design/Remedial Action CD (DTSC Case 5:13-cv-00074-VAP-OP, Document 5-1, Section VI (13b) and VIII and Section 2.25 of Appendix C). The scope is limited to the construction activities outlined in the C/RAWP. The CQAPP establishes the following:

- Project procedures and general responsibilities for the QA/QC program
- Protocols to ensure that the Topock groundwater remedy construction is executed in accordance with the relevant portions of the C/RAWP and contract documents, which include drawings, specifications, and other defined requirements

The contractors are responsible for constructing and controlling the quality of their work as specified in contract documentation (e.g., contract, drawings, and specifications). The contractor's QC is the systematic implementation of a program of inspections, tests, and production controls to attain the required standards of quality and to avoid problems resulting from noncompliance. Each contractor will establish an independent QC program and write a Contractor Quality Control Plan (CQCP). The CQCP must provide for tests and inspections pursuant to various technical specifications. It will define procedures to ensure that activities affecting quality are documented and accomplished in accordance with contract documents, written instructions, and industry standards, codes, and procedures. Furthermore, the CQCP defines the methods for ensuring that all activities will meet specified requirements. The CQCP will be reviewed by the Topock Project Manager, PG&E Construction Manager, the Site Operations Manager, and the Engineer of Record before being approved by the QA Manager.

Independently of the contractors, the QA Manager provides QA through periodic monitoring and scheduled inspections to verify the effectiveness of the contractor's QC program and ensure that the quality and contract requirements are met by the contractors.[1] The QA Manager ensures that the contractor's QC is working effectively and that the resultant construction complies with the quality requirements established by the contract.

Based on the CACA and CD requirements, the objectives of this CQAPP are to provide the following:

- Description of a complete and effective plan for ensuring that the groundwater remediation system is constructed to meet the specified standards (i.e., design criteria, plans, and specifications)
- Identification of construction QA objectives, specific QC requirements, and performance standards to be followed during implementation of remedial actions
- Description of a QA official (QA Manager), independent of the construction contractor, to oversee a QA program during the construction phase of the project
- Description of the QA/QC responsibilities and the authority of organizations and key personnel involved in the design and construction of the site remediation
- Description of the QA position qualifications
- Description of inspection activities, observations, and tests to be conducted, along with their schedules and scope.

1.3 CQAPP Organization

To address the topics noted in Section 1.2, this CQAPP is organized as follows:

- **Section 1, Introduction:** This section includes a brief review of the project history, remedy, project schedule, areas of interest and concern, and key stakeholders. It also defines the objective and scope of this CQAPP.
- **Section 2, Construction Quality Organization:** This section presents the construction quality organization and the roles, responsibilities, qualifications, and authority of key personnel.
- **Section 3, Plan for Quality:** The plan for quality addresses submittals, change control, document control, procurement and purchasing, testing and inspection plans, and stakeholder, regulatory, and mitigation measure requirements.
- **Section 4, Inspection and Verification:** This section presents the requirements for inspections during construction to address material handling, the four-phase inspection process, and measuring and testing equipment and audits.
- **Section 5, Deficiencies and Corrective Action:** This section presents the procedures for identifying, controlling, and resolving deficiencies and nonconformances, as well as the process for managing corrective and preventive actions.
- **Section 6, Continuous Improvement:** This section addresses continuous improvement, which includes a spectrum of strategies such as conduct of trend analyses, root cause analyses, and lessons learned.
- **Section 7, References:** This section presents the bibliographic references to key documents cited in this CQAPP.

[1] The groundwater remedy may include multiple contractors (and subcontractors) to support construction. This CQAPP uses the terms "contractor" and "construction contractor," both of which are interchangeable in the context of this quality document. Quality requirements and standards will apply to all contractors supporting the construction of this groundwater remedy.

- Appendices:
  - **Appendix A, Third Party Testing and Inspection by Quality Assurance:** This appendix is a preliminary list of third party testing methods and inspection frequencies for the groundwater remedy construction.
  - **Appendix B, Construction Quality Control Requirements:** This appendix outlines potential requirements for the construction contractor.
  - **Appendix C, Sample QA and QC Forms:** These forms are included as examples of what forms might be used during construction.

SECTION 2

Project Quality Organization

This section presents the responsibilities and authority of organizations and key personnel involved in the construction, the structure of the quality organization, the minimum training and experience of the quality personnel, and the training to be provided to these personnel.

2.1 Responsibilities and Authority of Key Organizations

The organizations involved in the construction phase of the groundwater remedy and their QA/QC roles and responsibilities are summarized in Sections 2.1.1, 2.1.2, and 2.1.3.

2.1.1 California Department of Toxic Substances Control

DTSC is the lead state agency overseeing corrective action for the groundwater remedy in accordance with the CACA. DTSC will be reviewing and approving the C/RAWP and this CQAPP, and will oversee, review, and verify that the remedy is constructed in accordance with the final design, performance standards (e.g., applicable or relevant and appropriate requirements [ARARs] and CEQA mitigation measures), and related QA/QC requirements.

2.1.2 Federal Agencies

The DOI is the lead federal agency overseeing response actions for land under its jurisdiction, custody, or control near the Compressor Station pursuant to CERCLA. In July 2005, PG&E and the federal agencies (DOI, BLM, USFWS, and BOR) entered into an Administrative Consent Agreement (DOI 2005). In addition, PG&E and the United States executed a Remedial Design/Remedial Action Consent Decree, on behalf of DOI, under CERCLA in 2012, which was approved by the U.S. District Court for the Central District of California in November 2013. These federal agencies will review the C/RAWP and this CQAPP, and DOI will approve these documents on behalf of the bureaus. Additionally, the federal agencies will oversee, review, and verify that the remedy is constructed in accordance with the final design, performance standards (including ARARS), and related QA/QC requirements.

2.1.3 Pacific Gas and Electric Company

As the "Owner," PG&E is responsible for the overall design, implementation, and closeout of the remedial action in accordance with the 1996 CACA and 2013 Remedial Design/Remedial Action CD, and for ensuring that its contractors and subcontractors perform the remedial action construction in accordance with these requirements. PG&E is also responsible for formal communications with and submittals to DTSC and DOI. DTSC and DOI are responsible for formal communications and submittals with the Tribes and other stakeholders, as required.

The PG&E Chromium Program Management Office (PMO) has been established by PG&E to implement PG&E's chromium remediation program, including construction of the Topock groundwater remedy. Although the specific contracting approach for this project has not been developed, the PMO will select the remedial action contractors for construction and startup of the groundwater remedy in conformance with PG&E purchasing and procurement requirements, and considering factors such as: cost; qualifications; ability to meet PG&E requirements for health and safety, and insurance; as well as the ability to support PG&E's efforts in sustainability and compliance. The PMO is responsible for verifying that the construction contractor it has retained effectively implements and manages the systems detailed in the final design.

PG&E has established a Construction Steering Committee to efficiently coordinate operations and engineering factors and ensure quality and compliance with regulations during the construction of the remedy. The Construction Steering Committee will be engaged in day-to-day construction activities and will report to the PG&E Construction Manager. The Construction Steering Committee consists of both PG&E as

well as contractor personnel. The Construction Steering Committee will provide oversight and guidance, as independently verified by the QA organization, to the construction contractor.

The key PG&E personnel overseeing the groundwater remedy construction include the Chromium Remediation Director, PMO, Topock Project Manager, PG&E Construction Manager, QA Manager, and Site Operations Manager. The key contractor personnel are the Engineer of Record, Construction Manager, Quality and Compliance Manager, and QA Manager. Each of these individuals has specific QA and/or QC roles, responsibilities, and authority that are further delineated in Section 2.3. As noted above, PG&E retains ultimate accountability for project success. If PG&E designates the PMO or another entity to represent its interests for certain areas of this remedy, this document will be updated to indicate related responsibilities, as appropriate.

2.2 Construction and Quality Organizational Structure

The quality functions of the project organizations are functionally integrated although contractually separate. Figure 2-1 shows the functional structure of the project quality team. Section 2.4 (QA/QC Personnel Requirements) provides details on the required qualifications for QA and QC personnel.

2.3 Responsibilities and Authority of Key Personnel

Key personnel involved in the construction of the groundwater remedy and their QA/QC roles and responsibilities are described in Sections 2.3.1 and 2.3.2.

The current PG&E organizational structure and related assignments represents the current concept for groundwater remedy construction. PG&E retains the right to reorganize and/or assign other parties to certain roles to ensure project success. Given that personnel assignments are subject to change during construction, the Topock Project Manager will maintain a staffing list of CQAPP personnel assignments, including each person's role and responsibilities.

2.3.1 Owner's Personnel

This section outlines the key roles and responsibilities of PG&E's personnel on the remedy construction with an emphasis on QA.

2.3.1.1 Chromium Remediation Director

The Chromium Remediation Director has leadership responsibilities for the entire remedial action, including this construction phase. As a lead corporate official, this individual manages the team in planning and executing business programs and works with PG&E's corporate contracts, finance, legal, and public relations personnel to ensure program success. The Chromium Remediation Director has the following responsibilities:

- Approve program management standards and methodologies to achieve program goals
- Perform business contract negotiations with the stakeholders, as needed
- Ensure that program deliverables meet quality standards and project requirements

2.3.1.2 Topock Project Manager

The Topock Project Manager develops the C/RAWP with the team and manages the team's performance on project tasks. The Topock Project Manager secures acceptance and approval of deliverables from the stakeholders. He or she is responsible for communication, including status reporting, risk management, and escalation of issues that cannot be resolved within the team. The Topock Project Manager also serves as review and approval authority if the construction project potentially affects long-term regulatory compliance of the remedy or acceptance by external stakeholders. In general, the Topock Project Manager serves as the primary point of contact between the Topock groundwater remedy construction project and other facets of the Topock project.

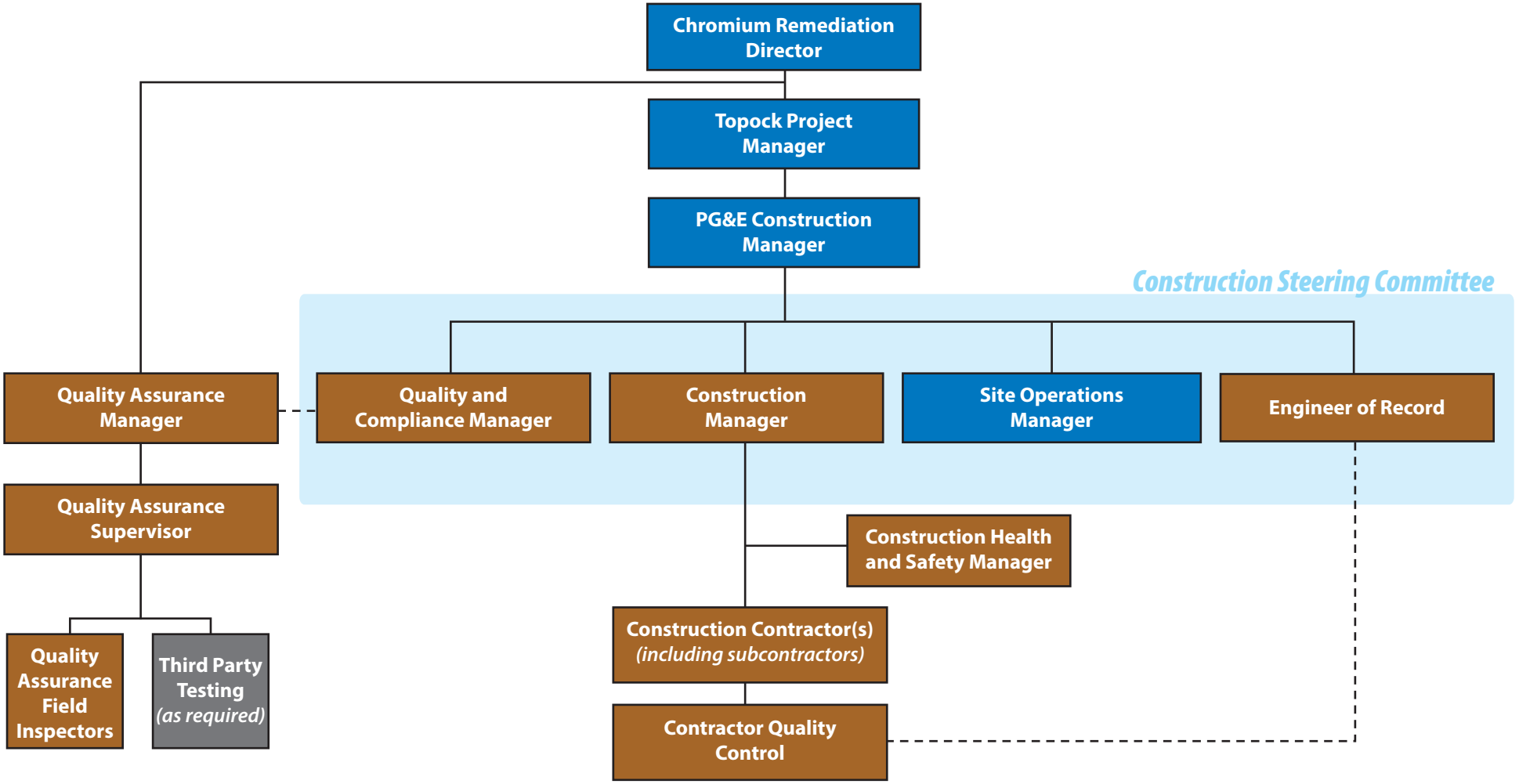

FIGURE 2-1
TOPOCK REMEDIAL ACTION PROJECT ORGANIZATION
GROUNDWATER REMEDY CONSTRUCTION QUALITY ASSURANCE PROJECT PLAN
PG&E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

The Topock Project Manager has oversight of the PG&E Construction Manager. The Topock Project Manager has the following responsibilities:

- Review/approve the technical and schedule components of the remedy construction as they relate to broader project issues
- Lead coordination efforts with external stakeholders
- Ensure implementation of rigorous risk identification and mitigation process on an ongoing basis and convey information effectively to internal management
- Monitor and support continuous improvement of the remedy construction

2.3.1.3 PG&E Construction Manager

The PG&E Construction Manager (or designee)[2] is the primary point of contact for the Owner on all construction activities and management issues. The PG&E Construction Manager is responsible for the overall management of activities related to the construction program, including the implementation of the C/RAWP, elements of this CQAPP, and the health and safety program. The PG&E Construction Manager holds project meetings and reviews/approves updates to the construction schedule. The PG&E Construction Manager has the following responsibilities:

- Manage, monitor, and report on the progress of the remedy construction
- Identify and manage technical, financial, safety, and schedule risks
- Work with the Topock Project Manager to secure the acceptance and approval of deliverables from the stakeholders
- Provide PG&E's review and approval authority for arbitrating nonconformances and construction claims
- Host meetings with the team, stakeholders, and PG&E management, as required

The PG&E Construction Manager works with the assigned Quality/Compliance Manager and Engineer of Record to confirm that all QA and QC aspects of this program are completed and that any nonconformances, either by PG&E or contractor personnel, are mitigated or corrected promptly.

2.3.1.4 Site Operations Manager

The Site Operations Manager is responsible for the overall onsite operations of the Topock remediation project. As a member of the Construction Steering Committee, the Site Operations Manager is the primary point of contact for field activities related to the construction project. The Site Operations Manager holds onsite meetings, coordinates site operations, and provides review for contractor submittals in coordination with the Construction Manager. The Site Operations Manager has the following responsibilities:

- Work with the Topock Project Manager to coordinate with external stakeholders
- Serve as primary onsite point of contact for external stakeholders
- Identify and manage technical, safety, and schedule risks
- Review and provide input to nonconformances and process claims
- Host daily, weekly, and monthly meetings with the team, stakeholders, and PG&E management, as required
- Participate in QC inspections during the performance of work

[2] The PG&E Construction Manager may designate a representative of the team to take actions or make a decision. Throughout this document where the PG&E Construction Manager is mentioned, the designee may be responsible as directed.

2.3.2 Contractor Personnel — Construction Steering Committee and Construction Contractor's Quality Control Personnel

This section outlines the key roles and responsibilities of contractor personnel who will serve as members of the Construction Steering Committee or are associated with construction contractor QC.

2.3.2.1 Engineer of Record

The Engineer of Record is an independent, duly qualified, licensed design professional firm retained by PG&E, and has responsible charge for engineering design of the groundwater remedy. During construction, the Engineer of Record has the following responsibilities:

- Work with the QA Manager to develop construction QC requirements such that the construction QC program adequately documents compliance of constructed work with the project specifications.
- Review construction QC conformance testing results to confirm compliance with the project specifications.
- Work with the Construction Manager and Site Operations Manager to coordinate collection of field design/technical data.
- Evaluate data collected in the field during construction against project design intent and, in coordination with PG&E and the Construction Manager, issue revisions to the project design as needed.
- Perform technical evaluation as required to respond to contractor Requests for Information.
- Review/approve contractor submittals as identified in the project specifications.
- Approve all parts and materials used in the project, including reviewing/approving proposed substitutions.
- Review construction variance requests that are pertinent to the engineering design of the project, and provide recommendation to the Construction Manager.
- Evaluate contractor non-conformance documentation pertinent to the engineering design of the project, and recommend response to the Construction Manager.
- Develop built system operational acceptance criteria, develop acceptance testing procedures, participate in system acceptance testing, review acceptance testing data, and provide recommendation of system acceptance to PG&E. If system acceptance testing results do not meet acceptance criteria, work with PG&E Construction Manager, Construction Manager, and QA Manager to develop corrective measures.

This definition includes subcontractors to the Engineer of Record. The Engineer of Record is a member of the Construction Steering Committee. Together with the Construction Manager, the Engineer of Record reviews contractor QC records to ensure that the groundwater remedy is constructed in accordance with the design plans and specifications. In addition, the Engineer of Record will review and approve the CQCP.

2.3.2.2 Construction Manager

The Construction Manager is responsible for the overall management of construction activities, including health and safety, and is a member of the Construction Steering Committee. The Construction Manager has the following responsibilities:

- Coordinate the day-to-day construction operations of the project, including sequencing and QC for all required construction tasks.
- Work with the PG&E Construction Manager to identify potential technical, compliance, or contractual issues that require Owner review and/or approval.
- Coordinate the flow of technical/design data collected during construction to the Engineer of Record.

- Work with the Engineer of Record to review and approve construction QC conformance testing results for adherence to the contract and other legal documents.
- Coordinate with the Quality and Compliance Manager to ensure adherence to the CQAPP and compliance with project requirements.
- Work to ensure that information, data, and/or activities requested by the QA Organization are fulfilled in a timely and coordinate manner.
- Manage and update the construction schedule.
- Identify and manage safety, and schedule risks.
- Work with the Construction Health and Safety Manager to ensure adherence to safety standards.
- Work with the Quality and Compliance Manager to ensure adherence to the CQAPP.
- Schedule and oversee construction QC inspections during the performance of work.
- Coordinate and lead the submittal, review, and response to project submittals and requests for information (RFIs).
- Hold meetings on plans and related actions.
- Prepare documentation and verification of constructed work.
- Review construction variance requests and construction claims, and provide the PG&E Construction Manager with recommended response.
- Provide documentation of contractor non-conformance.
- Provide input on lessons learned.

2.3.2.3 Quality and Compliance Manager

The Quality and Compliance Manager is responsible for overall compliance and quality, and working with QA to ensure implementation of the CQAPP. The Quality and Compliance Manager is a member of the Construction Steering Committee and is responsible for managing environmental compliance during construction and preparation of ARAR and mitigation measure compliance reports.

2.3.2.4 Construction Contractor(s)

Construction contractor(s), including subcontractors, are retained by the Owner to provide the labor, materials, and equipment required for remedy construction in accordance with the contract requirements. The construction contractor(s) and subcontractors are responsible for the QC of constructed work products as well as the necessary inspections and tests required to ensure that the work complies with the contract documents. The contractors exercise oversight and authority over their workforce, including QC personnel and related QC support services, and are independent of PG&E's QA organization.

2.3.2.5 Contractor Quality Control

The contractor(s) and subcontractors are required to submit their own Contractor Quality Control Plans that include an organization chart to show all QC personnel and how these personnel integrate with other management, production, and construction functions and personnel. All QC staff members are subject to acceptance by the Construction Manager. The requirements for the QC organization include a QC Manager and a sufficient number of additional qualified personnel to ensure contract compliance. The contractor must provide a QC organization that is represented on the site at all times during progress of the work and with authority to ensure compliance with the contract. Note that the contractor's QC organization is independent of the contractor's construction/production organization.

The contractor's CQCP will reflect a QC Manager as a full-time employee or subcontractor of the contractor and who has responsibility for construction QC. This individual will have full authority to institute actions

necessary for the successful implementation of the QC program to ensure compliance with the contract plans and technical specifications. The QC Manager reports directly to a responsible officer of the construction contractor.

The contractor's CQCP will also identify contractor QC Inspectors who will inspect materials, construction, plant, and equipment for conformance with the technical specifications, and who will perform QC tests as required by the technical specifications. Contractor QC Inspectors will be engineers, engineering technicians, or experienced craftsmen with qualifications in the appropriate field and as specified in Section 2.4 of this CQAPP.

2.3.2.6 Construction Health and Safety Manager

The Construction Health and Safety Manager is independent of the construction contractors and subcontractors and is responsible for construction health and safety. The Construction Health and Safety Manager reports to the Construction Manager. While each contractor and subcontractor is responsible for his or her own personnel, the Construction Health and Safety Manager reviews contractors, plans and performs independent safety reviews, and provides recommendations to the Construction Manager for hazard reduction and interactions among multiple parties and contractors.

2.3.3 Contractor Personnel - Quality Assurance

This section outlines the key roles and responsibilities of personnel overseeing the Quality Assurance program.

2.3.3.1 QA Manager

The QA Manager's overall responsibility is to monitor and verify the implementation of this CQAPP. Authority has been delegated to the QA Manager to identify and record quality problems via surveillance or a full audit. The QA Manager also performs periodic audits of the adequacy and implementation of the quality program based on articulated design and performance standards as documented in the Final Remedial Design and C/RAWP.

In addition to the QA role on this process, the QA Manager manages the team to verify all QC actions, including the four-phase inspection and testing process; implementation of controls for equipment and materials delivered to the site and their proper storage, and identification prior to their incorporation into project construction activities; verification that the products or fabricated items manufactured or constructed offsite by contractors, subcontractors, or suppliers comply with contract requirements; oversight of third-party testing services; verification (together with the Construction Manager) that the contractors/subcontractors submit related QC plans and implement these plans fully; and preparation and filing of QC documentation (e.g., logs, reports, and checklists).

The QA Manager has the following responsibilities:

- Implement this CQAPP during the construction phase of the groundwater remedy
- Verify contractor work products, QC testing, and services in collaboration with the Construction Manager
- Interface with the project personnel and contractors regarding the quality system and QA activities
- Plan, schedule, and perform project performance reviews as needed (e.g., audits and surveillances) to confirm acceptability of work
- Confirm compliance with quality performance criteria and performance improvement processes
- Provide reports to project and senior management on the project's quality performance
- Provide ongoing training on QA procedures to the team
- Develop skills, assess performance, and drive continuous improvement

- Initiate corrective actions to address internal audit findings
- Verify that QC activities are documented (i.e., field logbook, daily QC reports, and photographs)

This QA program is based on the concept that work performance is a process that can be planned, performed, assessed, and improved. The QA Manager is responsible for these ongoing activities. Because all work is accomplished using the resources of people, equipment, and procedures, the QA Manager is responsible for fostering an attitude of support and for encouraging personnel to perform high-quality work. Onsite personnel are encouraged to identify noncompliant work or areas for improvement. The QA Manager is responsible for identifying PG&E's needs and expectations (both internal and external). Meeting these needs and expectations is a measure of quality and success. Achieving quality is the responsibility of those who perform the work.

2.3.3.2 QA Supervisor

The QA Supervisor reports to the QA Manager and oversees the QA Field Inspectors' work. This individual supports the planning, scheduling, and review of related work products (e.g., audits and surveillances) on behalf of the QA Manager. He or she also will ensure follow-through on corrective actions and verify that all QA documentation is prepared and archived.

2.3.3.3 QA Field Inspectors

The Field Inspectors report to the QA Supervisor by conducting surveillances and inspections. These individuals will monitor the activities of the contractors, ensuring that contractors comply with the plans and specifications, applicable building codes, good workmanship, and the QC requirements of the contract. As part of this construction process, Field Inspectors have the following responsibilities:

- Verify that quality requirements are in compliance with products and services provided.
- Assist in QA audits of internal and external organizations. Audits will be performed to ensure that personnel are conforming to this CQAPP and related documentation and requirements. External organizations, such as the construction contractors, will be subject to audits to verify conformance to quality documentation such as the CQCP.
- Identify and report quality issues or trends in the assigned area or product based on data from a variety of sources.
- Recommend and/or verify implementation of appropriate corrective action for quality issues in coordination with program management, engineering, purchasing, construction management, and others.
- Review documentation related to product quality in the assigned area, such as quality manuals and procedures, technical deliverables, test procedures and operation sheets, purchase orders, and subcontracts.
- Provide support to management as directed for quality activities relating to internal or external organizations (customers, suppliers, subcontractors, and others).
- Perform other functions associated with this position as appropriate and directed by management.

The QA Field Inspectors must be alert to detecting, recording, and reporting any deviation from the contract documents. These individuals must keep accurate and detailed records of the contractor's performance and progress, delivery of materials, and other pertinent matters, including the inspection report.

2.3.3.4 Third Party Testing Personnel

The purpose of third party observation and documentation is to provide detailed written and photographic records of installation and placement of materials used during the construction process. An accurate and reliable observation inventory record contributes to the overall quality and success of this remedial action construction. This documentation can be particularly helpful when underground or hidden elements of

construction come into question, especially when verification testing or observation would require costly and destructive demolition and replacement work.

A preliminary list of third party testing methods and inspection frequencies is provided in Appendix A. These services will be planned and executed under the direction of the QA Manager, who will ensure that the companies providing third party testing have neither participated nor been involved in the design, procurement, purchasing, construction, or installation actions.

2.4 QA/QC Personnel Requirements

Table 2-1 specifies the typical qualifications for personnel involved in QA and/or QC activities during the remedial action construction phase.

TABLE 2-1
Typical Qualifications for QA/QC Personnel on the Topock Groundwater Remedy Construction

Position	Typical Qualifications
Quality Assurance (QA) Personnel	
QA Manager	• 4-year degree in engineering or related field and/or 5 years of related work experience in QA. • Preferred (not required): Lead Auditor certification (ISO 9001 or equal) or ASQ Certification (Construction Manager CMQ/OE, CQA, or CQE). Other related certifications may include Building Inspector, Nuclear Quality Assurance Level 1 (nuclear auditor), nondestructive testing (ASNT), Welding Inspector (AWS), and DOT. • Knowledge of industry quality systems and standards (e.g., ISO 9000, ASME, ANSI, ASTM). • Proficiency in the use of computers and software packages related to field. • Ability to communicate clearly and interface effectively with a diverse group of professionals.
QA Field Inspectors	• 4-year degree in engineering and/or related field (or equivalent experience) and 2 to 4 years of related work experience in the field of QA. • 5 years of related experience on a similar engineering/construction project. • Knowledge of industry quality systems and standards such as ISO 9001, ASME, ANSI, and ASTM. • Knowledge of QA/QC work practices and processes. • Preferred (not required): ASQ Certification (Construction Manager CMQ/OE, CQA, or CQE). • Proficiency in the use of computers and software packages related to field. • Ability to communicate clearly and interface effectively with a diverse group of professionals.
Quality Control (QC) Personnel	
QC Manager	• High school/trade school or additional education plus 10 years of related experience, or high school plus 7 years QC related experience with 2 years as QC Inspector and previous supervisory experience. • Preferred (not required): Associate's degree or 4-year degree (Bachelor of Arts or science). • Proficiency in use of computers and software packages related to field. • Ability to communicate clearly and interface effectively with a diverse group of professionals.
QC Inspectors	• High school/trade school plus 4 years of construction-related experience or 1 year as QC Inspector. • Preferred (not required): Associate's degree plus 1 year of construction-related experience or bachelor's degree (any discipline; engineering, physical science, mathematics, or QA). • Ability to communicate clearly and interface effectively with a diverse group of professionals.

Notes:

ANSI	American National Standards Institute	AWS	American Welding Society
ASME	American Society of Mechanical Engineers	CMQ/OE	Certified Manager of Quality/Organizational Excellence
ASNT	American Society for Nondestructive Testing	CQA	Certified Quality Auditor
ASQ	American Society for Quality	CQE	Certified Quality Engineer
ASTM	ASTM International (formerly American Society for Testing and Materials)	DOT	U.S. Department of Transportation
		ISO	International Organization for Standardization

2.5 Competence, Awareness, and Training

PG&E recognizes the need to maintain a high-quality, well-trained, and competent construction management and inspection team. PG&E personnel will receive ongoing training to maintain and improve their technical skills and level of competence to perform the work in their assigned roles. PG&E managers and staff are required to regularly review and assess training needs to maintain efficiency in existing job functions and to provide additional skills, knowledge, or competence required to adequately adapt to changes in technology, methods, or job functions.

Prior to the start of a project, the Chromium Remediation Director and the Topock Project Manager will assess the project-specific staffing needs and implement training, as necessary. The typical qualifications for construction and QA/QC positions on this project are described in Section 2.4 (QA/QC Personnel Requirements) of this CQAPP.

Project team members will be selected based on their qualifications, including education, licenses, certifications, training, experience, and capabilities to perform the specific tasks needed. Specific training will be provided to all personnel prior to starting a new job assignment within the project. Project staff are required to become familiar with and knowledgeable about the project specifications, drawings, addenda, RFIs (and subsequent responses), design clarifications, shop drawings, submittals, and contract change orders to ensure that the groundwater remedy is constructed in accordance with the latest project documents. Records of qualifications, training, indoctrination, briefings, and project-specific training are documented and maintained.

SECTION 3

Plan for Quality

This section describes the plan for QA and addresses QA/QC personnel requirements, submittals, change control, document control plans, procurement and purchasing, testing and inspection, and regulatory and mitigation measures to be applied during construction. Appendix B contains a summary of the minimum QC requirements for the construction contractor, which is to be used as a reference to fulfill project requirements. The objectives of the Topock Construction QA program are to 1) verify the implementation and effectiveness of the contractor's QC program, 2) ensure that the constructed work products comply with the quality requirement established in the contract documents, 3) ensure that changes to the approved CQAPP are communicated to the contractors, and 4) establish and maintain quality records that verify conformance to contract requirements and the CQAPP.

3.1 Introduction

This QA program is based on the concept that work performance is a process that can be planned, performed, assessed, and improved. The QA Manager implements and maintains this CQAPP throughout the course of the project. PG&E management ensures that the processes outlined in this plan are implemented in order to meet project requirements, and that the integrity of the quality management system is maintained when changes to the CQAPP are planned and implemented. Changes in the project scope or organization structure, and lessons learned from implementation of the CQAPP, are monitored and discussed by team members.

When a revision to the CQAPP is deemed necessary by the QA Manager, needed CQAPP changes will be planned, controlled, and approved by the QA Manager to ensure that the integrity of the CQAPP is maintained. Responsible and relevant members of the team and support personnel, including relevant contractors, subcontractors, and subconsultants, will be informed of the changes in details to ensure conformance to the CQAPP. At a minimum, the following individuals or a designee will receive a copy of the revised, approved CQAPP:

- Topock Project Manager
- PG&E Construction Manager
- QA Field Supervisor
- QA Field Inspectors
- Construction Manager
- Site Operations Manager
- Engineer of Record
- DTSC Project Manager
- DOI Project Manager
- Contractor's Project Manager
- Subcontractor's Project Manager
- Subconsultant's Project Manager

3.2 Submittals

The Construction Manager administers and controls the processing of supplier/contractor submittals, as specified in the contract. After the submittal documents are reviewed for completeness, they are transmitted to the relevant project staff for review and verification for compliance with contract requirements. The submittal's disposition is noted on the submittal, which is signed, dated and returned to the contractor. If required, the contractor revises the submittal by incorporating the comments and

resubmits the document for review and verification for compliance. The contractor must have a procedure for review and approval of submittals prior to submission. Submittals are maintained as project files.

3.2.1 Submittal Schedule

The contractor must submit and maintain a submittal schedule. The Construction Manager coordinates the review with the Engineer of Record and approves the submittal schedule. The schedule is initially submitted shortly after contract award and then periodically along with schedule updates. The Construction Manager works with the contractor to prioritize the sequence of submittals so that the most critical submittals are received and processed first. The submittal schedule becomes the baseline against which receipt of all required submittals is compared.

3.2.2 Submittal Process

Submittals are managed as follows:

1. Contractors number and certify the completeness of all submittals before submitting them to the Construction Manager.
2. Contractors must also complete submittal transmittal forms and submit paper copies, if specified, and one electronic copy of all required submittals to the Construction Manager's document manager (the submittal transmittal form must always accompany each submittal package to and from the contractor, the Construction Manager, and the Engineer of Record).
3. Upon receiving the submittal, the Construction Manager logs the submittal and provides a review to ascertain whether the package is complete. If the submittal is incomplete, it is returned to the contractor.
4. The original submittal transmittal and all copied attachments are logged into the document tracking system. The Construction Manager then forwards the submittal to the appropriate reviewers.
5. If the Construction Manager provides a submittal to the Engineer of Record for review, the firm will review it for general conformance with contract design documents, coordinate concurrent discipline reviews within the design team, coordinate concurrent reviews by Owner and other entities, and consolidate responses into a single coordinated action.
6. After reviewing the submittal, the Engineer of Record (or other designated reviewer) makes the appropriate notations and action taken on the submitted documents and returns the submittal to the Construction Manager.
7. The Construction Manager returns a minimum of one copy of the submittal to the contractor with an original stamp of the action required.
8. The six actions that may be taken for each submittal are as follows:
    - Approved: Submittal meets the contract requirements. No additional copies are required of the contractor.
    - Approved As Noted: Submittal meets contract requirements with minor corrections noted. Resubmittal is not required. Contractor must incorporate the required corrections into the work in the field. No additional copies are required of the contractor.
    - Revise and Resubmit: Submittal has some areas that do not meet requirements. These areas are revised to meet requirements, and the entire submittal must be resubmitted for review and approval. No work may begin in the field until the revised submittal has been approved.
    - Rejected: Submittal is inadequate and does not meet contract requirements. The complete submittal must be revised and resubmitted for approval. No work may begin in the field until the revised submittal has been approved.

- For Information Only: Submitted for information only. No response action is required.
- Received, No Action Taken: Receipt of submittal is noted; no further action is required.

9. When a submittal is to be revised and resubmitted, the contractor revises the submittal and indicates this revision by incrementing the revision number. The contractor's submittal process is then repeated.

The Construction Manager is responsible for tracking the submittal package during the entire review process and advising all concerned of any schedule impacts to ensure that the review process takes place within the required timeframe. The Construction Manager retains copies of all submittal documents and revisions, and ensures that an accurate file is available for ready retrieval during the life of the project. The Construction Manager maintains all submittal files. These submittals are filed in numeric sequence. Each submittal file must contain a complete submittal copy of the submittal before and after the review process.

3.3 Change Control

Design changes may be either internal or external. Internal changes may or may not result in a contract modification and are managed by PG&E. External changes represent a wide spectrum of changes (e.g., requests for information or changes in resources, contractor-initiated changes relating to construction technique, missed scope, regulatory changes such as code revisions, and field or construction changes as a result of a field issue).

If an agency such as DTSC or DOI requests a change, a formal request will be submitted to the Chromium Remediation Director or Topock Project Manager. This request will be reviewed by the Topock Project Manager, PG&E Construction Manager, Site Operations Manager, Construction Manager, QA Manager, and Engineer of Record. Upon review, a formal response will be provided to the requesting agency and all stakeholders, and related documents, drawings, or contracts will be updated and included in the record files.

All changes or potential changes to the technical design, drawings, and specifications must be identified and documented, whether they originated internally or were requested externally from the government, stakeholders, or other outside influencers. Changes are reviewed, verified, and validated, as appropriate, and approved by the Engineer of Record (or designee) prior to implementation. Change to the contract documents shall be reviewed and approved by the PG&E Construction Manager but any revisions to contract documents that affect the design elements shall also be reviewed and approved by the Engineer of Record. The Engineer of Record shall maintain a specification and drawings revision log and send the approved changes to the QA Manager for an evaluation of potentially new source inspections or other QA oversight checks. The review of design changes includes an evaluation of the effect of the changes on interfacing disciplines and products/services already delivered. Records of the results of the review of changes and any necessary actions are maintained as project records.

3.3.1 Contractor/Subcontractor Oversight

The construction contractor (or subcontractor) cannot make unauthorized changes or operate outside of its contract specifications. If the construction contractor has a question (or an inconsistency is identified) regarding the scope of work, this information will be documented in an RFI and forwarded to the Construction Manager for review. The RFI must be reviewed by a relevant subject matter expert who must approve, deny, or recommend another course of action. Appendix C includes a template form that may be used to support RFI documentation.

At a minimum, the RFI form must contain the following information:

- Identification of the originating organization
- Classification: Information, Clarification, Discrepancy, Other
- Description
- Contract or specification reference

- Proposed solution
- Cost impact (if any)
- Results of review/disposition
- Signature of review and approval authority

If QA staff members discover that the contractor is making unauthorized changes or is operating outside its contract, they should inform the contractor and recommend that the firms obtain proper authorization or request a change before proceeding. If the contractor is unresponsive, the QA staff must document the situation with their recommendations and send them to the Construction Manager. QA Field Inspectors or field engineers may submit written recommendations when they determine that a change to the construction contract drawings and/or specifications is necessary to complete the work or to conform to contract requirements. All written recommendations must be forwarded to the Construction Manager. No changes can be made unless they are authorized in writing by the Topock Construction Manager (or designee).

3.4 Document Control

Document control is the process of ensuring that documents are reviewed for adequacy, approved for release by authorized personnel, and distributed to and used at the location where the prescribed activity is performed. It is also a means of ensuring that personnel are using the most recent release of procedures, instructions, and plans in performing work functions. Document control applies to documentation distributed both internally and externally via hard copy or electronically, and it is essential to ensure consistent and technically defensible documents.

- A ***Document*** provides guidance and/or direction for performing work, making decisions, or rendering judgments that affect the quality of the products or services that customers receive. A *document* should be construed to mean any physical guide or direction, whether it be a written document, videotape, physical sample, sample drawing, computer program, or other medium.
- A ***Record*** proves that some type of required quality system action took place. Sometimes documents become records. For instance, Management Review Minutes become the record that a Management Review has taken place.

A document says “DO.”
A record says “DONE.”

Documents identified as part of the groundwater remedy construction will be controlled, including controlling/recording document approval, version, distribution, privilege, and archiving.

When a document (as described above) is developed or received for use in implementation of the project, a Document Control Form (DCF) will be completed and attached to the document (as appropriate for the nature of that document). A separate DCF will not be required if the document control information described below is included in the body of the form itself (e.g., the project submittal form will include this information in the submittal form itself and not require a DCF). Otherwise, any document that does not include a Document Control Form (DCF) will be treated as “draft” and not contractually enforceable.

All documents will need to include the following control information, either within the document or by an attached DCF:

- Approval: Record approval of the document, if required, by the required entity and date approved. Any document that provides direction under the terms of the construction contract requires signed approval, at a minimum, by the Construction Manager, and may require additional approval based on the nature of the document.
- Version: A revision log, including brief description of revision, date of revision, and approval for the revised version of the document.

- Distribution: To which entity(s) the document is being distributed.
- Privilege: Identify any restrictions to dissemination or communication of the document, including identifying Attorney-Client privilege.

Repository and Handling: Identify where the original document is to be stored (physically or electronically), and whether the document may be reproduced without prior approval. The project construction management team will include document control administration personnel who will be responsible for maintaining all project documents (as defined above), including processing all new documents to include a DCF(if required) and otherwise conform to project document control requirements, organizing and archiving project documents, and ensuring version control on all issued documents.

3.4.1 Construction Contractor Documentation

The construction subcontractor's QC documentation must cover all aspects of QC program activities, and it includes both daily inspection reports and daily test reports.

3.4.1.1 Daily Record Keeping

Project documents are managed through a combination of a secure document filing and storage system and a computerized document tracking system. Sufficient records must be prepared and maintained as work is performed to furnish documentary evidence of the quality of construction and laboratory analysis and of activities affecting quality. Each QC Inspector must maintain a daily log of all inspections performed for both contractor and subcontractor operations on a form acceptable to the Engineer of Record and Construction Manager. The daily inspection and daily test reports must be signed by the responsible QC Inspector and the QC Manager. The Construction Manager, Engineer of Record, and Site Operations Manager must be provided at least one copy of each daily inspection and test report on the work day following the day of record.

3.4.1.2 Daily Construction Report

Each contractor will be required to prepare a daily construction report. These reports will be submitted to the Construction Manager and Site Operations Manager, who will coordinate the required QC and QA as well as compliance review, compile, and issue externally. The report will include a summary of the contractor's daily construction activities. Supporting inspection data sheets are attached to the daily report, when needed. Example forms are provided in Appendix C. At a minimum, the daily construction report includes the following information:

- Date, project name, location, and other identification
- Description of weather conditions, including temperature, cloud cover, and precipitation
- Reports on meetings held and the results
- Record of visitors to the site
- Locations of construction underway during that day
- Equipment and personnel working in each activity, including subcontractors
- Descriptions of work being inspected
- Decisions made regarding approval of units of material or of work, and corrective actions to be taken
- Description of problems or delays and resolution
- Communications with contractor staff
- Construction activities completed or in progress
- Progress photos, where applicable
- Inspection and testing results (see Section 3.4.1.3)
- Signature of the report preparer

The construction reports are routed daily to the project QA/QC files and are maintained as part of the permanent project record. These reports are distributed to the appropriate parties within the team.

3.4.1.3 Inspection and Testing Forms

Report forms are completed for inspections and tests conducted. The forms vary by inspection or test type. Representative forms for several types of inspection and testing reports are included in Appendix C and include the following information:

- Description or title of the inspection activity
- Location of the inspection activity or location from which the sample was obtained
- Recorded observation or test data
- Results of the inspection activity
- Personnel involved in the inspection activity
- Signature of the inspector

3.4.1.4 Record Drawings

The original design drawings are marked up by the contractor as the project progresses to indicate as-built conditions. These are referred to as red-line drawings. If there is an Owner-approved change to a specified material, dimension, location, or other feature, the as-built drawing indicates the work performed. The contractor is responsible for ensuring that red-line record drawings are maintained daily throughout the construction process.

Upon completion of the as-built red-line drawings, the contractor submits the red-line markup drawings to the Construction Manager as a project submittal. The red-line markups are distributed to the Engineer of Record and Site Operations Manager for review. The Engineer of Record compiles review comments from the Site Operations Manager and Construction Manager, and provides submittal response as described in Section 3.2.2. Upon approval of red-line markups, the Engineer of Record develops and the final as-built drawings

3.4.2 Control of Quality Records

Quality records are maintained to demonstrate conformance to specified requirements and the effective operation of the quality system. Pertinent quality records from contractors and suppliers are an element of these data. Quality records must be legible and must be stored and retained for easy retrieval in a suitable environment to prevent damage, loss, or deterioration. The QA Manager establishes and maintains documented procedures for identification, collection, indexing, access, filing, storage, maintenance, and disposition of quality records. Retention times for quality records must be established and recorded. Quality records will be made available for evaluation by the relevant stakeholders. Records may be provided in either hard copy or electronic form. The records to be maintained must be listed. The maintenance of QA records must be a continuous process. Finally, the records management process must ensure compliance with contractual and statutory requirements.

Examples of records for this project include the following:

- Daily construction QA logs and records
- Inspection checklists and reports
- Surveillance reports
- Nonconformance reports (NCRs)
- Material receiving reports
- Monitoring and test data

The daily construction QA log will be used to record the daily events for QA. The daily Quality Surveillance Report (QSR) records will be maintained for material inspection and testing. Records that verify the conformance to applicable requirements are kept until completion of the project unless otherwise determined by the construction contract. All records are maintained (stored) so as to prevent deterioration. All records must be readily available for review by the relevant stakeholders. PG&E records are held in confidence, and no third party may access customer information without PG&E’s written authorization.

Pertinent quality records are retained to comply with governmental, contractual, or construction requirements, whichever is longer.

3.5 Construction Procurement and Purchasing Requirements

The Owner monitors and verifies, as necessary, that the contractor-purchased services or supplies conform to contract requirements. The degree of control over contractor-purchased supplies or services depends on how critical that purchased supply or service is for successful construction of the remedy, or the complexity of that supply or service, in the professional judgment of the Owner and/or Engineer. For example, the Owner or Engineer could specify a higher level of contractor procurement oversight and control for highly complex remedy well construction services compared to relatively straightforward procurement, such as temporary construction fencing.

The Owner evaluates and selects contractors based on their ability to supply products and/or services in accordance with the organization's requirements. Criteria for selection, evaluation, and re-evaluation are established and will be implemented for this groundwater remedy. Records of the results of evaluations and necessary actions arising from the evaluations will be documented and archived.

Contractors will apply their organizational protocols for obtaining products and services, as appropriate. PG&E may elect to review and assess these procedures to ensure conformance to contract requirements.

3.5.1 Purchasing Information

Subcontract information must describe the scope of work or products and or services to be purchased, including the following information, where appropriate:

- Requirements for approval of product, procedures, processes, and equipment
- Requirements for qualification of personnel
- Quality requirements

The Owner or its designee will ensure the adequacy of the specified scope of work or purchase requirements prior to the Owner's communication with the supplier. Each subcontract or purchase order must be reviewed for compliance with the project requirements (including the CQAPP requirements).

3.5.2 Verification of Purchased Product

The Owner's QA program establishes and implements the inspection or other activities necessary for ensuring that supplier or subcontractor products and services meet contract requirements. Where the Owner's QA staff intends to perform verification at the supplier's premises, the organization must state the intended verification arrangements and method of product release in the purchasing information. The verification process is described below.

3.5.3 Review of Supplier/Subcontractor Submittals

The Construction Manager administers and controls the review of supplier documents. The documents are transmitted to the pertinent project staff for review and verification for compliance with the approved process, technical, inspection, and test requirements, as appropriate. The subcontractor/supplier is advised of the results of the review, including, when necessary, any actions necessary to obtain approval.

3.5.4 Supplier/Subcontractor Surveillance Process

When required, QA personnel must develop, review, and approve source inspection plans to monitor supplier/subcontractor activities. Source inspection plans may be required for (e.g.) internal surge suppressors, coating surfaces, and tanks. The need for source inspection will depend on the level of complexity and review of vendor submittals. When applicable, the plans must be included in the designated purchase requisitions. The program is based on the contract, contractor's proposal, and documents submitted by the supplier/subcontractor. It is keyed to the major milestones or critical stages in the design,

construction, or manufacturing sequence. The source inspection plan establishes the requirements for review of the supplier/subcontractor processes, procedures, and witness hold points for inspections and tests verifying product conformance, as-built information, packing, and authorization for shipment.

When specified by the source inspection plan, the inspector must verify, at the supplier's/subcontractor's location, that the item or process complies with the specified requirements. Personnel performing the inspections are responsible for documenting the inspection and for reporting the results to the QA Manager, Construction Manager, and others, as applicable. If deficiencies are found during the inspection process, the supplier's management is advised to provide corrective action to correct the deficiencies. The inspector is responsible for reporting the status of the open noncompliance.

3.5.5 Acceptance of Supplier/Subcontractor Items or Services

The supplier/subcontractor must furnish documentary evidence that the item or service conforms to the procurement or subcontract requirement. The Owner, or designee, will identify the method for accepting the item, system, software, or service at the time of receipt or final inspection. In addition, the receipt or final inspection performed and documented by the project staff must confirm the configuration identification, dimensional, physical, and other characteristics, including freedom from shipping or construction damage, and cleanliness. The method of acceptance is based on the certificate of conformance or objective evidence of compliance, source verification (inspection, surveillance, or audit), or post-installation testing.

SECTION 4

Inspection and Verification Activities

This section addresses the contractor quality control, verification, and acceptance testing plans and testing for implementing each technical specification applicable to the contractor's contract requirements. The plans cover the type, test standard, frequency, control requirements, and assigned responsibility for inspections and tests. The Construction Manager and QA Manager review and approve these plans as part of the CQCP submittals.

Ongoing QA monitoring and oversight of contractor QC inspections and testing is performed by the Site Operations Manager, Construction Manager, and/or QA Manager. In this manner, the inspections and tests required to measure compliance with the relevant portions of the groundwater remedy are established and carried out.

4.1 General Construction Inspection and Verification Requirements

Contractors must perform the inspections and tests as prescribed in the technical specifications for the PG&E Topock Groundwater Remedy. QA inspection and testing is used to verify the adequacy and effectiveness of the contractor QC program. The QA inspection and testing frequency will be at the discretion of the QA Manager based on results of QC tests, evaluation of daily reports, audits of the QC program, and verification testing conducted by the Owner's third-party testing firm. If information becomes available that indicates a potential problem, the QA Manager will review in detail all pertinent information and order additional verification testing, if necessary.

The construction inspections are keyed to the schedule for tracking and are performed by the construction staff when the construction reaches the inspection points. The QA Manager will work with the construction contractor to ensure that required inspections and tests are witnessed by QA field technicians or other assigned personnel.

4.1.1 Inspection and Testing Plan

An Inspection and Testing Plan (ITP) is tied to the construction schedule, following the order of the specification technical sections, indicating what inspections and tests will be performed, the names of persons responsible for the inspection and testing of each segment of work, and the time schedule and frequency for each inspection and test.

The ITP consists of a list of definable features of work (DFOWs) with required inspections, tests, acceptance criteria, required documentation, and other controls to provide objective evidence of conformance for each item to stated specifications. A DFOW is a task that is separate from other tasks and has distinct controls and requirements. The DFOW will be agreed upon with the Construction Manager prior to the start of work. A sample list of DFOWs is shown in Table 4-1. This is not intended to be a complete list; the requirements for each project can vary. This list is provided for illustration only.

The ITP is prepared by the construction contractor and submitted to the Construction Manager and QA Manager for approval prior to the start of work. At a minimum, the ITP must contain the following information:

- Qualification (e.g., certification level) of test personnel
- Acceptance criteria with reference to relevant construction specifications
- Reference to the inspection or test procedure used

- Frequency of inspection or test (e.g., equipment installation inspection according to the contract requirements, witnessing field testing, and inspection of systems [architectural, civil, structural, mechanical, and electrical])
- Verification of material traceability (e.g., verify that installed equipment and materials are labeled and identified according to the contract plans and specifications)
- Format to be used for reporting the results (e.g., daily report, process checklist, or inspection reports)
- Mandatory hold and/or witness points

TABLE 4-1
Examples of Definable Features of Work

1	Earthwork (grading, excavation, compaction, and backfill)
2	Subgrade Concrete (footings and foundations)
3	Structural (slab on grade, fabricated steel, tank erection, and welding)
4	Architectural (wall construction and finishes, paintings and coatings, and roof coverings)
5	Plumbing (domestic piping, drain-waste-vent, and natural gas supply piping)
6	Electrical (conduit cable trays, distribution systems, and protection systems)
7	Mechanical and Piping (equipment installation, pumps, valves, compressors, piping assemblies, heating equipment, cooling equipment, and ductwork)
8	Controls and Instrumentation (installation and commissioning)

The contractor should review the *Quality Assurance Project Plan* (CH2M HILL 2012), environmental requirements, and cultural requirements for additional items that may have to be included in the ITP, as shown in Table 4-2. Related requirements will be documented in the contractor's documents and specifications.

TABLE 4-2
Example of Inspection and Testing Plan

Item	Definable Feature of Work (DFOW)	Inspection/ Test Type	Acceptance Criteria	Spec. Ref.	Frequency	Report Form	Code/ Standard	Hold/ Witness Point
1	Excavate for Foundation	Backfill Materials	”1.5-inch sieve, 80 to 100 passing a 1-inch sieve and 0 to 5% passing in #8 sieve	02200-2.1.c	Per Foundation	Geotechnical Field Report	ASTM	No
2	Excavate for Foundation	Earthwork	Moisture density 2% to 4%	02200-1.4.c	Per Foundation	Geotechnical Field Report	ASTM	No
3	Excavate for Foundation	Earthwork/ Compaction	Pack @ 95% of proctor	02325-3.4.E	Per Foundation	Geotechnical Field Report	ASTM/ACI	No
4	Foundation Concrete Pour	Concrete/Rebar	Size and placement	03301-2.1	Per Foundation	4-Step Report	ASTM/ACI	Yes
5	Foundation Concrete Pour	Concrete	3,000 psi	03301-3.1B	Every Truck	Geotechnical Lab Report	ASTM/ACI	No
6	Foundation Concrete Pour	Concrete	Slump not to exceed 3 inches	03301-3.6E	Every Truck	Geotechnical Field Report	ASTM/ACI	No
7	Equipment Installation	Visual Inspection	Certificate of conformance	13121.1.1	Per Each Delivery	4-Step Report	ASTM	Yes

TABLE 4-2
Example of Inspection and Testing Plan

Item	Definable Feature of Work (DFOW)	Inspection/ Test Type	Acceptance Criteria	Spec. Ref.	Frequency	Report Form	Code/ Standard	Hold/ Witness Point
8	Equipment Installation	Visual Inspection	Shelter lifting and placement	13121.1.3	Per Installation	4-Step Report	ASTM	Yes
9	Electronic Installation	Grounding and Bonding	Testing	16060-1a	Per Installation	4-Step Report	ASTM	Yes
10	Electronic Installation	Wires and Cables	Installation	16120.6.b	Per Installation	4-Step Report	ASTM	Yes
11	Electronic Installation	Wires and Cables	Testing	16120.8.0	Per Installation	4-Step Report	ASTM	Yes
12	Site Restoration	Grassing by Seeding	Placement	02920.3.1	Per Installation	4-Step Report	ASTM	Yes

Notes:
ACI = American Concrete Institute
ASTM = ASTM International (formerly American Society for Testing and Materials)
psi = pounds per square inch

4.1.2 QC Testing

As required by the contract specifications, the contractor must establish a test program to ensure that required testing is properly identified, planned, documented, and performed under controlled and suitable environmental conditions, including cleanliness. Testing must be performed in accordance with written test procedures in the CQCP. Such test procedures must incorporate or reference the requirements contained in the contract technical specifications, codes, and industry standards. Per the CQCP, the contractor must submit the test procedures to the Construction Manager, the Engineer of Record, and the QA Manager for review and acceptance prior to their implementation.

The contractor is responsible for establishing a system of daily test reports that will record all QC test results. Test results from each day's work period must be submitted to the QA Manager prior to the start of the next day's work period. When required by the technical specifications, the contractor will maintain statistical QC charts. The contractor's responsible technician and the QC Manager must sign the daily test reports. The QA Supervisor and/or QA Manager review the test results daily and identify any nonconforming test results for discussion with the Engineer of Record. After receiving the Engineer of Record's recommendation on response, the QA Manager or QA Supervisor and Construction Manager will initiate discussion with the contractor regarding potential corrective action.

4.1.3 QA Testing

The QA Manager is responsible for the QA materials sampling and testing program. QA testing is provided for the verification of the adequacy and effectiveness of the contractor's QC testing. QA testing is performed by the QA Manager/QA field technicians and is independent of, and in addition to, QC testing performed by contractors.

QA testing may be performed on a pre-established schedule or as directed by the QA Manager. QA testing is performed by, or under the supervision of, the QA staff to validate the contractor's QC sampling and testing. Such testing may be performed by third-party testing services. The typical test frequency is one QA test for every 10 to 15 of the construction contractor's QC tests. More frequent testing may be necessary during startup to verify that the process is under control and that it complies with the technical specifications of the construction contracts. In lieu of performing independent tests, the QA Manager may choose to witness QC testing or conduct tests on split samples from QC testing. When QA and QC test results do not compare or

have wide variances, additional testing may be needed to validate the results. Additional tests to be performed by QA field technicians or the third-party testing services will be at the direction of the QA Manager. The need for QA testing is based on the following considerations:

- The item's criticality to the function of a system and its reliability.
- Quality checks have to be performed for fabrication sequences not available for inspection at completion.
- Deficiencies are discovered.

QA testing must be performed in accordance with the following protocols:

- The QA Manager develops a weekly quality test and inspection schedule using the construction activity forecast as a guide. The schedule must identify the QA test activities and the hold points.
- The weekly quality test schedule is distributed to the Site Operations Manager, Construction Manager, Engineer of Record and QA Supervisor.
- The contractor is given a one-day advance notice of impending hold points. The QA Manager reviews QA tests and maintains files for all field QA documentation.

4.1.4 Material Handling Plan

Construction materials must be accepted by the QA Manager (or delegate) prior to incorporation into the project. Construction materials that are governed by specifications are subject to material acceptance requirements established herein (Sections 4.1.4 to 4.1.8). Appendix C includes a sample form to support material receiving and inspection.

The process documented in the CQCP by which materials are accepted for use and incorporation into the project is based on the following criteria:

- Source of supply approval.
- Material certification documentation provided by the material source that the delivered materials meet the contract specifications.
- Offsite inspections and construction QC sampling and testing in accordance with the CQCP.
- Visual inspection of materials, when required in the material frequency guide.
- After delivered materials are accepted by the QA Manager, or designee, the materials may be used for construction and incorporated into the project.

A certificate of compliance signed by the QC Manager and verified/approved by the QA Manager (or designee) indicating that all materials incorporated in the project conform to the contract requirements is submitted with the monthly pay request. All open nonconformances and nonconformance reports are noted as exclusions on the certificate of compliance. A final certificate of compliance is submitted at the completion of the project.

4.1.5 Source of Supply Approval

The contractor or subcontractor will submit to the Engineer of Record and QA Manager the sources of supply and item material types that will be used in the work in accordance with contract requirements.

For materials not initially identified or changes to the initial source provided, the source of supply must be provided sufficiently in advance of use to allow time for review and approval. Copies of documentation for all sources of supply must be provided as soon as known but must be provided to the Engineer of Record and QA Manager no less than 30 days (or another specified timeframe) prior to delivery to the site.

Sources of construction materials include manufacturers, fabricators, and/or suppliers of the materials. The QA Manager will approve select sources of supply for materials incorporated into project construction based on the recommendation of the Engineer of Record. Source approval will be based on contract requirements (including specification) and PG&E's list of qualified manufacturers, producers, and fabricators. Source approval, if applied, will be documented. The source of the supply documentation is maintained by the QC Manager as a project quality record. In addition, all source-of-supply records are entered into the QA Manager's quality record database.

Other sources may be used, providing that materials meet specifications, as assured by inspection and QC measures performed at the manufacturer's fabrication site. Material substitutions must be submitted for review and approved prior to their use in the project.

4.1.6 Material Certification/Certificates of Conformance

Material certification is required to verify that delivered materials fulfill contract requirements. Material certification is documented from the source that the materials conform to contract specifications and the QA Manager's approved suppliers/vendors list. The material certification must be written on the source's letterhead and must be signed by an officer of the company. Material certification documentation must be maintained by the QC Manager as a project quality record and must be submitted no less than 24 hours prior to installation or use of the materials. Material certification documentation is maintained in the quality records database, which is assessable to personnel in the field office.

Substitution of specified materials cannot occur without prior approval by the Construction Manager, who will consult with the QA Manager and the Engineer of Record. Furthermore, if approval is obtained, the source of supply must be submitted for approval, and material certification is required. Failure to acquire prior substitution approval will result in the assignment of an NCR.

4.1.7 Offsite Inspection, Sampling, and Testing for Material Acceptance

Offsite inspection or QC sampling and testing are required for the acceptance of some construction materials prior to delivery to the site. The requirements for offsite inspections, sampling, and testing are based on the materials frequency guide and will be detailed in the specifications. Additional offsite sampling and testing are performed as deemed necessary by the QA Manager. Inspection, sampling, and testing documentation for material acceptance are maintained by the QA Manager as project quality records.

4.1.8 Material Receiving Inspection

A visual material field inspection will be performed when materials arrive on the project site. The inspector performing the inspection will complete a materials field inspection report (see Appendix C), which is approved and signed by the QC Manager or his designee. The inspection verifies the quantity, dimensions, and condition of the material, and determines that it conforms to specified requirements. These reports are maintained by the construction QA Manager as a project quality record. Material shortages are noted on the materials field inspection report and are tracked by the contractor's QC manager until the remaining items are received and accepted.

4.1.9 Material Control

Materials that are found to be nonconforming through receipt inspection or that lack the required documentation must be marked with a red tag to identify the acceptance status as "on hold." The initials of the material receiving inspector and the inspection date must be incorporated into the marking. The tag must be appropriate to withstand the anticipated weathering effects of the storage area.

Materials with red (on-hold) markings must not be incorporated into the work until the material acceptance issue(s) have been resolved and any applicable NCRs have been closed (Section 5.3 describes the NCR process). Only the PG&E Construction Manager or QA Manager can authorize the removal of the tag and release the material for use.

4.1.10 Compliance with Handling, Storage, Packaging, Preservation, and Delivery Requirements

Field inspectors inspect the construction contractor's activities to ensure technical compliance in identification, handling, storage, packaging, preservation, and delivery of materials, parts, assemblies, and end products. Related quality records and documents are maintained and controlled in accordance with the procedures provided in Section 3.5 of this CQAPP.

4.1.11 Material Identification and Traceability

QA Field Inspectors monitor the construction contractor to ensure that identification and traceability requirements are met. Products and materials must be traced from receipt through all project stages to installation. Documentation such as project control checklists, material receipts, material tracking forms, procedures, sample and test documentation, and reports ensure that the applicable material item traceability is maintained. Project specifications and/or procedures define product identification and traceability requirements, which generally include the following:

- Materials or equipment intended for use in construction are identified and segregated until inspection confirms that they conform to technical and quality requirements.
- Materials are traceable to documents attesting to their conformance with technical requirements that are stated in specifications or drawings. Testing of materials is also conducted as necessary to verify conformance with material specifications.

4.2 Four-Phase Inspections

The contractor must establish a program for inspection of activities affecting quality and must cover all construction activities, including both onsite and offsite operations. Inspections must be performed to verify compliance with documented instructions, drawings, procedures, and specifications as required by the contract. All inspections must be documented by the contractor as required by the project specifications.

A four-phase inspection must be completed for each DFOW. Appendix C includes a template that can be used to support documentation of this process. The four phases of inspection (preparatory, initial, follow-up, and final) are described in Sections 4.2.1 to 4.2.4.

4.2.1 Preparatory Inspection

The contractor performs preparatory inspections prior to beginning any work on a DFOW to verify that the necessary prerequisites are met and that the required resources are available and in place. This inspection is also used to establish the acceptable work processes and procedures that will be followed for each DFOW. The preparatory inspection includes the following tasks:

- Review safety, environmental, and cultural requirements
- Ensure that preparatory inspections include a review of contract requirements
- Ensure that all materials and equipment have been tested, submitted, and approved
- Ensure that provisions have been made to provide required testing
- Examine the work area to ascertain that all preliminary work has been completed
- Examine materials, equipment, and samples to ensure that they conform to approved shop drawings or submittal data, that all materials and equipment are on hand, and that all monitoring and measuring equipment is properly calibrated and in proper working condition

4.2.2 Initial Inspection

The contractor must conduct an initial inspection at the beginning of each DFOW when enough work has been accomplished to enable an examination of the quality of workmanship. This inspection verifies that the contractor has commenced the work according to the drawings and specifications. The initial inspection checklist must address the following areas:

- Review the control testing for compliance with contract requirements
- Examine the quality of workmanship
- Verify that defective or damaged materials have not been used
- Verify that materials have not been omitted and that dimensional requirements are met

4.2.3 Follow-up Inspection

The contractor performs follow-up inspections periodically during individual work activities to verify continued compliance with the approved drawings and specifications, including control testing, until the completion of the work. The follow-up inspection includes the following tasks:

- Ensure continuing compliance with contract requirements.
- Ensure continuing compliance with control testing until completion of a particular feature of work.
- Contractor QC records follow-up inspection in daily QC reports.
- The QA Manager's inspection staff records follow-up inspections in the daily inspection report.
- Conduct final follow-up inspections and correct test deficiencies prior to the addition of new features of work.

4.2.4 Final Inspection

The contractor, Site Operations Manager, Construction Manager, and QA Manager (or designee) perform a final inspection at the completion of work. This is the witness and hold point indicated in the ITP. The contractor cannot continue with the work until given approval by the Construction Manager. The final inspection includes the following tasks:

- Develop a punch list of items that do not conform to the approved plans and specifications to be included in the construction QC documentation
- Perform a second completion inspection after punch list items have been completed and the QA/QC Manager has been notified by the contractor
- Complete the inspection reports that identify inspections conducted, results of inspections, location and nature of defects found, causes for rejection, and remedial or corrective action taken or proposed

Additional QA inspections may include inspection of third-party lab testing facilities, fabrication facilities, and suppliers. Other inspections outside the four-phase program described in Sections 4.2.1 to 4.2.4 are ordered or performed by the QA Manager to verify compliance with building codes and standards. These inspections must be performed and conducted at various points of construction that would typically require code compliance inspections.

When deficiencies are discovered during the four-phase or other inspection processes, the QA Manager must consider a focused inspection. If a focused inspection determines that material, performed work, or installation is deficient or does not meet the project specifications, the QA Manager ensures that the deficiency is corrected and documented.

4.3 Measurement and Testing Equipment

This section provides the protocol for measuring and testing equipment to be used during the groundwater remedy construction.

4.3.1 Purpose and Scope

The contractor must establish a Measuring and Test Equipment Control Plan for the control of monitoring, measuring devices, and test equipment and assigns responsibilities within the process. The scope of this procedure includes monitoring, measuring, and test equipment used to render values that are the basis of conclusions or assumptions incorporated into work products.

4.3.2 Responsibilities

The contractor is responsible for ensuring that the appropriately calibrated equipment is provided and used for related testing at the groundwater remedy construction site. The contractor is responsible for completing calibration records for test equipment and submitting calibration to the QA Manager as described in the project specifications. The QA Manager is responsible for retaining appropriate records in the project contract files. The QA Manager or other responsible individual, depending on project practice, must retain calibration records and must clearly identify and segregate equipment that fails verification or calibration requirements.

Measuring and testing responsibilities are associated with both the Owner and the contractor (as documented in the CQCP). Both of these organizational leads are responsible for ensuring that the appropriately calibrated equipment is provided and used for related testing at the groundwater remedy construction site. These individuals (or designees) also are responsible for retaining appropriate records in the project contract files and retaining calibration records and must clearly identify and segregate equipment that fails verification or calibration requirements.

4.3.3 Equipment Identification and Calibration

All monitoring and measuring equipment must have a unique identification number. This number may be the serial number of the equipment, or it may be assigned by the owner of the equipment. This number must be permanently affixed to the equipment in such a manner that it cannot readily be removed under normal use.

The user is responsible for knowing and complying with the specific calibration requirements for any measuring device. If the worker is using rented equipment, the instrument must be provided with documentation of calibration (including an expiration date) and instructions for calibration. For measurements to be considered valid, monitoring and measuring equipment must be calibrated according to the following practices:

- Equipment must be calibrated or verified at scheduled intervals, or prior to use, against measurement standards traceable to international or national measurement standards. Where no such standard exists, the basis used for calibration or verification must be documented and filed either with the equipment or in the project contract files.
- Calibration history should be used, along with other data and information, to determine the calibration interval.

If equipment is calibrated by the Owner's team members or contractor personnel, calibration must be to a documented method, and the calibration must be certified to have been performed according to the documented method. The certification should include the following information:

- Unique instrument identifier (ID)
- Date of calibration
- Individuals performing the calibration

- Traceability to acceptable reference (national or international) standards
- Result of comparison to calibration acceptance criteria

In addition, the calibrated equipment must be handled as follows:

- Be adjusted or readjusted, then recalibrated as necessary
- Be safeguarded from adjustments that would invalidate the measurement result
- Be protected from damage and deterioration during handling, maintenance, and storage
- Have the frequency of calibration based on specifications, codes, and manufacturer's recommendations

Users of the monitoring and measuring equipment are responsible for verifying that the equipment is free from damage, deterioration, or other conditions that may affect its accuracy or functionality.

Records of the results of calibration and/or verification activities may be maintained by the user assigned the equipment or the responsible owner of the equipment. Users of the equipment must explicitly identify equipment used in developing a work product or service, and maintain calibration and/or verification records in the project contract files. A log is also kept in the project quality documentation files.

4.3.4 Removal of Equipment from Service

Monitoring and measuring equipment must be immediately removed from service if one or more of the following conditions exists:

- Equipment has never been calibrated.
- Equipment calibration date is past due.
- Equipment failed calibration criteria.
- Equipment failed in operation.
- Equipment readings are suspect or known to be outside designated limits.
- Equipment is physically damaged in a manner that would affect its function or accuracy.

Such equipment must be identified as being out of service.

The validity of previous measuring results should, as appropriate, be assessed when equipment is found not to conform to requirements. The appropriate action must be taken on the equipment and on the work product or work product constituent affected by the nonconforming equipment.

Monitoring and measuring equipment that fails to stay in calibration for a practical period will be withdrawn from service and either repaired or replaced.

4.4 Construction Audits

The QA Manager establishes an auditing system to verify the Owner's and contractor's implementation of and conformance to this CQAPP and contract technical specification requirements. The auditing system is used to determine the effectiveness of the QC system.

The audit must be planned, performed, and documented in accordance with written instructions, procedures, or checks. The audit scope, frequency, and methods must be defined prior to the audit. Audits must be performed by qualified and properly trained personnel who are familiar with the quality system and auditing procedures and techniques. The QA Manager will ensure the objectivity and impartiality of the audit process by selecting personnel not involved with or responsible for the work. Auditors cannot audit their own work. The auditing system must cover all the quality-affecting activities for both construction and laboratories and must be applicable to onsite and offsite locations, including all subcontractors.

The results of the audits must be documented and reported to the Topock Project Manager, PG&E Construction Manager, QA Manager, Site Operations Manager, and Construction Manager. All nonconforming conditions identified during the audit are classified by severity. Nonconformances classified

as Level 2 and above require corrective action and must be re-audited to verify that the actions taken by the appropriate organization were effective. Table 4-3 defines the severity levels.

TABLE 4-3
Severity Levels and Descriptions for Audit Nonconformance Findings

Level	Severity Level	Description
4	Significant	A classification assigned to an adverse condition that has a significant impact on the company's ability to meet objectives, is systemic in nature, and requires consideration by executive management. A Significant finding requires an investigation for cause determination and corrective action to correct the condition.
3	Moderate	A classification assigned to an adverse condition that has either a significant impact on the audited organization or implications for a broader segment of the company. A Moderate finding requires an investigation for cause determination and corrective action to correct the condition.
2	Minor	A classification assigned to an adverse condition that has a direct impact on the project. A Minor finding requires an investigation for cause determination and corrective action to correct the condition.
1	Recommendation	The documented identification of a condition that is not an adverse condition but, if left uncorrected, may lead to an adverse condition. Recommendations are documented in the audit report but do not require written responses.

4.4.1 Audit Process

This section details the audit process, including related planning, execution, and documentation. Appendix C includes a sample form to document audit findings and related recommendations.

4.4.1.1 Audit Frequency

Audits are scheduled based on risk and complexity of the activities and processes being implemented. As a guideline, one audit will be conducted by a qualified Lead Auditor each year for each definable feature of work. The following are examples of DFOWs listed in Table 4-1:

- Earthwork (grading, excavation, compaction, and backfill)
- Subgrade Concrete (footings and foundations)
- Structural (slab on grade, fabricated steel, tank erection, and welding)
- Architectural (wall construction and finishes, paintings and coatings, and roof coverings)
- Plumbing (domestic piping, drain-waste vent, and natural gas supply piping)
- Electrical (conduit cable trays, distribution systems, and protection systems)
- Mechanical and Piping (equipment installation, pumps, valves, compressors, piping assemblies, heating equipment, cooling equipment, and ductwork)
- Controls and Instrumentation (installation and commissioning)

Audits may be conducted more frequently based on risk and complexity. Audits may also incorporate several DFOWs into one audit. After construction contractors are selected and construction schedules identified, onsite and offsite (shop fabrication) audits can be determined and scheduled.

4.4.1.2 Auditor Selection

The QA Manager assigns the Lead Auditor and other auditors. The Lead Auditor and auditors must be qualified and/or trained in applicable quality practices and must be familiar with requirements and

specifications of the project. The audit team may include auditors and subject matter experts from other departments and projects, when necessary.

4.4.1.3 Audit Notification

Before an audit begins, the Lead Auditor will notify the organization to be audited in writing. The audit notification must include the audit plan. Advance notification ensures that QA personnel and project teams are aware of the prescribed time for the audit and enables maximum participation by office or project staff.

4.4.1.4 Audit Plan and Checklist

The Lead Auditor must specifically schedule the audit, establish the audit scope, prepare an audit plan, and conduct the examination of records and activities. The audit plan must include the following information:

- Scope of the audit
- Organization and work areas to be audited
- Location, time, and dates of duration of the audit
- Documents that specify the criteria against which the work will be measured
- Auditing personnel
- Checklist to evaluate quality system elements

The individual selected to perform audit activities cannot have been assigned any past or present direct responsibilities for performing the work being audited.

4.4.1.5 Audit Entrance Meeting

The audit entrance meeting must be held among the auditor(s), the manager responsible for the areas to be audited, and applicable members of the organization being audited to introduce personnel, arrange for access to personnel and documents, arrange for access to the facilities, and explain the scope of the audit.

4.4.1.6 Audit Execution

Using the checklist as a guide, the auditor performs the audit using a combination of interviews, examination of project documents and records, and observation of work in progress. The auditors have the flexibility to examine other areas if the course of the audit indicates that other areas might need investigation. Objective evidence is examined to the depth necessary to determine whether audit elements are being effectively implemented and documented. Objective evidence examined is described in the audit checklist for each element assessed. The checklist results provide a basis for generating the findings and observations.

Daily briefings may be held with the management of the organization/task being audited to inform them on the progress of the audit, concerns, and preliminary findings and to exchange views and gather information. Any adverse condition requiring prompt corrective action is reported immediately to the management of the audited organization.

4.4.1.7 Audit Closeout Meeting

After the audit, the Lead Auditor arranges for a closeout meeting with the responsible manager and the relevant project team members. At that time, the Lead Auditor discusses the audit results and confirms the findings identified and observations made during the audit.

4.4.1.8 Audit Report

The Lead Auditor prepares and approves the audit report within 15 business days of the post-audit conference. At a minimum, the audit reports must include the following information:

- Time, dates, and location of the audit
- Scope of the audit
- Identification of and justification for any differences between the audit plan and the actual conduct of the audit

- Synopsis of results of the audit
- Description of the findings and observations that were discovered during the audit and an indication of their severity level

The Lead Auditor issues and distributes the report to the manager of the areas audited, QA Manager, Site Operations Manager, Construction Manager, and contractor management, as appropriate.

4.4.1.9 Corrective Action

For each finding in the audit report, the Lead Auditor completes an audit finding form (Appendix C) and issues it to the responsible personnel at the audit closeout meeting. The responsible personnel acknowledge the finding and then work with the Lead Auditor to determine the cause and appropriate corrective action to prevent recurrence of the finding. The Lead Auditor reviews and approves the recommended corrective action and the due date for implementation proposed by the responsible personnel.

4.4.1.10 Audit Closeout

The Lead Auditor or QA Manager verifies closure of the finding in a timely manner by reviewing objective evidence of the corrective action taken and documenting the conclusions in the audit finding form.

The QA Manager may schedule a follow-up audit, specifically examining the subsequent corrective action taken to close out the prior findings. This follow-up audit can be performed at the next scheduled audit. The conduct of the follow-up audit is not likely to require a pre-audit conference or daily briefing. A post-audit conference with the relevant individuals may be conducted to discuss the effectiveness and extent of implementation of the corrective actions. Verification of closeout action must include verification of the effectiveness of the corrective action. This information must be documented in the closeout audit report issued to project management at the conclusion of the follow-up audit.

4.4.1.11 Audit Records

Audit records include the audit reports, audit findings, and record/verification of completion of corrective action, as appropriate to the type and scope of the audit.

4.5 Construction Surveillance

During the construction phase of the project, QA Field Inspectors perform routine planned and unplanned surveillances on the work in progress. Surveillance activities are detailed verification processes that can be performed any time between audits and can be used as a supplement to audits to further verify closure of audit findings. Surveillance findings can also be instrumental in preparing future project audits. Appendix C includes a sample report form to support daily quality surveillances.

Construction surveillance is used for the following:

- Identify systemic weaknesses in the construction, installation, and commissioning of subcontractor activities
- Provide a measurable program for monitoring quality activities through the use of quality metrics as a result of sampling plans
- Verify that inspection and testing activities are performed as defined by the contract requirements
- Provide early identification and root cause determinations of systemic quality weaknesses prior to the completion of nonconforming items or activities protocols
- Provide a systematic program for verifying that deliverables conform to specified project, PG&E, or regulatory requirements
- Provide metrics on key performance indicators to allow PG&E to objectively assess the level of quality being achieved during construction

- Provide an added level of assurance that fabrication and laboratory/test facilities and equipment are adequate for the performance of required activities

Surveillance activities are performed by discipline to provide confidence that the quality-related activities of the construction site or contractor are being performed to an acceptable level. This practice is performed randomly and is based on a sampling of the activities performed.

The QA Manager coordinates the scheduling of surveillance activities with the contractor responsible for the activities being surveyed.

4.5.1 Acceptance Sampling

The QA Manager determines the acceptable sampling size based on a specific lot size for each of the items surveyed. This sampling is used to determine acceptability of the items being constructed or fabricated. It is expected that defects found are corrected, even if the lot as a whole has been accepted.

Listed below are some of the items that will be surveyed by QA. The list is for example purposes only and may be modified as needed to meet the specific requirements of this project:

- Material Control and Traceability: Construction site control of materials are monitored via routine surveillance of materials activities, verification of materials by reviewing material certificates, and witnessing of material testing, where practical.
- Material Receipt and Storage: The construction site receiving practices are monitored to ensure that receipt of material is properly recorded and deficiencies are reported. The storage of materials is monitored to ensure that materials are stored in a manner that prevents damage and that they are segregated from other non-project materials. Special attention is directed to segregation of various grades of materials. Receipt of tagged items is monitored in the manner described above and is verified, assuring adequate protection against damage, corrosion, and ingress of dirt or water.
- Material Traceability: Materials are monitored daily as part of this surveillance program to ensure compliance with requirements. When required by the contract, the following items are also reviewed:
  - Structural steel and piping materials traceable to material certificates
  - Welding consumables traceable to test certificates
  - Cables traceable to a batch number and drum through the cable schedule and pulling slips
  - Tagged equipment traceable through registers, indexes, and record drawings
  - Structural and piping components, which are sampled to ensure that they can be traced from the fabrication drawings to the materials certificates
  - Control of off-cuts (drop material) is also monitored to maintain traceability to the material certificate
- Material Preservation: As the materials are turned over, construction site personnel are responsible for handling, storing, and preserving materials and equipment intended for the project. A spot check is conducted periodically to ensure that preservation records are up to date and that manufacturers' preservation requirements and frequencies are in compliance.
- Welding (Structural and Piping): The construction site welding activities are monitored through the verification of welder qualifications, welder history logs, welding monitoring, and verification of welding parameters. These activities are carried out on a random basis and documented on the QSR.
- Dimensional Control: Dimensional control activities relating to the construction site are monitored and verified through a series of report reviews and by witnessing the construction site personnel taking dimensional checks.

- Visual Examination: The quality of visual examination is verified by examining the materials and welds randomly, on a periodic basis, and in critical areas defined in the QSR. If the standard of acceptance is found to be lacking, corrective action is implemented and the action is verified to be effective. No further nondestructive evaluation/inspection is performed until visual acceptance is achieved.
- Surface Protection (coating, fire proofing, and wrapping): Construction site material and equipment surface protection activities are monitored and verified through daily surveillance and verification of the coating quality. These activities are carried out randomly as determined by and documented in the QSR.
- Electrical: The construction site installation, testing, and preservation of electrical systems is monitored and verified through onsite surveillance and verification. The qualifications, experience, and performance of the electrical construction site personnel are monitored.
- Piping: Piping activities are monitored and verified through witnessing of tests. These activities are carried out randomly as determined by and documented in the QSR.
- Mechanical Completion/Ready for Commissioning: The status of mechanical completion/ready for commissioning is reviewed periodically to ensure that it is being completed on an ongoing basis and that any outstanding work or punch list items, including those originating from the equipment suppliers, are cleared and signed off accordingly.
- Mechanical Equipment: The mechanical activities are monitored and verified through witnessing of tests. These activities are implemented randomly as determined by and documented in the QSR.
- Insulation: Construction site material and insulation activities are monitored and verified through daily surveillance and verification of the insulation quality. These activities are carried out randomly as determined by and documented in the QSR.

4.5.2 Quality Surveillance Reports

Results of surveillances are documented in QSRs. At a minimum, the QSR includes the following information:

- Time, date, and location of the surveillance
- Scope of the surveillance
- Items and services inspected, including associated specifications and requirements, and indication of whether or not they are in conformance
- Description of any deficiencies identified during the surveillance

For each deficiency identified in the QSR, an NCR is issued to the responsible organization and corrective action is required as described in Section 5.3. QSRs, NCRs, and evidence of corrective action taken are retained as project records.

4.6 Regulatory and Mitigative Best Management Practices

The Construction/Remedial Action Work Plan includes a Project Management Plan that documents PG&E's organizational structure and processes for the construction and startup of the groundwater remedy. The Project Management Plan includes PG&E's organizational processes to track, document, and communicate compliance with mitigation measures, ARARs, and other agreements. In addition, the C/RAWP includes a Site Management Plan that describes procedures and protocols for maintaining compliance with mitigation measures, ARARs, and other agreements. The Site Management Plan addresses waste management, best management practices, monitoring, and decontamination in terms of how these measures will be monitored, tracked, and documented during construction.

SECTION 5

Construction Deficiencies

This section provides procedures for tracking construction deficiencies (noncompliance) from identification through acceptable corrective action. It defines the controls and related responsibilities and authority for dealing with noncompliant products or services.

5.1 Deficiency Identification

A deficiency occurs when a material, performed work, or installation does not meet the plans or specifications for the project.

5.2 Contractor QC Deficiency Identification and Control

The contractor is responsible for QC of constructed work products as well as the necessary inspections and tests required to ensure that the work complies with the contract documents. When material, performed work, or installation is found deficient through the contractor's own QA/QC process and/or PG&E's QA process, the contractor must ensure that the nonconforming material, work, or installation is identified and controlled to prevent unintended use or delivery. The Construction Manager notifies the contractor of noncompliance with any of the foregoing requirements. The contractor must, after receipt of such notice, immediately take corrective action.

5.2.1 Minor Deficiencies

Minor deficiencies noted during testing or inspection are reported verbally to the contractor's representative and noted on the Daily Construction Report. Minor deficiencies are items that do not require significant rework or repair work to correct and will not result in significant deviations from the required quality standard if corrected immediately.

Control and disposition of such deficiencies are handled by the originator of the Daily Construction Report and the contractor's supervisor responsible for the work; they do not require formal action by the contractor's QC Manager or the Construction Manager. Ideally, such minor deficiencies can be corrected on the spot by agreement with the contractor's supervisor.

5.2.2 Nonconformances

Nonconformances are major deviations from the contract requirement or accepted standards of quality. Nonconformances must be formally documented for corrective action by the Construction Manager's field staff or by the third-party testing group. If the contractor fails to correct a minor deficiency within 5 days of notification, the deficiency will be designated as a nonconformance. Nonconformances must be formally documented (see sample NCR form in Appendix C).

The NCR must be distributed to the contractor, and the contractor must follow up on the NCR as required to verify that corrective action has been completed. The QA Manager, or designee, must verify and accept the corrected work by actual inspection.

5.3 Nonconformance Report

The NCR is a formal notification to the contractor that work does not meet the plans or the specifications for the project. If an item of work is found to be deficient (i.e., out of conformance with the construction drawings or specifications), the inspector documents it on the NCR as described in this section. NCRs are included on the nonconformance log and are tracked through verification that the nonconformance has been corrected.

The NCR process is as follows:

1. Project (contractor or QA) personnel identify and document the nonconforming product on an NCR (Appendix C). The initiator enters the relevant project information, subject, references, and a description of the nonconforming condition and indicates, when applicable, if the nonconforming product is tagged.
2. The NCR is then reviewed by the QA Manager, or designee, who validates the nonconformance and assigns project staff familiar with the product or service to prepare action to correct the nonconformance. The NCR is then issued to the contractor.
3. If necessary, the QA Manager, or designee, may request that a root cause analysis be performed along with corrective action necessary to address the cause of the nonconformance and prevent its recurrence.
4. After the NCR is validated, the nonconforming product may be tagged or segregated from conforming product, when practical, to preclude its inadvertent use.
5. The individual responsible for resolving the nonconformance completes the disposition portion of the NCR with the action necessary to resolve the nonconformance and includes a schedule date for completion. Typical disposition of product may involve one of the following processes:

   - Reject and return to the supplier or scrap
   - Repair
   - Rework/rewrite
   - Use as is

   NOTE: A nonconforming item waiting for repair or rework may be conditionally released if justified in writing and approved by the QA Manager or designee. Justification for conditional release is documented on the NCR. A HOLD tag may be attached to the material or item traceable to the NCR.
6. The QA Manager or designee, and Engineer of Record then reviews and approves the disposition and/or corrective action and tracks completion based on the schedule date.
7. The QA Manager or designee verifies the satisfactory completion of actions required for disposition of the NCR. The repair and rework material or item is re-inspected to demonstrate conformance to the requirements. The verifier is responsible for removing the tagging of the nonconforming product, if such tagging is used. The QA Manager ensures that NCRs are closed or reviews their status regularly with the project staff and documents justification for keeping them open past the due date.

Completed NCRs are retained as project records.

5.4 Contractor QC Deficiency Correction

When material, performed work, or installation is found to be deficient and/or does not meet the project specifications, the QA Manager ensures that the deficiency is corrected. The QA Manager or designee ensures that the nonconforming material, work, or installation is identified and controlled to prevent its unintended use or delivery. When practical, the construction contractor must tag and segregate nonconforming material from conforming material to preclude its inadvertent use. If segregation is impractical or impossible because of the physical characteristics of the item or for other reasons, the nonconformance tag must be displayed prominently to preclude inadvertent use.

The contractor is responsible for documenting the nonconformance in an NCR, as specified in Section 5.2.2. The construction contractor implements corrective actions to remedy work that is not in accordance with the drawings and specifications. The corrective actions include removal and replacement of deficient work using methods approved by the Construction Manager or designee. Removal must be performed in a manner that does not disturb work and that meets specified criteria; otherwise, the disturbed material must

also be removed and replaced. Replacement must be performed in accordance with the corresponding technical specifications. The replacement is subjected to the same scope of quality inspection and testing as the original work. If the replacement work is not in accordance with the drawings and specifications, the replacement work must be removed, replaced, re-inspected, and retested.

5.5 Preventive Actions

Preventive actions are taken to eliminate the cause of a potential nonconformance. For example, defects that appear on the surface of concrete during construction or within a relatively short time after completion are usually caused by poor quality materials, improper mix design, lack of proper placing and curing procedures, or poor workmanship. The contractor must take preventive actions as necessary to eliminate the causes of potential deficiencies in order to prevent their occurrence. The contractor's CQCP must include quality improvement practices to continually improve construction practices and address quality problems at their source. The Site Operations Manager, Construction Manager, and QA Manager monitor, inspect, and audit the processes used to prevent erroneous information or construction products from being passed to the Owner. The Construction Manager and QA Manager have the authority to implement, verify, and review the project's preventive and corrective action effectiveness. They are empowered to improve the project's work processes to eliminate the causes of potential nonconformances.

SECTION 6

Continuous Improvement

PG&E strives to continually improve the effectiveness of the quality management system through the use of the quality policy, quality objectives, audit results, analysis of data, corrective and preventive actions, and management review. This section presents the strategy and plan to improve the construction process.

6.1 Root Cause Analysis

When a major deficiency is documented, a root cause analysis (RCA) is performed to determine and solve the root causes of deficiencies as opposed to addressing the symptoms. The root cause investigation and reporting process has five distinctive phases to ensure that the fundamental cause of the noncompliance is eliminated rather than applying a quick fix that does not prevent a recurrence of the noncompliance. Management involvement and adequate allocation of resources are essential to successful execution of the following five root cause investigation and reporting phases:

- **Phase 1: Data Collection.** To ensure that data are not lost, it is important to define the problem and begin the data collection phase of the RCA immediately after the condition is identified. The following information is collected:
  - Circumstances before, during, and after the condition was discovered
  - Personnel involved and actions taken
  - Environmental factors
  - Other information having relevance to the condition identified
- **Phase 2: Assessment.** Any RCA method may be used that includes the following steps:
  - Analyze the problem, coordinating (if necessary) with departments or individuals to adequately assess the problem
  - Determine the significance and severity of the problem
  - Identify the causes immediately preceding and surrounding the condition
  - Identify the reasons that the condition in the preceding step existed and continue working back to the root cause (the fundamental cause that, if corrected, will prevent recurrence of this problem and similar occurrences throughout the facility)

  The identification of the root cause or causes is the stopping point in the assessment phase.
- **Phase 3: Corrective Action(s).** Implementing effective corrective action(s) for each root cause reduces the probability that a problem will recur, and it improves reliability and safety.
- **Phase 4: Inform.** Discuss and explain the results of the analysis, including corrective action(s), with management and personnel involved in the occurrence.
- **Phase 5: Follow-up.** Follow-up includes determining whether corrective action has been effective in resolving problems. An effectiveness review is essential to ensure that corrective action(s) have been implemented and are preventing recurrence.

6.2 Lessons Learned/Best Practices

In support of process improvement, the Owner's management team, led by the PG&E Construction Manager, will schedule senior-level meetings to review and assess plans and progress, document lessons learned, and conduct formal and informal audits of the construction process to measure the success of QA/QC plans and procedures. Documentation of lessons learned and best practices is imperative to PG&E's performance and to providing assurance to its stakeholders that the construction process has achieved its quality goals.

Knowledge management is a recommended implementation technique for PG&E. This is a systematic method used by employees to capture and share knowledge across the corporation and to optimize business processes and the quality of work products so that the team can benefit from the experience of others and improve performance.

Table 6-1 documents the methods to ensure continuous improvement throughout the life cycle of the remedy construction.

TABLE 6-1
Methods to Ensure Achievement of and Continuous Improvement of Quality Goals and Objectives during Remedy Construction

Method [1]	Owner's Responsible Personnel [2]
Data Analysis and Trending	PG&E Construction Manager and Topock Project Manager
Root Cause Analyses	PG&E Construction Manager and Topock Project Manager
Documentation of Lessons Learned	PG&E Construction Manager and Topock Project Manager
Audits	PG&E Construction Manager and Topock Project Manager
Management Reviews	Chromium Remediation Director, PG&E Construction Manager, and Topock Project Manager

Notes:

[1] Stakeholder reviews will be evaluated in support of continuous improvement in accordance with measures documented in the Construction/Remedial Action Work Plan.

[2] QA Manager, Construction Manager, and team member support the data tracking and analyses.

SECTION 7

References

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Appendix A
Third Party Testing and Inspection by Quality Assurance

TABLE A-1

Draft Third Party Testing and Inspection by Quality Assurance

100% Specification Reference	Page No.	Item of Work	Test Required	Method	Frequency	Draft Third Party Testing and Inspection by QA
03 30 00		Cast-in-place Concrete				
	24	Source QC	Inspection of batch plants, cement mills, and related suppliers by engineer			QA qualified - source inspection may apply based on local history in the area - submittal dependent from subcontractor.
03 40 00		Precast Concrete				
	7	Source QC	Strength test	ASTM C31	3 cylinders per 50 cy	
03 62 00		Nonshrink Grouting				
	5	Field QC	Flow cone, strength, segregation, and bleed tests	ASTM C1107/ C1107M	3 cubes per 25 cf of grout	
03 64 23		Crack Repair Epoxy Injection Grouting				QA qualified - Third Party Testing only if problems arise through normal use.
	4	Source QC	Pot life test		1 per batch	
	4	Source QC	Bond test	AASHTO T237	1 per batch	
	8	Field QC	Two-component ratio test		Not specified	
	8	Field QC	Injection pressure test		Not specified	
	8	Field QC	Crack injection tests	Visual and strength (compression)	3 cores per first 100 lf and 1 per 500 lf after	
05 05 23		Welding				QA Third Party Testing required - see below:
	3	Shop weld inspections	Visual testing		100%	QA Third Party visual inspection at 10% rate. Inspection rate could drop or increase based on results of inspections.
			QC of WPS and WPQ			
	5	Field weld inspections (applies to 05 21 19, 05 31 00, 05 41 00)	Visual testing		100%	QA Third Party visual inspection at 10% rate. Inspection rate could drop or increase based on results of inspections.
	5		QC of WPS and WPQ			
	5		Radiograph (CJP groove, butt joint welds)		10% random	QA Third Party testing at 1% rate.
	5		Ultrasonic (all other CJP groove welds)		10% random	QA Third Party testing at 1% rate.
	5		Liquid penetrant or magnetic particle (fillet welds and PJP groove welds)		50% random	QA Third Party visual inspection at 5% rate.

TABLE A-1

Draft Third Party Testing and Inspection by Quality Assurance

100% Specification Reference	Page No.	Item of Work	Test Required	Method	Frequency	Draft Third Party Testing and Inspection by QA
05 12 00		Structural Steel Framing				QA Third Party Testing Required - see below:
	8	ASTM A6/A6M shapes	Charpy V-notch test	ASTM A6/A6M S30	Not specified	
	9	Fabrication welds	Visual testing		100%	QA Third Party visual inspection at 10% rate. Inspection rate could drop or increase based on results of inspections.
	9		Radiograph (groove welds)		10% random	QA Third Party testing at 1% rate.
	9		Liquid penetrant or magnetic particle (fillet welds)		10% random	QA Third Party testing at 1% rate.
	12	High-strength bolted connections	RCSC specification for structural joints using ASTM A325 or A490 bolts Applies to 05 21 19	Installation and tightening of bolts	Not specified	QA Third Party visual inspection at 10% rate. Inspection rate could drop or increase based on results of inspections.
05 50 00		Metal Fabrications				
	12	Fabrication welds	Visual testing	AWS D1.1/D1.1M	100%	
	12	Hot-dip galvanizing	Inspect and test	ASTM A123/A23M and A153/A153M	Not specified	
	16	Owner furnished QA	Special inspections	Not specified	Not specified	QA source inspection conducted based on risk and complexity - submittal dependent.
	16	Stud shear connectors (applies to 05 31 00)	Weld 2 test studs	AWS D1.1/D1.1M	Each production period	QA Inspection at 100% until satisfactory - then reduce over time to 10% inspection.
			Torque test threaded anchor studs	AWS D1.1/D1.1M	Each production period	
			Visual testing		Not specified	
05 52 00		Metal Railings				
	3	Railings	Calculations stamped by registered civil or structural engineer			
08 33 23		Overhead Coiling Doors				
	5	Source QC	UL certificate of inspection for oversize fire-rated door			
08 80 00		Glazing				
	10	Field QC	Hose test		Not specified	
08 90 00		Louvers and Vents				
	3	Source QC	Factory performance tests	Airflow versus pressure loss		
	3	Source QC		Rain penetration data		

TABLE A-1

Draft Third Party Testing and Inspection by Quality Assurance

100% Specification Reference	Page No.	Item of Work	Test Required	Method	Frequency	Draft Third Party Testing and Inspection by QA
09 96 35		Chemical-resistant Coatings				
	5	Field QC	Electrical spark or other tests		As required (by engineer)	
09 97 13		Steel Tank Coatings				
	8	Source QC	Shop inspection of surface preparation and shop application of paints by engineer	Visual		QA qualified for source inspection - based on submittal at the time.
	17	Coating surfaces	Thickness testing	DFT Gauge SSPC-PA 2	100%	QA Inspection may be required based on submittal from subcontractor.
	17	Submerged coated surfaces	Holiday (pinhole) testing	NACE RP0188	100%	QA Inspection may be required based on submittal from subcontractor.
22 30 00		Plumbing Equipment				
	9	Exchangers	Hydrostatic testing (Factory)	BPVC Section VIII, Div. 1	Not specified	
23 34 00		HVAC Fans				
	4	Source QC	Performance	AMCA 210		
	4	Source QC	Noise	AMCA 300		
	14	Source QC	Fabrication	AMCA 99		
23 81 00		Unitary Air-Conditioning Equipment				
	11	Source QC	Expansion coil leak test	200 psig air underwater; pressure test to 450 psig	Not specified	
	11	Source QC	Electrical heating coil test	2,000 volt dielectric test	Not specified	
	12	Field QC	Leak test			
	12	Field QC	Refrigerant pressure test			
	12	Field QC	Evaluate (if req'd)			
	12	Field QC	Dehydrate (if req'd)			
	12	Field QC	Charge condensing unit			
26 05 05		Conductors				
	18	<=600 V	Conductor test	UL 44 and 854	Not specified	
	18	>600 V	Conductor test	WC 71 and AEIC CS 8 corona level test for TR-XLP insulated cable	Not specified	

TABLE A-1

Draft Third Party Testing and Inspection by Quality Assurance

100% Specification Reference	Page No.	Item of Work	Test Required	Method	Frequency	Draft Third Party Testing and Inspection by QA
26 08 00		Commissioning of Electrical Systems				
	6	Systems	Voltage field test			
	7	Systems	Equipment line current tests			
	7	Switchgear and Switchboard Assemblies	Visual and mechanical inspection			
26 13 16.02		Pad-mounted Switchgear				
	15	Switchgear	Production test assembly	IEEE C37.20.3	Not specified	
	15	Fuses	Production test	IEEE C37.46	Not specified	
26 22 00		Low-voltage Transformers				
	4	Transformers	Production test	NEMA ST20	Not specified	
26 24 16		Panelboards				QA startup inspection and testing will be required based on O&M manual.
	5	Internal surge suppressors	Production test: Category C3 high exposure waveform (20 kV-1.2/50us, 10kA-8/20 us)	IEEE C62.41	Not specified	Independent QA source inspection required.
26 24 19		Motor Control Centers				
	11	Controller	Production test	Manufacturer's standard	Not specified	
26 29 23		Low-voltage Adjustable Frequency Drive System				
	11	Control panels	Factory test		100%	QA Startup inspection and testing will be required based on O&M Manual.
	11	Drive components	Functional test of diodes, transistors, and GTOs at 125 C		Not specified	
	12	Drive components	TTL and CMOS chips at 70 C		Not specified	
	12	Drive components	Run power sections at 40 C for 12 hours and with motors for 6 hours		Not specified	
	12	Assembled drive	Test at 40 C and full load, full speed, for 4 hours		Not specified	
	12	Drive components	Power capacitors and active components		Not specified	
	12	Controller and motor	Operate through its range and at rated power supply load for 1 hour		Not specified	

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Draft Third Party Testing and Inspection by Quality Assurance

100% Specification Reference	Page No.	Item of Work	Test Required	Method	Frequency	Draft Third Party Testing and Inspection by QA
	12	Harmonic filters	Performance test that filters do not resonate with rest of system		Not specified	
	12	Motors	Motor test (per mechanical equipment specifications)		Not specified	
26 32 13.16		Natural Gas Engine Generator Set				
	14	Field test	Performance test	NFPA 110	Each unit	
26 32 13.17		Diesel Engine Generators				
	13	Factory test	Performance test	NFPA 110	Each unit	
	13	Site test	Performance test	NFPA 110	Each unit	
26 32 13.18		Thermal Electric Generator Set				
	8	Field test	Performance test	NFPA 110	Each unit	
31 23 23		Fill and Backfill				QA Third Party Testing required - see below:
	9	Source QC	Import material gradation tests	ASTM C136	1 sample per 1,500 cy	QA Third Party Testing once per source.
	9	Field QC	In-place density and moisture	ASTM D6938	1 per 12-inch lift /500 sf or 1 per 25 lf of trench	QA Third Party Testing required at 10% specification test frequency. Rate may be reduced over time based on passing results.
	9	Field QC	Sand cone test	ASTM D1556	1 per fill type	QA visually spot checked in the field.
	9	Field QC	Proof roll fill materials	Loaded water truck, dump truck, or similar vehicle	1 per fill type that is too coarse for density gauge	QA visually spot checked in the field.
31 23 23.15		Trench Backfill				
	6	Earth backfill	Gradation tests	ASTM C136		QA Third Party Testing once per source.
	6	Source QC	Trench stabilization material gradation tests	ASTM C136	Not specified	QA Third Party Testing once per source.
	6	Source QC	Bedding and pipe zone material gradation tests	ASTM C136	Not specified	QA Third Party Testing once per source.
	6	Source QC	Controlled low-strength material; laboratory performance of mix design		Not specified	
31 32 00		Soil Stabilization				
	3	Field QC	Owner acceptance of preparation			QA visually spot checked in the field.
	3	Field QC	Owner acceptance of installation			QA visually spot checked in the field.

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Draft Third Party Testing and Inspection by Quality Assurance

100% Specification Reference	Page No.	Item of Work	Test Required	Method	Frequency	Draft Third Party Testing and Inspection by QA
32 11 23		Aggregate Base Courses				QA Third Party Testing once per source.
	4	Source QC	Gradation tests	ASTM C136	Not specified	
	4	Source QC	Plasticity index			
	7	Field QC	Gradation tests (placed material)	AAHSTO T11 and T27	1 sample per 500 tons	QA Third Party Testing once per source.
	7	Field QC	In-place density and moisture	ASTM D1557 Method D	One test per gradation produced	QA Third Party Testing required at 10% specification test frequency. Rate may be reduced over time based on passing results.
	8	Field QC	In-place density and moisture (in-place material)	ASTM D1556 or D9638 (nuclear)	One for each 200 tons or every 2,000 sf	
32 12 16		Asphalt Paving				
	9	Field QC	Field density tests	ASTM D2950	One per 500 tons or every 4 hours	QA Third Party Testing required at 10% specification test frequency. Rate may be reduced over time based on passing results.
	9	Field QC	Asphalt content, aggregate gradation		One per 500 tons or every 4 hours	QA Third Party Testing required at 10% specification test frequency. Rate may be reduced over time based on passing results.
	9	Field QC	Mix design (specific gravity)		One per 1,000 tons or every 8 hours	QA Third Party Testing required at 10% specification test frequency. Rate may be reduced over time based on passing results.
32 31 13		Chain Link Fences and Gates				
	4	Field QC	Fabric tension and line post rigidity	ASTM F1816		
33 05 01.02		Ductile Iron Pipe and Fittings				
	6	Source QC	Pressure testing, flushing and system sterilization (Section 33 12 16)			
33 05 13		Manholes				
	8	Source QC	Manhole section material and permeability test	ASTM C14	Up to 5%	
	8	Source QC	Manhole concrete compressive strength	ASTM C31/31M, C39/C39M, C192/C192M	Two cylinders per manhole	
	13	Field QC	Hydrostatic testing		25 percent (minimum)	

TABLE A-1

Draft Third Party Testing and Inspection by Quality Assurance

100% Specification Reference	Page No.	Item of Work	Test Required	Method	Frequency	Draft Third Party Testing and Inspection by QA
33 16 13.14		Frac Tanks				
	3	Source QC	Factory test and inspections			
33 46 00		Subsurface Drainage				
	9	Field QC	Drain line grade	Field survey	One per 250 lf	
	9	Field QC	Drain line stretching			
40 50 10		Underground Piping				HDPE fusion welding - QA inspection required - spot checked in the field. Third Party pressure testing may be requested of 10% of steel and HDPE pipe sections. QA Third Party visual inspection of bolted flange connections at 10% rate. Inspection rate could drop or increase based on results of inspections.
40 50 20		Aboveground Piping				HDPE fusion welding - QA inspection required - spot checked in the field. Third Party pressure testing may be requested of 10% of steel and HDPE pipe sections. QA Third Party visual inspection of bolted flange connections at 10% rate. Inspection rate could drop or increase based on results of inspections.
40 90 00		Instrumentation and Control for Process Systems				QA qualified based on complexity.
	36	Source QC	Factory demonstration test of panels			
41 22 13.13		Overhead Cranes				
	10	Source QC	Control panels and equipment inspection			
	10	Source QC	Factory no-load run test			
	10	Field QC	Alignment test		Each crane	
	10	Field QC	Performance test (load)	ASME B30.11 and B30.16	Each crane	
43 12 01		Compressed Air Systems				
	6	Source QC	Control panels and equipment inspection			
	6	Source QC	Control panels and equipment test			

TABLE A-1

Draft Third Party Testing and Inspection by Quality Assurance

100% Specification Reference	Page No.	Item of Work	Test Required	Method	Frequency	Draft Third Party Testing and Inspection by QA
43 40 02		High-density Polyethylene Tank				QA qualified source inspection may apply based on complexity.
	4	Source QC	Hydrostatic testing			
43 40 13		Steel Storage Tank				QA qualified source inspection may apply based on complexity.
	4	Source QC	Inspections			
	4	Source QC	Hydrostatic testing			
	4	Source QC	Laminate test reports			
	4	Field QC	Hydrostatic testing	24-hour leak test	Each tank	
44 42 56.04		Submersible Pumps				
	2	Source QC	Submersible motor function test	HIS 11.6		
44 42 56.09		Submersible Centrifugal Pumps				
	5	Source QC	Factory test with actual motor and pump	Hydraulic Institute	All pumps	
	6	Field QC	Alignment test			
	6	Field QC	Performance test			
44 42 56.10		Horizontal End Suction Centrifugal Pumps				
	2	Source QC	Factory inspection and test		All pumps	
	2	Source QC	Functional test	Manufacturer's standard	All pumps	
	2	Source QC	Performance test	Hydraulic Institute	All pumps	
	2	Source QC	Motor test	Manufacturer's standard	All pumps	
	2	Source QC	Hydrostatic test	Manufacturer's standard	All pumps	
	3	Field QC	Alignment test		All pumps	
	3	Field QC	Vibration test		All pumps	
	3	Field QC	Performance test		All pumps	
44 42 56.10		Horizontal End Suction Centrifugal Pumps				
	2	Source QC	Functional test	Manufacturer's standard	All pumps	
	3	Field QC	Alignment test		All pumps	
44 42 56.15		Air Operated Diaphragm Pumps				
	3	Field QC	Performance test		All pumps	

TABLE A-1

Draft Third Party Testing and Inspection by Quality Assurance

100% Specification Reference	Page No.	Item of Work	Test Required	Method	Frequency	Draft Third Party Testing and Inspection by QA
44 44 13.01		Chemical Metering Pumps				
	4	Source QC	Functional test	Manufacturer's standard	All pumps	
	5	Field QC	Functional test		All pumps	
	5	Field QC	Performance test		All pumps	
Remediation Wells						QA Third Party check on 1) plumbness/ alignment and 2) video surveys to ensure proper installation.

Notes:

AASHTO = American Association of State Highway and Transportation Officials
AMCA = Air Movement and Control Association
ASME = American Society of Mechanical Engineers
ASTM = ASTM International (formerly American Society for Testing and Materials)
AWS = American Welding Society
BPVC = Boiler and Pressure Vessel Code
C = Celsius
cf = cubic foot
CMOS = complementary metal-oxide semiconductor
cy = cubic yard
DFT = dry film thickness
GTO = gate turn-off thyristor
HDPE = high-density polyethylene
HIS = Hydraulic Institute Standards
HVAC = heating, ventilation, and air conditioning
IEEE = Institute of Electrical and Electronics Engineers
kV = kilovolt
lf = linear foot
NACE = National Association of Corrosion Engineers
NEMA = National Electrical Manufacturers Association
O&M = operations and maintenance
psig = pounds per square inch gauge
QA = quality assurance
QC = quality control
RCSC = Research Council on. Structural Connections
sf = square foot
SSPC = Society for Protective Coatings
TTL = transistor-transistor logic
WPQ = welder's performance qualification
WPS = welding procedure specification

Appendix B
Construction Quality Control Requirements

APPENDIX B

Construction Quality Control Requirements

This appendix summarizes the minimum quality control (QC) requirements for construction contractors covered in the Construction Quality Assurance Project Plan and a guide for developing the Contractor Quality Control Plan (CQCP) submittal.

B.1 Quality Control Plan Requirements

The CQCP must identify contract quality requirements for each activity and describe how the contractor intends to furnish control testing, certifications, and records in order to provide quality work. The CQCP must include procedures to ensure that equipment, workmanship, fabrication, construction, operations, and inspections comply with the contract documents. Minimum CQCP requirements are as follows:

- Name, resume, authority, and responsibility of QC Representative who will monitor the quality of construction activities.
- An organizational chart showing the lines of authority and responsibility among key project personnel.
- List of outside organizations, including testing laboratories, architects, or consulting engineers, that will be employed by the contractor. Include a description of services to be provided.
- List of definable features of work (DFOWs) that have distinct and separate control requirements.
- An inspection and test plan keyed to the construction schedule, following the order of the specification technical sections, indicating what inspections and tests will be performed, the names of persons responsible for the inspection and testing of each segment of work, and the time schedule and frequency for each inspection and test.
- Procedures for documenting QC operations and inspection and testing with a copy of all forms and reports to be used for this purpose.
- Contractor's procedure to identify, segregate, disposition, and correct nonconforming product and services.
- Contractor's procedure for initiating requests, control, and implementation of changes to the contract's scope of work, specifications, or requirements.

The contractor's CQCP must address the four-step inspection process (preparatory, initial, follow-up, and final inspections) for each DFOW. Minimum requirements are as follows:

- Checklists must be developed to document the four-step inspection process for each DFOW.
- A copy of the completed checklists must be submitted weekly to PG&E.

B.2 Contractor Quality Monitoring

The Owner may perform such inspections, tests, and monitoring as necessary to determine or verify the contractor's compliance with contract requirements. The contractor must provide such facilities and assistance for PG&E monitoring as may be reasonably required and must ensure that all QC records and places of work are open and available to the Owner. The Owner's monitoring activities may consist of review, observation, and inspection of contractor personnel, material, equipment, processes, and test results, including offsite inspections. PG&E may perform quality audits of records and performance of the contractor or its lower tier subcontractor and suppliers. The contractor, subcontractor, or supplier being audited must be available during the audit as required by the Owner. Testing or inspecting by the Owner,

government agencies, or stakeholders does not relieve the contractor or its subcontractors from performing work according to contract requirements.

QA personnel will notify the contractor of any detected noncompliance with these requirements or technical specifications. Such notice, when delivered to the contractor at the work site, must be deemed sufficient for the purpose of notification. The contractor must take immediate corrective action after receipt of a noncompliance notice and must maintain a detailed record of every noncompliance and corrective action taken.

B.3 Submittal Register

The Construction Manager or contractor must provide a submittal register to schedule, manage, and track all required subcontract submittals.

B.4 Quality Control Reports

The contractor must provide forms to be used in conjunction with QC reporting. A copy of all forms must be included with the CQCP. The following requirements are listed for specific reports:

- **Test Reports.** The contractor is responsible for establishing a system that will record all test results. Information on test designation, location, date of test, specification requirements, results and retest results, causes for rejection, and recommended remedial actions must be documented. A copy of test results must be sent directly from the agency performing the testing services to the QA Manager. A copy of any failing report must be sent immediately. All test reports provided by a testing agency must be reviewed and signed by a competent, qualified individual in the related discipline of the test subject matter.
- **Construction Reports.** Submit duplicate copies to the Site Operations Manager and Construction Manager on the business day following the day of report. At a minimum, daily construction reports must include the following information:
  - List of subcontractors at the site
  - List of separate contractors at the site
  - Approximate count of personnel at the site
  - High and low temperatures, general weather conditions
  - Accidents
  - Meetings and significant decisions
  - Unusual events
  - Stoppages, delays, shortages, and losses
  - Meter readings and similar recordings
  - Emergency procedures
  - Orders and requests of governing authorities
  - Change orders received and implemented
  - Services connected and disconnected
  - Equipment or system tests and startups
  - Partial completions/occupancies
  - Substantial completions authorized
  - Number of days used in the subcontract period to date

B.5 Record Drawings

The contractor’s QC personnel must ensure that the record drawings required by the contract are scalable, kept current on a daily basis, and marked to show deviations from the contract drawings. Ensure that each deviation has been identified with the appropriate modifying documentation.

B.6 Inspections and Testing Laboratory

All inspections and testing on and offsite required by the contract must be performed as specified in individual specification sections by a certified independent firm employed by the contractor, at the contractor's expense. Inspecting, testing, and source QC may occur on or offsite. Qualifications and certifications of the independent inspections and testing firm must be submitted for Owner approval. Testing reports by the independent firm must be submitted to the QA Manager, in duplicate, indicating observations and results of tests and indicating compliance or noncompliance with contract documents. The contractor must furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested. Any retesting required because of nonconformance to specified requirements must be performed by the same independent firm at the contractor's expense.

Appendix C
Example Quality Forms

APPENDIX C

Example Quality Forms

1. Daily Quality Surveillance Report Form
2. Laboratory Inspection Form
3. Material Receipts and Inspection Form
4. Audit Finding Form
5. Nonconformance Report (NCR) Form
6. Request for Information (RFI) Form
7. Four-Phase Inspection Form

1. Daily Quality Surveillance Report Form

Daily Quality Surveillance Report

Project Name:		Contract No:				Report Date:
Subcontractor:		Location:				Report No.:
SURVEILLANCE ACTIVITIES		SURVEILLANCE TYPE AND COMMENTS (Enter N/A if sampling is not required.)				
Quality Control Activities		Lot Size	Sample Size	Accepted No.	Rejected No.	Comments - (reference Surveillance Deficiency Reports for details, as necessary)
Civil/ Structural	Survey Control					
	Earthwork/ Soil					
	Soil Preloading & Consolidation					
	Piling					
	Concrete					
	Structural Steel					
	Buildings					
	Foundations					
	Formwork					
	Clearing/ Disposal					
	Roads/ Paving					
	Grouting					
	Excavation					
	Bolts, Bolt Tensioning, Bolt Torquing					
	Test Cylinders					
	Piping - Drainage/ Sewer					
Mechanical	Equipment – Rotating, Other					
	Vessels, Tanks, Exchangers, Boilers, Columns					
	Piping					
	Mechanical Testing					
	Cleaning, Flushing, Hydrotesting					

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Daily Quality Surveillance Report

Project Name:		Contract No:			Report Date:	
Subcontractor:		Location:			Report No.:	
SURVEILLANCE ACTIVITIES		SURVEILLANCE TYPE AND COMMENTS (Enter N/A if sampling is not required.)				
Quality Control Activities		Lot Size	Sample Size	Accepted No.	Rejected No.	Comments - (reference Surveillance Deficiency Reports for details, as necessary)
Electrical	Raceways, Wire & Cable					
	Transformers					
	Motors					
	Insulation					
	MCC, Switchgear, Panels					
	Heat Trace					
	Conduit					
	Direct Buried Cable					
	Terminations					
	Cable Testing					
	Breakers, Fuses, Circuit Interrupters					
	Batteries, Chargers					
	Electrical Testing					
Instrumentation	Instrumentation					
	Calibration, Testing					
	Flow, Temperature, Pressure Devices					
	Protective, Alarm					
	Installation					
Coating, Painting, & Wrapping	Painting, Coating					
	Insulation, Refractory					
	Fireproofing					

Daily Quality Surveillance Report

Project Name:		Contract No:				Report Date:
Subcontractor:		Location:				Report No.:
SURVEILLANCE ACTIVITIES		SURVEILLANCE TYPE AND COMMENTS (Enter N/A if sampling is not required.)				
Quality Control Activities		Lot Size	Sample Size	Accepted No.	Rejected No.	Comments - (reference Surveillance Deficiency Reports for details, as necessary)
Non Destructive Examination	NDE					
	Visual					
	Radiographic					
	Ultrasonic					
	Magnetic Particle					
	Liquid Penetrant					
	Positive Material Identification					
Calibration	Calibration					

2. Laboratory Inspection Form

Laboratory - Test Facility Inspection Checklist

Facility:	Project Number:
Location of Facility:	Project Name:
Facility Contact Name:	Contact Number :
Inspector/Appraiser:	Date Performed:

S. No.	Description of checking to be carried out	Status
1.0	GENERAL	
1.1	Is the lab accredited by a properly authorized body for the tests being carried out?	
1.2	Is the lab approved by SC/ PMC/ Client/ etc., as per project requirements?	
1.3	Is the lab approved by local authorities if/ as per project requirements?	
1.4	Is the lab operating under a documented Quality Assurance Program?	
1.5	Does the testing staff (lab techs) have the required qualifications and experience (e.g. ACI Level 1, etc.), as per project requirements?	
1.6	Is the testing facility of sufficient size to accommodate all necessary test equipment and technicians and to correctly conduct the tests included in the scope of accreditation?	
1.7	Is a complete copy of required project specifications available and accessible by all technical staff?	
1.8	Is a hard copy of required test standards (ASTM, BS, AASHTO, others) available and accessible by all concerned technical staff?	
1.9	Is the Inspection and Testing Plan?	
1.10	Are records of lab staff (qualification, contact, annual leave schedule, blood group, etc. along with the other routine data) available?	
1.11	Are all staff positions documented in the lab's organization chart?	
1.12	Is the record of all test equipment maintained with serial numbers, and calibration due dates?	
1.13	Is the equipment calibrated by proper accredited body and calibration of equipment is traceable to internationally recognized standards?	

Laboratory - Test Facility Inspection Checklist

S. No.	Description of checking to be carried out	Status
1.14	Are specimen samples being kept under Consultant's supervision?	
1.15	Are walkways in and around the lab clear, with no chemical storage? Are entrance and exits also clear of obstructions?	
1.16	Are emergency notification, procedures, contacts and phone numbers posted?	
1.17	Is lab neat, clean with no excess accumulation of combustibles?	
1.18	Are appropriate trash containers in use and emptied when full?	
1.19	Are lab surfaces clean and sanitary with no excess visible contamination?	
1.20	Are proper disposal containers available for sharp items?	
1.21	Is there unrestricted access to eyewashes, safety showers, and fire extinguishers?	
1.22	Are experiments conducted on stable non-moving surfaces?	
1.23	Are chemicals stored in cabinets and not on open benches when not in use?	
1.24	Is food and/or drink present in lab, in refrigerators or on lab benches?	
1.25	Are chemicals or lab coats present in designated eating areas or other non-lab areas?	
1.26	Do sinks and sink traps look clean/ free of chemical residue?	
1.27	Is glassware free of chips, cracks, sharp edges and other defects?	
1.28	Are container caps and lids are in good condition?	
2.0	**PERSONAL PROTECTIVE EQUIPMENT/PRACTICES**	
2.1	Is proper personal protective equipment available for employees & visitors and are correct sizes being used?	
2.2	Are lab workers are dressed properly?	
2.3	Are lab coats in use?	
2.4	Has lab Supervisor completed any HSE session/ curriculum/ assignments?	

Laboratory - Test Facility Inspection Checklist

S. No.	Description of checking to be carried out	Status
2.5	Have lab workers received HSE training or completed appropriate HSE sessions?	
3.0	**GAS CYLINDERS**	
3.1	Does gas piping appear gas tight and intact?	
3.2	Are cylinders stored properly (heat compatible materials and distance from combustibles)?	
3.3	Are gas cylinders secured in an upright position?	
4.0	**SAFETY EQUIPMENT**	
4.1	Are appropriate fire extinguishers present, mounted and accessible? Are smoke detectors/ fire alarms available?	
4.2	Is all safety equipment properly maintained with proper inspection tags attached?	
4.3	Are first aid kits available and maintained?	
5.0	**ELECTRICAL EQUIPMENT**	
5.1	Is electrical equipment in good condition?	
5.2	Are electrical cords are frayed?	
5.3	Are all electrical equipment properly grounded?	
5.4	Are electrical outlets overloaded?	
5.5	Are circuit breaker panels closed and unobstructed?	
5.6	Are extension cords used only in temporary applications?	
5.7	Are multi-plug adapters in use?	
6.0	**LABORATORY EQUIPMENT**	
6.1	Note the general condition of lab equipment (rust, etc.).	
6.2	Are moving parts of equipment guarded to prevent physical contact?	
6.3	Has calibration been completed and are proper inspection tags attached?	
6.4	Are lab equipment calibration certificates available?	
7.0	**SAMPLING & TESTING**	
7.1	Do sampling & testing procedures comply with specified international test standards?	

Laboratory - Test Facility Inspection Checklist

S. No.	Description of checking to be carried out	Status
7.2	Does contractor's "Request for Inspection & Testing" Procedure comply with Client's requirements?	
7.3	Have all tests been witnessed by the Consultant or by Consultant's authorized body?	
7.4	Do test request provide information of previous tests, if conducted, at same location?	
7.5	Are test forms (working forms/ reporting forms) available?	
7.6	Are working test forms signed by Consultant or by Consultant's authorized body?	
7.7	Do reporting forms show names and signatures of: Tested by/ Checked by/ Witnessed by/ Approved By?	
7.8	Do records of Daily Testing show No. of samples passed and failed?	
7.9	Do records of Monthly Testing showing No. of samples passed and failed?	
8.0	**MATERIALS**	
8.1	Are material specimens stored under Consultant's supervision?	
8.2	Are reference samples stored under Consultant's supervision?	
8.3	Is sampling of delivered materials done as per required frequency?	
9.0	**Filling (Soft Copies and Hard Copies):**	
9.1	Are complete copies of Approved Materials' Submittals (including Test Reports, Certificates, Technical Data, Final Approved Shop drawing, Method Statements, etc.) available?	
9.2	Are logs of Material Submittals showing all required parameters and status including complete information regarding Conditions of Approval and Fulfillment of Conditions of Approval?	
9.3	Are Client's / SC's / Overview Consultant's Material Approvals available?	
9.4	Are Independent/third party lab, government, and/ or Client lab test reports and logs available?	
9.5	Are test reports for all field tests available?	

Laboratory - Test Facility Inspection Checklist

S. No.	Description of checking to be carried out	Status
9.6	Are reports/ logs of all site-lab tests showing all parameters and including location/ date of test/ test results/ status/ etc. available?	
9.7	Is a log of Materials Testing vis-à-vis required testing frequency available?	
9.8	Is a log of lab equipment with equipment identification available?	
9.9	Is lab equipment breakdown/ maintenance record available?	
9.10	Are lab equipment user manuals, circuit drawings etc. available?	
9.11	Are records of Testing & Inspection Requests available?	

Remarks:

Accompanying documents:

Inspector/Appraiser	Facility Contact
Name:	**Name:**
Sign :	**Sign :**
Date :	**Date :**

3. Material Receipts and Inspection Form

QUALITY CONTROL MATERIALS/EQUIPMENT RECEIVING REPORT

Date: _____ Day of Week (circle one): Su M Tu W Th F S Page: _____ of _____

Name: _____ (Please Print)

Location: _____ Activity #: _____ Spec. Sect.: _____

Equipment or Material Received: _____

_____

Parameters Inspected (Check all that apply)

- ☐ Identification
- ☐ Quantity
- ☐ Damage
- ☐ Required Markings
- ☐ Conformance with Specifications
- ☐ Material Classification
- ☐ Test Reports/Mill Certificates
- ☐ Dimensions
- ☐ Cleanliness
- ☐ Properly Stored and Protected

Disposition _____ ACCEPTED _____ REJECTED _____ HOLD _____

Additional Information: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Except as noted above, all permanent materials meet the requirements of the plans and specifications.

Signed: _____ Title: _____

4. Audit Finding Form

Quality Audit Finding

AUDITED AREA:	AUDIT # FINDING #
AUDITOR:	CHECKLIST ITEM NO.:
DATE(S) OF AUDIT/SURVEILLANCE:	REFERENCE:
REQUIREMENT:	
FINDING: **SEVERITY:** ___3_____ FINDING ACKNOWLEDGED BY: _____ DATE: _____	
ROOT CAUSE:	
RECOMMENDED ACTION:	
CORRECTIVE ACTION PLAN:	
SCHEDULED COMPLETION DATE:	CORRECTIVE ACTION RESPONSIBILITY ASSIGNED TO:
CORRECTIVE ACTION TAKEN: CORRECTIVE ACTION COMPLETED DATE: _____ SIGNATURE: _____	
CORRECTIVE ACTION VERIFIED BY: _____ DATE: _____ (AUDITOR) COMMENTS:	

5. Nonconformance Report (NCR) Form

Nonconformance Report (To be reviewed by the QAM and forwarded to the Contractor / Supplier)		Form:	Page 1 of 1
		Rev	Date
RE / PM:	**Work Release:**	**Report #:**	
Sub/Supplier:	**Site / Location:**	**Date:**	
Requirement:			
Description of Nonconformance:			
Contractor / Supplier Signature:		**Date:**	
Disposition (NCR Only): ☐ Repair ☐ Rework ☐ Reject / Scrap ☐ Re-Use			
Cause of Nonconformance:			
Corrective Action Plan to Prevent Reoccurrence:			
Assigned To (Contractor / Supplier):		**Due Date:**	
Corrective / Preventive Action Taken:			
Close-Out Verification			
QA Mgr Signature:		**Date:**	
QA Field Inspector:		**Date:**	

6. Request for Information (RFI) Form

Request for Information (To be used to request technical information, clarification, or direction as a result of field conditions or an inconsistency)	Form:	Page 1 of 1
	Rev	Date

RFI Number:	**Date:**	**Reason:** ☐ Information ☐ Clarification ☐ Discrepancy ☐ Other _____
Work Release Number:	**Discipline**	

Submitted by:
Reference (DWG, spec, ref, etc.):
Description:
Proposed Solution:
Cost Impact (if yes, include cost breakdown): ☐ Yes ☐ No
Reply:
NOTE: Response to this RFI is a technical solution only to the above query and does not authorize additional cost. If Subcontractor feels additional cost is justified, a "Change Request" must be submitted by the contractor and approved by PG&E Construction Management prior to the work being performed in the field.

REVIEW AND APPROVAL	
Reviewed by:	**Date:**
Reviewed by:	**Date:**
Project Manager:	**Date:**

7. Four-Phase Inspection Form

EXAMPLE 4-STEP INSPECTION CHECKLISTS

PREPARATORY INSPECTION CHECKLIST: _____ **DATE:** _____

SUBCONTRACT NO: _____ NTP DATE: _____

PROJECT: _____ LOCATION: _____

DEFINABLE SCOPE OF THE WORK FEATURES (DFOW): _____

PROJECT TEAM

SUPERINTENDENT _____ FOREMAN _____

SITE SAFETY OFFICER _____ TESTING REP. _____

INSTALLER _____ MANUFACTURER'S REP. _____

CERTIFIED INSPECTOR _____ RESIDENT ENGINEER (RE) _____

QUALITY CONTROL REPRESENTATIVE _____

No.	Item	Description	Yes	No	N/A	Comments
1	Safety	Has the Hazard Analysis been submitted for review?	☐	☐	☐	
2	Safety	Are there additions to the Activity Hazard Analysis (AHA) and are they incorporated?	☐	☐	☐	
3	Safety	Has the Site Specific Safety Plan been reviewed?	☐	☐	☐	
4	Safety	Has the Emergency Action Plan including contact list been reviewed and posted on site?	☐	☐	☐	
5	Safety	Are Materials Safety Data Sheets (MSDS) on hand and reviewed?	☐	☐	☐	
6	Safety	Do all members have the required Personal Protective Equipment (PPE)?	☐	☐	☐	
7	Materials	Does the project team have copies of all the approved submittals for this DFOW on site?	☐	☐	☐	
8	Equipment	Are all operators certified to run the necessary equipment and is proof of certification on site?	☐	☐	☐	
9	Equipment	Has a checklist been completed for all equipment prior to use, and have copies been submitted to the General Contractor?	☐	☐	☐	
10	Permits	Are the required work permits posted on site?	☐	☐	☐	
11	Plans / Specs	Are the latest plans and specifications on site and have they been reviewed by the Superintendent?	☐	☐	☐	
12	Tolerances	Is the Superintendent aware of all construction tolerances for this DFOW?	☐	☐	☐	
13	Testing	Is there testing required for this DFOW?	☐	☐	☐	
14	Testing	If required is the third party testing agency available to perform the testing?	☐	☐	☐	
15	Inspect/ Testing	Have the Quality Control Representative (QCR) and Resident Engineer (RE) reviewed the Inspection and Test Plan?	☐	☐	☐	

INITIAL INSPECTION CHECKLIST

SUBCONTRACT NO: _____ DATE: _____

PROJECT: _____ LOCATION: _____

DEFINABLE SCOPE OF THE WORK FEATURES (DFOW) INSPECTED: _____

PERSONNEL PERFORMING INSPECTION: _____

No.	Item	Description	Yes	No	N/A	Comments
1	Safety	Do all members have the required Personal Protective Equipment (PPE)?	☐	☐	☐	
2	Safety	Is there any additional Activity Hazard Analysis (AHA), and have they been reviewed by all staff?	☐	☐	☐	
3	Safety	Is the site well organized and maintained?	☐	☐	☐	
4	Material	Are the materials being used in strict compliance with the contract requirements?	☐	☐	☐	
5	Equipment	Is the equipment being used in strict compliance with the contract requirements?	☐	☐	☐	
6	Equipment	Have all tools and equipment been verified that it meets manufacture's recommendations for operation?	☐	☐	☐	
7	Tolerances	Is all work being installed per the tolerances detailed in the drawings and specifications?	☐	☐	☐	
8	Testing	Are any tests required for this DFOW and have they been completed and properly documented?	☐	☐	☐	
9	Inspections	Does this DFOW require a Witness and Hold Point? If so has it been properly documented?	☐	☐	☐	
10	Plans	Are all variations to the original plans being updated on the as-built drawings?	☐	☐	☐	

QUALITY CONTROL REPRESENTATIVE: _____ **DATE:** _____

FOLLOW-UP INSPECTION CHECKLIST

SUBCONTRACT NO: _____ DATE: _____

PROJECT: _____ LOCATION: _____

DEFINABLE SCOPE OF THE WORK FEATURES (DFOW) INSPECTED: _____

PERSONNEL PERFORMING INSPECTION: _____

No.	Item	Description	Yes	No	N/A	Comments
1	Safety	Do all members have the required Personal Protective Equipment (PPE)?	☒	☐	☐	
2	Safety	Is the site well organized and maintained?	☐	☐	☐	
3	Materials and Equipment	Are the materials and equipment being used in strict compliance with the contract requirements?	☐	☐	☐	
4	Equipment	Have all tools and equipment been verified that it meets manufacture's recommendations for operation?	☐	☐	☐	
5	Tolerances	Is all work being installed per the tolerances detailed in the drawings and specifications?	☐	☐	☐	
6	Testing	Are any tests required for this DFOW, and have they been completed and properly documented?	☐	☐	☐	
7	Inspections	Does this DFOW require a Witness and Hold Point? If so, has it been properly documented?	☐	☐	☐	
8	Plans	Are all variations to the original plans being updated on the as-built drawings?	☐	☐	☐	

QUALITY CONTROL REPRESENTATIVE: _____ **DATE:** _____

FINAL INSPECTION CHECKLIST

SUBCONTRACT NO: _____ DATE: _____

PROJECT: _____ LOCATION: _____

DEFINABLE SCOPE OF THE WORK FEATURES (DFOW) INSPECTED: _____

PERSONNEL PERFORMING INSPECTION: _____

No.	Item	Description	Yes	No	N/A	Comments
1	Plans	Are the as-built drawings completed for this DFOW?	☐	☐	☐	
2	Safety	Have all affected areas been cleaned and / or returned to a condition that will protect others from injury or incident?	☐	☐	☐	
3	Testing	Does the RE have copies of all test results?	☐	☐	☐	
4	Material	Are all unused materials returned or stored?	☐	☐	☐	
5	Equipment	Have all equipment instructions been submitted to the RE?	☐	☐	☐	
6	Equipment	Is all equipment tested and operable?	☐	☐	☐	

List of Punchlist items:

1. _____

Anticipated Completion: _____ Actual Completion: _____

2. _____

Anticipated Completion: _____ Actual Completion: _____

3. _____

Anticipated Completion: _____ Actual Completion: _____

4. _____

Anticipated Completion: _____ Actual Completion: _____

5. _____

Anticipated Completion: _____ Actual Completion: _____

QUALITY CONTROL REPRESENTATIVE: _____ **DATE:** _____

Appendix B
Standard Operating Procedures
(On CD-ROM Only)

APPENDIX B

Standard Operating Procedures

This appendix contains the following SOPs:

- Remedy-SOP-01 – Process Water Sampling
- Remedy-SOP-10 – Sampling of Concrete/Asphalt Demolition Waste
- RTP-SOP-01 – System "Hot" Startup and Shutdown
- RTP-SOP-08 – Off-site Trucking of Remedy-produced Water
- RTP-SOP-10 – Disposal of Produced Water in Evaporation Ponds via the TCS Wastewater Tank Discharge Connection
- IRZ-SOP-01 – MW-20 Bench System Startup
- IRZ-SOP-02 – MW-20 Bench System Shutdown/Emergency Shutdown
- IRZ-SOP-05 – MW-20 Bench Carbon Storage Tank Delivery/Filling
- IRZ-SOP-10 – Discharge of Clean-in-Place Water to the Remedy-Produced Water Conditioning Plant
- IRZ-SOP-12 – Offsite Trucking of Clean-in-Place Water from MW-20 Bench
- FWS-SOP-01 – Startup and Shutdown of Freshwater Supply Conveyance and Storage System
- Well-SOP-01 – Well and Borehole Decommissioning
- SOP-A1 – Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method
- SOP-A2 – Purging and Sampling of 1-inch-diameter Groundwater Monitoring Wells, Modified Well-Volume Method
- SOP-A3 – Purging and Sampling of Active and Inactive Water Supply Wells
- SOP-A5 – Groundwater Sampling from Sonic Drilling Boreholes
- SOP-A6 – Sample Field Filtration and Preservation for Metals Analyses
- SOP-A7 – Water Level Measurements
- SOP-A8 – Field Water Quality Measurements Using a Flow-through Cell
- SOP-A9 – Calibration of Field Instruments
- SOP-A10 – Decontamination of Water Sampling Equipment
- SOP-A11 – Total Depth Measurements
- SOP-A12 – Field Water Quality Measurements for Grab Samples
- SOP-A13 – Spill Prevention, Containment, and Control Measures for Monitoring Well Sampling
- SOP-A16 – Access Routes
- SOP-A17 – Groundwater and Surface Water Mobile Integrated Sample Tracking
- SOP-A18 – Purging and Sampling of Groundwater Wells Minimal Drawdown Method
- SOP-A19 – Sampling of Groundwater Monitoring Wells Hydrasleeve No Purge Method
- SOP-A23 – Sample Handling and Custody
- SOP-B3 – Borehole Sampling and Logging of Soil Borings
- SOP-B4 – Boring Abandonment
- SOP-B5 – Decontamination of Personnel and Equipment, Well Drilling, and Subsurface Sampling and Investigations
- SOP-B7 – Homogenization of Soil and Sediment Samples
- SOP-B9 – Drilling – Sonic Method
- SOP-B11 – Site Clearance and Permitting
- SOP-B16 – Field-Portable X-Ray Fluorescence Soil Sampling
- SOP-L1 – Hexavalent Chromium Analysis by Hach Method 1560
- SOP-L2 – Ferrous Iron Analysis by Hach Method 8146

- SOP-L3 – Total Chromium Analysis by Hach Method 8024
- SOP-L4 – Conductivity Analysis by Hach Method 8160
- SOP-L8 – Matrix Spike Preparation
- SOP-L9 – pH Measurement
- SOP-L10 – HACH Model 2100P Turbidimeter Calibration and Analysis Procedures
- SOP-L13 – Nitrate Analysis by Hach Method 8171
- SOP-L14 – Sulfate Analysis by Hach Method 8051
- SOP-L15 – Alkalinity Analysis
- SOP-L16 – Total Organic Carbon Analysis by Hach Method 10129
- SOP-L17 – Orthophosphate Analysis by Hach Method 8048
- SOP-L18 – Manganese Analysis by Hach Method 8149
- SOP-L19 – Total Dissolved Solids Analysis

Standard Operating Procedure
PG&E Topock Groundwater Remedy
Operation and Maintenance Plan

Title: Process Water Sampling

Number: Remedy-SOP-01_Rev0

Created Date: June 19, 2012

1 Background and Scope

Pacific Gas and Electric Company (PG&E) is implementing a groundwater remedy near the intersection of Park Moabi Road and Interstate 40, approximately 12 miles southeast of Needles, California at the PG&E Topock Compressor Station (TCS). This standard operating procedure (SOP) addresses the procedures to be used for collection of process water samples from the groundwater remediation system.

2 Required Documents

1. Event-specific sampling and analysis plan (SAP), work plan, or field instructions.
2. Applicable project work plan, monitoring plan, quality assurance project plan (QAPP), and/or Operation and Maintenance (O&M) Manual.
3. Topock Program Health and Safety Plan (HSP).
4. Blank sampling log and field notebook.

3 Preparation, Setup, and Sampling Procedures

1. Review event-specific SAP or event-specific field instructions, O&M Manual, and HSP.
2. Review sampling procedures and equipment and planned sample ports with field crew.
3. Inventory sample bottles, review required analyses, and understand lab courier schedule.
4. Prepare sampling log (use field notebook and summarize relevant information on sampling form).
5. Gather sample containers and equipment and mobilize to the first sample location.
6. Open the sampling port and allow enough water to flow to flush the 'off main pipe'.
7. Remove the cap of the sample container and collect the sample. Continue one container at a time, beginning with the containers for metals [including Cr(VI) and Cr(T)] and then the containers for general chemistry parameters.
8. After all containers for that sampling location have been filled, complete the sampling log sheet.
9. Repeat steps 5 through 8 for each sampling location.

Refer to the O&M Manual for sample handling and management, equipment decontamination, and waste management procedures.

Standard Operating Procedure
PG&E Topock Groundwater Remedy
Operation and Maintenance Plan

Title: Safe Fueling and Fuel Handling Policy

Number: Remedy-SOP-02_Rev0

Created Date: July 15, 2013

1 Background and Scope

Pacific Gas and Electric Company (PG&E) is implementing a groundwater remedy near the intersection of Park Moabi Road and Interstate 40, approximately 12 miles southeast of Needles, California at the PG&E Topock Compressor Station (TCS). The objective of this Standard Operating Procedure (SOP) is to describe the policy required to refuel vehicles, fuel tanks, and equipment/portable containers safely during work on and off the project site.

2 Approvals

Each vendor/contractor must obtain approval from PG&E Topock Site Operations Manager, and or Sr. Environmental Inspector of a) the planned fueling and re-fueling methods for the contracted activities to be performed at the site, and b) the commercial fuel supplier prior to first use for contracted activities.

3 Safety Guidelines During Fueling Operations

PG&E requires all vendors/contractors to follow appropriate procedures during fueling/refueling activities in order to avoid spills and incidents. The following general guidelines will be followed unless pre-approved otherwise:

Preparation, Pre-Fueling and Fueling Guidelines

- Turn off all equipment or engines before refueling.
- When fueling at a pump, remain attentive to the fuel nozzle.
- When not fueling at a fixed pump, stage splash pad containment as needed.
- Identify and locate fire extinguisher prior to fueling.
- Do not become distracted while fueling by electronic devices, reading materials, or conversations with bystanders.
- Use only UL-approved containers for portable gasoline storage cans.
- When filling a portable container, always place the container on level ground and keep the pump nozzle in contact with the container when refueling to avoid a static electricity ignition of fuel vapors. Fill slowly to avoid spillage and skin/clothing contact and use a funnel if needed.
- When fueling from a portable container, stage splash containment as needed.
- Only store fuel in locations approved by PG&E, and never near any ignition sources.

- In the event of a fire, make use of fire extinguisher that is available. If fire cannot be contained, relocate yourself to a safe location and call 911.

General Remote Fueling Considerations

- Position the fuel supply source as close to the equipment to be fueled as is practicable and safe.
- Inspect fuel conveyance hose/equipment and all connections and fittings for signs of wear or defects prior to the initiation of fuel pumping or pouring. If pouring fuel from a portable container, a funnel constructed of suitable material must be used to avoid splashing.
- Stage splash containment and fire extinguisher as needed.
- Ensure the area is free from ignition sources (i.e., hot equipment/work, sources of spark or static electricity).
- Once fueling is complete, deactivate the fuel supply pump prior to removing the fill nozzle from the equipment, and ensure that residual fuel has been emptied from the conveyance hose (as appropriate based on design of the equipment used).
- Inspect work area for any signs of spills, and remove spill pad(s), as appropriate.

3 Communication and Contingency Action

If a spill occurs the appropriate clean-up actions should commence as efficiently and safely as possible. Use a natural fiber push broom and/or a spark resistant shovel or scoop.

In addition, the reason for the spill will be investigated, and the team will modify the fueling procedure or conduct equipment repairs as determined appropriate to minimize the potential for future spills. Further, PG&E Site Operations Manager/Sr. Environmental Inspector must be notified immediately.

4 Waste Management

All waste generated during refueling, such as oily absorbent pads, must be transported and disposed of as directed by PG&E immediately following generation. Do not dispose of any oil/fuel contaminated pads or rags in the soil roll-off bins or waste dumpsters.

SOP-A1

Purging and Sampling of Groundwater Monitoring Wells
Well-Volume Method
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) addresses the procedures and equipment to be used for purging and sampling all groundwater monitoring wells at the Topock site with casing diameters in excess of 1-inch. This SOP will be used for sampling groundwater monitoring wells using a dedicated electric submersible pump with a single discharge rate, a dedicated electric pump with a controllable discharge rate, or a portable electric pump with a controllable discharge rate. A peristaltic pump or inertial pump (Waterra or similar) can be used if an electrical submersible pump is not appropriate. A well-volume based purging and sampling method will be used for these wells. This SOP does not apply to FLUTe wells, or Blatypus pump equipped wells (MW-58BR). Those wells will be sampled according to the relevant Field Activities Work Plan (available from on-site field coordinator).

REQUIRED DOCUMENTS:

- Event-specific planned sample table (PST).
- Applicable project work plan or monitoring plan. Refer to the Topock Program Sampling, Analysis, and Field Procedures Manual (Procedures Manual).
- Construction/Remedial Action Work Plan (C/RAWP) during the construction phase.
- Operation and Maintenance Manual (O&M Manual) and Quality Assurance Project Plan (QAPP) (Appendix B of the O&M Manual Volume 2, Sampling and Monitoring Plan) as required during the O&M phase.
- Topock Program Health and Safety Plan (HSP)
- Well construction logs/specifications
- Mobile Integrated Sample Tracking (MIST) handheld database
- Previous sampling logs or tabular historic field data tables
- Current site access map
- Blank sampling logs, maps, sample labels, chains of custody (COCs), and the designated groundwater sampling field notebook
- Applicable SOPs may include:
  - SOP-A2, *Purging and Sampling of 1-inch Diameter Groundwater Monitoring Wells, Modified Well-Volume Method*
  - SOP-A3, *Purging and Sampling of Active and Inactive Water Supply Wells*
  - SOP-A4, *Depth-Specific River Water Sampling*
  - SOP-A5, *Groundwater Sampling from Sonic Drilling Boreholes*

- SOP-A6, *Field Filtration*
- SOP-A7, *Water Level Measurements*
- SOP-A8, *Field Water Quality Measurements Using a Flow-through Cell*
- SOP-A9, *Calibration of Field Instruments*
- SOP-A10, *Decontamination of Water Sampling Equipment*
- SOP-A11, *Total Depth Measurements*
- SOP-A12, *Field Water Quality Measurements for Grab Samples*
- SOP-A13, *Spill Prevention, Containment, and Control Measures for Monitoring Well Sampling*
- SOP-A14, *Pore Water Sampling*
- SOP-A16, *Access Routes*
- SOP-A18, *Purging and Sampling of Groundwater Monitoring Wells, Minimal Drawdown Method*
- SOP-A19, *Sampling of Groundwater Monitoring Wells, Hydrasleeve No Purge Method*
- SOP-A23, *Sample Handling and Custody*
- SOP-C1, *Solinst Pressure Transducers*

REQUIRED EQUIPMENT:

- 2 or more (i.e. one is backup) YSI-556 WQ instruments with flow through cells, or equivalent.
- Hach 2100P turbidimeter or equivalent.
- 200 foot (or longer as needed) water level indicator (WLI).
- Trimble Rugged Reader hand held instrument for MIST data collection.
- Two, 200 gallon capacity purge tanks.
- Utility vehicles (UTV's) as necessary.
- Back-up 2-inch pump and controller.
- Honda 2000 watt generator or alternate power source.

PREPARATION & SETUP:

- Review event-specific PST or event-specific field instructions, previous sampling logs, Procedures Manual, HSP, and groundwater sampling supplies and equipment check list. (NOTE: the PST should also be reviewed for required "non-analytical event activities" such as water level measurements or other data collection that is planned in association with the groundwater sampling event).
- Acquire the existing field logbook for groundwater sampling and initiate entries.

- Inspect all equipment and verify that the field water quality (WQ) meters have been calibrated prior to use according to the manufacturer's instructions and SOP-A9, *Calibration of Field Instruments*.
- Inventory sample bottles, build sample sets for the required analytes at each sample location, ensure a sufficient supply of lab de-ionized water for equipment blanks, and confirm the lab courier schedule.
- Field-check sampling equipment and supplies: water level indicator (WLI), WQ meters, flow-through cell, pump controller, power supply, pump discharge/sampling tubing, N-dex gloves, D.I water sprayers, 5 gallon buckets, paper towels, 0.45 micron in-line filters, etc.

FIELD PROCEDURES:

- **Prior to opening any monitor well, remove all pens, lighters, calculators, or any other loose items from vest pockets, or from any other location where they could fall into the well.**
- Upon arrival at the monitoring well, at least 2 members of the sampling team must confirm the well ID. Wells should be clearly marked on the well monument. If the well cannot be positively identified by the marking, measure total depth of the well and compare to the well installation details to confirm the correct location. Report worn or unclear well markings to the on-site field coordinator.
- Place spill containment according to SOP-A13, *Spill Prevention, Containment, and Control Measures for Monitoring Well Sampling.*
- Collect an "EB", equipment blank, ***prior to pump installation*** if necessary according to the PST.
- Open the protective casing lid and, ***prior to moving it***, note the exact configuration of the transducer installation if present. Measure static WL according to SOP-A7, *Water level Measurements,* moving the transducer if necessary, and record WL value in MIST and on the sampling log.
- If the well is equipped with a transducer and does not have a dedicated pump installed, remove the transducer from the well according to SOP-C1, *Solinst Pressure Transducers*.
- If the well does not have a dedicated pump installed, but does have dedicated sample tubing, attach the dedicated tubing to the appropriate pump and install decontaminated pump at the same intake/sampling depth as used in prior events. There is a marking on the purge tubing which corresponds with the monitor well top of casing (TOC) to facilitate this requirement. Purge and sample the well as described below.
- If the well does not have a dedicated pump ***or*** tubing, or has not been previously sampled, use new low-density polyethylene tubing and install the pump with the intake 15 feet below the surface of the static water column, or at the depth prescribed by the Project Manager (PM) or Field Team Manager (FTM), and record the intake depth in MIST and on the field data sheet. Purge and sample the well as described below.

- If the well ***does*** have a dedicated pumping system, connect the discharge tubing and purge and sample the well as described below.
- Collect daily equipment blanks and duplicate samples as required by the PST and instructed by the field team leader.

PURGING AND SAMPLING PROCEDURES:

- Prepare the groundwater sampling log. Use the static water level and the total depth provided on the field data sheet and in the PST to calculate the volume of one casing of standing water in the well.
- Calculate 3 casing volumes for the minimum required purge amount and record on sampling log.
- Evaluate previous purge rates, amount of drawdown, stability of field parameters, and total purge volume prior to sample collection from previous sampling records and historical data tables (Appendix B of *Monitoring Plan for Groundwater and Surface Water Monitoring Program*). If the well has not been previously sampled, estimate the expected purge rate using previous sampling information from nearby wells.
- If the pumping rate is in excess of one gpm, install the provided flow splitter so that the pumping rate does not need to be decreased to collect the sample. If the flow rate is at two gpm or above, install a second flow splitter to control the flow through the flow through cell.
- Install the pump as previously described. Immediately after installation, stuff a large trash bag, or place another barrier into the well bore around the pump discharge tubing. This will help to prevent foreign objects from falling into the well.
- Ensure that all tubing connections are properly tightened and then start the pump. Check for any leaks, monitor drawdown, and calculate/set the purge rate. The purge rate can be determined using the fill-time of a graduated container, or using a flow meter if available. The well specific purge rate and pump setting should be available on the previous purge form. Record pump setting (i.e. hertz) on sampling log if available.
- Purge water should be contained in a portable purge water storage tank. If approved by well owner and the governing regulatory agencies, water may be discharged directly to the ground (this presently applies to PM-03 and PM-04 water supply wells), as directed by the FTM.
- Continue purging, measuring WL and field indicator parameters periodically (time, pH, conductivity, turbidity, dissolved oxygen, temperature, salinity, TDS, ORP, appearance, and any odors present). Time the readings such that there are a minimum of 4 sets of data collected over the course of the full purge.
- If significant drawdown is observed or turbidity increases dramatically, decrease the purge rate and measure/record new purge rate. Significant drawdown is considered to be 5 percent of the total height of the water column or to the top of screen. Record time for all measurements collected. Note and provide qualifying remarks if parameter readings are anomalous or unstable due to instrument problems and change out the instrument.

- During the purge, compare the field parameters to historical purge data. If the parameters are significantly different (greater than 50% difference for SC, pH, and/or ORP) re-confirm the ID of the well. If the well ID is re-confirmed by 2 crew members, and the readings continue to be significantly different than prior readings, set up a second WQ instrument in series to confirm readings. If the anomalous readings are confirmed by the second instrument, contact the field coordinator to resolve the issue. If the second WQ instrument produces readings that are comparable to historic values, note an instrument change and use the second instrument's readings.
- Continue purging until ***3-casing volumes*** have been removed ***and*** field parameters stabilize. Indicator parameters are considered stabilized when 3 consecutive readings made several minutes apart fall within the following EPA stabilization criteria:
  - pH +/- 0.1 pH units
  - Specific conductance +/- 3%
  - ORP +/- 10 millivolts
  - Turbidity 10 NTU units or less unless other parameters have stabilized during an extended purge and turbidity is trending flat if still over 10 NTU units. The target turbidity goal (but not a hard criterion) is 5 to 10 NTUs.
  - Dissolved oxygen +/- 0.3 mg/L
  - Temperature +/- 2° Celsius
- When the requirements above have been satisfied and the purge cycle is complete, disconnect the flow through cell and prepare to collect samples directly from the pump discharge tubing for analyses according to event-specific PST.
- If flow splitters have been used, do not change the flow rate, and collect the sample from the dedicated sampling port of the first splitter in line.
- Prepare sample containers and collect gas-sensitive analytes first. The preferred collection order will be volatile organic compounds (VOCs), semi-volatile organic compound (SVOCs), metals (including hexavalent chromium [Cr(VI)] and total chromium [Cr(T)]; see SOP-A6), then general chemistry (cations, anions, stable isotopes).
- For filtered samples, attach a 0.45 micron in-line filter to the pump discharge and allow approximately 500 mL of sample to pass through the filter before beginning sample collection in accordance with SOP-A6, *Field filtration* and the QAPP.
- When sample collection is complete, record sample information, final WL, and purge volume data in MIST and on the field sampling log.
- If transient pump previously installed, remove the pump from the well, detach the dedicated tubing and carefully drain any residual water to the purge water tank. Install appropriate tubing cap to prevent any residual water from leaking from the sample tubing. Store the dedicated tubing in a sealed, labeled trash bag. Decontaminate the pump according to SOP-A10, *Decontamination of Water Sampling Equipment.*

- If well was equipped with a transducer, replace the transducer in exactly the same configuration in which it was found and in accordance with SOP-C1, *Solinst Pressure Transducers*.
- Close and secure well protection lid.
- Follow the applicable SOPs, O&M Manual and the Procedures Manual for sample handing and management, equipment decontamination, and investigation-derived waste (IDW) management (O&M Manual Volume 1, Section 6 during O&M or Appendix R of the C/RAWP during construction).

LOW VOLUME AND POOR RECOVERY WELLS:

Some groundwater monitoring wells under the GMP may exhibit slow or poor recovery upon purging. These monitoring wells may not recharge sufficiently during purging, and may run completely dry without an opportunity to collect the required series of groundwater stabilization parameters, or requisite samples. The following procedures will be followed for collecting representative groundwater samples from wells that go dry during purging.

PREPARATION & SETUP:

Follow the steps above.

PURGING AND SAMPLING PROCEDURES FOR LOW RECOVERY WELLS:

- Prepare the groundwater sampling log. Use the static water level and the total depth provided on the field data sheet (comparing to the previous values used on the PST) to calculate the volume of one casing of standing water in the well.
- Calculate 3 casing volumes for the minimum required purge amount, and record on purge log.
- Evaluate previous purge rates, amount of drawdown, stability of field parameters, and total purge volume prior to sample collection from previous sampling records and historical data tables (Appendix B of *Monitoring Plan for Groundwater and Surface Water Monitoring Program*). If the well has not been previously sampled, estimate the expected purge rate using previous sampling information from nearby wells.
- Connect the dedicated purge tubing if available or use new tubing if necessary. Install the pump within the well screen or to the previously determined depth and start the purge. Monitor drawdown, and calculate/set the purge rate. Record the pump setting (i.e. hertz) on the sampling log if available.
- Continue purging, measuring WL and field indicator parameters periodically (time, pH, conductivity, turbidity, dissolved oxygen, temperature, salinity, TDS, ORP, and any odors present). Space the readings such that there are a minimum of 4 sets of data collected over the course of the available purge volume.
- During the purge, compare the field parameters to previous purge data. If the parameters are significantly different (greater than 50% difference for SC, pH, and/or ORP) confirm the ID of the well. If the well ID is confirmed by 2 crew members, and the

readings continue to be significantly different than prior readings, set up a second WQ instrument in series to confirm readings. If the anomalous readings are confirmed by the second instrument, contact the field coordinator to resolve the issue. If the second WQ instrument produces readings that are comparable to historic values, note an instrument change and use the second instrument's readings.

- Continue purging until ***3-casing volumes*** have been removed ***and*** field parameters stabilize, or until the well purges dry. If 3 casing volumes are removed, sample as described above. If the well runs dry, continue as instructed below.
- If previously installed, remove the pump from the well and decontaminate according to SOP A-10, *Decontamination of Water Sampling Equipment*. The pump may also be left in place to facilitate subsequent purging and sampling.
- Record the final water level, time, the volume of water discharged and the elapsed time for the dewatering of the well.
- Allow the well to recharge to 80 percent of the original height of the water column. Ideally, this should be within 24 hours of the monitoring well being purged dry. The recovery period to achieve 80 percent of the height of the water column could take longer than 24 hours in some instances (MW-48).
- ***At MW-24BR only,*** return to the well the following day and continue purging until a total of 190 gallons have been removed, then sample normally.
- Once recovery has reached 80%, or 48 hours have elapsed (whichever comes first), a bailer can be used for sample collection. Collect samples for analyses according to PST. Prepare sample containers and collect gas-sensitive analytes first. The preferred collection order will be volatile organic compounds (VOCs), semi-volatile organic compound (SVOCs), metals (including hexavalent chromium [Cr(VI)] and total chromium [Cr(T)]), then general chemistry (cations, anions, stable isotopes).
- If an insufficient volume of water is available to fill all of the sample containers, first contact laboratory personnel to determine the minimum allowable volumes needed for the required analyses. *(Talk to FTM as the FTM may have already contact lab personnel and may have the instructions for you.)* Then verify the critical analyte list with the PM or the FTM and prioritize the sample collection to obtain the critical analytes for the main contaminants of concern first. Continue collecting samples until all samples have been collected, or the groundwater supply is exhausted. Unfiltered samples are to be filled by transferring water directly from the bailer to the sample container.
- For filtered samples, attach a 0.45 micron in-line filter to the bailer and allow approximately 200 mls of sample to pass through the filter before beginning sample collection in accordance with SOP-A6 *Field filtration*. If gravity flow is insufficient to filter the sample, use a pressurized bailer and filter for sample filtration.
- When sample collection is complete, record sample information, final WL, and purge volume data in MIST and on the field sampling log.
- If well was equipped with a transducer, replace the transducer in exactly the same configuration in which it was found and according to SOP-C1, *Solinst Pressure Transducers*.

- Close and secure well protection lid.
- Follow applicable SOPs, the O&M Manual and Procedures Manual for sample handing and management, equipment decontamination, and IDW management (O&M Manual Volume 1, Section 6 during O&M or Appendix R of the C/RAWP during construction).

Standard Operating Procedure
PG&E Topock Groundwater Remedy
Operation and Maintenance Plan

Title: Sampling of Concrete/Asphalt Demolition Waste

Number: Remedy-SOP-10_Rev0

Creation Date: 6/19/2015

1 Background and Scope

Pacific Gas and Electric Company (PG&E) is implementing a groundwater remedy near the intersection of Park Moabi Road and Interstate 40, approximately 12 miles southeast of Needles, California at the PG&E Topock Compressor Station (TCS). Construction and demolition of remedial facilities is expected to generate concrete and asphalt pavement rubble that will be managed for reuse, recycling, or offsite disposal.

Concrete and asphalt rubble will be managed as waste as outlined in Waste Management Plans for the project: see Appendix F of the Construction/Remedial Action Work Plan (Interim Measure No. 3 Decommissioning, Removal and Restoration Work Plan), and Appendix R of the Construction/Remedial Action Work Plan (Waste Management Plan). For concrete and asphalt associated with known hazardous waste or hazardous materials operations (such as the inside of containment structures for process chemicals) or that exhibit visual evidence of contamination, surface samples will be collected prior to demolition to determine if the material is contaminated. If contaminated, the concrete/asphalt demolition waste will be managed by either (1) offsite disposal under the assumption that the surface sample is representative of the entire mass of the slab, or (2) removing the surface contamination by cleaning (e.g., pressure washing with surfactant solution) or scarifying, and managing the cleaning fluids/scarified materials separately from the remaining concrete/asphalt mass as different waste streams. The classification and management requirements for the waste streams are described in the Waste Management Plans and are not repeated herein.

The objective of this Standard Operating Procedure (SOP) is to describe the procedure for sampling of concrete and asphalt surfaces/slabs to be demolished during the remedial action for purposes of determining whether the material is contaminated. Representative samples will be collected from concrete and asphalt surfaces/slabs associated with known hazardous waste or hazardous materials operations as described herein.

Concrete and asphalt slabs that are not associated with known hazardous material operations and that exhibit no visual evidence of contamination (staining, residue, etc.) will not be sampled. Asphalt that exhibits oil stains in areas with no history of polychlorinated biphenyl use will not be sampled.

2 Equipment/Supplies

- Appropriate personal protective equipment (PPE)
- Health and Safety Plan
- Waste Management Plan (see Appendix F or Appendix R of the Construction/Remedial Action Work Plan)
- Map and/or detailed description of concrete and asphalt sampling locations
- Coring drill and coring barrel, rotary impact hammer variable speed drill, or similar

- Hose and water supply for coring drill
- Aluminum foil
- Stainless steel chisel and hammer
- Stainless steel spoon
- Plastic Ziploc bags
- Sample bottles/jars
- Sample labels
- Sample logbook
- Chain-of-custody forms
- Chain-of-custody seals
- Waste container (e.g., 55-gallon drum)

3 Preconditions

- **Sampling and Analysis Plan:** A sampling and analysis plan will be prepared and provided by the Construction Manager or designee.
- **Sampling Approach:** In general, sampling areas shall be determined based on the history of activities performed in the demolished structure or pavement. The approach is based on defining distinct areas of the structure, roadway, or pad or any other feature (e.g., sump), based on historical use. The preferred sampling timing is prior to the demolition of the concrete or asphalt surface.
    - One composite sample will be collected at each distinct area of the structure for demolition (e.g., roadway, concrete pad, process area, tank containment).The composite sample will be collected from locations most likely to have contacted hazardous waste or hazardous materials, such as knowledge of use (inside containment structures for process chemicals), areas of visual staining, or other indication of potential contamination (coloration, or odor) to identify the nature of the contaminants.
    - Prior to sample collection, sample locations will be marked, typically by painting boxes on the designated slab. The samples will be collected within the interior of the painted box but not the painted surface.
    - Samples will be collected by chipping or coring. Typically samples should be no deeper than 1 inch unless staining or discoloration indicates that contamination may extend below that depth. Sampling logs shall record he depth of core samples. Typically, three chips or cores will be collected from each designated area; sufficient sample will be collected for the designated analytical methods.
- **Analytical Parameters:** Analytical parameters shall be selected based on the history of activities performed in the area. The analytical lab shall be consulted to determine sample volumes, preservatives, containers, and any other special requirements.

4 Procedure

1. Take photograph(s) of sample location.
2. Connect power or water supply line to drill, per the drill manufacturer's instruction manual.
3. Remove debris with a clean brish or cloth prior to drilling. Place the drill over the specified sampling location.
4. For coring:
    - Keep a steady downward pressure on the coring barrel.

- Raise the core barrel every few minutes to facilitate the removal of drill cuttings.
- Drill sample so that it extends throughout the entire thickness of the concrete or asphalt.

- Once the cut has been completed, remove the coring barrel from the hole.Typically the concrete/asphalt core will remain in the core barrel. Tap the outside of the core barrel gently with a hammer until the core drops out.

5. For drilling:
   - Lock a 0.5”-1” drill bit into the impact hammer drill. and an impact drill.
   - Drill vertically to the desired depth, capturing chips or powder with a scoop or spoon. The sampler can also drill multiple holes closely together so that the concrete/asphalt between the drilled holes breaks into chips.
6. Place sample, including powder and smaller chips generated during the drilling, in a stainless steel bowl.
7. To collect a COMPOSITE sample:

   NOTE: If analytical laboratory provides alternative composite sample collection procedures, follow the instructions of the laboratory instead of those listed below.

   - Repeat steps 1 through 6 for core/chip sample locations that are to be composited.
   - After all samples to be composited are in a stainless steel bowl, break samples into smaller pieces (the size of pieces shall be instructed by analytical lab).
   - Use a stainless steel spoon to homogenize the sample.
   - Transfer the sample into sample container(s).
   - Attach sample label, custody seal, and immediately place sample into cooler with ice.
8. Transfer any drill cuttings left over from the sampling into a waste container.
   - Ensure waste container is sealed, labeled, and handled appropriately.

5 References

Byrnes, Mark Edward. 2008. *Field Sampling Methods for Remedial Investigations, Second Edition.* CRC Press.

U.S. Environmental Protection Agency (EPA). 2002. *RCRA Waste Sampling Draft Technical Guidance*. http://www.epa.gov/epawaste/hazard/testmethods/sw846/samp_guid.htm. Accessed May 12, 2015.

Standard Operating Procedure
PG&E Topock Remedy-produced Water Conditioning Plant Operation and Maintenance Plan

Title: System "Hot" Startup and Shutdown

Number: RTP-SOP-01_Rev1

Created Date: 12/19/13

1 Background and Scope

Pacific Gas and Electric Company (PG&E) is implementing a groundwater remedy near the intersection of Park Moabi Road and Interstate 40, approximately 12 miles southeast of Needles, California at the PG&E Topock Compressor Station (TCS). The Remedy-produced Water Conditioning Plant (RTP) will treat the water produced by the groundwater remedy prior to re-use or re-injection onsite.

The objective of this Standard Operating Procedure (SOP) is to describe the procedures for (a.) starting up the RTP after a short-term shutdown and (b.) shutting down the RTP for a short term.

2 Drawing Numbers

- Influent Tanks 1 through 4, Instrumentation: I-11-01 through I-11-04
- Filter Systems A and B Side, Instrumentation: I-12-01 and I-12-02
- Remedy-produced Water Conditioning Systems, Instrumentation: I-12-03 and I-12-04
- Air Compressor and Seal Water System, Instrumentation: I-12-05
- Conditioned Water Storage Tanks, Instrumentation: I-14-01 and I-14-02

3 Equipment List

- Health and Safety Plan

4 Preconditions

a. System startup:

- Operators should have system training and operating experience before attempting a system startup.
- Power has been restored (if startup is occurring after a power outage).
- All master control center (MCC) breakers are energized except the "Spare Starter" and "Spare Breaker."

b. System shutdown:

- Operators should have system training and operating experience before attempting a system shutdown.
- The daily scheduled backwash and treatment processes are complete, or it is otherwise necessary to manually shutdown the RTP.

5 Procedure

a. System startup:

1. Go to HMI in the Office/Sample Room on the second floor of the Plant.
2. Ensure that the HVAC unit is ON.
3. Confirm the air compressor and air dryer/filter DRYER-RTP01-1202 are ON.
4. Confirm that seal water package system is ON.
5. Switch Influent Tank 1 recirculation pump PMP-RTP01-1101 to AUTO.
6. Switch Influent Tank 2 recirculation pump PMP-RTP01-1102 to AUTO.
7. Switch Influent Tank 3 recirculation pump PMP-RTP01-1103 to AUTO.
8. Switch Influent Tank 4 recirculation pump PMP-RTP01-1104 to AUTO.
9. Switch A Side filter feed pumps PMP-RTP01-1210 and -1220 to AUTO.
10. Switch B Side filter feed pumps PMP-RTP01-1230 and -1240 to AUTO.
11. Enable chemicals feed pumps:
    - Caustic feed pumps, PMP-RTP01-1211 and -1212
    - Coagulant feed pumps, PMP-RTP01-1221 and -1222
    - Acid feed pumps PMP-RTP01-1231 and -1232
12. Switch conditioned water transfer pumps PMP-RTP01-1405 and PMP-RTP01-1406 to AUTO.
13. Switch truck fill pump PMP-RTP01-1403 to AUTO

b. System shutdown:

1. Go to HMI in the Office/Sample Room on the second floor of the Plant.
2. Switch Influent Tank 1 recirculation pump PMP-RTP01-1101 to OFF.
3. Switch Influent Tank 2 recirculation pump PMP-RTP01-1102 to OFF.
4. Switch Influent Tank 3 recirculation pump PMP-RTP01-1103 to OFF.
5. Switch Influent Tank 4 recirculation pump PMP-RTP01-1104 to OFF.
6. Switch A Side filter feed pumps PMP-RTP01-1210 and -1220 to OFF.
7. Switch B Side filter feed pumps PMP-RTP01-1230 and -1240 to OFF.
14. Disable chemicals feed pumps:
    - Caustic feed pumps, PMP-RTP01-1211 and -1212
    - Coagulant feed pumps, PMP-RTP01-1221 and -1222
    - Acid feed pumps PMP-RTP01-1231 and -1232
8. Switch conditioned water transfer pumps PMP-RTP01-1405 and -1406 to OFF.
9. Switch truck fill pump PMP-RTP01-1403 to OFF.

Standard Operating Procedure
PG&E Topock Remedy-Produced Water Conditioning Plant Operation and Maintenance Plan

Title: Off-site Trucking of Remedy-produced Water

Number: RTP-SOP-08_Rev1

Created Date: 2/13/14

1 Background and Scope

Pacific Gas and Electric Company (PG&E) is implementing a groundwater remedy near the intersection of Park Moabi Road and Interstate 40, approximately 12 miles southeast of Needles, California at the PG&E Topock Compressor Station (TCS). The Remedy-produced Water Conditioning Plant (RTP) will treat the water produced by the groundwater remedy prior to re-use or re-injection onsite.

The objective of this Standard Operating Procedure (SOP) is to describe the procedures for transferring conditioned water to the TCS truck fill station for off-site trucking

This procedure is controlled both manually and through the SCADA/HMI.

If question/concerns arise throughout the procedure, contact the Maintenance Supervisor to determine how to proceed.

2 Drawing Numbers

- Conditioned Water B-Side, Instrumentation: I-14-02

3 Equipment List

- Appropriate personal protective equipment (PPE)
- Health and Safety Plan
- OSHA suggested spotting signals for vehicles (attached)
- Safety cones
- 5-gallon bucket

4 Preconditions

- B-Side conditioned water storage tank (TNK-RTP01-1410) water level is above the low-level set point (LSL-RTP01-1452).

5 Procedure

1. Be aware that you are working around large equipment with limited visibility. You must make sure that the driver sees you and knows what you intend to do. DO NOT put yourself in a position where you can get crushed or pinched.

2. Prepare loading site:

    a. Adjust containment pad so that when trailer tandems are at the front lip of the pad the loading hose will lie within the rear area of the containment pad.

    b. Confirm that all the adapters are present and that the loading hose is properly stored and not in the path of the trucks as they enter the loading area.

    c. Confirm that the safety cones are in place at the north end of the containment pad (where the truck will be entering) and that you have a 5-gallon bucket to place under the trailer's drip tray valves.

3. Stage truck on the containment pad:

    a. When the driver arrives to the entrance of the loading area, the operator will discuss with the driver the preferred orientation of the truck on the loading pad: The truck will be stopped when the front trailer axle is at the south end of the containment pad (opposite of the entrance). This assures enough room in the containment pad behind the trailer to catch any minor spills. This also provides enough room for the hose to be in the containment pad in case it is dropped during connecting or disconnecting to the trailer. The operator will also discuss with the river that they will direct the driver onto the containment pad using hand signals. The operator will verify that the OSHA suggested spotting signals for vehicles (attached to this SOP) are okay to use, and add/modify hand signals as needed.

    b. As the truck moves to the loading area, the operator directs the truck driver for the placement of the truck on the containment pad using the agreed upon hand signals.

    c. Check that the driver has a valid license and appropriate credentials.

    d. Check that the driver has completed a pre-trip inspection on the truck and trailer.

    e. Check that the driver currently driving the truck is the same driver who performed the pre-trip inspection.

        Note: If there are any discrepancies in Steps 3.b, 3.c and 3.d please contact the Project Manger before proceeding.

    f. Allow the driver to hook up to the load-out hose.

        Note: The driver is responsible for:

        i. Attaching the load-out hose to the truck.

        ii. Making sure the truck tank is vented.

        iii. Determining how many gallons are to be loaded.

        iv. Disconnecting the load-out hose.

        v. Operating the load valve on the truck.

        The operator is responsible for:

        i. All valves upstream of the load-out hose.

        ii. Operating the load-out pump.

        iii. Telling the driver how many gallons have been loaded.

4. Select tank and activate pump:

    a. Confirm using the HMI that the conditioned storage water tank (TNK-RTP01-1410) is in appropriate condition to discharge.

    b. Write the beginning totalizer reading on the shipping documentation.

c. Confirm with the driver that the line isolation valves are properly positioned before opening tank valves.

d. Open the manual valve upstream of the TCS Truck Fill Pump (V-RTP01-1403A).

e. Open the manual valve downstream of the TCS Truck Fill Pump (V-RTP01-1403C).

f. Double check truck valves and vents and confirm with the driver that the truck is ready to receive water before opening the load-out supply hose valve (remember that water may gravity-flow out of the hose even if the pump is off).

g. Open the load-out supply hose valve.

h. Turn on the truck fill/transfer pump PMP-RTP01-1403 by turning the hand switch HS-RTP01-1403 to ON.

i. The truck fill/transfer pump will draw from the conditioned water storage tank (TNK-RTP01-1410).

j. During the pumping operation the operator must stay in the load control area and the driver must stay by the trailer valve.

k. There are numerous ways the drivers use to load their trucks to the legal limits. This means that the operator and the driver need to work together to assure that the truck goes out properly loaded.

l. When the truck is loaded, first turn off the transfer pump PMP-RTP01-1403 by turning the hand switch HS-RTP01-1403 to OFF. Then close the load supply valve.

m. The driver will close the trailer valve.

5. Disconnect the hose from trailer valve:

   a. Confirm that the 5-gallon bucket is under drip tray valve and drip tray valve is open.

   b. The operator will disconnect the load-out hose.

   c. Hang the hose on the storage hook, remove any adapters used and replace trailer valve cap or plug.

   d. Close drip tray valve and remove 5-gallon bucket from under drip tray.

6. Fill out shipping documentation and record the load:

   a. Write the ending totalizer reading on the shipping documentation.

   b. Confirm that you and the driver have filled out and signed the manifest and that the manifest has been properly filled in and the manifest number recorded.

   c. Confirm that you and the driver have signed the shipping documentation and give the driver their copies.

7. Shutdown after loading is completed:

   a. Verify with the driver that the truck is in a safe condition and that it is not overly full.

   b. Instruct the driver to exit the decontamination pad in the eastbound direction. Assist the truck driver with exiting the decontamination pad.

   c. Adjust placement of containment pad in the loading area if it has slipped during the loading operation.

   d. Empty the 5-gallon buckets into the decontamination pad secondary containment trench.

   e. Take all paperwork to office and file in the appropriate place.

Standard Operating Procedure
PG&E Topock Remedy-produced Water Conditioning Plant Operation and Maintenance Plan

Title: Disposal of Produced Water in Evaporation Ponds via the TCS Wastewater Tank Discharge Connection

Number: RTP-SOP-10_Rev1

Created Date: 2/24/14

1 Background and Scope

Pacific Gas and Electric Company (PG&E) is implementing a groundwater remedy near the intersection of Park Moabi Road and Interstate 40, approximately 12 miles southeast of Needles, California at the PG&E Topock Compressor Station (TCS). The Remedy-produced Water Conditioning Plant (RTP) will treat the water produced by the groundwater remedy prior to re-use or re-injection onsite.

The objective of this Standard Operating Procedure (SOP) is to describe the procedures for transferring water from the following locations to the evaporation ponds:

a. Unconditioned water from the Remedy A-Side
b. Conditioned water from the Remedy A-Side
c. Liquids/solids from Influent Tank Farm secondary containment
d. Liquids/solids from A-Side Conditioned Water Storage Tank Farm secondary containment

This procedure will require coordination with TCS Operations. Permission to transfer a specific quantity of water must be approved by TCS and steps must be taken to assure that only the specific quantity of water is transferred.

Water is transferred to the evaporation ponds via a connection to the TCS wastewater tank discharge. This procedure is controlled manually and through the SCADA/HMI.

2 Drawing Numbers

- Influent Tanks 1 through 4, Instrumentation: I-11-01 through I-11-04
- Filter System A-Side, Instrumentation: I-12-01
- Conditioned Water Storage Tanks, Instrumentation: I-14-01 and I-14-02

3 Equipment List

- Appropriate personal protective equipment (PPE)
- May also require handheld pH and conductivity meters

4 Preconditions

a. Unconditioned water from the Remedy A-side:

- PG&E has instructed for unconditioned water to be sent from the Remedy A-side to the evaporation ponds via the TCS wastewater tank discharge connection.
- Designated influent tank(s) (TNK-RTP01-1101, -1102, -1103, -1104) water level is full and/or backwash pumps have completed their designated cycles.

b. Conditioned water from the Remedy A-side Conditioned Water Tank Farm:

- PG&E has instructed for water to be sent from the Remedy A-side conditioned water storage tanks (TNK-RTP01-1401 and -1402) to evaporation ponds via the TCS wastewater tank discharge connection.
- Designated Remedy A-side conditioned water storage tank(s) water level(s) are above the low-level set point (LSL-RTP01-1451 and -1453).

c. Liquids/solids from Influent Tank Farm secondary containment:

- PG&E has instructed for water to be sent from the Influent Tank Farm secondary containment to evaporation ponds via the TCS wastewater tank discharge connection.
- There are liquids/solids in the Influent Tank Farm sump.
- The manual valves are configured to pump liquids/solids to the influent tanks.

d. Liquids/solids from A-side Conditioned Water Storage Tank Farm secondary containment:

- PG&E has instructed for water to be sent from Conditioned Water Storage Tank Farm A-side secondary containment to evaporation ponds via the TCS wastewater tank discharge connection.
- There are liquids/solids in the Conditioned Water Storage Tank Farm sump.
- The manual valves are configured to pump liquids/solids to the Influent Tank Farm sump.

5 Procedure

a. Transferring unconditioned water from the Remedy A-side to evaporation ponds via the TCS wastewater tank discharge connection:

1. Notify and coordinate with TCS Operations before water is transferred. Confirm the allowable flow rate and allowable volume of liquid that may be transferred to the TCS evaporation ponds.
2. Use the HMI to turn off the primary filter feed pump on the filter system A-side (PMP-RTP01-1210 or PMP-RTP01-1220).
3. Close the valves upstream of the primary coarse cartridge filter (FV-RTP01-1211A or -1221A).
4. Open the normally closed (NC) manual valve downstream of the primary filter feed pump that routes liquids/solids to the TCS waste water tank (V-RTP01-1210E or -1220E).
5. Use the HMI to program the primary filter feed pump (PMP-RTP01-1210 or -1220) to transfer only the volume of water determined in Step 1 to the TCS evaporation ponds.
6. Use the HMI to turn on the primary filter feed pump (PMP-RTP01-1210 or -1220). Use the speed command to adjust the flow rate to the allowable flow rate determined in Step a.1.
7. The filter feed pump will move water to the TCS evaporation ponds when the second Precondition is met.

8. The filter feed pump will turn off when the volume of water to be transferred that was programmed in Step a.6 is reached.
9. Close the NC manual valve downstream of the primary filter feed pump that routes liquids/solids to the TCS evaporation ponds (V-RTP01-1210E or -1220E).
10. Open the valves upstream of the primary coarse cartridge filter (FV-RTP01-1211A or -1221A).
11. Use the speed command on the HMI to adjust the flow rate of the primary filter feed pump back to its initial flow rate (prior to Step a.4).
12. Use the HMI to return the primary filter feed pump on the filter system A-side (PMP-RTP01-1210 or -1220) to the regular operations mode, unless otherwise instructed.

b. Transferring conditioned water from the Remedy A-side Conditioned Water Tank Farm to evaporation ponds via the TCS wastewater tank discharge connection:

1. Notify and coordinate with TCS Operations before water is transferred. Confirm the allowable flow rate and allowable volume of liquid that may be transferred to the TCS evaporation ponds.
2. Use the HMI to turn off the conditioned water transfer pump (PMP-RTP01-1405 or -1406).
3. Use the HMI to close FV-RTP01-1416.
4. Use the HMI to open FV-RTP01-1415, which allows water to be transferred to the TCS wastewater tank discharge connection.
5. Use the HMI to program the conditioned water transfer pump (PMP-RTP01-1405 or PMP-RTP01-1406) to transfer only the volume of water determined in Step b.1 to the TCS evaporation ponds.
6. The conditioned water transfer pump (PMP-RTP01-1405 or -1406) will move water to the TCS evaporation ponds when the Preconditions are met. The volume of water transferred can be monitored using the flow meter FM-RTP01-1471.
7. The conditioned water transfer pump will turn off when the volume of water to be transferred that was programmed in Step b.5 is reached.
8. Use the HMI to close FV-RTP01-1415.
9. Use the HMI to open FV-RTP01-1416 so that water will be transferred to the T-IRZ00-0620 conditioned water frac tank, unless otherwise instructed.
10. Use the HMI to return the conditioned water transfer pumps on the filter system A-side (PMP-RTP01-1405 or -1406) to the regular operations schedule, unless otherwise instructed.

c. Transferring liquids/solids from the Influent Tank Farm secondary containment to evaporation ponds via the TCS wastewater tank discharge connection:

1. Notify and coordinate with TCS Operations before water is transferred. Confirm the allowable flow rate and allowable volume of liquid that may be transferred to the TCS evaporation ponds.
2. Open manual valve V-RTP01-1105C and then close manual valve V-RTP01-1105A.
3. Plug in sump pump PMP-RTP01-1105. Keep track of the volume of liquids/solids transferred to the TCS evaporation ponds using the flow meter FM-RTP01-1171.
4. When the maximum allowable volume determined in Step c.1 has been reached **or** all liquids/solids in the sump have been pumped before the maximum allowable volume has been reached, unplug the sump pump.
5. Open manual valve V-RTP01-1105A and then close manual valve V-RTP01-1105C.

d. Transferring conditioned water from the Conditioned Water Storage Tank Farm A-side secondary containment to evaporation ponds via the TCS wastewater tank discharge connection:

1. Notify and coordinate with TCS Operations before water is transferred. Confirm the allowable flow rate and allowable volume of liquid that may be transferred to the TCS evaporation ponds.
2. Open manual valve V-RTP01-1407D and then close manual valve V-RTP01-1407B.
3. Plug in PMP-RTP01-1407 at the outlet. Keep track of the volume of liquids/solids transferred to the TCS evaporation ponds using the flow meter FM-RTP01-1472.
4. When the maximum allowable volume determined in Step e.1 has been reached **or** all liquids/solids in the sump have been pumped before the maximum allowable volume has been reached, unplug the sump pump.
5. Open manual valve V-RTP01-1407B and then close manual valve V-RTP01-1407D.

Standard Operating Procedure
PG&E Topock IRZ
Operation and Maintenance Plan

Title: MW-20 Bench System Startup
Number: IRZ-SOP-01_Rev1
Creation Date: 9/8/2014

1 Background and Scope

Pacific Gas and Electric Company (PG&E) is implementing a groundwater remedy near the intersection of Park Moabi Road and Interstate 40, approximately 12 miles southeast of Needles, California at the PG&E Topock Compressor Station (TCS).

The objective of this Standard Operating Procedure (SOP) is to describe the procedures for startup of the National Trails Highway (NTH) In-Situ Reactive Zone (IRZ), Inner Recirculation Loop (IRL), and Topock Compressor Station (TCS) Recirculation Loop extraction and injection well recirculation systems. The NTH IRZ consists of four extraction wells and up to 24 injection wells, while the IRL consists of five River Bank Extraction Wells and four Inner Recirculation Loop Injection Wells. The TCS Recirculation Loop consists of two Transwestern Bench Extraction Wells, five East Ravine Extraction Wells, and two TCS Injection Wells. Below-grade piping networks allow for the conveyance of extracted groundwater, carbon-amended water, and fresh water between extraction wells, the MW-20 Bench, and injection wells. Ethanol dosing facilities are located at the MW-20 Bench with dosing procedures outlined in IRZ-SOP-04.

2 Drawing Numbers

- I-03-01: TCS Loop East Ravine Extraction Wells P&ID
- I-03-02: TCS Loop Transwestern Bench Extraction Wells P&ID
- I-03-03: TCS Loop Injection Wells P&ID
- I-04-01: IRZ Single Screen NTH IRZ Extraction Wells P&ID
- I-04-02: IRZ Dual Screen NTH IRZ Extraction Wells P&ID
- I-04-03: IRZ Single Screen NTH IRZ Injection Wells P&ID
- I-04-04: IRZ Dual Screen NTH IRZ Injection Wells P&ID
- I-04-05: IRZ Dual Screen Cluster NTH IRZ Injection Wells P&ID Sheet 1 of 2
- I-04-06: IRZ Dual Screen Cluster NTH IRZ Injection Wells P&ID Sheet 2 of 2
- I-05-01: Inner Recirculation Loop Extraction Wells P&ID
- I-05-02: Inner Recirculation Loop Injection Wells Type 1 P&ID
- I-05-03: Inner Recirculation Loop Injection Wells Type 2 P&ID
- I-06-01: MW-20 Bench Carbon Amendment Building P&ID Sheet 1 of 4

- I-06-02: MW-20 Bench Carbon Amendment Building P&ID Sheet 2 of 4
- M-03-01: TCS Loop Extraction Well Construction Details
- M-03-02: TCS Loop Injection Well Construction Details
- M-03-03: TCS Loop Extraction Well Vaults Mechanical Details
- M-03-04: TCS Loop Injection Well Vaults Mechanical Details Sheet 1 of 2
- M-03-05: TCS Loop Injection Well Vaults Mechanical Details Sheet 2 of 2
- M-04-03: IRZ Single Screen Extraction Well Vault Mechanical Details
- M-04-04: IRZ Dual Screen Extraction Well Vault Mechanical Details
- M-04-05: IRZ Single Screen Injection Well Vaults Mechanical Details
- M-04-06: IRZ Dual Screen Injection Well Vaults Mechanical Details
- M-04-07: IRZ Dual Screen Injection Well Vaults Mechanical Sections
- M-04-08: IRZ Dual Screen Cluster Injection Well Vaults Mechanical Details
- M-04-09: IRZ Dual Screen Cluster Injection Well Vaults Mechanical Sections
- M-05-05: Inner Recirculation Loop Injection Well Vault Type 1 Mechanical Details
- M-05-06: Inner Recirculation Loop Injection Well Vault Type 1 Mechanical Sections
- M-05-07: Inner Recirculation Loop Injection Well Vault Type 2 Mechanical Details
- M-05-08: Inner Recirculation Loop Injection Well Vault Type 2 Mechanical Sections

3 Equipment

- Appropriate PPE
- Health and Safety Plan
- Ethanol spill kit
- Fire extinguisher
- Eyewash supplies and safety shower

4 Procedure

1. Prefield Meeting
    1.1 Confirm with Maintenance Supervisor which injection and extraction wells are desired to operate
2. Pre-startup human machine interface (HMI) checks
    2.1 Check system alarm status on HMI
        2.1.1 Select “ALARMS” tab on HMI
        2.1.2 Verify if any alarm condition exist
            1. Document any alarm conditions in the checklist if they exist
    2.2 Call Maintenance Supervisor or Project Engineer if any alarms are active

2.3 Select the “Injection Well” tab on the HMI to view the NTH IRZ, IRL, and TCS Recirculation Loop injection well valve positions

2.3.1 Place desired wells to operate in “AUTO” position (this will not open the valves at this point)

2.4 Select the “Extraction Well” tab on the HMI to view the extraction well valve positions

2.4.1 Place desired wells to operate in “AUTO” position (this will not activate the pumps)

3. System startup

3.1 Select the “SYSTEM” tab on the HMI screen

3.2 Initiate recirculation by pressing “STARTUP”. Injection wells will open first followed by startup of extraction wells

4. Post-startup HMI checks

4.1 Confirm and record proper operating parameters

4.1.1 MW-20 Bench extraction header pressures. Record pressures on tablet

1. PIT-IRZ00-0662
2. PIT-IRZ00-0663

4.1.2 NTH IRZ

1. Extraction well flow rate (FIT-*0470A, FIT-*0471A, FIT-*0471B). Record flow rates on tablet
2. Extraction well water level (LT-*0460B, LT-*0461B, LT-*0461C). Record water levels on tablet
3. Injection well flow rate (FIT-*0472A, FIT-*0473A, FIT-*0473B, FIT-*0474A, FIT-*0474B, FIT-*0475A, FIT-*0475B). Record flow rates on tablet
4. Injection well water levels (LT-*0462E, LT-*0463H, LT-*0463I, LT-*0464H, LT-*0464I, LT-*0465H, LT-*0465I). Record water levels on tablet

4.1.3 IRL

1. Extraction well flow rate (FIT-*0570A). Record flow rates on tablet
2. Extraction well water level (LT-*0560B). Record water levels on tablet
3. Injection well flow rate (FIT-*0571A). Record flow rates on tablet
4. Injection well water levels (LT-*0561F). Record water levels on tablet

4.1.4 TCS Loop

1. Extraction well flow rate (FIT-*0370A and FIT-*0371A) Record flow rates on tablet
2. Extraction well water level (LT-*0360B and LT-*0361B). Record water levels on tablet
3. Injection well flow rate (FIT-*0372A and FIT-*0372B). Record flow rates on tablet
4. Injection well water levels (LT-*0362E and LT-*0362F) . Record water levels on tablet

4.2 Call Project Engineer if any equipment is operating outside of acceptable range (PLC and tablet will provide warnings if a parameter is out of range)

5. Post-startup manual system checks

5.1 Confirm and record proper operating parameters

5.1.1 MW-20 Bench IRZ injection header pressures. Record pressures on tablet

1. PI-IRZ00-0660A
2. PI-IRZ00-0660B
3. PI-IRZ00-0660C
4. PI-IRZ00-0660D

5.2 Check piping for any leaks within the MW-20 Bench carbon amendment building

Standard Operating Procedure
PG&E Topock IRZ
Operation and Maintenance Plan

Title: MW-20 Bench System Shutdown/Emergency Shutdown
Number: IRZ-SOP-02_Rev1

Creation Date: 9/8/2014

1 Background and Scope

Pacific Gas and Electric Company (PG&E) is implementing a groundwater remedy near the intersection of Park Moabi Road and Interstate 40, approximately 12 miles southeast of Needles, California at the PG&E Topock Compressor Station (TCS).

The objective of this Standard Operating Procedure (SOP) is to describe the procedures for normal shutdown along with emergency shutdown of the MW-20 Bench System, which includes the National Trails Highwah (NTH) In-Situ Reactive Zone (IRZ), Inner Recirculation Loop (IRL), and Topock Compressor Station (TCS) Recirculation Loop systems. The NTH IRZ consists of four extraction wells and up to 24 injection wells, while the IRL consists of five River Bank Extraction Wells and four Inner Recirculation Loop Injection Wells. The TCS Recirculation Loop consists of two Transwestern Bench Extraction Wells, five East Ravine Extraction Wells, and two TCS Injection Wells. Ethanol dosing facilities are located at the MW-20 Bench. Below-grade piping networks allow for the conveyance of extracted groundwater, carbon-amended water, and fresh water between extraction wells, the MW-20 Bench, and injection wells. The following SOP provides procedures for shutdown of the system along with subsequence checks to verify system parameters are in safe conditions. In the event of an emergency system shutdown it is important to keep human health and safety as the top priority. The system E-Stop should be engaged and then the environment should be deemed safe prior to continuance of procedures. If an unsafe circumstance remains go to a safe location and contact the project engineer.

2 Drawing Numbers

- I-03-01: TCS Loop East Ravine Extraction Wells P&ID
- I-03-02: TCS Loop Transwestern Bench Extraction Wells P&ID
- I-03-03: TCS Loop Injection Wells P&ID
- I-04-01: IRZ Single Screen Extraction Wells P&ID
- I-04-02: IRZ Dual Screen Extraction Wells P&ID
- I-04-03: IRZ Single Screen Injection Wells P&ID
- I-04-04: IRZ Dual Screen Injection Wells P&ID
- I-04-05: IRZ Dual Screen Cluster Injection Wells P&ID Sheet 1 of 2
- I-04-06: IRZ Dual Screen Cluster Injection Wells P&ID Sheet 2 of 2
- I-05-01: Inner Recirculation Loop Extraction Wells P&ID

- I-05-02: Inner Recirculation Loop Injection Wells Type 1 P&ID
- I-05-03: Inner Recirculation Loop Injection Wells Type 2 P&ID
- I-06-01: MW-20 Bench Carbon Amendment Building P&ID Sheet 1 of 4
- I-06-02: MW-20 Bench Carbon Amendment Building P&ID Sheet 2 of 4
- I-06-03: MW-20 Bench Carbon Amendment Building P&ID Sheet 3 of 4
- I-06-04: MW-20 Bench Carbon Amendment Building P&ID Sheet 4 of 4
- M-03-01: TCS Loop Extraction Well Construction Details
- M-03-02: TCS Loop Injection Well Construction Details
- M-03-03: TCS Loop Extraction Well Vaults Mechanical Details
- M-03-04: TCS Loop Injection Well Vaults Mechanical Details Sheet 1 of 2
- M-03-05: TCS Loop Injection Well Vaults Mechanical Details Sheet 2 of 2
- M-04-05: IRZ Single Screen Injection Well Vaults Mechanical Details
- M-04-06: IRZ Dual Screen Injection Well Vaults Mechanical Details
- M-04-07: IRZ Dual Screen Injection Well Vaults Mechanical Sections
- M-04-08: IRZ Dual Screen Cluster Injection Well Vaults Mechanical Details
- M-04-09: IRZ Dual Screen Cluster Injection Well Vaults Mechanical Sections
- M-05-05: Inner Recirculation Loop Injection Well Vault Type 1 Mechanical Details
- M-05-06: Inner Recirculation Loop Injection Well Vault Type 1 Mechanical Sections
- M-05-07: Inner Recirculation Loop Injection Well Vault Type 2 Mechanical Details
- M-05-08: Inner Recirculation Loop Injection Well Vault Type 2 Mechanical Sections

3 Equipment

- Appropriate PPE
- Health and Safety Plan
- Ethanol spill kit
- Fire extinguisher
- Eyewash supplies and safety shower

4 Procedure

Routine Shutdown Procedures

1. Pre-shutdown human machine interface (HMI) checks
    1.1 Check system alarm status on HMI
        1.1.1 Select “ALARMS” tab on HMI
        1.1.2 Verify if any alarm conditions exist

1. Document any alarm conditions in the checklist
2. Troubleshoot any alarms
3. Call Maintenance Supervisor or Project Engineer if alarms cannot be readily addressed

2. System shutdown

2.1 Scroll to the “SYSTEM” tab on the HMI

2.2 Initiate shutdown by pressing “SYSTEM SHUTDOWN”

2.3 Verify that operating equipment on the HMI process flow diagram graphic visually turns from green (operating) to red (inactive)

2.3.1 Red (inactive) equipment to note

1. Pump PMP-IRZ00-0640
2. Pump PMP-IRZ00-0641
3. Pump PMP-IRZ00-0642
4. FV-IRZ00-0611 (located downstream of Tank T-IRZ00-0601) should be closed
5. FCV-IRZ00-0612 (located downstream of Pump PMP-IRZ00-0640) should be closed
6. FCV-IRZ00-0613 (located downstream of Pump PMP-IRZ00-0641) should be closed
7. FCV-IRZ00-0614 (located downstream of Pump PMP-IRZ00-0642) should be closed
8. FCV-IRZ00-0615 (located on ethanol conveyance line upstream of tee with IRL Injection Header) should be closed
9. FCV-IRZ00-0616 (located on ethanol conveyance line upstream of tee with North NTH IRZ Injection Header) should be closed
10. FCV-IRZ00-0617 (located on ethanol conveyance line upstream of tee with South NTH IRZ Injection Header) should be closed
11. FCV-IRZ00-0618 (located on ethanol conveyance line upstream of tee with TCS Injection Header) should be closed
12. FV-*0307, FV-*0308, FCV-*0404, FCV-*0408, FCV-*0409, FCV-*0414, FCV-*0415, FCV-*0416, FCV-*0417, FV-*0507, and FCV-*0510 (located in NTH IRZ, IRL, and TCS injection meter vaults) should be closed
13. FCV-*0509 (located on IRL injection well ASR Pump Package backwash lines) should be closed

3. Post-shutdown human machine interface (HMI) checks

3.1 Check system flow rates

3.1.1 NTH IRZ

1. Extraction well flow rate (FIT-*0470A, FIT-*0471A, FIT-*0471B): 0 gallons per minute (gpm) per well

2. Injection well flow rate (FIT-*0472A, FIT-*0473A, FIT-*0473B, FIT-*0474A, FIT-*0474B, FIT-*0475A, FIT-*0475B): 0 gpm per well

3.1.2 IRL

1. Extraction well flow rate (FIT-*0570A): 0 gpm per well
2. Injection well flow rate (FIT-*0571A): 0 gpm per well

3.1.3 TCS Loop

1. Extraction well flow rate (FIT-*0370A and FIT-*0371A): 0 gpm per well
2. Injection well flow rate (FIT-*0372A and FIT-*0372B): 0 gpm per well

3.1.4 Carbon Amendment Building (* indicates IRZ00)

1. Carbon substrate hose pump PMP-*0640 flow rate (FIT-*0671): 0 gpm
2. Carbon substrate hose pump PMP-*0641 flow rate (FIT-*0675): 0 gpm
3. Carbon substrate hose pump PMP-*0642 flow rate (FIT-*0676 and FIT-*0681): 0 gpm
4. River bank extraction well header flow rate (FIT-*0672): 0 gpm
5. IRZ-23 well and Northern NTH IRZ extraction network header well flow rate (FIT-*0673 and FIT-*0674): 0 gpm
6. TCS extraction well network header flow rate (FIT-*0680): 0 gpm

3.2 Call Maintenance Supervisor or Project Engineer if any detectable flow rate is still observed following shutdown

4. Post-shutdown manual system checks

4.1 Record system pressures – Verify MW-20 Bench System pressures are 0 pounds per square inch (psi). Notify project engineer if system pressures above 5 psi remain in section of the piping

4.1.1 Injection header pressure (* indicates IRZ00)

1. PI-*0660A
2. PI-*0660B
3. PI-*0660C
4. PI-*0660D

4.1.2 Extraction header pressure (* indicates IRZ00)

1. PIT-*0662
2. PIT-*0663

4.2 Check piping for any leaks

Emergency System Shutdown

Note: Human health and safety is the first priority in any emergency situation.

1. System shutdown

1.1 Hit the E-Stop Button

1.1.1 Locations

1. Exterior of the IRZ Carbon Amendment Building
2. On the control panel in the electrical and control room of the IRZ Carbon Amendment Building

1.2 Determine if the emergency condition has been mitigated

1.2.1 If yes proceed to Step 2

1.2.2 If no, locate yourself to a safe area and call the Maintenance Supervisor or Project Engineer

2. System shutdown verification

2.1 Verify that operating equipment on the HMI process flow diagram graphic visually turned from green (operating) to red (inactive)

2.1.1 Pump PMP-IRZ00-0640

2.1.2 Pump PMP-IRZ00-0641

2.1.3 Pump PMP-IRZ00-0642

2.1.4 FV-IRZ00-0611 (located downstream of Tank TNK-IRZ00-0601) should be closed

2.1.5 FCV-IRZ00-0612 (located downstream of Pump PMP-IRZ00-0640) should be closed

2.1.6 FCV-IRZ00-0613 (located downstream of Pump PMP-IRZ00-0641) should be closed

2.1.7 FCV-IRZ00-0614 (located downstream of Pump PMP-IRZ00-0642) should be closed

2.1.8 FCV-IRZ00-0615 (located on ethanol conveyance line upstream of tee with IRL Injection Header) should be closed

2.1.9 FCV-IRZ00-0616 (located on ethanol conveyance line upstream of tee with North NTH IRZ Injection Header) should be closed

2.1.10 FCV-IRZ00-0617 (located on ethanol conveyance line upstream of tee with South NTH IRZ Injection Header Leg IRZ 24-40) should be closed

2.1.11 FCV-IRZ00-0618 (located on ethanol conveyance line upstream of tee with TCS Loop Injection Header) should be closed

2.1.12 FV-*0307, FV-*0308, FCV-*0404, FCV-*0408, FCV-*0409, FCV-*0414, FCV-*0415, FCV-*0416, FCV-*0417, FV-*0507, and FCV-*0510 (located in NTH IRZ, IRL, and TCS injection meter vaults) should be closed

2.1.13 FCV-*0509 (located on IRL injection well ASR Pump Package backwash lines) should be closed

3. Post-shutdown human machine interface (HMI) checks

3.1 System flow rates

3.1.1 NTH IRZ

1. Extraction well flow rate (FIT-*0470A, FIT-*0471A, FIT-*0471B): 0 gpm per well
2. Injection well flow rate (FIT-*0472A, FIT-*0473A, FIT-*0473B, FIT-*0474A, FIT-*0474B, FIT-*0475A, FIT-*0475B): 0 gpm per well

3.1.2 IRL

1. Extraction well flow rate (FIT-*0570A): 0 gpm per well

2. Injection well flow rate (FIT-*0571A): 0 gpm per well

3.1.3 TCS Loop

1. Extraction well flow rate (FIT-*0370A and FIT-*0371A): 0 gpm per well
2. Injection well flow rate (FIT-*0372A and FIT-*0372B): 0 gpm per well

3.1.4 Carbon Amendment Building (* indicates IRZ00)

1. Carbon substrate hose pump PMP-*0640 flow rate (FIT-*0671): 0 gpm
2. Carbon substrate hose pump PMP-*0641 flow rate (FIT-*0675): 0 gpm
3. Carbon substrate hose pump PMP-*0642 flow rate (FIT-*0676 and FIT-*0681): 0 gpm
4. River bank extraction well header flow rate (FIT-*0672): 0 gpm
5. IRZ-23 well and Northern NTH IRZ extraction network header well flow rate (FIT-*0673 and FIT-*0674): 0 gpm
6. TCS extraction well network header flow rate (FIT-*0680): 0 gpm

3.1.5 Call Maintenance Supervisor or Project Engineer if any detectable flow rate is still observed following shutdown

4. Post-shutdown manual system checks

4.1 Record system pressures – Verify MW-20 Bench System pressures are 0 psi. Notify project engineer if system pressures above 5 psi remain in section of the piping

4.1.1 Injection header pressure (* indicates IRZ00)

1. PI-*0660A
2. PI-*0660B
3. PI-*0660C
4. PI-*0660D

4.1.2 Extraction header pressure

1. PIT-*0662
2. PIT-*0663

4.2 Check piping for any leaks

Standard Operating Procedure
PG&E Topock IRZ
Operation and Maintenance Plan

Title: MW-20 Bench Carbon Storage Tank Delivery/Filling
Number: IRZ-SOP-05_Rev1

Creation Date: 9/8/2014

1 Background and Scope

Pacific Gas and Electric Company (PG&E) is implementing a groundwater remedy near the intersection of Park Moabi Road and Interstate 40, approximately 12 miles southeast of Needles, California at the PG&E Topock Compressor Station (TCS).

The objective of this Standard Operating Procedure (SOP) is to describe the procedure for ethanol delivery and filling at IRZ Carbon Substrate Tank T-IRZ00-0601, located adjacent to the MW-20 Bench Carbon Amendment Building. Tank T-IRZ00-0601 is a 15,000-gallon, above-grade, horizontal saddle tank that is fully compatible with ethanol. T-IRZ00-0601 has double-wall construction and an integral interstitial zone to provide secondary containment. T-IRZ00-0601 also includes a primary pressure/vacuum vent, emergency vents to prevent damage from failure of the primary vent, and a vapor recovery system designed to capture any emissions generated during the storage tank filling process.

2 Drawing Numbers

- I-06-01: MW-20 Bench Carbon Amendment Building P&ID Sheet 1 of 4
- I-06-02: MW-20 Bench Carbon Amendment Building P&ID Sheet 2 of 4
- I-06-03: MW-20 Bench Carbon Amendment Building P&ID Sheet 3 of 4
- I-06-04: MW-20 Bench Carbon Amendment Building P&ID Sheet 4 of 4
- M-06-04: MW-20 Bench Carbon Substrate Storage Tank Mechanical Details and Sections

3 Equipment

- Appropriate PPE
- Health and Safety Plan
- Carbon substrate spill kit
- Water hose and fire extinguisher
- Wheel chocks to be placed behind delivery truck tires
- Electrical grounding equipment for truck, tank, and transfer equipment
- Eyewash supplies and safety shower
- Non-sparking tools (as needed)

4 Procedure

1. Safety equipment check
    1.1 Manually test safety shower and eyewash station
        1.1.1 Troubleshoot safety shower and eyewash station if not functioning properly.
        1.1.2 Do not proceed with tank filling unless functioning safety shower and eyewash station are available.
2. Human machine interface (HMI) system status check (* indicates IRZ00)
    2.1 Confirm Tank T-*0601 transducers are active
        2.1.1 Level transducer LT-*0652
        2.1.2 Temperature transducer TT-*0690
    2.2 Confirm that carbon substrate hose pumps PMP-*0640, PMP-*0641, and PMP-*0642 are not active
        2.2.1 Look at HMI to confirm they are all in the “OFF” position
    2.3 Confirm solenoid valve FV-*0611 is closed
    2.4 Verify alarm status of level switches within carbon storage secondary tanks and discharge piping to detect leaks
        2.4.1 LS-*0651 – IRZ Carbon Substrate Tank T-*0601 secondary tank
        2.4.2 LS-*0653 - IRZ Carbon Substrate Tank T-*0601 discharge piping
3. Tank T-IRZ00-0601 leak inspection
    3.1 Walk around entire tank
    3.2 Check for:
        3.2.1 Leaks along equipment surfaces
        3.2.2 Accumulated liquid on the ground
    3.3 Immediately alert project team if a leak is detected
4. Delivery truck staging
    4.1 Instruct truck driver not to exceed 5 miles per hour (mph) while driving onsite
    4.2 Use a spotter during delivery truck approach and parking
    4.3 Park delivery truck in designated parking space next to Tank T-IRZ00-0601
    4.4 Avoid backing transfer truck
    4.5 Place wheel chocks behind truck tires once it is parked
    4.6 Place buckets under hose connections in transfer equipment
5. Tank T-IRZ00-0601 volume check
    5.1 Check Tank T-IRZ00-0601 level on HMI
    5.2 Verify tank level manually with level gauge staff
    5.3 Request delivery volume from truck driver
    5.4 Calculate available space in tank

5.4.1 Verify Tank T-IRZ00-0601 has adequate available space for delivery volume

5.4.2 Float valve will shut off flow to tank at 90% of tank capacity

6. Delivery specification check

6.1 Confirm the appropriate product is being delivered

CAUTION: Open flames around ethanol fumes may cause a fire creating immediate danger to personnel conducting the procedures.

7. Ignition source check

7.1 Confirm truck engine has been turned off

7.2 Confirm no electrical equipment is operational near the transfer connections

7.3 Staff is not smoking (smoking not allowed onsite)

8. Tank T-IRZ00-0601 and equipment inspection

8.1 Inspect concrete pad for signs of settling or wear

8.2 Visually inspect secondary containment tank, pipes, and hoses for signs of leaks and/or wear

8.3 Ensure check valve V-IRZ00-0601B is installed in the appropriate direction

8.4 Ensure ball valve V-IRZ00-0601A is in the open position

8.5 Connect camlock hose to the camlock connections on the truck and T-IRZ00-0601

8.5.1 Visually inspect the hose for signs of wear

8.6 Manually (by hand) check that pipe, hose, and camlock connections are secure

8.6.1 Secure connections if they are loose

8.7 Visually inspect truck transfer hose, valves, and pump

9. Electrical grounding

9.1 Install electrical ground connection cable and clamp to prevent buildup of static charge

9.1.1 To be installed on truck, tank, and transfer equipment

9.1.2 Grounding cables and clamps to be connected to designated grounding electrode

10. Ethanol transfer

10.1 Initially check Tank T-IRZ00-0601 and transfer equipment for signs of leaks

10.1.1 Immediately stop ethanol transfer if a leak is observed

10.2 Monitor transfer pressure at start of transfer and every 2-3 minutes thereafter

10.2.1 Allowable pressure range: 0 – 10 PSI

10.3 Check Tank T-IRZ00-0601 level on the HMI every 2-3 minutes throughout transfer

11. Ethanol transfer completion

11.1 Disconnect delivery truck from Tank T-IRZ00-0601

11.1.1 Confirm the line is not under pressure

11.1.2 Confirm with driver that ethanol has been purged from delivery lines prior to disconnecting transfer equipment

1. Typically performed by pushing air through the lines

11.1.3 Confirm buckets are placed under connections prior to disconnecting transfer equipment

11.1.4 Disconnect hoses

11.1.5 Clean up any minor carbon substrate spills immediately with absorbent pads

11.1.6 Disconnect grounding/bonding cables and clamps

12. Delivery truck departure

12.1 Unchock the tires

12.2 Remind driver to stay under 5 mph

12.3 Have driver pull through to parking lot exit. Spot driver out to the main road

13. System status check (* indicates IRZ00)

13.1 Check system status on HMI

13.1.1 Record new Tank T-*0601 level upon transfer completion from LT-*0652

13.1.2 Record temperature on TT-*0690

13.1.3 Open solenoid valve FV-*0611

13.1.4 Activate carbon substrate hose pumps PMP-*0640, PMP-*0641, and PMP-*0642 on HMI

Standard Operating Procedure
PG&E Topock IRZ
Operation and Maintenance Plan

Title: Discharge of Clean-in-Place Water to the Remedy-Produced Water Conditioning Plant

Number: IRZ-SOP-10_Rev1

Creation Date: 9/8/2014

1 Background and Scope

Pacific Gas and Electric Company (PG&E) is implementing a groundwater remedy near the intersection of Park Moabi Road and Interstate 40, approximately 12 miles southeast of Needles, California at the PG&E Topock Compressor Station (TCS).

The objective of this Standard Operating Procedure (SOP) is to describe the procedure for the transfer of clean-in-place (CIP) water from MW-20 Bench Frac Tank T-IRZ00-0623 to the Remedy-Produced Water Conditioning Plant. CIP maintenance activities produce water that must be conveyed to the Remedy-Produced Water Conditioning Plant for treatment on an as needed basis. This SOP covers the manual and automated procedures for conveyance of CIP water in tank T-IRZ00-0623 to the Remedy-Produced Water Conditioning Plant. This SOP assumes that all CIP application to the In Situ Reactive Zone (IRZ) conveyance lines outlined in IRZ-SOP-09 has been completed and the CIP water is being stored in frac tank T-IRZ00-0623 awaiting transfer.

2 Drawing Numbers

- I-06-04: MW-20 Bench Carbon Amendment Building P&ID Sheet 4 of 4
- REMEDY-SOP-06

3 Equipment

- Appropriate personal protective equipment (PPE)
- Health and Safety Plan

4 Procedure

1. Pre-startup human machine interface (HMI) checks
    1.1 Check system alarm status on HMI
        1.1.1 Select “ALARMS” tab on HMI
        1.1.2 Verify if any alarm conditions exist associated with the system
            1. Document any alarm conditions in the checklist if they exist

1.2 Attempt to troubleshoot alarms

1.2.1 Call project engineer or maintenance supervisor if alarms cannot be easily addressed

2. Shutdown of automatic backwashing activities

2.1 Select the "AUTOMATIC BACKWASH" tab on the HMI to view the National Trails Highway (NTH) IRZ and Inner Recirculation Loop (IRL) injection well valve positions

2.1.1 To remove ALL wells from automatic operation place extraction pumps in the "OFF" position

2.2 Verify that the Backwash Frac Tank T-IRZ00-0621 is not receiving flow from other processes during the scheduled transfer

3. Valve check

3.1 Select the "CIP TRANSFER" tab on the HMI

3.1.1 Select "CLOSE" for actuated valve FCV-IRZ00-0632

3.2 Manually close valve V-IRZ00-0626B on the backwash transfer line to Backwash Frac Tank T-IRZ00-0621

3.3 Manually open valve V-IRZ00-0626O to transfer pump PMP-IRZ00-0645 to the Remedy-produced Water Conditioning Plant

4. Transfer of CIP water to the Remedy-produced Water Conditioning Plant

4.1 Select the "CIP TRANSFER" tab on the HMI to view the CIP process screen

4.2 Place FCV-IRZ00-0633 into the "OPEN" position

4.3 Place PMP-IRZ00-0645 into "AUTO" to begin the transfer

4.3.1 Transfer will only commence if the water levels in the Remedy-produced Water Conditioning Plant influent tanks (TNK-RTP01-1101, -1102, -1103, -1104) are below the high-level switch (LSH-RTP01-1151, -1153, -1155, -1157) elevations

4.4 Visually inspect the lines for signs of leaks

4.5 Once T-IRZ00-0623 is empty LT-IRZ00-0658 will initiate the programmable logic controller to do the following

4.5.1 FCV-IRZ00-0633 will close

4.5.2 PMP-IRZ00-0645 will automatically shutoff

4.6 Place transfer pump PMP-IRZ00-0645 into "OFF" to make sure it does not turn on again in association with future CIP activities

5. Manual valve check

5.1 Manually close valve V-IRZ00-0626O to the Remedy-produced Water Conditioning Plant

5.2 Manually open valve V-IRZ00-0626B on the backwash transfer line to Backwash Frac Tank T-IRZ00-0621

6. Proceed to REMEDY-SOP-06 for procedures on restarting the automatic backwashing

Standard Operating Procedure
PG&E Topock IRZ
Operation and Maintenance Plan

Title: Offsite Trucking of Clean-in-Place Water from MW-20 Bench

Number: IRZ-SOP-12_Rev1

Creation Date: 9/8/2014

1 Background and Scope

Pacific Gas and Electric Company (PG&E) is implementing a groundwater remedy near the intersection of Park Moabi Road and Interstate 40, approximately 12 miles southeast of Needles, California at the PG&E Topock Compressor Station (TCS).

The objective of this Standard Operating Procedure (SOP) is to describe the procedure for transferring clean-in-place (CIP) water from frac tank T-IRZ00-0623 at the MW-20 Bench to the truck fill station for off-site trucking. This procedure is controlled both manually and through automation with the use of the human machine interface (HMI). This SOP assumes that all CIP application to the In Situ Reactive Zone (IRZ) conveyance lines outlined in IRZ-SOP-09 has been completed and the CIP water is currently stored in frac tank T-IRZ00-0623 awaiting transfer.

2 Drawing Numbers

- I-06-04: MW-20 Bench Carbon Amendment Building P&ID Sheet 4 of 4

3 Equipment

- Appropriate personal protective equipment (PPE)
- Health and Safety Plan
- 5-gallon buckets
- Tablet for data recording

4 Procedure

1. Pre-transfer health and safety procedures
   - 1.1 Manually test the eyewash station and safety shower at the MW-20 Bench Carbon Amendment Building
   - 1.2 Run water and verify the temperature of the water is cool enough for exposure
2. Pre-startup human machine interface (HMI) checks
   - 2.1 Check system alarm status on HMI
   - 2.2 Select “ALARMS” tab on HMI

2.3 Verify if any alarm conditions exist associated with the system

1. Document any alarm conditions in the checklist if they exist
2. Attempt to troubleshoot any alarms

2.4 Call project engineer or maintenance supervisor if alarms cannot be readily addressed

3. Loading site preparation

3.1 Inspect concrete pad for signs of settling or wear

3.2 Confirm that load-out hose is properly stored and not in the path of trucks entering the loading area

3.3 Visually inspect load-out hose for signs of wear

3.4 Confirm that necessary hoses and connections are present

4. Truck staging and hook-up

4.1 Instruct truck driver not to exceed 5 miles per hour (mph) while driving onsite

4.2 Confirm that driver and equipment meet job requirements

1. Verify that the driver has completed a pre-trip inspection on the truck and trailer
2. Verify that the driver currently driving the truck is the same driver who performed the pre-trip inspection

NOTE: If any deficiencies are discovered per Step 4.2, contact the Maintenance Supervisor before proceeding.

4.3 Use a spotter to direct truck driver during approach and alignment of truck on containment pad

1. Spotter to use hand signals to stop truck when the front trailer axle is at the north end of the containment pad (opposite of entrance)
2. Ensure that there is enough room in the containment pad behind the trailer to catch any minor spills

4.4 Place wheel chocks behind truck tires once truck is parked

4.5 Place 5-gallon bucket under trailer's inlet connection

4.6 Have driver hook up to the load-out hose

NOTE: Driver is responsible for:

- Attaching the load-out hose to the truck
- Making sure the truck tank is vented
- Determining how many gallons are to be loaded
- Disconnecting the load-out hose
- Operating the load valve (trailer valve) on the truck

Operator is responsible for:

- All valves upstream of the load-out hose

- Operating the transfer pump PMP-IRZ00-0644
- Telling the driver how many gallons have been loaded

4.7 Connect load-out hose to the dry-break coupling on the remedy-produced water line

4.8 Manually check that pipe, hose, and connections are secure

1. Secure any loose connections

4.9 Place 5-gallon buckets under hose connections in transfer equipment

5. Remedy-produced water transfer

5.1 Record the beginning totalizer reading (FIT-IRZ00-0680A) on the shipping documentation and tablet

5.2 Confirm with the driver that the line isolation valves are properly positioned before opening tank valves

5.3 Valve check (* indicates IRZ00)

1. Open manual valves/verify position
    a. V-*0626C
    b. V-*0626F
    c. V-*0626H
    d. V-*0626J
2. Close manual valve/verify position
    a. V-*0626I
    b. V-*0626O

5.4 Have driver check truck valves and vents

5.5 Confirm with driver that truck is ready to receive water

1. Open load supply valve V-IRZ00-0626L

5.6 Select the “CIP TRANSFER” tab on the HMI to view the CIP process screen

5.7 Place FCV-IRZ00-0632 into the “OPEN” position

5.8 Place PMP-IRZ00-0644 into “AUTO” to begin the transfer

5.9 Visually inspect the lines for signs of leaks

5.10 During the pumping operation, the operator must stay in the load control area and the driver must stay by the trailer valve

5.11 Communicate with driver to ensure that truck is not loaded beyond legal limits

5.12 Once T-IRZ00-0623 is empty LT-IRZ00-0658 will initiate the programmable logic controller to do the following

5.13 FCV-IRZ00-0632 will close

5.14 PMP-IRZ00-0644 will automatically shutoff

5.15 Place transfer pump PMP-IRZ00-0644 into “OFF” to make sure it doesn’t turn on again in association with future CIP activities

5.16 Confirm that remedy-produced water line is not under pressure

5.17 Close load supply valve V-IRZ00-0626L

5.18 Have driver close the trailer valve

5.19 Select the “CIP TRANSFER” tab on the HMI to view the CIP process screen

5.20 Place FCV-IRZ00-0632 into the “CLOSE” position

6. Truck disconnection

6.1 Confirm that 5-gallon buckets are under hose connection points

6.2 Have driver open connection to truck (water will be in hose)

6.3 Have driver disconnect load-out hose from trailer valve

6.4 Disconnect load-out hose from the cam-lock coupling on the remedy-produced water line

6.5 Allow load-out hose to drain into 5-gallon buckets

6.6 Remove any adapters used

6.7 Have driver replace trailer valve cap or plug

6.8 Have driver close drip tray valve

6.9 Remove 5-gallon buckets from under connection points

6.10 Empty 5-gallon buckets into containment pad sump

6.11 Store equipment (hose, adapters, buckets) properly

7. Shipping documentation preparation

7.1 Record the ending totalizer reading (FIT-IRZ00-0680A) on the shipping documentation and tablet

7.2 Confirm that appropriate forms are filled out and signed

7.3 Confirm that shipping documentation is complete and signed

7.4 Confirm that shipping documentation number is recorded

7.5 Provide driver with appropriate copies

8. Truck demobilization

8.1 Work with driver to inspect that truck is in safe condition

8.2 Confirm that hose, buckets, and other equipment have been removed from path of truck exiting the loading area

8.3 Unchock tires

8.4 Remind driver to stay under 5 mph while onsite

8.5 Instruct driver to exit the containment pad heading north

8.6 Spot driver out to the main road

9. Post-transfer system checks

    9.1 Select the “CIP TRANSFER” tab on the HMI to view the CIP process screen

        1. Check and record the new tank level on LT-IRZ00-0658 for T-IRZ00-0623 on the tablet
        2. Verify that actuated valve FCV-IRZ00-0632 is in the “CLOSE” position

    9.2 Valve check (* indicates IRZ00)

        1. Close manual valve/verify position
            a. V-*0626J
            b. V-*0626L
            c. V-*0626O

    9.3 Scan/file paperwork/shipping documentation

Standard Operating Procedure
PG&E Topock Freshwater Supply Conveyance and Storage Operation and Maintenance Plan

Title: Startup and Shutdown of Freshwater Supply Conveyance and Storage System

Number: FWS-SOP-01_Rev1

Created Date: 6/25/14

1 Background and Scope

Pacific Gas and Electric Company (PG&E) is implementing a groundwater remedy near the intersection of Park Moabi Road and Interstate 40, approximately 12 miles southeast of Needles, California at the PG&E PN: Topock Compressor Station (TCS).

The objective of this Standard Operating Procedure (SOP) is to describe the procedures for (a.) starting up and (b.) shutting down the freshwater supply conveyance and storage system. The procedures should only be used to perform (a.) a "hot" startup after a short term shutdown, (b.) a short term system shutdown, or (c.) system shutdown for major maintenance or repair at the well. This procedure applies to the primary freshwater supply well, HNWR-1A. The HNWR-1 well will serve as a secondary supply well and the Site B well will serve as a contingency supply well, if needed.

2 Equipment List

- Health and Safety Plan
- Appropriate personal protective equipment (PPE)

3 Drawing Numbers

- Freshwater Supply Well (HNWR-1A), Instrumentation: I-01-01
- Freshwater Tank, Instrumentation: I-02-01

4 Preconditions

Operators should have system training and operating experience before attempting a system startup or shutdown.

For (a.) system startup, power has been restored (if startup is occurring after a power outage).

For (b.) system shutdown, a power outage has occurred or system needs a manual shutdown for reasons related to the downstream users of freshwater.

For (c.) system shutdown, major maintenance or repair at the well is to be performed.

5 Procedure

a. Startup Procedure

   1. If system power outage has occurred, power first needs to be restored.
   2. Using the HMI, Switch HNWR-1A well pump PMP-HNWR1A-0110A to AUTO.

b. Short-term Shutdown Procedure

   1. Use the HMI to switch HNWR-1A well pump PMP-HNWR1A-0110A to OFF.

c. Shutdown Procedure for Major Maintenance or Repair

   1. Use the HMI to switch HNWR-1A well pump PMP-HNWR1A-0110A to OFF.
   2. Go to the Pump Control Panel on the Control Panel Equipment Pad at HNWR-1A.
   3. Turn switches for the “Main Disconnect” and “Pump Disconnect” to OFF.
   4. Lockout/ Tagout the pump (see SOP-HSE-310 Lockout/Tagout, Enterprise Standard Operating Procedure).
   5. To startup the pump after the completion of major maintenance or repair:
      a. Remove lock and tag from the pump per SOP-HSE-310.
      b. Verify manual valves V-HNWR1A-0110B, -0171A, -0161A, and -0120A, and -0120C are open.
      c. At the Pump Control Panel on the Control Panel Equipment Pad at HNWR-1A, turn switches for the “Main Disconnect” and “Pump Disconnect” to ON.
      d. Use the HMI to switch HNWR-1A well pump PMP-HNWR1A-0110A to AUTO.

Well-SOP-01 Rev. 0

Standard Operating Procedure for Well and Borehole Permanent Decommissioning

PREPARED FOR:	Topock Groundwater Remediation Project
COPY TO:	Project File
PREPARED BY:	Pacific Gas & Electric Company
DATE:	August 27, 2014

This document defines the standard operating procedures (SOP) for decommissioning groundwater wells and boreholes associated with the Pacific Gas and Electric Company (PG&E) Topock Remediation Project, Needles, California (Site). This document was developed, in part, as a direct result of Tribal concerns that included dialog regarding future decommissioning activities at the site between PG&E, agencies, and Native American Indian Tribes (Tribes). PG&E acknowledges that the Topock Remediation Project is an area that is culturally important to the Tribes and that the activities, materials, and procedures used in this process are of specific interest. Tribes have raised concerns with drilling intrusions, well and borehole decommissioning, emplacement of foreign materials into the earth, and retention of soils displaced as a result of drilling. Based on Tribal input, the potential for use of displaced site material in the decommissioning process, which may require a variance with the applicable permitting agency, is included in this document (Section 2.2.3).

An initial draft of this SOP was submitted for review and comment by the agencies and Tribes. The comments received, PG&E responses to these comments, as well as the conclusions of discussion during a June 6, 2014 conference call regarding the PG&E responses to comments are documented in Attachment A.

This SOP will be used as a reference to guide the development of future work plans required for agency, Tribal, and stakeholder review prior to conducting all well and borehole decommissioning tasks associated with the groundwater remedy. For the purpose of this SOP, an exploratory borehole (borehole) is defined as a drilled borehole in which no casings have been installed, regardless of whether or not the borehole was drilled to the water table. However, California boreholes drilled to the water table must be decommissioned per water well standards. The technical procedures included in this SOP are based on applicable regulatory and project-specific guidance information; however, specific work plans for well decommissioning tasks are necessary to evaluate task-specific details and ensure overall compliance. The structure of the SOP has been developed to provide adequate flexibility such that it can be applied to different well types and sizes in a variety of environmental settings. Specifically, this SOP provides a summary of the following key criteria that must be considered when developing a scope of work to decommission a well or exploratory borehole:

- Regulatory information and project-specific resources
- General technical specifications and procedures used for well or borehole decommissioning
- Evaluation of the well or borehole decommissioning scenarios

1.0 Summary of Guidance Information

Multiple sources of guidance information must be considered prior to conducting well or borehole decommissioning activities. Groundwater wells at the Site are located in the states of California and Arizona. Both states regulate the minimum specifications and procedures for the decommissioning of groundwater monitoring and supply wells to protect the quality of groundwater. Further, project-specific documents provide additional guidance related to sensitive cultural and biological resources. A summary of key regulatory information (project-specific applicable or relevant and appropriate [ARAR] numbers are provided) and project-specific resource documents associated with conducting groundwater well or borehole decommissioning activities is provided in the following subsections.

1.1 Regulatory Information – California (ARAR #98)

Statewide minimum standards for decommissioning a groundwater well in the State of California were established by the California Department of Water Resources (DWR) in the California Well Standards. The California Well Standards were originally established in Bulletin 74 (February 1968), later re-written as Bulletin 74-81 (December 1981), and later supplemented by Bulletin 74-90 (June 1991). The DWR states that the California Well Standards may not be sufficient for local conditions and local permitting agencies may need to adopt more stringent standards to ensure groundwater quality protection. However, The County of San Bernardino is the local permitting agency for Site wells located in California and have adopted the DWR standards.

The California Well Standards identify well destruction (or decommissioning for this SOP) requirements for both water supply wells (Part III of Bulletin 74-81), and monitoring wells and exploratory boreholes[1] (Part III of Bulletin 74-90). Although San Bernardino County does not require permits for the decommissioning of boreholes that do not reach the water table, DTSC has stated that they may request that some exploratory boreholes that do not reach the water table be decommissioned as wells under certain circumstances. For example, a borehole that terminates within 10 to 20 feet the water table and is located in an area where the potential for infiltration (e.g., wash channels) or future spills (e.g., an area of active industrial operations) is greater. The general requirements for both well types are similar; however, special considerations for monitoring wells and exploratory boreholes address the potential for these well types to be in areas of known or potential pollution or contamination.

1.2 Regulatory Information – Arizona (ARARs #48 and #49)

Development of rules for adopting standards for the construction and abandonment (or decommissioning for this SOP) of a groundwater well in the State of Arizona are required under Arizona Revised Statute 45-594(A). In response to the statute, the Arizona Department of Water Resources (ADWR), adopted the Well Abandonment Rule. The Well Abandonment Rule as Arizona Administrative Code (A.A.C) R12-15-816 was originally established on March 5, 1984. An amendment to the rule was effected on June 18, 1990. The Well Abandonment Rule requires that the abandonment (decommissioning) of a well be accomplished through filling or sealing the well so as to prevent the well from allowing the vertical movement of water. The rule contained general guidance for the decommissioning process, but lacked specific information regarding applicable aquifer conditions, and for the depths, types of materials and methods for the well decommissioning. ADWR provided additional written guidance for well abandonment to comply with A.A.C. R12-15-816(G) in the Well Abandonment Handbook on October 3, 2008.

The Well Abandonment Handbook (WAH) provides a standard well decommissioning method to be used for the post-installation of any well or borehole, regardless of the aquifer or vadose zone conditions applicable to the well (Section IV A). In addition, the WAH details five alternative abandonment methods. The five alternatives are for specific vadose zone and aquifer conditions which may include contamination, single or multiple aquifers, or dry wells (Section IV B). For example, Alternative 4, which applies to wells that only penetrate a single aquifer without vertical flow components and no water quality contamination issues, might be applicable to wells in the Topock area that are 8-inches or greater in diameter. A variance option to Alternative 4 permits the use of clean fine sand to fill the well being decommissioned.

Legal authorization from the ADWR is required to decommission most types of wells in the State of Arizona. ADWR requires a statewide decommissioning form to be filed and reviewed prior to decommissioning. The notice of intention to abandon a well (NOIA) can be obtained from the ADWR Groundwater Management Support Section in Phoenix or other local offices. In addition, all forms are available online at http://www.azwater.gov/azdwr/WaterManagement/NOI/documents/PermitsFormsApplicationsNOI.htm. The permit must be signed and filed by the well owner. The information on the NOIA must include a well construction diagram with proposed decommissioning specifications; casing type, description of the proposed method of decommissioning (over-drilling, jacking, perforation, etc.); a description of the method of emplacing sealing or fill materials; and the specific type and estimated amount of grout material to be used (water-cement ratio, water-

[1] San Bernardino County does not require permits for the installation or decommissioning of boreholes that do not reach the water table.

bentonite ratio and/or other materials or additives used). ADWR performs a completeness and substantive review of the NOIA to determine whether the proposed abandonment methods and materials meet the requirements of the ADWR abandonment rule in R12-15-816(G). If an alternative method of decommissioning is proposed in lieu of the standard method, further substantive review is performed by ADWR to verify that the proposed methods apply, and whether appropriate fill materials were chosen. A proposal to use an alternative decommissioning method requires an application to ADWR for a variance from the well decommissioning rule (a deviation from the standard decommissioning method). Following ADWR confirmation that the proposed well decommissioning methods and materials meet the requirements of the rule, a well decommissioning authorization card is mailed to the designated well drilling contractor and well decommissioning operations may begin.

1.3 Project-specific Resources

In addition to regulatory guidance, project specific requirements or information must be considered prior to initiating well decommissioning activities. The following is a list of documents that may be applicable:

- **Topock Well Inventory Data Package** – Inventory of wells related to the Topock Remediation Project for reference when developing specific plans for well decommissioning. This data package includes a technical memorandum, well location map, and a searchable spreadsheet of well details. As requested by DTSC, the well inventory spreadsheet (electronic file) and available well logs associated with the Topock Project will be archived on the DTSC website. This archive will be updated periodically as additional wells and boreholes are installed.
- **Environmental Impact Report (EIR) Mitigation Measures Reporting Program (MMRP)** – This document details specific compliance criteria that must be considered before, during, and after implementation of well decommissioning activities.
- **Management Protocol for Handling and Disposition of Displaced Site Material** – This document identifies the general approach and management protocols required for the handling and disposition of soil and/or rock that is displaced as a result of activities associated with the Pacific Gas and Electric Company (PG&E) Topock Remediation Project. The use of displaced site material for use in the well decommissioning process is discussed in Section 2.2.3.
- **Special Handling for Clay Material Encountered During Drilling** – As requested by the Hualapai Department of Cultural Resources, special handling procedures for drill cuttings generated from clay beds will be used in the field (this does not include clay-containing sediment mixtures, only clay beds). If clay bed(s) are encountered during drilling, then the cutting from those interval(s) will be set aside on 100% cotton muslin (dye free) for future disposition, following discussions with the Tribes. PG&E will notify the agencies and Tribes in the event clay material is encountered and separated for storage.
- **Previous Well Decommissioning Work Plans** –
  - Well PGE-6 Revised Decommissioning Work Plan (November 10, 2006).
  - Final Revised Implementation Plan for Repair of Monitoring Wells MW-38S and MW-38D and Old Well/Pipe Reconnaissance (February 11, 2011).
- **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Permit Exemption –** Per the November 16, 2007 Memorandum from the United States Department of the Interior, remedial actions including well decommissioning are exempt from the federal, state, and local permitting process. Since the issuance of this memorandum, the applicability of this exemption has been confirmed with the County of San Bernardino, California in February 2008 and January 2011. However, the County of San Bernardino will need to be consulted in the event a variance to the California Well Standards is required. The applicability of this exemption has not been confirmed with the State of Arizona. Regardless of the permit exemption, all work plans for decommissioning activities will be reviewed and approved by the appropriate state and federal agencies prior to implementation.

1.4 General Technical Resources

In addition to regulatory guidance and project specific information various technical resources should be considered during the development of a work plan for well or borehole decommissioning. The following is a list of documents that may be useful:

- Monitoring Well Design and Construction for Hydrogeologic Characterization. Guidance Manual for Ground Water Investigations. July 1995. State of California, Environmental Protection Agency.
- ASTM Standard D5299-99 (2005), "Standard Guidance for Decommissioning of Groundwater Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities", ASTM International, West Conshohocken, PA, 2005, www.astm.org.
- ASTM Standard C150/C150M-12, "Standard Specification for Portland Cement", ASTM International, West Conshohocken, PA, 2012, www.astm.org.
- ASTM Standard D4380-84 (2006), "Standard Test Method for Density of Bentonitic Slurries", ASTM International, West Conshohocken, PA, 2012, www.astm.org.

2.0 General Technical Specifications and Procedures for Decommissioning Wells and Exploratory Boreholes

Monitoring wells or exploratory boreholes that are no longer useful must be properly decommissioned to ensure the quality of groundwater is protected and eliminate a possible physical hazard to humans and animals. Notification or permitting requirements should be evaluated prior to the initiation of well decommissioning activities in the field. Involved oversight agencies will be notified in advance of any decommissioning activities to ensure concurrence with decommissioning of a particular well(s). The general process for decommissioning a well at the Topock site is presented on Figure 1, Well Decommissioning Decision Protocol. The information provided in this section is intended to be applicable for wells or boreholes located in either California or Arizona; however, it is assumed that the details included in the specific work plan(s) will be designed in compliance with the appropriate state regulations, and reviewed by the appropriate permitting agency. In addition, depending on the condition of the aquifer and well(s) subject to decommissioning, potentially applicable variance options that include the minimization of the placement of sealing material should be evaluated with the lead agencies during well decommission work plan development (e.g., Arizona Alternative 4 – variance option). A discussion of the primary steps identified in this protocol, including the potential materials and methods required for each, is presented in the following subsections.

2.1 Evaluation of Well or Borehole

Key well or borehole information should be assembled and reviewed prior to initiating decommissioning activities to determine lithologic and well construction details, the current condition of the well or borehole, soil and water quality information, applicable regulatory criteria, and identification of the procedures and materials that should be used. The majority of this information will be available through review of drilling and well installation information, the Topock Well Inventory, groundwater sample collection logs, or other related documents. The Topock Well Inventory can be found online at: http://dtsc-topock.com/sites/default/files/Topock-Well-Inventory_Tech-Memo.pdf. However, it is possible that additional survey of the given well or borehole will be required to obtain all key information. The following is a list of survey techniques that may be utilized to evaluate the condition of well or borehole (list is not intended to be all-inclusive):

- Well measurement – Evaluation of the depth to the bottom of, or the depth to water within, a well or borehole. This is typically accomplished using a graduated measuring tape with a water sensor or blunt weight at the end.
- Video survey – An in-well video camera can be used to evaluate the condition of the well casing and screen, and identify obstructions. In-well cameras are typically calibrated for depth and orientation (i.e. north, south, east and west), and deployed on a cable using a winch.

- Geophysical survey – Depending on the well casing type, depth to water, potential presence of metallic centralizers or other well construction components, and other variables, select geophysical survey tools may be useful. Similar to an in-well camera, in-well geophysical tools are deployed on a cable using a winch. While not a complete list, examples of geophysical tools that may be useful include:
  - Acoustic (Cement Bond Log) – Used to determine the quality of cement bonding in cased or sealed wells.
  - Gamma – Used to determine intervals of bentonite seals and gravel pack.
  - Caliper – Used to verify diameter of the well or borehole, which is used to calculate borehole and well casing volumes, and identifies obstructions or areas of borehole washout or constriction.
  - Casing Inspection Thickness Measurement (CITM) – An in well survey that uses electromagnetic waves to measure well casing wall thickness in carbon based steels. Survey can be used to understand or measure the integrity of the well casing.

2.2 Identification of Materials and Placement Requirements

Different types of materials are required for different well or borehole decommissioning scenarios depending on above-ground, and subsurface environment. Sealing materials are required when the potential for flow of water through the material must be kept to an absolute minimum such that the volume of water and possible pollutants and contaminants passing through them will be of minimal consequence (no material is completely impervious). Filler material is permitted for use under some circumstances when the flow of water through the material is not of critical concern. Potential materials suitable for use during well and borehole decommissioning at the Topock site and associated placement requirements are listed in the following subsections.

2.2.1 Sealing Material

Conventional sealing activities are performed with the objective of completely filling the borehole or well casing, voids in the formation in the vicinity of the borehole, and if not over-drilled, the gravel pack and annular spaces. Sealing materials are required for use when decommissioning wells and boreholes regardless of whether they are located in an area of known or potential pollution or contamination. In uncontaminated areas where the well is wholly situated in unconsolidated material in an unconfined groundwater zone, the sealing material is focused in the upper 20 feet of the well or borehole to prevent the infiltration of potential surface contamination. In areas of known or potential soil or groundwater contamination, sealing material is required throughout the entirety of the well or borehole. The following is a list of sealing materials that may be used at the Topock site:

- Neat cement – Compose entirely of Type II/V Portland cement grout with up to 6% bentonite powder.
- Sand-cement grout – Composed of Portland cement with no more than two parts sand to one part cement by weight of sand.
- Concrete – Composed of Portland cement and aggregated mixed at a ratio of at least 564 lbs. of cement per cubic yard of aggregate. Aggregate used must be smaller than 1/5 of the radial thickness of the annular seal and is typically reserved for large volume/diameter borehole or well decommissioning.
- Bentonite clay – Composed of commercially prepared, powdered, granulated, pelletized, or chipped/crushed sodium montmorillonite clay with the largest dimension of pellet or chip being less than 1/5 the radial thickness of the annular seal. Bentonite cannot be used as a sealing material opposite zones of fractured rock, unless otherwise approved by lead agencies. As bentonite seals may have a tendency to dry, shrink and crack in arid and semi-arid areas where subsurface moisture levels can be low, they are not recommended for sealing the vadose zone at the Topock site. In addition, bentonite is not recommended for application in high TDS environments (e.g., >5,000 parts per million) due to the adverse effects on its ability to properly swell and seal in these conditions.

According to Arizona and California Well Standards, drilling mud or cuttings are not acceptable sealing materials.

Water used for the preparation of sealing materials should be potable, compatible with the type of sealing material used and free of contaminants and suspended matter. All manufacturers' specifications for mixture

volumes and curing times must be strictly followed (typically, ASTM C150, Standard Specification for Portland cement). Further, the use of any additives must comply with the requirements of ASTM C494 (Standard Specification for Chemical Admixtures for Concrete).

Sealing material must be placed into a well or borehole at the required interval(s) in one continuous decommissioning operation, which may include multiple lifts of sealant, using methods that prevent the free-fall, dilution, and/or separation of aggregates from the cementing materials. Typically, fluid sealing material is placed using a tremie pipe with positive displacement pumping (pumped under pressure), beginning at the bottom of the sealed interval with the end of the tremie pipe submerged two feet or more below the surface of the grout during placement. When using a tremie pipe, if sealing material is placed throughout the well or borehole, static water is either displaced out of the top by the injected column of sealing material, or into the formation (applicable SOPs for waste management/spill containment will followed). Alternatively, fluid sealing material may need to be pumped into the well under pressure, using the well casing as the conduit. In this case the static water and the sealing material are forced into the voids of the well/borehole and formation. When fluid sealing material is placed under pressure, the pressure must be maintained long enough for the sealing material to cure, as applicable. Dry sealing material, such as bentonite chips or pellets, are typically placed by using a tremie pipe or the well casing as a conduit. Dry sealing materials require water for hydration and proper sealing. Regardless of sealing material type or placement method, verification shall be made that the volume of the material placed in the well or borehole is at least equal to the calculated volume of void space to be sealed.

2.2.2 Filler Material

Filler materials are permitted for use in select portions of the decommissioned well or borehole when located in uncontaminated areas. Suitable filler materials include clay, silt, sand, gravel, crushed stone, native soils, mixtures of the aforementioned types, as well as sealing materials defined above. However, materials containing organic matter are not acceptable.

Filler material must be placed into the well or borehole from the bottom up, such that bridging does not occur and the entire void space is filled. To assure that bridging has not occurred during placement, verification shall be made that the volume of the material placed in the well or borehole (with appropriate porosity assumptions) is at least equal to the calculated volume of void space to be filled (i.e., empty hole).

2.2.3 Displaced Site Material

As discussed in Section 1.3 (Management Protocol for Handling and Disposition of Displaced Site Material), soil and rock that are displaced as a result of the Topock Remediation Project may be retained on site for future use. One of the potential reuses for this material identified in the management protocol is replacement into borings. If the material was generated as drill cuttings, then lead agencies must agree that the material can be used as a component of either sealing or filler material for the purpose of well or borehole decommissioning (a variance may be required).

The requirements for placement of displaced site material, should it be deemed appropriate for use based on physical and chemical composition, are the same as that for filler material. Additional processing of the displaced material may be required to ensure that grain size requirements are met, that the material is free of organic matter, and that the material can be practicably placed into the well or borehole (i.e., prevent bridging). This processing may require the use of heavy equipment for grading or crushing the material so that it is suitable for use in the decommissioning process. An appropriate onsite location would need to be identified if such processing were required.

2.3 Well or Borehole Decommissioning Scenarios

Following evaluation of the well or borehole and in coordination with lead agencies, it must be determined if the well can be decommissioned in place (with or without modification) or if the well materials must be removed. The following subsections define the decommissioning scenarios that may apply pending completion of the well evaluation and coordination with lead agencies, responsible agencies (San Bernardino County or Arizona

Department of Water Resources), affected land owner, Tribes, and other stakeholders. Artesian groundwater conditions have not been observed at the Topock site, and therefore, are not considered in this SOP.

All wells associated with the Topock Remediation Project are considered to be in non-urban areas. When developing work plans that include well or borehole decommissioning, lead and responsible agencies (San Bernardino County) in California will be consulted to confirm this assumption. For the purpose of this SOP, well or borehole decommissioning scenarios are presented for two types of well site environments. These environments, Type 1 and Type 2, are defined as:

- Type 1 Well Environment – A well classified as Type 1 is located outside the area of known or potential soil or groundwater contamination (e.g., as determined by the soil and/or groundwater quality data available for the location or the likelihood of a future release in the area) and is not located in an area that is subject to increased surface water infiltration relative to nearby upland areas (e.g., channel of Bat Cave Wash).
- Type 2 Well Environment – A well classified as Type 2 is located in an area of known or potential soil or groundwater contamination (e.g., as determined by the soil and/or groundwater quality data available for the location or the likelihood of a future release in the area) and/or in an area that is subject to increased surface water infiltration relative to nearby upland areas (e.g., channel of Bat Cave Wash). Any wells located on the Topock Compressor Station, within wash channels, within areas of concern (AOCs), or within/adjacent to roads are in a Type 2 environment.

Three approaches to well and borehole decommissioning, including one approach that would require the approval of a variance to the California Well Standards, were presented by DTSC as draft concepts for discussion during the January 19, 2012 TWG Meeting. This information is provided as Attachment B to this SOP for consideration when developing future work plans that involve borehole or well decommissioning. The overriding consideration for the variance scenario presented in Attachment B was that the decommissioning method would provide seals that had a net permeability equal to or less than the naturally occurring geologic materials encountered along the borehole.

2.3.1 Exploratory Borehole

Typically, exploratory boreholes at the Topock site are installed as part of a data collection effort (i.e., lithologic, soil or groundwater sample collection) and are immediately decommissioned once the data collection objectives for that borehole have been achieved. Therefore, the borehole is typically decommissioned while the drilling tools or casing is still in place, prior to demobilization from that borehole. The following general procedure should be followed for decommissioning an exploratory borehole:

1. Evaluate the borehole for obstructions immediately prior to conducting decommissioning activities. If an obstruction is encountered that will prevent successful sealing of the borehole, attempts must be made to remove it prior to placement of the sealing material.
2. Place sealing material from total depth to ground surface. Typically, sealing material will be placed using a tremie pipe with positive displacement pumping. Industry practice is to place sealing material from total depth to the ground surface. However, if the boring is not within an area of known or potential pollution or contamination as determined by the soil and/or groundwater quality data available for the borehole, evaluate using displaced site material, or filler material if displaced site material is not available or appropriate, in lieu of sealing material in the upper 5 to 10 feet of the borehole. The use of displaced site material or filler material may require a permit variance if the borehole reached the water table.
3. Verify that the resulting condition of the borehole opening at the surface does not present a physical hazard to humans or animals. If voids are present fill voids created with displaced site material, or filler material if displaced site material is not available or appropriate.

2.3.2 Decommissioning a Well in Place

Wells determined to have been constructed in conformance with applicable standards without indication of compromise since the time of installation may be decommissioned in place. This decommissioning option should be utilized whenever acceptable to the regulatory agencies as it represents the field procedures that are least intrusive and create the least amount of disturbance. Further, this decommissioning method is appropriate if the well is in good repair but cannot be removed (e.g., wells constructed with large diameter steel casing), or if removal would negatively influence sealing of the well (e.g., a collapse during removal). In this case the monitoring well casing and any other significant voids (i.e., pore spaces in the gravel pack), at a minimum, should be completely filled with sealing material. The following general procedure should be followed for decommissioning a well in place:

1. Conduct evaluation of the well as detailed in Section 2.1 and verify with lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources), affected land owner, Tribes, and other stakeholders that the well should be decommissioned in place, and whether it is in a location considered to be Type 2.
2. Evaluate well for obstructions immediately prior to conducting decommissioning activities. If an obstruction is encountered that will prevent successful sealing of the well, attempts must be made to remove it prior to placement of the sealing and/or filler material.
3. Place sealing material. Typically, if fluid sealing material is used, this will be conducted using a tremie pipe with positive displacement pumping.
    a. Type 1 Well – Evaluate using filler material in lieu of sealing material in portions of the well casing. Place sealing material from total depth to near ground surface.
    b. Type 2 Well – Place sealing material from total depth to within 5 feet of the ground surface (bgs).
4. Decommission well head.
    a. Type 1 Well – Remove all well head protection and excavate around the well casing to a depth of approximately 1 to 5 feet bgs, or as practicable. Remove all well materials to a depth of approximately 1 to 5 feet bgs, or as practicable, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.
    b. Type 2 Well – Remove all well head protection and excavate around the well casing to a depth of 5 feet bgs. Remove all well materials to a depth of 5 feet bgs, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.

Note that the Type 1 and Type 2 well scenarios are subtly different. While the Type 2 scenario requires the removal of all well materials to a depth of 5 feet bgs (per CA well standards), Type 1 wells do not require the removal of any well materials. The removal of well materials to a depth of approximately 1 to 5 feet bgs, or as practicable, is not required by CA well standards, but included per stakeholder comments.

2.3.3 Decommissioning a Well in Place with Modification

It may be determined that a well should be decommissioned in place, but requires modification prior to sealing. This method may be appropriate in the event well materials or an obstruction cannot be removed, clogged screen cannot be removed, or if removal would negatively influence sealing of the well. In this scenario it may be required to remove a portion of the well casing, perforate sections of the well screen or casing, or conduct other well modifications to facilitate proper sealing. The following general procedure should be followed for decommissioning a well in place when a modification is required:

1. Conduct evaluation of the well as detailed in Section 2.1 and verify with lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources), affected land owner, Tribes, and other stakeholders that the well should be decommissioned in place, what modification work is required, and whether it is considered to be Type 2.
2. Implement required well modification.
3. Place sealing material. The condition that warrants well modification must be evaluated to determine the method use to place the sealing material. For example, if casing perforations above the water table are required, sealing under pressure may be appropriate.
    a. Type 1 Well – Evaluate using filler material in lieu of sealing material in portions of the borehole. Place sealing material from total depth to near ground surface, or in the event casing is removed, the new top of casing depth. If a portion of the casing is removed, sealing or filler material requirements for the interval above the top of casing must be determined through discussion with lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources), affected land owner, Tribes, and other stakeholders.
    b. Type 2 Well – Place sealing material from total depth to within 5 feet of the ground surface (bgs). If a portion of the casing is removed, sealing or filler material requirements for the interval above the top of casing must be determined through discussion with lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources), affected land owner, Tribes, and other stakeholders.
5. Decommission well head.
    a. Type 1 Well –Remove all well head protection and excavate around the well casing to a depth of approximately 1 to 5 bgs, or as practicable. Removal all well materials to a depth of approximately 1 to 5 feet bgs, or as practicable, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.
    b. Type 2 Well – Remove all well head protection and excavate around the well casing to a depth of 5 bgs. Removal all well materials to a depth of 5 feet bgs, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.

2.3.4 Decommissioning a Well by Removing Well Materials

In some cases a well may be decommissioned by complete removal of the well materials. This method may be appropriate in the event a well was not constructed in accordance with applicable standards and the deficiencies may prevent the proper sealing of the well, even with modification. Further, when removal is practicable, lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources), affected land owner, or other stakeholders may determine this method preferable to others. Removal is typically conducted by over-drilling the existing well materials with larger diameter drilling tools. Typically, this method is only applied to wells constructed with polyvinyl chloride (PVC) casing or limited lengths of smaller diameter steel casing. Other methods of casing removal (e.g., hydraulic casing jacks) may be useful to remove limited lengths of larger diameter steel casing. The following general procedure should be followed for decommissioning a well by removing the well materials:

1. Conduct evaluation of the well as detailed in Section 2.1 and verify with lead agencies, responsible agencies (San Bernardino County or Arizona Department of Water Resources), affected land owner, Tribes, and other stakeholders that the well should be decommissioned by removal.
2. Remove well materials. Typically, this is conducted by over-drilling or in some cases by combination of the use of hydraulic casing jacks combined with over-drilling.

3. Evaluate borehole for obstructions immediately prior to conducting decommissioning activities. If an obstruction is encountered that will prevent successful sealing of the borehole, it must be removed prior to placement of the sealing material.
4. Place sealing/filler material from total depth to ground surface. Typically, this will be conducted using a tremie pipe with positive displacement pumping. Industry practice is to place sealing material from total depth to the ground surface. However, if the boring is not within an area of known or potential pollution or contamination, evaluate using filler material in lieu of sealing material in portions of the borehole.
5. Decommission remaining elements of the well head protection and fill voids created with displaced site material, or filler material if displaced site material is not available or appropriate.

Other methods may be employed for removal of the well, particularly for steel well materials and steel conductor casings used to seal off upper lithologic zones. Specifically, the well string (or conductor casing) may be pulled by jacking with external equipment, or with the drill rig. Once the well string is removed from the borehole, the remaining materials in the original borehole should be over-drilled to remove them from the formation.

2.4 Well Decommissioning Reporting

Following completion of well decommissioning tasks, reporting of field activities must be completed in compliance with the lead agencies requirements. In addition, project-specific reporting must be completed (as required) and the Topock Well Inventory must be updated to reflect the results of decommissioning activities. The timeline for reporting requirements will be specified in the project-specific work plan. The Well Decommissioning Report will be submitted to lead agencies no later than 90 days after completion of well decommissioning activities and will include, at a minimum:

- A summary of the approval process completed prior to well decommissioning, including reference to submitted work plans, subsequent communication and modifications (as applicable) and documentation of approval to proceed;
- Discussion regarding application of the Well Decommissioning Decision Protocol;
- Details of the work performed, including explanation of the applicable well decommissioning scenario and materials utilized;
- Documentation of compliance with applicable permitting requirements, and;
- Signature and seal of an appropriately licensed professional geologist or engineer.

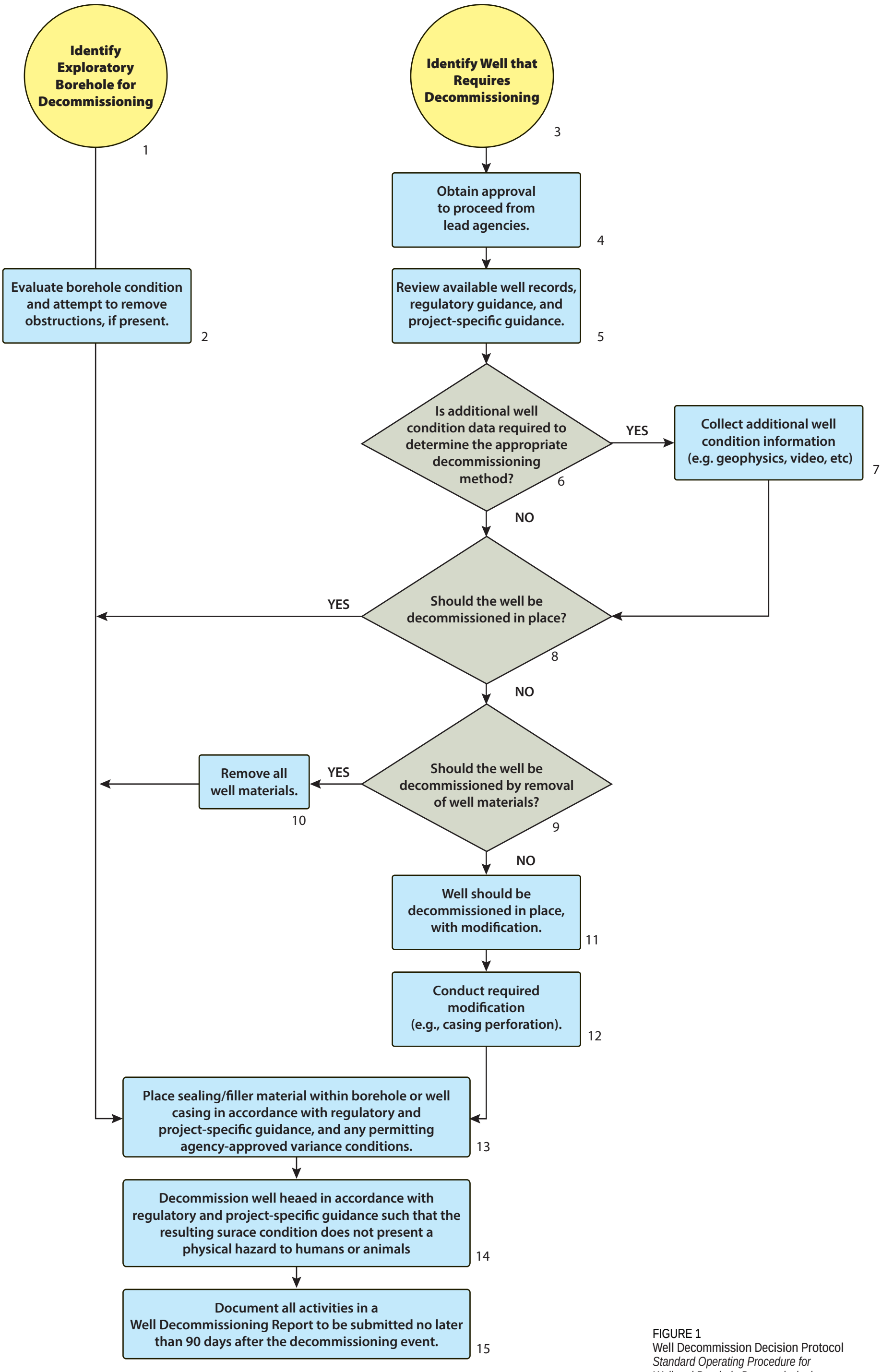


FIGURE 1
Well Decommission Decision Protocol
Standard Operating Procedure for
Well and Borehole Decommissioning
PG&E Topock Compressor Station
Needles, California

Attachment A
Responses to Comments on Draft *Standard Operating Procedure for Well and Borehole Decommissioning*

Responses to Comments on *Standard Operating Procedure for Well and Borehole Decommissioning*, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
1	Arizona Department of Water Resources (ADWR) February 28, 2013 Letter ADWR-1			The text in the Standard Operation Procedure (SOP), section 1.2 states that all required forms can be obtained from the Phoenix ADWR offices. All forms are available online at: http://www.azwater.gov/iazdwr/WaterManagement/NOI/documents/PermitsFormsApplicationsNOI.htm	The text in **bold** will be added to the following statement. The notice of intention to abandon a well (NOIA) can be obtained from the ADWR Groundwater Management Support Section in Phoenix or other local offices. **In addition, all forms are available online at:** http://www.azwater.gov/iazdwr/WaterManagement/NOI/documents/PermitsFormsApplicationsNOI.htm	No additional comments.
2	ADWR-2			The SOP document describes requirements for abandoning (decommissioning) wells in Arizona and California and technical specifications and procedures for abandoning wells at the Topock Compressor Station remediation site. The proposed methods are thorough, protective of the aquifer, and consistent with minimum well construction and abandonment requirements in Arizona Administrative Code (A.A.C.) R12-15-816 and substantive policy described in the ADWR "Well Abandonment Handbook" (2008).	PG&E appreciates the review and input from ADEQ and ADWR on this SOP.	No additional comments.
3	ADWR-3			The proposed methods suggested for abandoning exploratory boreholes in Arizona utilizing "granulated material" are satisfactory. The methods are consistent with the variance option of Alternative 4 in the "Well Abandonment Handbook". Notices of Intent to Abandon a Well must be accompanied with a written request for a variance from the provisions of the minimum well construction and abandonment standards and in accordance with A.A.C. R12-15-820.	This comment is specific to the *Revised Implementation Plan for Evaluation of Alternative Freshwater Sources in the Topock Remediation Project Area, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California* (January 28, 2013). However, as noted by the Fort Mojave Indian Tribe in comment FMIT-6, this represents an example of successful application of a variance to the standard well decommissioning procedure in Arizona. This variance was approved by ADWR based on project-specific information about the condition of the aquifer and planned boreholes (not a well in this example). PG&E anticipates similar discourse with the regulatory agencies based on future project-specific information in the development of future well decommissioning work plans.	No additional comments.
4	Department of Toxics Substances Control (DTSC) Document edits in redline strikeout DTSC-1	2nd paragraph	However, California boreholes drilled to the water table must be decommissioned per water well standards.	[DTSC Comment CG1]: Revise text. Clarify that an exploratory borehole drilled to the water table in California must comply with well decommissioning standards. Underlined text indicates new text inserted into document.	The text in **bold** will be added to the following statement. For the purpose of this SOP, an exploratory borehole (borehole) is defined as a drilled borehole in which no casings have been installed, regardless of whether or not the borehole was drilled to the water table. **However, California boreholes drilled to the water table must be decommissioned per water well standards.**	No additional comments.
5	DTSC-2	1.1	[1.] San Bernardino County does not require permits for the installation or decommissioning of boreholes that do not reach the water table.	[DTSC Comment CG2]: Please note that DTSC may request that some exploratory boreholes that do not reach the water table be decommissioned as wells under certain circumstances (e.g., deep boreholes that almost reach the water table). Please incorporate this concept into the SOP.	The text in **bold** will be added to the following statement. The California Well Standards identify well destruction (or decommissioning for this SOP) requirements for both water supply wells (Part III of Bulletin 74-81), and monitoring wells and exploratory boreholes[1]. **Although San Bernardino County does not require permits for the decommissioning of boreholes that do not reach the water table, DTSC has stated that they may request that some exploratory boreholes that do not reach the water table be decommissioned as wells under certain circumstances. For example, a borehole that terminates within 10 to 20 feet the water table and is located in an area where the potential for infiltration (e.g., wash channels) or future spills (e.g., an area of active industrial operations) is greater.**	No additional comments.

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
6	DTSC-3	1.3	However, the County of San Bernardino will need to be consulted in the event a variance to the California Well Standards is required.	[DTSC Comment CG3]: As the SOP is now sufficiently developed, it is important to have San Bernardino review the next version and provide input as they are a key decision maker regarding well decommissioning.	After PG&E response to comments from ADWR, DTSC, Fort Mojave Indian Tribe and the Hualapai Dept of Cultural Resources included in this table have been addressed and discussed by the Well Decommissioning Subgroup, a draft of this SOP will be submitted to the County San Bernardino for their review and input.	No additional comments.
7	DTSC-4	2.0	Involved oversight agencies will be notified in advance of any decommissioning activities to ensure concurrence with decommissioning of a particular well(s).	Underlined text indicates new text inserted into document.	The proposed text has been added to the document.	No additional comments.
8	DTSC-5	2.1	drilling and well installation information	[DTSC Comment YA4]: A repository of drilling logs and installation notes should be put into a central archive for access by involved stakeholders.	Drilling logs and installation notes, where available, have been included in various documents submitted to the agencies following field work. As specific well decommissioning work plans are developed, this information will be included in those plans. **Further, as requested by DTSC, the well inventory spreadsheet (electronic file) and available well logs associated with the Topock Project will be archived on the DTSC website. This archive will be updated periodically as additional wells and boreholes are installed.** The text above in **bold** will be added to Section 1.3, first bullet (Topock Well Inventory Data Package).	No additional comments.
9	DTSC-6	2.1	Topock Well Inventory	[DTSC Comment CG5]; Include the current Topock Well Inventory as an electronic attachment to this SOP.	The text in **bold** will be added to the following statement. The majority of this information will be available through review of drilling and well installation information, the Topock Well Inventory, groundwater sample collection logs, or other related documents**. An electronic copy of the Topock Well Inventory has been included in this SOP under Attachment A.**	No additional comments.
10	DTSC-7	2.1	Geophysical survey – Depending on the well casing type, depth to water, presence or absence of centralizers, and other variables, select geophysical survey tools may be useful.	Underlined text indicates new text inserted into document.	The modified text in **bold** will be added to the statement. Geophysical survey – Depending on the well casing type, depth to water, **potential presence of metallic centralizers or other well construction components**, and other variables, select geophysical survey tools may be useful.	No additional comments.
11	DTSC-8	2.2.1	Bentonite cannot be used as a sealing material opposite zones of fractured rock, unless otherwise approved by lead agencies (DTSC/DOI).	Underlined text indicates new text inserted into document. Deleted text includes "the permitting" agency. Subsequent comment from DTSC regarding when bentonite is appropriate as a sealing material…	The proposed edit has been incorporated into the document. In addition, based on subsequent discussion with DTSC, the following text in **bold** has been added to Section 2.2.1, fourth bullet (bentonite clay): **In addition, bentonite is not recommended for application in high TDS environments (e.g., >5,000 parts per million) due to the adverse effects on its ability to properly swell and seal in these conditions.**	No additional comments.
12	DTSC-9	2.2.3	If the material was generated as drill cuttings, then lead agencies must agree that the material can be used as a component of either sealing or filler material for the purpose of well or borehole decommissioning (a variance may be required).	[DTSC Comment CG6]: Change text as a permit exemption may be used and since DOI and DTSC will, at a minimum, be approving agencies. Underlined text indicates new text inserted into document. Deleted text includes "the permitting" agency.	The proposed edit has been incorporated into the document.	No additional comments.

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
13	DTSC-10	2.3	Following evaluation of the well or borehole and in coordination with the lead agencies, it must be determined if the well can be decommissioned in place (with or without modification) or if the well materials must be removed.	Underlined text indicates new text inserted into document. Deleted text includes "the permitting" agency.	The proposed edit has been incorporated into the document.	No additional comments.
14	DTSC-11	2.3	The following subsections define the decommissioning scenarios that may apply pending completion of the well evaluation and coordination with lead agencies, responsible agencies **(San Bernardino County or Arizona Department of Water Resources)**, affected land owner, **Tribes,** and other stakeholders.	Underlined text indicates new text inserted into document. Deleted text includes "the permitting" agency.	The proposed edit has been incorporated into the document.	Tech in **bold and underlined** in the "Reference Text" column has been added globally as requested during the call.
15	DTSC-12	2.3.2	1. Conduct evaluation of the well as detailed in Section 2.1 and verify with lead agencies, responsible agencies, affected land owner, and other stakeholders that the well should be decommissioned in place.	[DTSC Comment CG7]: The urban versus non-urban terms created concern to some tribes and distracted from the technical issues at hand. It is recommended that explicit reference to the term be minimized (see highlights in text and Figure 1). Perhaps just referencing the standards will suffice. Underlined text indicates new text inserted into document. Deleted text includes "the permitting" agency.	The proposed edit has been incorporated into the document. See response to comment DTSC-16 regarding the urban and non-urban topic. Reference June 6, 2014 RTC Discussion and what changes result (e.g. Type 1 and Type 2).	As a result of the June 6, 2014 RTC Discussion the terms "urban" and "non-urban" have been removed from the SOP. These terms have been replaced throughout with "Type 1" and "Type 2". A definition for these terms has been added to the beginning of Section 2.3. In addition, Figure 1 has been revised to include the new terminology.
16	DTSC-13	2.3.2	a. Non-urban Area – Place sealing material from total depth to near ground surface.	Yellow highlight added.	See response to comment DTSC-16.	See summary for comment DTSC-12.
17	DTSC-14	2.3.2	b. Urban Area – Place sealing material from total depth to within 5 feet of the ground surface (bgs).	Yellow highlight added.	See response to comment DTSC-16.	See summary for comment DTSC-12.
18	DTSC-15	2.3.2	c. For urban or non-urban area wells located outside an area of known or potential pollution or contamination as determined by the soil and/or groundwater quality data available for the location, evaluate using filler material in lieu of sealing material in portions of the well casing.	[DTSC Comment CG8]: Made edit assuming that well is left in place and could only fill well casing with filler or sealing material. Yellow highlight added. Underlined text indicates new text inserted into document. Deleted text includes "borehole".	The proposed edits have been incorporated into the document. See response to comment DTSC-16 regarding highlighted text.	See summary for comment DTSC-12.

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
19	DTSC-16	2.3.2	a. Non-urban Area – Remove all well head protection and excavate around the well casing to a depth of approximately 5 feet bgs, or as practicable. Remove all well materials to a depth of approximately 5 feet bgs, or as practicable, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate. b. Urban Area – Remove all well head protection and excavate around the well casing to a depth of 5 <u>feet</u> bgs. <u>Remove</u> all well materials to a depth of 5 feet bgs, cap casing with sealing material <u>such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole</u>. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.	[DTSC Comment YA9]: Urban and non-urban decommissioning scenarios appear to be the same. If that the case, let's not differentiate between the two. Yellow highlight added. Underlined text indicates new text inserted into document.	The proposed edits have been incorporated into the document. The following text in **bold** has been added at the end of Section 2.3.2 to address the comment regarding the urban and non-urban topic: **Note that the urban and non-urban scenarios are only subtly different. While the urban scenario requires the removal of all well materials to a depth of 5 feet bgs (per CA well standards), non-urban areas do not require the removal of any well materials. The removal of well materials to a depth of approximately 5 feet bgs, or as practicable, is not required by CA well standards, but included per stakeholder comments.** To further clarify this difference in the text, bullet 4a (decommission well head, non-urban area) has been revised to indicate a range of 1 to 5 feet bgs. The same revision has been made to Section 2.3.3, bullet 4a, and Figure 1.	See summary for comment DTSC-12.
20	DTSC-17	2.3.3	1. Conduct evaluation of the well as detailed in Section 2.1 and verify with <u>lead agencies</u>, <u>responsible agencies</u>, affected land owner, and other stakeholders that the well should be decommissioned in place, what modification work is required, and whether it is in a location considered to be urban.	Underlined text indicates new text inserted into document. Deleted text includes "the permitting".	The proposed edit has been incorporated into the document.	See summary for comment DTSC-11.
21	DTSC-18	2.3.3	a. Non-urban Area – Place sealing material from total depth to near ground surface, or in the event casing is removed, the new top of casing depth. If a portion of the casing is removed, sealing or filler material requirements for the interval above the top of casing must be determined through discussion with <u>lead agencies, responsible agencies</u>, affected land owner, and other stakeholders.	Yellow highlight added. Underlined text indicates new text inserted into document. Deleted text includes "the permitting".	The proposed edit has been incorporated into the document. See response to comment DTSC-16 regarding highlighted text.	See summary for comment DTSC-12.
22	DTSC-19	2.3.3	b. Urban Area – Place sealing material from total depth to within 5 feet of the ground surface (bgs). If a portion of the casing is removed, sealing or filler material requirements for the interval above the top of casing must be determined through discussion with <u>lead agencies, responsible agencies</u>, affected land owner, and other stakeholders.	Yellow highlight added. Underlined text indicates new text inserted into document. Deleted text includes "the permitting".	The proposed edit has been incorporated into the document. See response to comment DTSC-16 regarding highlighted text.	See summary for comment DTSC-12.

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
23	DTSC-20	2.3.3	c. For urban or non-urban area wells located outside an area of known or potential pollution or contamination, evaluate using filler material in lieu of sealing material in portions of the borehole.	Yellow highlight added.	See response to comment DTSC-16.	See summary for comment DTSC-12.
24	DTSC-21	2.3.3	a. Non-urban Area –Remove all well head protection and excavate around the well casing to a depth of approximately 5 bgs, or as practicable. Remove all well materials to a depth of approximately 5 feet bgs, or as practicable, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate. b. Urban Area – Remove all well head protection and excavate around the well casing to a depth of 5 bgs. Removal all well materials to a depth of 5 feet bgs, cap casing with sealing material such that it extends beyond the diameter of the borehole and will drain fluids away from the borehole. Backfill the void created with displaced site material, or filler material if displaced site material is not available or appropriate.	[DTSC Comment CG10]: See Comment YA9 above. Urban and non-urban decommissioning scenarios appear to be the same. If that the case, let's not differentiate between the two. Yellow highlight added.	See response to comment DTSC-16.	See summary for comment DTSC-12.
25	DTSC-22	2.3.4	Further, when removal is practicable, lead agencies, responsible agencies, affected land owner, or other stakeholders may determine this method preferable to others. Removal is typically conducted by over-drilling the existing well materials with larger diameter drilling tools.	Underlined text indicates new text inserted into document. Deleted text includes "the permitting".	The proposed edit has been incorporated into the document.	See summary for comment DTSC-11.
26	DTSC-23	2.3.4	1. Conduct evaluation of the well as detailed in Section 2.1 and verify with lead agencies, responsible agencies, affected land owner, and other stakeholders that the well should be decommissioned by removal.	Underlined text indicates new text inserted into document. Deleted text includes "the permitting".	The proposed edit has been incorporated into the document.	See summary for comment DTSC-11.
27	DTSC-24	2.4	Following completion of well decommissioning tasks, reporting of field activities must be completed in compliance with the lead agencies requirements.	Underlined text indicates new text inserted into document.	The proposed edit has been incorporated into the document.	No additional comments.
28	DTSC-25	2.4	The Well Decommissioning Report will be submitted to lead agencies no later than 90 days after completion of well decommissioning activities.	Underlined text indicates new text inserted into document.	The proposed text and text deletions have been incorporated into the document.	No additional comments.
29	DTSC-26	Figure 1	Between steps 3 and 4	Insert step: "Obtain approval to proceed from lead agencies"	The proposed revision to Figure 1 has been incorporated.	

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
30	DTSC-27	Figure 1	After step 13	Insert step: "Document all activities in a Well Decommissioning Report to be submitted no later than 90 days after the decommissioning event.	The proposed revision to Figure 1 has been incorporated.	
31	DTSC-28	Figure 1	Step 12	Delete "e.g., urban area vs. non-urban area" within the brackets.	The proposed revision to Figure 1 has been incorporated.	
32	Hargis + Associates, Inc. Fort Mojave Indian Tribe (FMIT) April 19, 2013 Letter FMIT-1	General	No specific text.	The Tribe has asked for and supported this effort to proceduralize the decommissioning of the physical intrusions into the landscape created by the drilling of wells and boreholes. Nevertheless, the alternatives available for the decommissioning procedure remain hurtful as they represent a permanent disfiguration of the hallowed landscape across which the project will be constructed. Basically, once a well/borehole is in place, the options for decommissioning involve either the emplacement of foreign, unnatural materials in place of the materials emplaced for during well construction/operation, or attempting to destroy the original downhole materials. In the process of well destruction, however, an even greater disturbance results. Neither option is attractive to the Tribe. Avoiding further disturbances by not constructing additional wells/boreholes of course is the Tribe's preference, particularly recognizing that the cumulative number of anticipated intrusions will perhaps be 350 or more before the project is over. Nevertheless, considering the reality that more disturbances will be created as a result of the remedy, the Tribe emphasizes that flexibility must be maintained. The decision as to how to proceed with decommissioning will necessarily be case-specific and requires advance discussions and consultations with the Tribes.	Comment noted. PG&E has drafted this SOP in coordination with the agencies and Tribes to meet regulatory requirements and minimize both disturbance and the placement of foreign materials. PG&E anticipates further discussions with and input from the Tribes on future work plans, as well as consultation with Tribes in accordance with the consultation protocol detailed in the Programmatic Agreement.	
33	FMIT-2	Preface	"This document was developed as a direct result of Tribal concerns …	The preface claims that "This document was developed as a direct result of Tribal concerns …" While this is in part true, it should be acknowledged that it would have been necessary to develop and SOP for this purpose for overall project purposes anyway. The Tribal request is consistent with the ARARs identified for this action.	Comment noted. The second sentence of the first paragraph has been edited to read as follows (new text in **bold**): This document was developed**, in part,** as a direct result of Tribal concerns that included dialog regarding future decommissioning activities at the site between PG&E, agencies, and Native American Indian Tribes (Tribes).	No additional comments.
34	FMIT-3	Preface	"… use of displaced site material in the decommissioning process …"	The preface also asserts that the "… use of displaced site material in the decommissioning process …" is based on Tribal input. This again is not a possibility related to Tribal input or preference. Provisions for backfilling certain boreholes with drill cuttings is an option that is commonly exercised, such as for exploratory borings. Nevertheless, the Tribe generally regards the earth materials removed from their natural place as a disturbance and potentially a desecration of the land. This section should probably also reference the preparation of an SOP for the handling and disposition of soils displaced as a result of project activities.	While permits are not required for the decommissioning of exploratory boreholes that do not reach the water table, based on the regulations~~, it is not best industry practice to backfill boreholes with drill cuttings~~. The SOP for the handling of disposition of soils displaced as a result of project activities (Management Protocol for Handling and Disposition of Displaced Site Material) is referenced in Section 1.3. A reference to the use of displaced site material (Section 2.2.3) is already included in the first paragraph of the document.	The response has been revised per the discussion. Changes shown in ~~strikeout~~.
35	FMIT-4	Preface	"exploratory borehole."	The preface offers a definition of an "exploratory borehole." Considering that the shelf life of this document is anticipated to be in excess of three decades, there should be a definition section for this term as well as others used throughout the text, such as "decommissioning," "displaced site material," "sealing material," "filler material," "monitor well," "production or extraction well," "injection well," etc. It is understood that some of these terms do not presently appear in the text, but it is necessary to establish the types of wells/boreholes to which this SOP applies. Perhaps a section further explaining the applicability and scope of this SOP is needed.	The first sentence of the second paragraph of the SOP has been revised as follows (new text in **bold**): This SOP will be used as a reference to guide the development of future work plans required for agency, Tribal, and stakeholder review prior to conducting **all** well and borehole decommissioning tasks **associated with the groundwater remedy**. Based on the revised text definition of well types would only add complexity to the SOP. The definition of "sealing material", "filler material", and "displaced site material" is provided in detail in Sections 2.2.1, 2.2.2, and 2.2.3, respectively.	No additional comments.

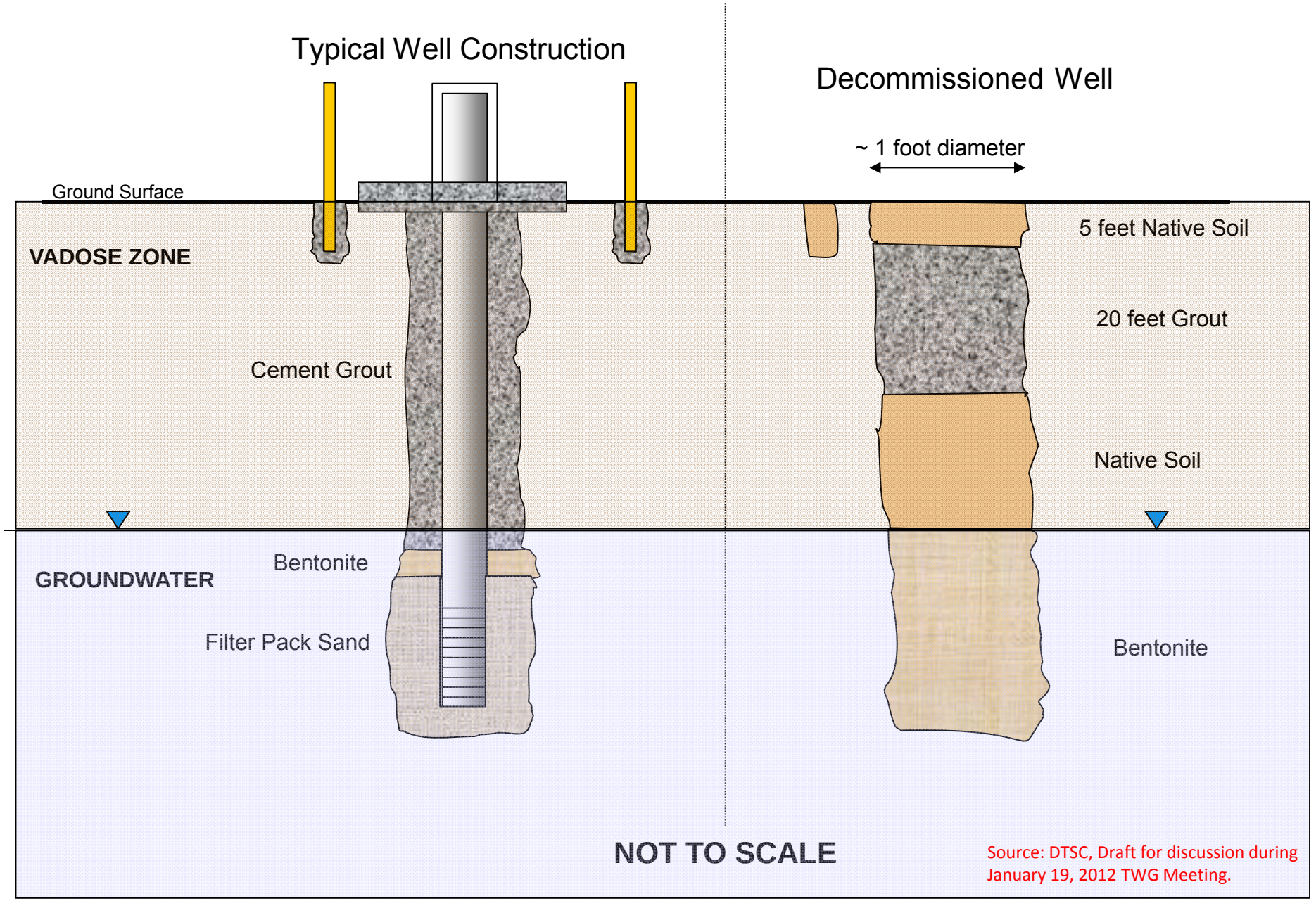
Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
36	FMIT-5	Section 1.0		Both California and Arizona regulatory requirements are outlined in Section 1.0, however, the respective subsections fail to mention provisions for variances within the regulations and guidance documents cited. Additionally, are there any conflicts between the rules promulgated by the two states?	Section 1.2 (Regulatory Information – Arizona [ARARs #48 and #49]) states: *If an alternative method of decommissioning is proposed in lieu of the standard method, further substantive review is performed by ADWR to verify that the proposed methods apply, and whether appropriate fill materials were chosen. A proposal to use an alternative decommissioning method requires an application to ADWR for a variance from the well decommissioning rule (a deviation from the standard decommissioning method).* The technical specifications and procedures for decommissioning well and exploratory boreholes presented in Section 2 of the SOP were developed to be in compliance with both California and Arizona regulations.	No additional comments.
37	FMIT-6	Section 1.3		Section 1.3 discusses CERCLA exemptions for permitting proposed well abandonment. It refers to various discussions with San Bernardino County authorities in this regard and further indicates that, to date, no discussions have been scheduled. It is strongly recommended that PG&E initiate the further discussions with the respective regulatory authorities in both California and Arizona. In fact, it may be advisable to familiarize the regulatory personnel with the context of this particular procedure. The Tribe notes that a preliminary exchange has been made with the Arizona Department of Water Resources (ADWR) through the Arizona Department of Environmental Quality (ADEQ) in regard to the decommissioning of borings proposed in support of exploration for a freshwater source in Arizona. The February 28, 2013, letter from ADWR addresses a proposed variance for this purpose. This seems to indicate ADWR's willingness to work with PG&E in regard to such requests. Accordingly, further liaison with these agencies may be helpful in future situations. If the Tribe can do anything to facilitate such discussions in the interest of its preferences, it stands ready to support such an effort.	PG&E appreciates the Tribe's willingness to assist with discussions with state permitting agencies related to well decommissioning variance options. PG&E anticipates holding these discussions with the agencies when future work plans that involves well decommissioning are being developed so that specific aquifer and well conditions can be contemplated in the context of potential variance options. Further, given that the groundwater remediation project is estimated to last for tens of years, the evaluation of variance options at the time each well decommissioning plan is developed will allow for potential changes in well decommissioning regulations to also be considered.	No additional comments.

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
38	FMIT-7	Section 2.0		Section 2.0 discusses general procedures for decommissioning. Considering the subsections that follow, it appears that PG&E is targeting a specific recommendation for the well/borehole decommissioning procedure under consideration. As discussed earlier, the Tribe requires discussion and consultation on a case-by-case basis because of the variation in construction characteristics, location, and other factors that enter into the decision. Accordingly, at the outset of such discussions, the Tribe would need information in regard to the alternative procedures available for each case. This information would facilitate the Tribes' decisions on the long-term fate of the intrusions.	As stated at the beginning Section 2.0, *The information provided in this section is intended to be applicable for wells or boreholes located in either California or Arizona; however, it is assumed that the details included in the specific work plan(s) will be designed in compliance with the appropriate state regulations, and reviewed by the appropriate permitting agency.* To more clearly acknowledge that potential for well decommissioning procedures that would require a variance to the applicable state regulations, the following statement in **bold** has been added to the document after the text referenced above: **In addition, depending on the condition of the aquifer and well(s) subject to decommissioning, potentially applicable variance options that include the minimization of the placement of sealing material should be evaluated with the lead agencies during well decommission work plan development (e.g., Arizona Alternative 4 – variance option).** In addition, the following text has been added to the end of the second paragraph in Section 1.2 (new text in **bold**): *The Well Abandonment Handbook (WAH) provides a standard well decommissioning method to be used for the post-installation of any well or borehole, regardless of the aquifer or vadose zone conditions applicable to the well (Section IV A). In addition, the WAH details five alternative abandonment methods. The five alternatives are for specific vadose zone and aquifer conditions which may include contamination, single or multiple aquifers, or dry wells (Section IV B).* ***For example, Alternative 4, which applies to wells that only penetrate a single aquifer without vertical flow components and no water quality contamination issues, might be applicable to wells in the Topock area that are 8-inches or greater in diameter. A variance option to Alternative 4 permits the use of clean fine sand to fill the well being decommissioned.*** Further, the text included in box number 13 on the decision flow chart presented in Figure 1 has been revised as follows (including text strikeout per comment DTSC-28 and with new text in **bold**): Place sealing/filler material within the borehole or well casing in accordance with regulatory and project-specific guidance**, and any permitting agency-approved variance conditions**.	During the June 6, 2014 subgroup discussion, the Tribes requested that additional information on potential variance conditions that had been previously developed by DTSC be added to this SOP. Please advise if the three schematics included in new Attachment A to this SOP are appropriate and meet the intent of this comment. Thank you.
39	FMIT-8	Section 2.2		The subsections under Section 2.2 do not appear to recognize provisions for variances as discussed earlier. Indeed such scenarios need to be developed and discussions held with the respective regulatory authorities as to the acceptability, need and justifications, and technical rationale for such requests. To this point, the subcommittee has spent time on alternative conceptual designs. This SOP does not include or acknowledge this work.	The subsections under Section 2.2 simply present the different types of materials that can be used for various well or borehole decommissioning scenarios, and not is not intended to evaluate or disqualify variance well decommissioning options. See the response to FMIT-7, which adds text to more clearly acknowledge the potential for variance options.	During the June 6, 2014 subgroup discussion, the Tribes requested that additional information on potential variance conditions that had been previously developed by DTSC be added to this SOP. Please advise if the three schematics included in new Attachment A to this SOP are appropriate and meet the intent of this comment. Thank you.

Absolute Comment No.	Comment Source/Number	Section	Reference Text	Comment	Response	Summary of June 6, 2014 RTC Discussion
40	FMIT-9	Section 2.3		Section 2.3 develops different scenarios. However, these scenarios only relate to standard situations and again do not consider the possibilities of variances. The situations in which variances are appropriate and applicable for consideration need to be developed in this procedure, otherwise those following the procedure will simply adhere strictly to the content. Additionally, this section appears to only consider the California rules, which distinguish between "urban" and "non-urban" areas. This, for example, is not a relevant consideration for the Site and is not referenced in the Arizona guidelines. The design for well decommissioning should not have to be a choice between these two options.	The evaluation of scenarios in Section 2.3 were developed in consideration of both California and Arizona regulations. The distinction between urban and non-urban is subtle and has been clarified as detailed in the response to comment DTSC-16. Both California and Arizona regulations detail specific procedures depending on aquifer and well conditions. California regulations do not reference any variance conditions, while the Arizona regulations reference alternatives to the recommended standard decommissioning procedure and some variance options associated with those alternatives. Variance conditions or potential scenarios that may or may not be approved by regulatory agencies should not be included in an SOP. Also, see comment FMIT-7.	During the June 6, 2014 subgroup discussion, the Tribes requested that additional information on potential variance conditions that had been previously developed by DTSC be added to this SOP. Please advise if the three schematics included in new Attachment A to this SOP are appropriate and meet the intent of this comment. Thank you.
41	FMIT-10	Section 2.4		Section 2.4 discusses "Well Decommissioning Reporting," and specifies that the information be reported in the Topock Well Inventory. Is this information also reported in the Well Registry for the respective states?	Yes, well decommissioning reports are filed with ADWR and California DWR in accordance with the respective well standards for each state. As noted in the first sentence of Section 2.4 (including edit made in accordance with comment DTSC-24): Following completion of well decommissioning tasks, reporting of field activities must be completed in compliance with the lead agencies requirements.	No additional comments.
42	FMIT-11	Figure 1		Figure 1 needs to be changed to reflect the above comments.	See response to comment FMIT-7.	No additional comments.
43	Hualapai Department of Cultural Resources (HDCR) April 24, 2013 Letter HDCR-1			On behalf of the Hualapai Tribe, we feel that is very important to have minimal disturbance in an area that has been under constant environmental change due to the operations of the Topock Compressor Station. As wells and well materials are intrusive, we feel that it is best that all well casings be left in-situ when and if wells are to be decommissioned. This will be the least intrusive and create the least amount of disturbance.	PG&E agrees that the decommissioning procedure which involves the least amount of disturbance that is acceptable to the regulatory agencies should be implemented. The following text in **bold** has been added to Section 2.3.2 (Decommissioning a Well in Place): **This decommissioning option should be utilized whenever acceptable to the regulatory agencies as it represents the field procedures that are least intrusive and create the least amount of disturbance.**	No additional comments.
44	HDCR-2			In the process of decommissioning, Hualapai prefer that natural materials from the immediate vicinity be placed inside the well-casings, and that wells be capped with the least amount of invasive materials, i.e. concrete, steel bolts, etc. As wells come under the decommissioning process, Hualapai would like to be informed about each well that is going to be subject to decommissioning.	See response to comment FMIT-1 regarding consultation with the Tribes on future work plans, and FMIT-7 regarding clarifying information that is being added to the document to acknowledge the potential for variance conditions.	No additional comments.

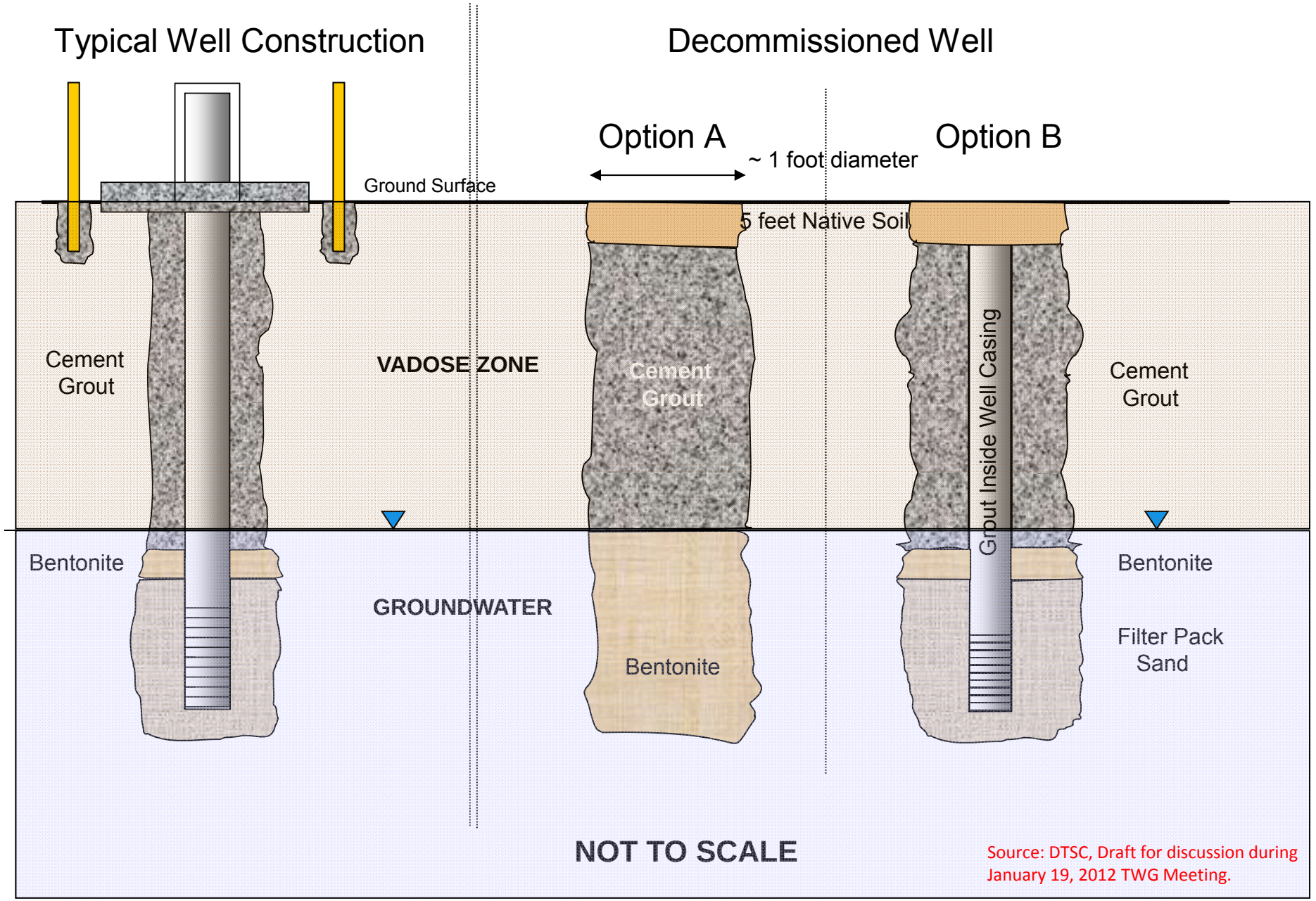
Attachment B
Draft DTSC Concepts for Well and Borehole Decommissioning

Category 1: Contaminant Free – No Variance



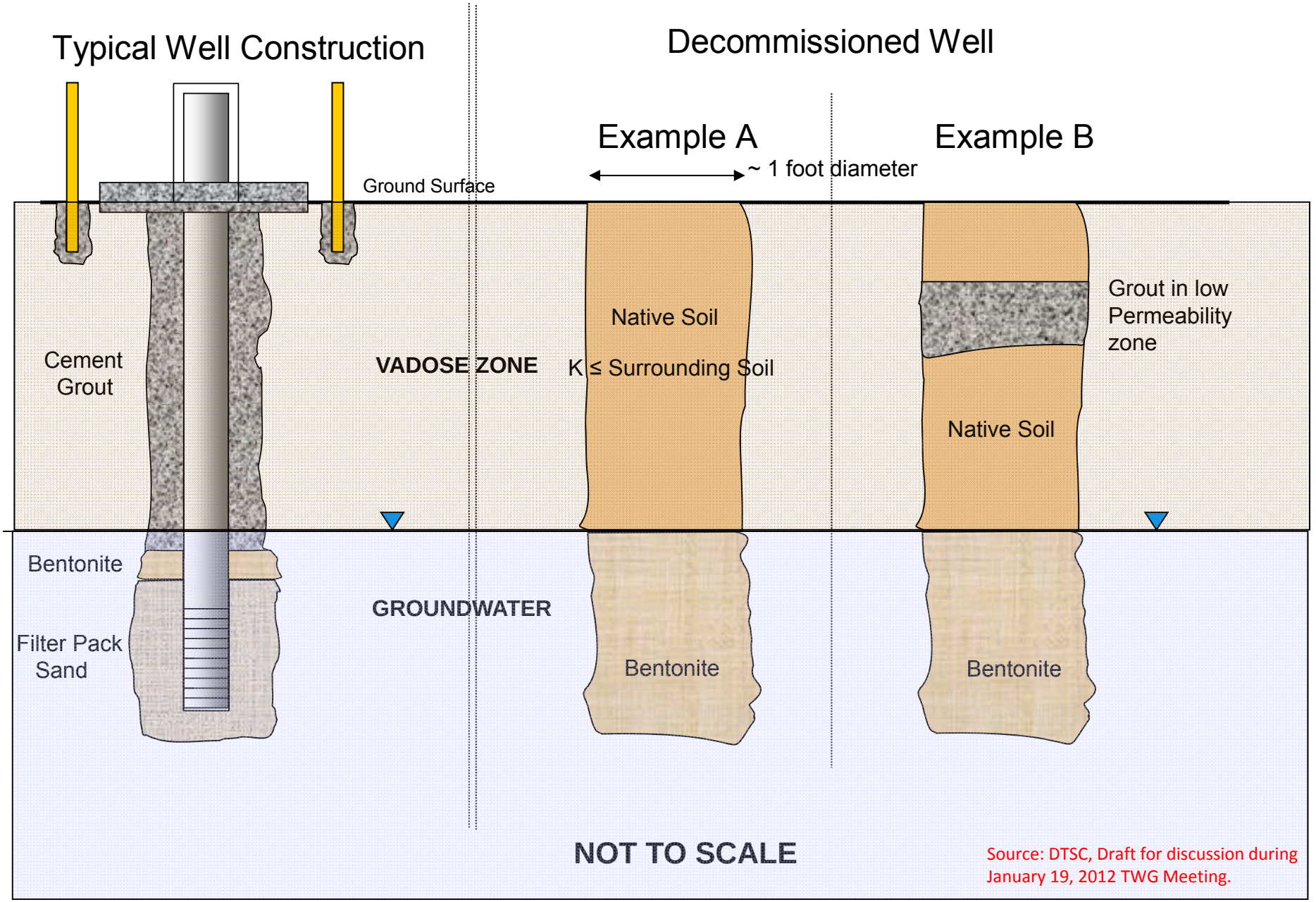
Source: DTSC, Draft for discussion during January 19, 2012 TWG Meeting.

Category 2: Contaminanted Area – No Variance



Source: DTSC, Draft for discussion during January 19, 2012 TWG Meeting.

Category 3: Contaminant Free – Variance



Source: DTSC, Draft for discussion during January 19, 2012 TWG Meeting.

SOP-A1

Purging and Sampling of Groundwater Monitoring Wells
Well-Volume Method
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) addresses the procedures and equipment to be used for purging and sampling all groundwater monitoring wells at the Topock site with casing diameters in excess of 1-inch. This SOP will be used for sampling groundwater monitoring wells using a dedicated electric submersible pump with a single discharge rate, a dedicated electric pump with a controllable discharge rate, or a portable electric pump with a controllable discharge rate. A peristaltic pump or inertial pump (Waterra or similar) can be used if an electrical submersible pump is not appropriate. A well-volume based purging and sampling method will be used for these wells. This SOP does not apply to FLUTe wells, or Blatypus pump equipped wells (MW-58BR). Those wells will be sampled according to the relevant Field Activities Work Plan (available from on-site field coordinator).

REQUIRED DOCUMENTS:

- Event-specific planned sample table (PST).
- Applicable project work plan or monitoring plan. Refer to the Topock Program Sampling, Analysis, and Field Procedures Manual (Procedures Manual).
- Construction/Remedial Action Work Plan (C/RAWP) during the construction phase.
- Operation and Maintenance Manual (O&M Manual) and Quality Assurance Project Plan (QAPP) (Appendix B of the O&M Manual Volume 2, Sampling and Monitoring Plan) as required during the O&M phase.
- Topock Program Health and Safety Plan (HSP)
- Well construction logs/specifications
- Mobile Integrated Sample Tracking (MIST) handheld database
- Previous sampling logs or tabular historic field data tables
- Current site access map
- Blank sampling logs, maps, sample labels, chains of custody (COCs), and the designated groundwater sampling field notebook
- Applicable SOPs may include:
  - SOP-A2, *Purging and Sampling of 1-inch Diameter Groundwater Monitoring Wells, Modified Well-Volume Method*
  - SOP-A3, *Purging and Sampling of Active and Inactive Water Supply Wells*
  - SOP-A4, *Depth-Specific River Water Sampling*
  - SOP-A5, *Groundwater Sampling from Sonic Drilling Boreholes*

- SOP-A6, *Field Filtration*
- SOP-A7, *Water Level Measurements*
- SOP-A8, *Field Water Quality Measurements Using a Flow-through Cell*
- SOP-A9, *Calibration of Field Instruments*
- SOP-A10, *Decontamination of Water Sampling Equipment*
- SOP-A11, *Total Depth Measurements*
- SOP-A12, *Field Water Quality Measurements for Grab Samples*
- SOP-A13, *Spill Prevention, Containment, and Control Measures for Monitoring Well Sampling*
- SOP-A14, *Pore Water Sampling*
- SOP-A16, *Access Routes*
- SOP-A18, *Purging and Sampling of Groundwater Monitoring Wells, Minimal Drawdown Method*
- SOP-A19, *Sampling of Groundwater Monitoring Wells, Hydrasleeve No Purge Method*
- SOP-A23, *Sample Handling and Custody*
- SOP-C1, *Solinst Pressure Transducers*

REQUIRED EQUIPMENT:

- 2 or more (i.e. one is backup) YSI-556 WQ instruments with flow through cells, or equivalent.
- Hach 2100P turbidimeter or equivalent.
- 200 foot (or longer as needed) water level indicator (WLI).
- Trimble Rugged Reader hand held instrument for MIST data collection.
- Two, 200 gallon capacity purge tanks.
- Utility vehicles (UTV's) as necessary.
- Back-up 2-inch pump and controller.
- Honda 2000 watt generator or alternate power source.

PREPARATION & SETUP:

- Review event-specific PST or event-specific field instructions, previous sampling logs, Procedures Manual, HSP, and groundwater sampling supplies and equipment check list. (NOTE: the PST should also be reviewed for required "non-analytical event activities" such as water level measurements or other data collection that is planned in association with the groundwater sampling event).
- Acquire the existing field logbook for groundwater sampling and initiate entries.

- Inspect all equipment and verify that the field water quality (WQ) meters have been calibrated prior to use according to the manufacturer's instructions and SOP-A9, *Calibration of Field Instruments*.
- Inventory sample bottles, build sample sets for the required analytes at each sample location, ensure a sufficient supply of lab de-ionized water for equipment blanks, and confirm the lab courier schedule.
- Field-check sampling equipment and supplies: water level indicator (WLI), WQ meters, flow-through cell, pump controller, power supply, pump discharge/sampling tubing, N-dex gloves, D.I water sprayers, 5 gallon buckets, paper towels, 0.45 micron in-line filters, etc.

FIELD PROCEDURES:

- **Prior to opening any monitor well, remove all pens, lighters, calculators, or any other loose items from vest pockets, or from any other location where they could fall into the well.**
- Upon arrival at the monitoring well, at least 2 members of the sampling team must confirm the well ID. Wells should be clearly marked on the well monument. If the well cannot be positively identified by the marking, measure total depth of the well and compare to the well installation details to confirm the correct location. Report worn or unclear well markings to the on-site field coordinator.
- Place spill containment according to SOP-A13, *Spill Prevention, Containment, and Control Measures for Monitoring Well Sampling.*
- Collect an "EB", equipment blank, ***prior to pump installation*** if necessary according to the PST.
- Open the protective casing lid and, ***prior to moving it***, note the exact configuration of the transducer installation if present. Measure static WL according to SOP-A7, *Water level Measurements,* moving the transducer if necessary, and record WL value in MIST and on the sampling log.
- If the well is equipped with a transducer and does not have a dedicated pump installed, remove the transducer from the well according to SOP-C1, *Solinst Pressure Transducers*.
- If the well does not have a dedicated pump installed, but does have dedicated sample tubing, attach the dedicated tubing to the appropriate pump and install decontaminated pump at the same intake/sampling depth as used in prior events. There is a marking on the purge tubing which corresponds with the monitor well top of casing (TOC) to facilitate this requirement. Purge and sample the well as described below.
- If the well does not have a dedicated pump ***or*** tubing, or has not been previously sampled, use new low-density polyethylene tubing and install the pump with the intake 15 feet below the surface of the static water column, or at the depth prescribed by the Project Manager (PM) or Field Team Manager (FTM), and record the intake depth in MIST and on the field data sheet. Purge and sample the well as described below.

- If the well ***does*** have a dedicated pumping system, connect the discharge tubing and purge and sample the well as described below.
- Collect daily equipment blanks and duplicate samples as required by the PST and instructed by the field team leader.

PURGING AND SAMPLING PROCEDURES:

- Prepare the groundwater sampling log. Use the static water level and the total depth provided on the field data sheet and in the PST to calculate the volume of one casing of standing water in the well.
- Calculate 3 casing volumes for the minimum required purge amount and record on sampling log.
- Evaluate previous purge rates, amount of drawdown, stability of field parameters, and total purge volume prior to sample collection from previous sampling records and historical data tables (Appendix B of *Monitoring Plan for Groundwater and Surface Water Monitoring Program*). If the well has not been previously sampled, estimate the expected purge rate using previous sampling information from nearby wells.
- If the pumping rate is in excess of one gpm, install the provided flow splitter so that the pumping rate does not need to be decreased to collect the sample. If the flow rate is at two gpm or above, install a second flow splitter to control the flow through the flow through cell.
- Install the pump as previously described. Immediately after installation, stuff a large trash bag, or place another barrier into the well bore around the pump discharge tubing. This will help to prevent foreign objects from falling into the well.
- Ensure that all tubing connections are properly tightened and then start the pump. Check for any leaks, monitor drawdown, and calculate/set the purge rate. The purge rate can be determined using the fill-time of a graduated container, or using a flow meter if available. The well specific purge rate and pump setting should be available on the previous purge form. Record pump setting (i.e. hertz) on sampling log if available.
- Purge water should be contained in a portable purge water storage tank. If approved by well owner and the governing regulatory agencies, water may be discharged directly to the ground (this presently applies to PM-03 and PM-04 water supply wells), as directed by the FTM.
- Continue purging, measuring WL and field indicator parameters periodically (time, pH, conductivity, turbidity, dissolved oxygen, temperature, salinity, TDS, ORP, appearance, and any odors present). Time the readings such that there are a minimum of 4 sets of data collected over the course of the full purge.
- If significant drawdown is observed or turbidity increases dramatically, decrease the purge rate and measure/record new purge rate. Significant drawdown is considered to be 5 percent of the total height of the water column or to the top of screen. Record time for all measurements collected. Note and provide qualifying remarks if parameter readings are anomalous or unstable due to instrument problems and change out the instrument.

- During the purge, compare the field parameters to historical purge data. If the parameters are significantly different (greater than 50% difference for SC, pH, and/or ORP) re-confirm the ID of the well. If the well ID is re-confirmed by 2 crew members, and the readings continue to be significantly different than prior readings, set up a second WQ instrument in series to confirm readings. If the anomalous readings are confirmed by the second instrument, contact the field coordinator to resolve the issue. If the second WQ instrument produces readings that are comparable to historic values, note an instrument change and use the second instrument's readings.
- Continue purging until ***3-casing volumes*** have been removed ***and*** field parameters stabilize. Indicator parameters are considered stabilized when 3 consecutive readings made several minutes apart fall within the following EPA stabilization criteria:
  - pH +/- 0.1 pH units
  - Specific conductance +/- 3%
  - ORP +/- 10 millivolts
  - Turbidity 10 NTU units or less unless other parameters have stabilized during an extended purge and turbidity is trending flat if still over 10 NTU units. The target turbidity goal (but not a hard criterion) is 5 to 10 NTUs.
  - Dissolved oxygen +/- 0.3 mg/L
  - Temperature +/- 2° Celsius
- When the requirements above have been satisfied and the purge cycle is complete, disconnect the flow through cell and prepare to collect samples directly from the pump discharge tubing for analyses according to event-specific PST.
- If flow splitters have been used, do not change the flow rate, and collect the sample from the dedicated sampling port of the first splitter in line.
- Prepare sample containers and collect gas-sensitive analytes first. The preferred collection order will be volatile organic compounds (VOCs), semi-volatile organic compound (SVOCs), metals (including hexavalent chromium [Cr(VI)] and total chromium [Cr(T)]; see SOP-A6), then general chemistry (cations, anions, stable isotopes).
- For filtered samples, attach a 0.45 micron in-line filter to the pump discharge and allow approximately 500 mL of sample to pass through the filter before beginning sample collection in accordance with SOP-A6, *Field filtration* and the QAPP.
- When sample collection is complete, record sample information, final WL, and purge volume data in MIST and on the field sampling log.
- If transient pump previously installed, remove the pump from the well, detach the dedicated tubing and carefully drain any residual water to the purge water tank. Install appropriate tubing cap to prevent any residual water from leaking from the sample tubing. Store the dedicated tubing in a sealed, labeled trash bag. Decontaminate the pump according to SOP-A10, *Decontamination of Water Sampling Equipment.*

- If well was equipped with a transducer, replace the transducer in exactly the same configuration in which it was found and in accordance with SOP-C1, *Solinst Pressure Transducers*.
- Close and secure well protection lid.
- Follow the applicable SOPs, O&M Manual and the Procedures Manual for sample handing and management, equipment decontamination, and investigation-derived waste (IDW) management (O&M Manual Volume 1, Section 6 during O&M or Appendix R of the C/RAWP during construction).

LOW VOLUME AND POOR RECOVERY WELLS:

Some groundwater monitoring wells under the GMP may exhibit slow or poor recovery upon purging. These monitoring wells may not recharge sufficiently during purging, and may run completely dry without an opportunity to collect the required series of groundwater stabilization parameters, or requisite samples. The following procedures will be followed for collecting representative groundwater samples from wells that go dry during purging.

PREPARATION & SETUP:

Follow the steps above.

PURGING AND SAMPLING PROCEDURES FOR LOW RECOVERY WELLS:

- Prepare the groundwater sampling log. Use the static water level and the total depth provided on the field data sheet (comparing to the previous values used on the PST) to calculate the volume of one casing of standing water in the well.
- Calculate 3 casing volumes for the minimum required purge amount, and record on purge log.
- Evaluate previous purge rates, amount of drawdown, stability of field parameters, and total purge volume prior to sample collection from previous sampling records and historical data tables (Appendix B of *Monitoring Plan for Groundwater and Surface Water Monitoring Program*). If the well has not been previously sampled, estimate the expected purge rate using previous sampling information from nearby wells.
- Connect the dedicated purge tubing if available or use new tubing if necessary. Install the pump within the well screen or to the previously determined depth and start the purge. Monitor drawdown, and calculate/set the purge rate. Record the pump setting (i.e. hertz) on the sampling log if available.
- Continue purging, measuring WL and field indicator parameters periodically (time, pH, conductivity, turbidity, dissolved oxygen, temperature, salinity, TDS, ORP, and any odors present). Space the readings such that there are a minimum of 4 sets of data collected over the course of the available purge volume.
- During the purge, compare the field parameters to previous purge data. If the parameters are significantly different (greater than 50% difference for SC, pH, and/or ORP) confirm the ID of the well. If the well ID is confirmed by 2 crew members, and the

readings continue to be significantly different than prior readings, set up a second WQ instrument in series to confirm readings. If the anomalous readings are confirmed by the second instrument, contact the field coordinator to resolve the issue. If the second WQ instrument produces readings that are comparable to historic values, note an instrument change and use the second instrument's readings.

- Continue purging until ***3-casing volumes*** have been removed ***and*** field parameters stabilize, or until the well purges dry. If 3 casing volumes are removed, sample as described above. If the well runs dry, continue as instructed below.
- If previously installed, remove the pump from the well and decontaminate according to SOP A-10, *Decontamination of Water Sampling Equipment*. The pump may also be left in place to facilitate subsequent purging and sampling.
- Record the final water level, time, the volume of water discharged and the elapsed time for the dewatering of the well.
- Allow the well to recharge to 80 percent of the original height of the water column. Ideally, this should be within 24 hours of the monitoring well being purged dry. The recovery period to achieve 80 percent of the height of the water column could take longer than 24 hours in some instances (MW-48).
- ***At MW-24BR only,*** return to the well the following day and continue purging until a total of 190 gallons have been removed, then sample normally.
- Once recovery has reached 80%, or 48 hours have elapsed (whichever comes first), a bailer can be used for sample collection. Collect samples for analyses according to PST. Prepare sample containers and collect gas-sensitive analytes first. The preferred collection order will be volatile organic compounds (VOCs), semi-volatile organic compound (SVOCs), metals (including hexavalent chromium [Cr(VI)] and total chromium [Cr(T)]), then general chemistry (cations, anions, stable isotopes).
- If an insufficient volume of water is available to fill all of the sample containers, first contact laboratory personnel to determine the minimum allowable volumes needed for the required analyses. *(Talk to FTM as the FTM may have already contact lab personnel and may have the instructions for you.)* Then verify the critical analyte list with the PM or the FTM and prioritize the sample collection to obtain the critical analytes for the main contaminants of concern first. Continue collecting samples until all samples have been collected, or the groundwater supply is exhausted. Unfiltered samples are to be filled by transferring water directly from the bailer to the sample container.
- For filtered samples, attach a 0.45 micron in-line filter to the bailer and allow approximately 200 mls of sample to pass through the filter before beginning sample collection in accordance with SOP-A6 *Field filtration*. If gravity flow is insufficient to filter the sample, use a pressurized bailer and filter for sample filtration.
- When sample collection is complete, record sample information, final WL, and purge volume data in MIST and on the field sampling log.
- If well was equipped with a transducer, replace the transducer in exactly the same configuration in which it was found and according to SOP-C1, *Solinst Pressure Transducers*.

- Close and secure well protection lid.
- Follow applicable SOPs, the O&M Manual and Procedures Manual for sample handing and management, equipment decontamination, and IDW management (O&M Manual Volume 1, Section 6 during O&M or Appendix R of the C/RAWP during construction).

SOP-A2

Purging and Sampling of 1-inch-diameter Groundwater Monitoring Wells Modified Well-Volume Method Standard Operating Procedures for PG&E Topock Program

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This standard operating procedure (SOP) addresses the procedures and equipment to be used for purging and sampling all groundwater monitoring wells at the Topock site with 1-inch casing diameters. This SOP will be used for sampling groundwater monitoring wells using dedicated tubing and a peristaltic pump or a mini-bladder pump. A well-volume based purging and sampling method will be used for such wells.

REQUIRED DOCUMENTS:

- Event-specific planned sample table (PST).
- Applicable project work plan or monitoring plan. Refer to the Topock Program Sampling, Analysis, and Field Procedures Manual (Procedures Manual).
- Construction/Remedial Action Work Plan (C/RAWP) during the construction phase.
- Operation and Maintenance Manual (O&M Manual), and Quality Assurance Project Plan (QAPP) (Appendix B of the O&M Manual Volume 2, Sampling and Monitoring Plan), as required during the O&M phase.
- Topock Program Health and Safety Plan (HSP)
- Applicable SOPs may include:
  - SOP-A1, *Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method*
  - SOP-A3, *Purging and Sampling of Active and Inactive Water Supply Wells*
  - SOP-A4, *Depth-Specific River Water Sampling*
  - SOP-A5, *Groundwater Sampling from Sonic Drilling Boreholes*
  - SOP-A6, *Field Filtration*
  - SOP-A7, *Water Level Measurements*
  - SOP-A8, *Field Water Quality Measurements Using a Flow-through Cell*
  - SOP-A9, *Calibration of Field Instruments*
  - SOP-A10, *Decontamination of Water Sampling Equipment*
  - SOP-A11, *Total Depth Measurements*
  - SOP-A12, *Field Water Quality Measurements for Grab Samples*
  - SOP-A13, *Spill Prevention, Containment, and Control Measures for Monitoring Well Sampling*
  - SOP-A14, *Pore Water Sampling*
  - SOP-A16, *Access Routes*

  - SOP-A18, *Purging and Sampling of Groundwater Monitoring Wells, Minimal Drawdown Method*
  - SOP-A19, *Sampling of Groundwater Monitoring Wells, Hydrasleeve No Purge Method*
  - SOP-A23, *Sample Handling and Custody*
  - SOP-C1, *Solinst Pressure Transducers*
- Well construction logs/specifications
- Mobile Integrated Sample Tracking (MIST) handheld database
- Previous sampling logs or tabular historic field data
- Current site access map
- Blank sampling logs, maps, sample labels, chains of custody (COC's), and the designated groundwater sampling field notebook

REQUIRED EQUIPMENT:

- 2 or more YSI-556 water quality (WQ) instruments with flow through cells, or equivalent.
- Hach 2100P turbidimeter or equivalent.
- 200 foot Water level indicator (WLI).
- Trimble Rugged Reader hand held instrument for MIST data collection.
- 30 gallon purge water tank.
- Decontamination spray bottles
- Utility vehicles (UTVs) as necessary.
- 12 volt peristaltic pump or mini-bladder pump.
- 12 volt power source.

PREPARATION & SETUP:

- Review event-specific PST or event-specific field instructions, previous sampling logs, Procedures Manual, O&M Manual, HSP, and groundwater sampling supplies and equipment check list. (NOTE: the PST should also be reviewed for required "non-analytical event activities" such as water level measurements or other data collection to be performed in association with the groundwater sampling event).
- Acquire the existing field logbook for groundwater sampling and initiate entries.
- Inspect all equipment and verify that the field WQ meters have been calibrated prior to use according to the manufacturer's instructions and SOP-A9, *Calibration of Field Instruments*.

- Inventory sample bottles, build sample sets for the required analytes at each sample location, ensure a sufficient supply of lab de-ionized water for equipment blanks, and confirm the lab courier schedule.
- Field-check sampling equipment and supplies: WLI, WQ meters, flow-through cell, peristaltic pump or mini-bladder pump, power supply, pump discharge/sampling tubing, N-dex gloves, de-ionized water sprayers, 5 gallon buckets, paper towels, 0.45 micron in-line filters, etc.
- Field-check and setup sampling equipment: WLI, WQ meters, flow-through cell, pump and power supply, pump discharge/sampling tubing, etc. Install dedicated tubing and connect to peristaltic pump. Connect peristaltic pump or mini-bladder pump to 12 volt power supply.

FIELD PROCEDURES:

- **Prior to opening any monitor well, remove all pens, lighters, calculators, or any other loose items from vest pockets, or from any other location where they could fall into the well.**
- Upon arrival at the monitoring well, at least 2 members of the sampling team must confirm the well ID. Wells should be clearly marked on the well monument. If the well cannot be positively identified by the marking, measure total depth of the well and compare to the well installation details to confirm the correct location.
- Place spill containment according to SOP-A13, *Spill Prevention, Containment, and Control Measures for Monitoring Well Sampling.*
- Open the protective casing lid and, ***prior to moving it***, note the exact configuration of the transducer installation if present. Measure static water level (WL) according to SOP-A7, *Water Level Measurements,* moving the transducer if necessary, and record WL value in MIST on the sampling log.
- If the well is equipped with a transducer, remove the transducer from the well according to SOP-C1, *Solinst Pressure Transducers*.
- Collect daily equipment blanks and duplicate samples as required by the PST and instructed by the field team leader.

PURGING AND SAMPLING PROCEDURES:

- Prepare the groundwater sampling log. Use the static water level determined above and the total depth provided on the field data sheet and in the PST to calculate the volume of one casing of standing water in the well. Calculate 3 casing volumes for the minimum required purge amount, and record on purge log.
- Prior to purging, evaluate previous purge rates, amount of drawdown, and purge volume from previous sampling records and historical data tables (Appendix B of *Monitoring Plan for Groundwater and Surface Water Monitoring Program*). If the well has not been previously sampled, estimate the expected purge parameters using previous sampling information from nearby wells.

- Install the dedicated tubing if available, or use new tubing as necessary. Connect the tubing to the peristaltic pump or mini-bladder pump, check that all fittings are tight, and start purging the well. Check for leaks. Measure WL and calculate the purge rate immediately and adjust if necessary. Purge rate will be measured by using the fill-time of a graduated container. The well specific purge rate and pump setting should be available on the previous purge form.
- Allow the flow through cell to fill and field parameters to stabilize, then start recording field indicator parameters on the sampling sheet and in MIST.
- Continue purging, measuring WL and field indicator parameters periodically (time, pH, conductivity, turbidity, dissolved oxygen, temperature, salinity, TDS, ORP, appearance, and any odors present). Time the readings such that there are a minimum of 5 sets of data collected over the course of the full purge.
- If significant drawdown is observed, or turbidity increases dramatically, decrease the purge rate and measure/record new purge rate. Significant drawdown is considered to be 5 percent of the total height of the water column or to the top of screen. Record time for all measurements collected. Note and provide qualifying remarks if parameter readings are anomalous or unstable due to instrument problems.
- During the purge, compare the field parameters to historical purge data. If the parameters are significantly different (greater than 50% difference for SC, pH, and/or ORP) confirm the ID of the well. If the well ID is confirmed by 2 crew members, and the readings continue to be significantly different than prior readings, set up a second WQ instrument in series to confirm readings. If the anomalous readings are confirmed by the second instrument, contact the field coordinator to resolve the issue. If the second WQ instrument produces readings that are comparable to historic values, note an instrument change and use the second instrument's readings.
- Continue purging until ***3-casing volumes*** have been removed ***and*** field parameters stabilize. Indicator parameters are considered stabilized when 3 consecutive readings made several minutes apart fall within the following EPA stabilization criteria:

-	pH	+/- 0.1 pH units
-	Specific conductance	+/- 3%
-	ORP	+/- 10 millivolts
-	Turbidity	10 NTU units or less unless other parameters have stabilized during an extended purge and turbidity is trending flat if still over 10 NTU units. The target turbidity goal (but not a hard criterion) is 5 to 10 NTUs.
-	Dissolved oxygen	+/- 0.3 mg/L
-	Temperature	+/- 2° Celsius

- When the requirements above have been satisfied and the purge cycle is complete, disconnect the flow through cell and prepare to collect samples directly from the pump discharge tubing for analyses according to event-specific PST. For all samples, decrease the discharge rate as necessary to reduce water turbulence at the pump discharge point.

Prepare sample containers and collect gas-sensitive analytes first. The preferred collection order will be volatile organic compounds (VOCs), semi-volatile organic compound (SVOCs), metals (including hexavalent chromium [Cr(VI)] and total chromium [Cr(T)]; see SOP-A6), then general chemistry (cations, anions, stable isotopes).

- For filtered samples, attach a 0.45 micron in-line filter to the pump discharge and allow approx. 500 mls of sample to pass through the filter before beginning sample collection in accordance with SOP A6, *Field filtration*.
- When sample collection is complete, record sample information, final WL, and purge volume data in MIST and on the field sampling log.
- If previously installed, remove the pump from the well, detach the dedicated tubing and carefully drain any residual water to the purge water tank. Fold both ends of the purge tubing and secure with wire ties as a further deterrent to leakage. Store the dedicated tubing in a sealed, labeled trash bag. Decontaminate the pump according to SOP-A10, *Decontamination of Water Sampling Equipment.*
- If well was equipped with a transducer, replace the transducer in exactly the same configuration in which it was found and according to SOP-C1, *Solinst Pressure Transducers*.
- Close and secure well protection lid.
- Follow applicable SOPs in the Procedures Manual and O&M Manual for sample handling and management, equipment decontamination, and investigation-derived waste (IDW) management (O&M Manual, Volume 1, Section 6 during O&M or Appendix R of the C/RAWP during construction).

LOW VOLUME AND POOR RECOVERY WELLS:

Some groundwater monitoring wells under the GMP may exhibit slow or poor recovery upon purging. These groundwater monitoring wells may not recover sufficiently during purging and run completely dry without an opportunity to collect the required series of groundwater stabilization parameters, or run dry prior to sampling. The following procedures should be followed for collection representative groundwater samples from wells that go dry during purging activities in preparation for groundwater sampling.

PREPARATION & SETUP:

Follow steps above.

PURGING AND SAMPLING PROCEDURES FOR LOW RECOVERY WELLS:

- Prepare the groundwater sampling log. Use the static water level determined above and the total depth provided on the field data sheet and in the PST to calculate the volume of one casing of standing water in the well.
- Calculate 3 casing volumes for the minimum required purge amount, and record on purge log.

- Evaluate previous purge rates, amount of drawdown, stability of field parameters, and total purge volume prior to sample collection from previous sampling records and historical data tables (Appendix B of *Monitoring Plan for Groundwater and Surface Water Monitoring Program*). If the well has not been previously sampled, estimate the expected purge rate using previous sampling information from nearby wells.
- Connect the dedicated purge tubing if available, or use new tubing if necessary. Install the pump within the well screen or to the previously determined depth and start the purge. Monitor drawdown, and calculate/set the purge rate.
- Continue purging, measuring WL and field indicator parameters periodically (time, pH, conductivity, turbidity, dissolved oxygen, temperature, salinity, TDS, ORP, and any odors present). Space the readings such that there are a minimum of 5 sets of data collected over the course of the available purge volume.
- During the purge, compare the field parameters to previous purge data. If the parameters are significantly different (greater than 50% difference for SC, pH, and/or ORP) confirm the ID of the well. If the well ID is confirmed by 2 crew members, and the readings continue to be significantly different than prior readings, set up a second WQ instrument in series to confirm readings. If the anomalous readings are confirmed by the second instrument, contact the field coordinator to resolve the issue. If the second WQ instrument produces readings that are comparable to historic values, note an instrument change and use the second instrument's readings.
- Continue purging until ***3-casing volumes*** have been removed ***and*** field parameters stabilize, or until the well purges dry. If 3 casing volumes are removed, sample as described above. If the well runs dry, continue as instructed below.
- If previously installed, remove the pump from the well and decontaminate according to SOP-A10, *Decontamination of Water Sampling Equipment.* The pump may also be left in place to facilitate subsequent purging and sampling.
- Record the final water level, time, the volume of water discharged and the elapsed time for the dewatering of the well.
- Allow the well to recharge to 80 percent of the original height of the water column. Ideally, this should be within 24 hours of the monitoring well being purged dry. The recovery period to achieve 80 percent of the height of the water column could take longer than 24 hours in some instances (MW-48).
- Once recovery has reached 80%, or 48 hours have elapsed (whichever comes first), a bailer can be used for sample collection. Collect samples for analyses according to PST. Prepare sample containers and collect gas-sensitive analytes first. The preferred collection order will be volatile organic compounds (VOCs), semi-volatile organic compound (SVOCs), metals (including hexavalent chromium [Cr(VI)] and total chromium [Cr(T)]), then general chemistry (cations, anions, stable isotopes).
- If an insufficient volume of water is available to fill all of the sample containers, first contact laboratory personnel to determine the minimum allowable volumes needed for the required analyses, then verify the critical analyte list with the PM or the FTM and prioritize the sample collection to obtain the critical analytes for the main contaminants

of concern first. Continue collecting samples until all samples have been collected, or the groundwater supply is exhausted. Unfiltered samples are to be filled by transferring water directly from the bailer to the sample container.

- For filtered samples, attach a 0.45 micron in-line filter to the bailer and allow approx. 200 mls of sample to pass through the filter before beginning sample collection in accordance with SOP-A6, *Field filtration*. If gravity flow is insufficient to filter the sample, use a pressurized bailer and filter for sample filtration.
- When sample collection is complete, record sample information, final WL, and purge volume data in MIST and on the field sampling log.
- If well was equipped with a transducer, replace the transducer in exactly the same configuration in which it was found and according to SOP-C1, *Solinst Pressure Transducers*.
- Close and secure well protection lid.
- Follow applicable SOPs, the Procedures Manual, and the O&M Manual for sample handing and management, equipment decontamination, and IDW management (O&M Manual, Volume 1, Section 6 during O&M or Appendix R of the C/RAWP during construction).

SOP-A3

Purging and Sampling of Active and Inactive Water Supply Wells Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) addresses the procedures and equipment to be used for purging and sampling active and inactive water supply wells in the vicinity of the Topock site. This procedure also applies to the collection of water quality samples from long-screen extraction, injection, and test wells. Active and inactive water supply wells with functional dedicated pumps and a sampling port will be sampled directly from the sampling port. Inactive supply wells without functional pumps will be sampled using a temporary submersible pump following the well-volume sampling procedure.

REQUIRED DOCUMENTS:

- Event-specific planned sample table (PST).
- Applicable project work plan or monitoring plan. Refer to the Topock Program Sampling, Analysis, and Field Procedures Manual (Procedures Manual).
- Construction/Remedial Action Work Plan (C/RAWP) during the construction phase.
- Operation and Maintenance Manual (O&M Manual), and Quality Assurance Project Plan (QAPP) and Addendum to the QAPP (Appendix B of the O&M Manual Volume 2, Sampling and Monitoring Plan), as required during the O&M phase.
- Topock Program Health and Safety Plan (HSP)
- Applicable SOPs may include:
  - SOP-A1, *Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method*
  - SOP-A3, *Purging and Sampling of Active and Inactive Water Supply Wells*
  - SOP-A4, *Depth-Specific River Water Sampling*
  - SOP-A5, *Groundwater Sampling from Sonic Drilling Boreholes*
  - SOP-A6, *Field Filtration*
  - SOP-A7, *Water Level Measurements*
  - SOP-A8, *Field Water Quality Measurements Using a Flow-through Cell*
  - SOP-A9, *Calibration of Field Instruments*
  - SOP-A10, *Decontamination of Water Sampling Equipment*
  - SOP-A11, *Total Depth Measurements*
  - SOP-A12, *Field Water Quality Measurements for Grab Samples*
  - SOP-A13, *Spill Prevention, Containment, and Control Measures for Monitoring Well Sampling*
  - SOP-A14, *Pore Water Sampling*
  - SOP-A16, *Access Routes*

  - SOP-A18, *Purging and Sampling of Groundwater Monitoring Wells, Minimal Drawdown Method*
  - SOP-A19, *Sampling of Groundwater Monitoring Wells, Hydrasleeve No Purge Method*
  - SOP-A23, *Sample Handling and Custody*
  - SOP-C1, *Solinst Pressure Transducers*
- Well construction logs/specifications
- Mobile Integrated Sample Tracking (MIST) handheld database
- Previous sampling logs or tabular historic field data
- Current site access map
- Blank sampling logs, maps, sample labels, chains of custody (COCs), and the designated groundwater sampling field notebook

REQUIRED EQUIPMENT:

- 2 or more YSI-556 water quality (WQ) instruments with flow through cells, or equivalent.
- Hach 2100P turbidimeter or equivalent.
- 200 foot Water level indicator (WLI).
- Trimble Rugged Reader hand held instrument for MIST data collection.
- 200 gallon capacity purge tanks (2).
- Utility vehicles (UTV's) as necessary.
- Back-up 2 inch pump and controller.
- Honda 2000 watt generator or alternate power source.

PREPARATION AND SETUP:

- Review event-specific PST or event-specific field instructions, previous sampling logs, Procedures Manual, O&M Manual, QAPP and the Addendum to the QAPP, HSP, and groundwater sampling supplies and equipment check list.
- Acquire the existing field logbook for surface water sampling and initiate entries.
- Inspect all equipment and verify that the field WQ meters have been calibrated prior to use according to the manufacturer's instructions and SOP-A9, *Calibration of Field Instruments*.
- Inventory sample bottles, build sample sets for the required analytes at each sample location, ensure a sufficient supply of lab de-ionized water for equipment blanks, and confirm the lab courier schedule.
- Field-check sampling equipment and supplies: WLI, WQ meters, flow-through cell, pump controller, power supply, pump discharge/sampling tubing, N-dex gloves, D.I water sprayers, paper towels, etc.

PURGING AND SAMPLING PROCEDURES FOR *ACTIVE* WATER SUPPLY WELLS:

- **Prior to opening any well, remove all pens, lighters, calculators, or any other loose items from vest pockets, or from any other location where they could fall into the well.**
- Upon arrival at the well, at least 2 members of the sampling team must confirm the well ID. If the well cannot be clearly identified by the marking, measure total depth of the well and compare to the well installation details to confirm the correct location.
- Access the well and, ***prior to moving it***, note the exact configuration of the transducer installation if present. If the well has been inactive for more than 24 hours, a water level measurement can be taken. Measure static water level (WL) according to SOP-A7, *Water Level Measurements,* moving the transducer if necessary, and record WL value in MIST on the sampling log.
- If the well is equipped with a transducer and transducer removal is required for sampling, follow SOP-C1, *Solinst Pressure Transducers*.
- If it is known that 3-casing volumes have been purged from the well in the last 24-hour period, purging will not be necessary prior to sampling. Connect one end of a new or dedicated piece of LDPE tubing to the pump discharge port and connect the other to the inlet of the flow through cell. If it is not possible to connect the flow-through cell, a clean 5-gallon bucket may be used by filling the bucket with purge water and inserting the instrument probes directly into the bucket. If a bucket is used, turbulence in the bucket should be minimized to the extent possible.
- Carefully open the valve at the sampling port until the desired flow rate is achieved, then allow the flow through cell to fill and the parameters to stabilize before collecting a single set of water quality parameters. Record in MIST and on the field data sheet. Note and provide qualifying remarks if parameter readings are anomalous or unstable due to instrument problems. Purge water should be contained in a portable purge water storage tank. If approved by well owner and the governing regulatory agencies, water may be discharged directly to the ground, as directed by the Field Team Manager (FTM).
- Observations on sample appearance and clarity during purging and at sampling are required! For standardization, use a clear glass jar to collect and record observations of discharge water appearance during purging. Also note characteristics such as any odors associated with the discharge water.
- Compare the field parameters to historical purge data. If the parameters are significantly different (greater than 50% difference for SC, pH, and/or ORP) confirm the ID of the well. If the well ID is confirmed by 2 crew members, and the readings continue to be significantly different than prior readings, set up a second WQ instrument in series to confirm readings. If the anomalous readings are confirmed by the second instrument, contact the field coordinator to resolve the issue. If the second WQ instrument produces readings that are comparable to historic values, note an instrument change and use the second instrument's readings.
- Disconnect the flow through cell and collect samples for analyses according to the PST. Sample containers are to be filled by transferring water directly from the pump discharge or sampling spigot to the appropriate sample container.

- For filtered samples, attach a 0.45 micron in-line filter to the pump discharge and allow approx. 500 mls of sample to pass through the filter before beginning sample collection in accordance with SOP-A6, *Field filtration*.
- When sample collection is complete, record sample information, final WL, and purge volume data on field log. If the pump is equipped with a flow meter, record the flow rate as well.
- If well was equipped with a transducer, replace transducer according to SOP-C1, *Solinst Pressure Transducers*.
- Close and secure well including access gates or fences.
- Follow applicable SOPs, the Procedures Manual, and the O&M Manual for sample handing and management, equipment decontamination, and investigation-derived waste (IDW) management (O&M Manual Volume 1, Section 6 during O&M or Appendix R of the C/RAWP during construction).

PURGING AND SAMPLING PROCEDURES FOR *INACTIVE* WATER SUPPLY WELLS:

Inactive water wells may include: (1) wells with functioning dedicated pumps, (2) wells without dedicated pumps, and (3) wells with non-functioning dedicated pumps. A well-pump subcontractor may be required to install temporary pumps for purging wells without pumps and non-functioning dedicated pumps.

- **Prior to opening any monitor well, remove all pens, lighters, calculators, or any other loose items from vest pockets, or from any other location where they could fall into the well.**
- Upon arrival at the well, at least 2 members of the sampling team must confirm the well ID. Wells will be clearly marked on the well monument. If the well cannot be clearly identified by the marking, measure total depth of the well and compare to the well installation details to confirm the correct location.
- Access the well and, ***prior to moving it***, note the exact configuration of the transducer installation if present. If the well has been inactive for more than 24 hours, a water level measurement can be taken. Measure static WL according to SOP-A7, *Water Level Measurements,* moving the transducer if necessary, and record WL value in MIST on the sampling log.
- If the well is equipped with a transducer and transducer removal is required for sampling, follow SOP-C1, *Solinst Pressure Transducers*.
- If the well has had well volumes purged in the last 24 hours, then it is an active well and purging before *sampling may be limited to volume sufficient f*or field parameter measurement.
- If it is determined that 3-casing volumes ***have not*** been purged in the last 24-hours, calculate 3-casing volumes using measured WL depth, casing diameter, and total well depth information. If it is not possible to measure the depth to water or total depth of the well, use well records or prior knowledge to calculate 3-casing volumes.
- Start purging using the functional dedicated equipment, if available. Check for any leaks, monitor drawdown, and calculate/set the purge rate.

- If dedicated equipment is not present or nonfunctional, a portable pump installed by subcontractor may be used for purging and sampling. Install a decontaminated pump at the same intake/sampling depth used in prior events and record intake depth. If the well has not been previously sampled, install the pump with the intake in the middle of the screened interval ,or the midpoint of the saturated interval if the water level is lower than the top of the screen, or at the depth proscribed by the Project Manager or FTM.
- Purge water should be contained in a portable purge water storage tank. If approved by well owner and the governing regulatory agencies, water may be discharged directly to the ground, (at present this is only the case at PM-03 and PM-04 supply wells), as directed by the Field Team Manager.
- Continue purging, measuring WL and field indicator parameters periodically (time, pH, conductivity, turbidity, dissolved oxygen, temperature, salinity, TDS, ORP, and any odors present). Time the readings such that there are a minimum of 5 sets of data collected over the course of the full purge.
- Decrease the purge rate and measure/record new purge rate if significant drawdown is observed or turbidity increases dramatically. Significant drawdown is considered to be 5 percent of the total height of the water column or to the top of screen. Record time for all measurements collected. Note and provide qualifying remarks if parameter readings are anomalous or unstable due to instrument problems.
- During the purge, compare the field parameters to previous purge data. If the parameters are significantly different (greater than 50% difference for SC, pH, and/or ORP) confirm the ID of the well. If the well ID is confirmed by 2 crew members, and the readings continue to be significantly different than prior readings, set up a second WQ instrument in series to confirm readings. If the anomalous readings are confirmed by the second instrument, contact the field coordinator to resolve the issue. If the second WQ instrument produces readings that are comparable to historic values, note an instrument change and use the second instrument's readings.
- Continue purging until ***3-casing volumes*** have been removed ***and*** field parameters stabilize. Indicator parameters are considered stabilized when 3 consecutive readings made several minutes apart fall within the following EPA stabilization criteria:

- pH	+/- 0.1 pH units
- Specific conductance	+/- 3%
- ORP	+/- 10 millivolts
- Turbidity	10% NTU units or less unless other parameters have stabilized during an extended purge and turbidity is trending flat if still over 10 NTU units.
- Dissolved oxygen	+/- 0.3 mg/L
- Temperature	+/- 2° Celsius

- When the requirements above have been satisfied and the purge cycle is complete, disconnect the flow through cell and prepare to collect samples directly from the pump discharge tubing for analyses according to event-specific PST. For all samples, decrease the discharge rate as necessary to reduce water turbulence at the pump discharge point.

Prepare sample containers and collect gas-sensitive analytes first. The preferred collection order will be volatile organic compounds (VOCs), semi-volatile organic compound (SVOCs), metals (including hexavalent chromium [Cr(VI)] and total chromium [Cr(T)]; see SOP-A6), then general chemistry (cations, anions, stable isotopes).

- For filtered samples, attach a 0.45 micron in-line filter to the pump discharge and allow approx. 500 mls of sample to pass through the filter before beginning sample collection in accordance with SOP-A6, *Field filtration*.
- When sample collection is complete, record sample information, final WL, and purge volume data in MIST and on the field sampling log.
- If previously installed, remove the pump from the well and decontaminate according to SOP-A10, *Decontamination of Water Sampling Equipment.*
- If well was equipped with a transducer, replace the transducer in exactly the same configuration in which it was found and according to SOP-C1, *Solinst Pressure Transducers*.
- Close and secure well, including fences and gates.
- Follow applicable SOPs, the Procedures Manual, and O&M Manual for sample handing and management, equipment decontamination, and IDW management (O&M Manual Volume 1, Section 6 during O&M or Appendix R of the C/RAWP during construction).

SOP-A5

Groundwater Sampling from Sonic Drilling Boreholes
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) addresses the procedures and equipment to be used for purging and collection of grab groundwater samples from boreholes during sonic drilling. When a pump sampling system (Prosonic "Isoflow") is available and feasible, Isoflow sampling is the preferred method. When Isoflow sampling is not available or not feasible then a bailer method will be used for grab groundwater sampling while drilling.

REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan (SAP), Work Plan or event-specific field instructions. Planned borehole depth, proposed well construction/specifications, and field sampling summary table, if available.
2) Applicable project work plan or monitoring plan. Refer to Topock Program Sampling, Analysis, and Field Procedures Manual (Procedures Manual).
3) Construction/Remedial Action Work Plan (C/RAWP) during the construction phase.
4) Operation and Maintenance (O&M) Manual, and the Quality Assurance Project Plan (QAPP) and Addendum to the QAPP (Appendix B of the O&M Manual Volume 2, Sampling and Monitoring Plan), as required during the O&M phase.
5) Topock Program Health and Safety Plan (HSP)
6) Previous sampling, drilling, or well construction logs from other boreholes or wells in the vicinity, if available
7) Blank sampling log and field notebook
8) Applicable SOPs may include:
   - SOP-A1, *Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method*
   - SOP-A2, *Purging and Sampling of 1-inch Diameter Groundwater Monitoring Wells, Modified Well-Volume Method*
   - SOP-A3, *Purging and Sampling of Active and Inactive Water Supply Wells*
   - SOP-A4, *Depth-Specific River Water Sampling*
   - SOP-A6, *Field Filtration*
   - SOP-A7, *Water Level Measurements*
   - SOP-A8, *Field Water Quality Measurements Using a Flow-through Cell*
   - SOP-A9, *Calibration of Field Instruments*
   - SOP-A10, *Decontamination of Water Sampling Equipment*
   - SOP-A11, *Total Depth Measurements*

- SOP-A12, *Field Water Quality Measurements for Grab Samples*
- SOP-A13, *Spill Prevention, Containment, and Control Measures for Monitoring Well Sampling*
- SOP-A14, *Pore Water Sampling*
- SOP-A16, *Access Routes*
- SOP-A18, *Purging and Sampling of Groundwater Monitoring Wells, Minimal Drawdown Method*
- SOP-A19, *Sampling of Groundwater Monitoring Wells, Hydrasleeve No Purge Method*
- SOP-A23, *Sample Handling and Custody*
- SOP-C1, Solinst Pressure Transducers

PREPARATION & SETUP

1) Review event-specific Work Plan or event-specific field instructions, Procedures Manual, O&M Manual, QAPP and the Addendum to the QAPP, and HSP.
2) Initiate field logbook for sampling activity.
3) Review sampling procedures and equipment, and planned sample depths with drilling contractor and field crew.
4) Inspect all required field equipment and calibrate field water quality (WQ) meters according to SOP-A9, *Calibration of Field Instruments*.
5) Inventory sample bottles, review required analyses, and understand lab courier schedule.
6) Field-check and setup sampling equipment: Decontaminated Isoflow pump or stainless steel bailer, rig hoist, generator, containers for purge water management, water level (WL) meter, WQ meters, flow-through cell, pump control and power supply, pump discharge/sampling tubing, health and safety equipment, etc.

PURGING AND SAMPLING PROCEDURES FOR ISOFLOW SAMPLING FROM BOREHOLE

1) Prepare groundwater sampling log (use field notebook and summarize relevant information on sampling form).
2) Insert the Isoflow into the sonic casing. After the Isoflow is set, retract the sonic casing approximately 10 feet. Record the top and bottom of this open borehole interval and identify the grab groundwater sample as the mid-point of this interval. If possible, a water level measurement can be taken before Isoflow pumping begins. Measure initial static WL according to SOP-A7, *Water Level Measurements*. Record WL value on sampling log. Monitor and record Isoflow pumping rate and WL measurements made while pumping. The length of the open borehole interval will be a field decision based on the frequency of Isoflow sampling and the formation conditions. Shorter open borehole intervals (as short as 5 feet) are appropriate for Isoflow sampling frequency of every 20 feet of drilled depth, or in heterogeneous conditions where it is desired to

sample from a specific conductive zone. Longer open borehole intervals of up to 20 feet are appropriate if the Isoflow sampling frequency is every 50 to 60 feet of drill depth.

3) Measure water quality parameters using a flow-through cell connected directly to the sampling port. If it is not possible to connect the flow-through cell, a clean 5-gallon bucket may be used by filling the bucket with purge water and inserting the instrument probes directly into the bucket. If the bucket is used, turbulence in the bucket should be minimized to the extent possible. Record time for all measurements collected. Note and provide qualifying remarks if parameter readings are anomalous or unstable due to instrument problems. Record the purge rate. Purge water should be contained in a portable water storage tank, as directed by the Field Team Manager.

4) Observations on sample appearance and clarity during purging and at sampling are required. For standardization, use a clear glass jar to collect and record observations of discharge water appearance during purging. Also note characteristics such as any odors associated with the discharge water. Record the following water quality data on the field data sheet: pH, specific conductance, ORP, turbidity, TDS, and dissolved oxygen, and temperature. Indicator parameters are considered stabilized, and thus sampling may commence, when 3 consecutive readings made several minutes apart fall within the following EPA-recommended stabilization criteria:

   - pH +/- 0.1 pH units
   - Specific conductance +/- 3%
   - ORP +/- 10 millivolts
   - Turbidity 10% NTU units or less unless other parameters have stabilized during an extended purge and turbidity is trending flat if still over 10 NTU units.
   - Dissolved oxygen +/- 0.3 mg/L

   However, parameter stabilization is not a requirement for sampling from open boreholes. Typically, TDS is used as a reliable indicator for borehole sampling at the site, given the known increasing concentration with depth across the site.

5) Collect samples for analyses according to event-specific SAP. For all samples, decrease the discharge rate to reduce water turbulence at the pump discharge point. Prepare sample containers and collect gas-sensitive analytes first. The preferred collection order will be volatile organic compounds (VOCs), semi-volatile organic compound (SVOCs), metals (including hexavalent chromium [Cr(VI)] and total chromium [Cr(T)]), then general chemistry (cations, anions, stable isotopes). Sample containers are to be filled by transferring water directly from the pump discharge to the appropriate sample container.

6) Record sample information, final WL, and purge volume data on field log.

7) Oversee the driller's removal and decontamination of the Isoflow sampling pump.

8) Oversee the driller in resuming drilling and soil sampling.

9) Follow applicable SOPs, the Procedures Manual and O&M Manual for sample handing and management, equipment decontamination, and investigation-derived waste (IDW) management (O&M Manual, Volume 1, Section 6 during O&M or Appendix R of the C/RAWP during construction).

PURGING AND SAMPLING PROCEDURES FOR BAILER SAMPLING FROM BOREHOLE

1) Prepare groundwater sampling log (use field notebook and summarize relevant information on sampling form).

2) Collect the grab groundwater sample by bailing the open hole interval below the sonic casing after removing a 10 to 20-foot sonic core run.

3) Sound the bottom of the borehole after removing the core barrel. Measure initial static WL according to SOP-A7, *Water Level Measurements*. Record WL value on sampling log.

4) Calculate 1-casing volume using measured WL depth, casing diameter, and total well depth information. Insert the decontaminated stainless steel bailer into the borehole and begin bailing a minimum of one casing volume. Purge water should be contained in a portable water storage tank, as directed by the Field Team Manager.

5) Measure water quality parameters using a clean 5-gallon bucket and inserting the instrument probes directly into the bucket. If the bucket is used, turbulence in the bucket should be minimized to the extent possible. Record time for all measurements collected. Record the following water quality data on the field data sheet: pH, specific conductance, ORP, turbidity, TDS, dissolved oxygen, sample appearance, and odor. Parameter stabilization is not a requirement for sampling from open boreholes. Typically, TDS is used as a reliable indicator for borehole sampling at the site, given the known increasing concentration with depth across the site.

6) Collect samples for analyses according to event-specific SAP. Prepare sample containers and collect gas-sensitive analytes first. The preferred collection order will be volatile organic compounds (VOCs), semi-volatile organic compound (SVOCs), metals (including hexavalent chromium [Cr(VI)] and total chromium [Cr(T)]), then general chemistry (cations, anions, stable isotopes). Sample containers are to be filled by transferring water directly from the bailer to the appropriate sample container. For all samples, handle the bailer with care and decant from the bailer slowly to minimize the potential for aeration and turbulence as containers are filled.

7) Record sample information, final WL, and purge volume data on field log.

8) Follow applicable SOPs, the Procedures Manual and O&M Manual for sample handing and management, equipment decontamination, and IDW management (O&M Manual, Volume 1, Section 6 during O&M or Appendix R of the C/RAWP during construction).

SOP-A6

Sample Field Filtration and Preservation for Metals Analyses
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) addresses the procedures and equipment to be used for collecting groundwater / surface water samples for field filtered metals analyses at the Topock site. Refer to SOP-A1, A2, A3, or A4 for specific groundwater and surface water sampling methods.

REQUIRED DOCUMENTS

1) Event-specific planned sample table (PST).
2) Applicable project work plan or monitoring plan. Refer to the PG&E Program Quality Assurance Project Plan, (QAPP) or the Addendum to the PG&E Program Quality Assurance Project Plan for the Topock Groundwater Remedy, as required.
3) Topock Program Health and Safety Plan (HSP).
4) Previous sampling logs or tabular table of historic field data.
5) Blank sampling logs and field notebook.

PREPARATION & SETUP

1) Review event-specific PST or event-specific field instructions, previous sampling logs, Procedures Manual, Operation and Maintenance (O&M) Manual, and HSP.
2) Initiate field logbook for sampling activity.
3) Inventory sample containers and labels, required analyses, and lab courier schedule.
4) Field-check and setup sampling equipment: field filters, buffering solution, acid, and sample containers.

FIELD-FILTRATION AND SAMPLE COLLECTION PROCEDURES FOR GROUNDWATER FROM MONITORING AND EXTRACTION WELLS

1) Follow SOPs A1 and A2.

Sample Collection

1) Once parameters are stabilized and a minimum 3-casing volumes have been removed from the well, disconnect the tubing from the flow-through cell and connect the inline 0.45 micron filter. (Note: do not change the pump rate, continue to purge from the well at the same rate as used during the stabilization of the parameters.)
2) Allow 500 milliliters (mL) to flow through the inline filter, prior to sample collection. Fill the sample container by transferring water directly from the filter discharge to the appropriate sample container.

Total Chromium and Metals analyzed by the 6000 / 7000 Series of SW 846 Methods and metals analyzed by EPA Methods of the 200 Series

i. Fill a laboratory provided pre-preserved sample container (250 or 500 mL poly containing (HNO_3). CARE MUST BE TAKEN NOT TO OVERFILL THE CONTAINER.

In the event that no pre-preserved sample containers are available, the sampling team will need to follow the following protocol.

ii. If you are preserving the container in the field, check the pH of the sample with laboratory provided pH paper. If the pH of the sample is greater than 2, add 5 drops of HNO_3. Close the container, shake and check the pH. Continue adding HNO_3 in 5-drop increments until the pH is less than 2.

iii. Record the total amount of HNO_3 added to the sample and the pH on the chain of custody and field form. Seal, label, and place the sample on ice.

Hexavalent Chromium Method SM3500 and EPA 218.6

i. Fill a laboratory provided pre-preserved sample container (250 mL poly containing (NH4)2S O4/NH4OH buffer solution) to the top of the container neck.

ii. Seal, label, and place the sample on ice.

In the event that no pre-preserved sample containers are available, the sampling team will need to follow the following protocol.

i. If you are preserving the container in the field, fill a laboratory provided sample container (250 mL poly) to approximately 235 mL, leaving headspace for the addition of buffer solution.

ii. Add 5 mL of laboratory provided buffer solution using a pipette. Place the lid on the sample container and shake gently. Check the pH using laboratory provided pH strips.

iii. If the pH is less than 9.3, add one drop of 20% NaOH, close container, gently shake, and check the pH. Continue until the pH is between 9.3 and 9.7.

iv. When the pH of the sample is between 9.3 and 9.7, record the total amount of pH buffer and NaOH added to the sample and the pH of the sample on the chain of custody and field form. Seal, label, and place the sample on ice.

3) Discard used pH paper(s) and filter in IDW bin.

4) Record sample information, final WL, and purge volume data on field log.

SOP-A7

Water Level Measurements
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) addresses the procedures and equipment to be used for manually measuring the depth to water at surface water locations, groundwater monitoring wells, and production wells.

REQUIRED DOCUMENTS:

- Event-specific planned sample table (PST).
- Applicable project work plan or monitoring plan. Refer to the Topock Program Sampling, Analysis, and Field Procedures Manual (Procedures Manual).
- Construction/Remedial Action Work Plan (C/RAWP) during the construction phase.
- Operation and Maintenance (O&M) Manual, and the Quality Assurance Project Plan (QAPP) and Addendum to the QAPP (Appendix B of the O&M Manual Volume 2, Sampling and Monitoring Plan), as required during the O&M phase.
- Topock Program Health and Safety Plan (HSP)
- Well construction logs/specifications
- Current site access map
- Previous water level data
- Water level data collection sheet and field notebook
- Blank sampling logs, if applicable
- Applicable SOPs may include:
  - SOP-A1, *Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method*
  - SOP-A2, *Purging and Sampling of 1-inch Diameter Groundwater Monitoring Wells, Modified Well-Volume Method*
  - SOP-A3, *Purging and Sampling of Active and Inactive Water Supply Wells*
  - SOP-A4, *Depth-Specific River Water Sampling*
  - SOP-A5, *Groundwater Sampling from Sonic Drilling Boreholes*
  - SOP-A6, *Field Filtration*
  - SOP-A7, *Water Level Measurements*
  - SOP-A8, *Field Water Quality Measurements Using a Flow-through Cell*
  - SOP-A9, *Calibration of Field Instruments*
  - SOP-A10, *Decontamination of Water Sampling Equipment*
  - SOP-A11, *Total Depth Measurements*

- SOP-A12, *Field Water Quality Measurements for Grab Samples*
- SOP-A13, *Spill Prevention, Containment, and Control Measures for Monitoring Well Sampling*
- SOP-A14, *Pore Water Sampling*
- SOP-A16, *Access Routes*
- SOP-A18, *Purging and Sampling of Groundwater Monitoring Wells, Minimal Drawdown Method*
- SOP-A19, *Sampling of Groundwater Monitoring Wells, Hydrasleeve No Purge Method*
- SOP-A23, *Sample Handling and Custody*
- SOP-C1, *Solinst Pressure Transducers*

PREPARATION & SETUP:

- Review event-specific PST or event-specific field instructions, previous sampling logs, Procedures Manual, O&M Manual, and HSP.
- Ensure that the water level indicator (WLI) has been decontaminated (check for label/tag) or decontaminate as needed following SOP-A10, *Decontamination of Water Sampling Equipment*.
- Initiate field logbook for sampling activity.
- Inspect all equipment and calibrate WLIs if multiple meters are being used according to SOP-A9, *Calibration of Field Instruments*.
- If a transducer is present in the well and it is necessary to remove the transducer to allow well access, first note the exact position of the transducer and refer to SOP-C1, *Solinst Pressure Transducers*, before proceeding.

REQUIRED EQUIPMENT/SUPPLIES:

- 200-foot or 400-foot WLI
- A set of spare batteries for the field equipment
- Well access keys, including gate keys if necessary
- De-ionized (DI) water spray bottle
- Nitrile gloves, paper towels, clipboard

MEASUREMENT PROCEDURES:

1. Prepare groundwater sampling log or water level data collection form.
2. Decontaminate the lower 5 feet of the water level probe before using by rinsing thoroughly with DI water according to SOP-A10*, Decontamination of Water Sampling Equipment*.
3. Place WLI probe into well, or measure from surface water monitoring point and lower the probe until the tone sounds. Raise the probe out of the water and gently shake the

line to remove any retained water. Adjust the WLI sensitivity if necessary. (The groundwater onsite is highly conductive and may cause a constant tone from the WLI. This means that the sensitivity is set too high; turn the knob to the left to decrease sensitivity. Conversely, if measuring surface water which typically has very low conductance, and you are having difficulty getting a tone, the sensitivity may be set too low; increase the sensitivity by turning the knob to the right.) Slowly lower the probe once again just until the tone sounds. Note depth to water (DTW) value at the measuring point on the PVC well casing. If there is no mark on the PVC casing, measure DTW at the northern edge of the PVC casing. Repeat the measurement 3 times to confirm DTW, and record to the nearest hundredth of a foot on the sampling log. Record well identification, time, date, DTW, and WLI number.

4. Replace pressure transducer if removed. Ensure that transducer is placed exactly as it was before removal.

5. Compare DTW measurement with previous data and note discrepancies on the sampling form. Repeat the previous steps as necessary if an unexpected discrepancy is noted.

6. Decontaminate any portion of the instrument that came in contact with water by rinsing thoroughly with DI water, or wiping with a DI water moistened paper towel according to SOP-A10, *Decontamination of Water Sampling Equipment*.

7. Close and secure well.

Note: Field water level measurements will be loaded into the PG&E database regularly. Once loaded into the database, manual water levels will be adjusted to groundwater elevations and converted to freshwater equivalent heads following the procedures outlined in SOP-A22, *Procedures for Calculation of Freshwater Equivalent Heads*.

SOP-A8

Field Water Quality Measurements Using a Flow-through Cell Standard Operating Procedures for PG&E Topock Program

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This Standard Operating Procedure (SOP) provides general guidelines for using the YSI-556® water quality (WQ) meter and flow-through cell, or similar device for field measurements of pH, specific conductance, turbidity, dissolved oxygen, oxidation-reduction potential (ORP), and temperature of groundwater samples. Also addressed are procedures for measuring water sample turbidity using the Hach turbidity meter. All instruments will be calibrated daily in accordance with the manufacturer's instructions and SOP-A9, *Calibration of Field Instruments*.

REQUIRED DOCUMENTS:

- Event-specific planned sample table (PST).
- Applicable project work plan or monitoring plan. Refer to the Topock Program Sampling, Analysis, and Field Procedures Manual (Procedures Manual).
- Construction/Remedial Action Work Plan (C/RAWP) during the construction phase.
- Operation and Maintenance (O&M) Manual, and the Quality Assurance Project Plan (QAPP) and Addendum to the QAPP (Appendix B of the O&M Manual Volume 2, Sampling and Monitoring Plan), as required during the O&M phase.
- Topock Program Health and Safety Plan (HSP)
- Applicable SOPs may include:
  - SOP-A1, *Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method*
  - SOP-A2, *Purging and Sampling of 1-inch Diameter Groundwater Monitoring Wells, Modified Well-Volume Method*
  - SOP-A3, *Purging and Sampling of Active and Inactive Water Supply Wells*
  - SOP-A4, *Depth-Specific River Water Sampling*
  - SOP-A5, *Groundwater Sampling from Sonic Drilling Boreholes*
  - SOP-A6, *Field Filtration*
  - SOP-A7, *Water Level Measurements*
  - SOP-A9, *Calibration of Field Instruments*
  - SOP-A10, *Decontamination of Water Sampling Equipment*
  - SOP-A11, *Total Depth Measurements*
  - SOP-A12, *Field Water Quality Measurements for Grab Samples*

- SOP-A13, *Spill Prevention, Containment, and Control Measures for Monitoring Well Sampling*
- SOP-A14, *Pore Water Sampling*
- SOP-A16, *Access Routes*
- SOP-A18, *Purging and Sampling of Groundwater Monitoring Wells, Minimal Drawdown Method*
- SOP-A19, *Sampling of Groundwater Monitoring Wells, Hydrasleeve No Purge Method*
- SOP-A23, *Sample Handling and Custody*
- SOP-C1, *Solinst Pressure Transducers*

- Well construction logs/specifications
- Mobile Integrated Sample Tracking (MIST) handheld database
- Previous sampling logs or tabular historic field data
- Current site access map
- Blank sampling logs, maps, sample labels, chains of custody (COC's), and the designated groundwater sampling field notebook

REQUIRED EQUIPMENT:

- YSI-556 WQ meter or equivalent
- YSI-556 flow through cell or equivalent
- Hach 2100P turbidimeter or equivalent
- Trimble Rugged Reader hand held device with the CH2M HILL event specific MIST electronic data collection database loaded
- Spare batteries for each piece of equipment

PREPARATION & SETUP:

- Review event-specific PST or event-specific field instructions, previous sampling logs, Procedures Manual, and HSP.
- Acquire the existing field logbook for the specific field activity and initiate entries.
- Inspect all equipment : YSI-556 WQ meter or similar device, flow-through cell, o-rings, and fittings , Hach turbidity meter, distilled water in spray bottle.
- Prior to each day's use, clean the probes and flow-through cell and calibrate the field water quality (WQ) meters according to SOP-A9, *Calibration of Field Instruments* and the manufacturer's instructions. Calibration is performed to compensate for changes in potential within the measuring and reference electrodes, as well as any change of potential between them. The calibration also involves checking the slope of the measuring electrode. Slope defines the ability of the measuring electrode to change its output by 59.16 mV per pH unit at 25°C. Virtually all pH instruments use a slope adjustment to compensate for the inability of the measuring electrode to accurately

produce its output signal. If the slope falls outside the manufacturers' recommended range, the probe is replaced.

YSI-556 WQ Meter (or equivalent):

- Attach the probe body securely to the flow through cell. Attach the pump discharge line to the bottom fitting of the flow through cell, and a second discharge line to the top fitting of the flow through cell. Route the flow through cell discharge line to the purge water storage tank and secure.
- Prior to starting the pump, place the flow through cell into a 5 gallon bucket, ensure that all fittings are properly tightened and that spill containment is in place in accordance with SOP-A13, *Spill Prevention, Containment, and Control Measures for Monitoring Well Sampling.*
- Start the pump and allow the flow through cell to fill. Check for excessive leakage from the cell. A small amount of leakage is typical and allowable, and will be caught by the 5 gallon bucket. If leakage is excessive, stop the pump, remove the probe body from the flow through cell and inspect the O-ring and threads for damage. Replace if necessary, re-attach to flow through cell, and restart the pump.
- Ensure that there are no air bubbles entering the flow through cell since this will skew the dissolved oxygen and ORP readings.
- Allow instrument readings to stabilize and collect water quality data in MIST and on the field data sheet. Time the readings such that there at least 5 sets of readings collected over the length of the full purge. During operation of the WQ meter, the screen on the handheld portion should be shielded from direct sunlight.
- When sampling is complete, carefully remove the fittings and drain the flow through cell into the bucket. Rinse the instrument probes and flow through cell thoroughly with de-ionized water in accordance with SOP-A10, *Decontamination of Water Sampling Equipment,* catching the rinsate in the bucket.
- Mount the specially cut "dumping lid" on the bucket, and carefully pour the contents into the purge water storage tank.
- Carefully clean and store the WQ instrument in accordance with the manufacturer's recommendations in preparation for the next use.

HACH 2100P TURBIDIMETER:

- Turn the turbidity meter on and select the auto-range mode.
- Inspect the measurement vial for scratches, dirt or staining. Replace or clean as necessary.
- Fill the measurement vial with water and carefully wipe dry.
- If bubbles cling to the side of the vial, gently swirl the sample to sweep them loose.
- Place the measurement vial in the instrument, close the lid and press the measure button.

- Record the value on the sample sheet and in MIST.
- Clean and store the instrument and vial. Fill the vial with DI water for storage, this prevents water spotting.

SOP-A9

Calibration of Field Instruments
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) addresses the procedures and equipment to be used for calibration of field instruments at the Topock site. This SOP will be used for calibration of water level meters, YSI-556 water quality (WQ) meter, In-Situ Troll 9500 WQ meter, and Hach turbidity meter.

Required Documents:

- Event-specific planned sample table (PST).
- Applicable project work plan or monitoring plan. Refer to the Topock Program Sampling, Analysis, and Field Procedures Manual (Procedures Manual).
- Construction/Remedial Action Work Plan (C/RAWP) during the construction phase.
- Operation and Maintenance (O&M) Manual, and the Quality Assurance Project Plan (QAPP) and Addendum to the QAPP (Appendix B of the O&M Manual Volume 2, Sampling and Monitoring Plan), as required during the O&M phase.
- Equipment Manufacturers' Manuals
- Previous Calibration Records
- Field Equipment Binder (documents equipment servicing, calibration, etc.)
- Blank Calibration Sheets (see attached)
- Zobells ORP vs. temperature chart (see attached)

YSI-556 WQ Meter Calibration Equipment List:

- pH 4, 7, and 10 buffer solutions
- 1000 micro-mhos/cm conductivity solution
- Zobell's ORP check solution
- Spare batteries
- DI water sprayer
- Rinsate bucket
- Calibration vessels

In-situ Troll 9500 WQ Meter Calibration Equipment List:

- Quick-cal. solution
- DI water sprayer
- Spare batteries
- Rinsate bucket
- Calibration vessels
- Dissolved oxygen bubbler

Hach Turbidity Meter Calibration Equipment List:

- Lab DI water, NTU = <1
- Standard Hach solutions, NTU= 10 and NTU=100
- Spare batteries
- Paper towels or cloth rag

Preparation and Setup:

- Acquire the existing field logbook for the specific sampling activity and initiate entries.
- Always use fresh, unexpired solutions for calibration.
- Calibration should be performed prior to use each day, but, with the exception of dissolved oxygen (DO) on the YSI-556, may also be completed in the afternoon of the day before use.
- DO calibration on the YSI-556 is dependent on the current barometric pressure and should be calibrated immediately before use. The DO measurement from the YSI-556 will be used only as backup.
- The Rugged Dissolved Oxygen (RDO) sensor on the Troll 9500 is very resistant to drift and only requires a 100% saturated water calibration once every 3 months. The 0% oxygen calibration is only required once every 3 months as well. The optical O_2 sensor in the Troll 9500 will be used as the primary DO measurement instrument.
- Review Field Equipment Binder and equipment servicing records to anticipate next service.
- All equipment and solutions are stored in an air-conditioned office onsite to maintain their integrity.
- The YSI-556, and In-Situ Troll 9500 WQ meters and Hach turbidity meter will be used as the principal field instruments for measuring water quality parameters during groundwater and surface water sampling.

Calibration Procedures:

YSI-556 WQ Meter:

- Check expiration date of calibration solutions and discard if expired.
- DO calibration: Remove the protective probe cover and thoroughly rinse probes and probe cover with DI water. Gently shake the probe body to remove excess water. Pour about ¼ to ½ inch of water into the protective probe cover and screw slightly onto the probe body. The idea is that the ambient atmospheric pressure be maintained within the vessel, while retaining the water saturated air necessary for calibration. Turn the YSI-556 instrument on, it will be in "run" mode. Using the navigation buttons on the face of the instrument, hit "escape", then scroll down to "calibrate" and hit the "enter" key to begin calibration. Select DO, 2 mil PE (the probe style), then DO %. Enter the current barometric pressure in millimeters of Hg. Of the two YSI-556's on site, one has an on board barometer and the other doesn't. When calibrating the instrument with no barometer, simply enter the barometric pressure displayed by the other instrument. The

barometric pressure is also available at various web sites and also at airports. Press the "enter" key again to begin the calibration. Wait for 10 to 15 minutes for the DO probe to stabilize. When satisfied that that the reading is stable, press the "enter" key a final time to lock in the calibration. Record the temp., barometric pressure, and DO value on the calibration sheet.

- pH calibration: Thoroughly rinse the probes and calibration cups with DI water and gently shake off the excess liquid. Pour a sufficient volume of pH buffer 4 into a calibration cup and insert the probe body, ensuring that the pH probe is fully immersed, and stir gently. Using the navigation keys as above, "escape" from "run" mode and enter "calibration" mode. You may still be in calibration mode if you've just completed the DO calibration. Scroll down to the "pH" entry and push the "enter" key to begin the pH probe calibration process. Select a "3 point calibration", and enter the first pH buffer value (usually 4.00). Allow several minutes for the probe to stabilize, then press the "enter" key to lock in the calibration. Enter the calibration value on the calibration form. Repeat the above steps for the remaining 2 pH buffers, 7.00 and 10.00, rinsing the probe and calibration cup with DI water between buffers. Dispose of used solutions in the rinsate bucket and thoroughly rinse the calibration vessels with DI water.

- Specific conductance (SC) calibration: Thoroughly rinse the probes and calibration cups with DI water and gently shake off the excess liquid. Pour a sufficient volume of 1000 micro-mhos/cm specific conductivity (SC) solution into a calibration cup and insert the probe body, ensuring that the conductivity probe is fully immersed, and stir gently. The SC probe has sensors located very high in the probe, so near full submergence is required. Using the navigation keys as above, "escape" from "run" mode and enter "calibration" mode. You may still be in calibration mode if you've just completed the DO or pH calibrations. Scroll down to the "conductivity" entry and push the "enter" key to begin the SC probe calibration process. Select "specific conductance" and enter the SC solution value (usually 1.000 milli-mhos/cm) making sure of the correct units. The instrument may measure in **milli**-mhos/cm or micro-mhos/cm, and the calibration standard is commonly referenced in **micro**-mhos/cm (1.000 milli-mhos = 1000 micro-mhos). Allow several minutes for the probe to stabilize, then press the "enter" key to lock in the calibration. Enter the calibration value on the calibration form. Dispose of used solutions in the rinsate bucket and thoroughly rinse the calibration cups with DI water.

- ORP calibration: Thoroughly rinse the probes and calibration cups with DI water and gently shake off the excess liquid. Pour a sufficient volume of Zobells ORP solution into a calibration cup and insert the probe body, ensuring that the pH/ORP probe is fully immersed, and stir gently. Using the navigation keys as above, "escape" from "run" mode and enter "calibration" mode. You may still be in calibration mode if you've just completed the DO, pH or SC calibrations. Scroll down to the "ORP" entry and push the "enter" key to begin the ORP probe calibration process. Consult the Zobells ORP vs. temp. table provided with the ORP solution, and enter the temperature corrected ORP value into the instrument. Allow several minutes for the probe to stabilize, then press the "enter" key to lock in the calibration. Enter the calibration value on the calibration form. Dispose of used solutions in the rinsate bucket and thoroughly rinse the calibration vessels with DI water.

- Proceed with field measurements as needed while noting:
  - probes must be rinsed thoroughly with DI water after each well.
  - probes must always be submersed in liquid (DI water or pH 7 buffer when not in use).
  - absolutely no air bubbles or leaks should be present in the flow-through cell, repair and/or replace as needed.
  - ensure all readings have stabilized prior to recording a measurement.
  - all field parameters must be compared with historic data and documented on the field data sheet.

In-Situ Troll 9500 WQ multisensor probe:

- Check expiration date of calibration solutions and discard if expired.
- Connect the Troll 9500 to a data collection device (Trimble Recon or equivalent) and start the Win-situ 4 or Pocket-situ 4 program. Tap to highlight the "COM-1-19200" on the start-up screen, then tap "Find" at the bottom left of the screen to connect to the Troll 9500.
- While waiting for the device to connect, spray the Troll 9500 multi-sensors thoroughly with DI water and shake gently over the rinsate bucket to remove excess water. Fill the In-Situ calibration vessel to the "fill" line with "Quick Cal" solution and gently screw the calibration vessel onto the probe body.
- After the data collection device "finds" the Troll 9500, tap "parameters" near the top of the screen and wait for the device to change screens, then tap "Quick Cal" at the bottom right of the screen. After the screen changes, ensure that the correct parameters are checked (pH, SC, and ORP, but ***not*** DO), then tap "Next" to access the calibration screen.
- Tap "Run" in the middle left of the screen to start the calibration stabilization process. A tone will sound when the pH, ORP, SC, and temperature stabilize to nominal values. The calibration values can be accepted at this point, but it is better to continue to wait until a second tone sounds to indicate that the calibration values are completely stable.
- Tap the "Accept" button at the bottom of the screen to lock the calibration values. After accepting the calibration you will be asked if you want to view the calibration reports. Tap "yes", review, and document on the field calibration data sheet.

Dissolved oxygen (DO) calibration: (Note: DO calibration is only required once every 3 months) Remove the protective probe cover and thoroughly rinse probes and probe cover with DI water.

- Fill the In-Situ DO calibration bubbler with room temperature potable water and activate the pump to begin oxygenation of the water. Place the multi-sensor into the bubbler and ensure that the Rugged Dissolved Oxygen (RDO) sensor is not in the direct stream of the rising bubbles.
- Connect the Troll 9500 to a data collection device (Trimble Recon or equivalent) and start the Win-situ 4 or Pocket-situ 4 program. Tap to highlight the "COM-1-19200" on the

start-up screen, then tap "Find" at the bottom left of the screen to connect to the Troll 9500.

- After the data collection device "finds" the Troll 9500, tap "parameters" near the top of the screen and wait for the device to change screens, then double tap on "DO" in the parameter list. This will open the DO calibration menu. Tap "Calibrate" to continue.
- You will be asked if you want to edit the barometric pressure, tap "Yes", review and record the barometric pressure on the field calibration sheet. Tap "Next" to continue.
- The next screen will show three choices for calibration: "Calibrate", "Restore defaults then calibrate", and "Restore defaults and don't calibrate". Select option one or option two.
- Tap "Run" to begin the 100% DO saturation calibration routine. A tone will sound when the DO and temperature stabilize to nominal values. The calibration values can be accepted at this point, but it is better to continue to wait until a second tone sounds to indicate that the calibration values are completely stable.
- Tap "Accept" to lock in the 100% DO saturation calibration.
- Tap "Next" to continue. You will then be asked if you want to conduct a 0% DO calibration (Note: This calibration is only required once every 3 months). If you are completing a 100% saturated water calibration only, hit "Next", then "Next" again to complete the single point calibration.
- If you want to complete the 0% calibration as well, immerse the probe in the 0% DO solution (Sodium sulfite (Na2SO3), Catalog No. 0017670) and tap "Next", then "Run". The calibration routine will run as before. When the readings are stable hit "Accept", then review the calibration report and record on the field calibration data sheet. This will complete the DO calibration routine.
- Close the calibration report, tap "Parameters", then "Profiler" to enter run mode.
- If you intend to collect electronic data, name the file and hit "Next" to proceed to the live parameters screen. In this screen you may choose to collect continuous or snapshot data.
- If you do not intend to collect electronic data simply hit "Next" to go to the live parameters screen and record the data by hand as necessary.
- Proceed with field measurements as needed while noting:
  - probes must be rinsed thoroughly with DI water after each well.
  - probes must always be submersed in liquid (DI water when not in use).
  - absolutely no air bubbles or leaks should be present in the flow-through cell, repair and/or replace as needed.
  - ensure all readings have stabilized prior to recording a measurement.
  - all field parameters must be compared with historic data and documented on the field data sheet.

Hach Turbidity Meter:

- Perform a check as per manufacturer's instructions with Hach DI water and standard solutions. Wipe each calibration vial carefully to remove any dust and place into instrument.
- Press the measure button and record the result on the calibration sheet. Record reading, time, and date on calibration sheet for both DI water and standard solution.
- If the readings are within 10%, proceed with turbidity measurements; If not within this range, troubleshoot and repeat as needed.

Water-level Meters:

When using multiple water-level meters at the site it is necessary to calibrate each against the other at least once during the sampling event using the following procedure:

- At a well with shallow depth to water (less than 20 feet), without dedicated tubing, piping, pump, or transducer, lower each water level meter into the well and record the reading to the nearest hundredth of a foot on the calibration sheet along with water-level meter number, time, and date.
- Repeat step #1 at a well with deep depth to water (greater than 70 feet).

Horiba U-22/U-23, ORION, and Hach Turbidity Meter Calibration Sheet Updated: February 2005
Project Site: PG&E Topock

Calibrate each day prior to inititating sampling following SOP-A9.

U-22 instrument serial #								
Auto Calibration Performed: Y / N	**Units**	**Date/Time**	**Standard**	**Measured**	**Standard**	**Measured**	**Standard**	**Measured**
Auto Calibration solution reading:								
pH	pH		4.00		4.00		4.00	
Conductivity	mS/cm		4.49		4.49		4.49	
Turbidity	ntu							
DO	mg/L							
Temperature	celsius		25.00		25.00		25.00	
Salinity	%							
TDS	g/L							
ORP	mV (Ag/AgCl)							
Manufacturer, expiration date, lot number of auto calibration solution								
Manual Calibration Performed: Y / N								
Readings (Auto Calibration solution)								
pH	pH							
Conductivity	mS/cm							
Turbidity	ntu							
DO	mg/L							
Temperature	celsius							
Salinity	%							
TDS	g/L							
ORP	mV (Ag/AgCl)							
Manufacturer, expiration date, lot number of auto calibration solution								
Level II Solution Readings								
pH	pH		6.68		6.68		6.68	
Conductivity	mS/cm		53.00		53.00		53.00	
Turbidity	ntu		10 or 100		10 or 100		10 or 100	
DO	mg/L							
Temperature	celsius							
Salinity	%							
TDS	g/L							
ORP	mV (Ag/AgCl)							
Manufacturer, expiration date, lot number of solution								
Manual Calibration Performed: Y / N								
Readings (Level II solution)								
pH	pH							
Conductivity	mS/cm							
Turbidity	ntu							
DO	mg/L							
Temperature	celsius							
Salinity	%							
TDS	g/L							
ORP	mV (Ag/AgCl)							

Auto Calibration Performed: Y / N	Units	Date/Time	Standard	Measured	Standard	Measured	Standard	Measured
Auto Calibration solution reading:								
ORP - Zobell Check Only								
Temperature	celsius							
ORP	mV (Ag/AgCl)							
Manufacturer, expiration date, lot number of solution								
Within 25 mV of ORP standard? Y / N								
End of Day Zobell Check								
Temperature	celsius							
ORP	mV (Ag/AgCl)							
ORION Serial #								
pH 7 calibrated: Y / N								
pH 7 solution reading								
pH 10 Calibrated: Y / N								
pH 10 Solution Reading								
Manufacturer, expiration date, lot number of solution								
ORP - Zobell Check Only								
pH	pH							
Conductivity	mS/cm							
Turbidity	ntu							
DO	mg/L							
Temperature	celsius							
Salinity	%							
TDS	g/L							
ORP	mV (Ag/AgCl)							
Manufacturer, expiration date, lot number of solution								
Within 25 mV of ORP standard? Y / N								
Turbidity meter serial #								
	Units		**Standard**	**Measured**	**Standard**	**Measured**	**Standard**	**Measured**
Hach DI water reading	NTU		0					
Standard Solution Reading	NTU		10 or 100					
Manufacturer, expiration date, lot number of solution								
			DTW at one site well					
Water Level Meter ID								
Water Level Meter ID								
Water Level Meter ID								

Notes: * From the measured temperature value, find the closest standard temperature from the Zobell table and use the corresponding ORP standard.

Zobell solution-Temp/ORP Table

Temp in deg C	ORP (Ag/AgCl) (4M KCl) mV	Temp in deg C	ORP (Ag/AgCl) (4M KCl) mV
-5	270.0	23	233.6
-4	268.7	24	232.3
-3	267.4	25	231.0
-2	266.1	26	229.7
-1	264.8	27	228.4
0	263.5	28	227.1
1	262.2	29	225.8
2	260.9	30	224.5
3	259.6	31	223.2
4	258.3	32	221.9
5	257.0	33	220.6
6	255.7	34	219.3
7	254.4	35	218.0
8	253.1	36	216.7
9	251.8	37	215.4
10	250.5	38	214.1
11	249.2	39	212.8
12	247.9	40	211.5
13	246.6	41	210.2
14	245.3	42	208.9
15	244.0	43	207.6
16	242.7	44	206.3
17	241.4	45	205.0
18	240.1	46	203.7
19	238.8	47	202.4
20	237.5	48	201.1
21	236.2	49	199.8
22	234.9	50	198.5

SOP-A10

Decontamination of Water Sampling Equipment
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) addresses the procedures and equipment to be used for decontamination of sampling equipment at the Topock site.

REQUIRED DOCUMENTS:

- Event-specific planned sample table (PST).
- Applicable project work plan or monitoring plan. Refer to the Topock Program Sampling, Analysis, and Field Procedures Manual (Procedures Manual).
- Construction/Remedial Action Work Plan (C/RAWP) during the construction phase.
- Operation and Maintenance (O&M) Manual, and the Quality Assurance Project Plan (QAPP) (Appendix B of the O&M Manual Volume 2, Sampling and Monitoring Plan) as required during the O&M phase.
- Topock Program Health and Safety Plan (HSP)
- Applicable SOPs may include:
  - SOP-A1, *Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method*
  - SOP-A2, *Purging and Sampling of 1-inch Diameter Groundwater Monitoring Wells, Modified Well-Volume Method*
  - SOP-A3, *Purging and Sampling of Active and Inactive Water Supply Wells*
  - SOP-A4, *Depth-Specific River Water Sampling*
  - SOP-A5, *Groundwater Sampling from Sonic Drilling Boreholes*
  - SOP-A6, *Field Filtration*
  - SOP-A7, *Water Level Measurements*
  - SOP-A8, *Field Water Quality Measurements Using a Flow-through Cell*
  - SOP-A9, *Calibration of Field Instruments*
  - SOP-A11, *Total Depth Measurements*
  - SOP-A12, *Field Water Quality Measurements for Grab Samples*
  - SOP-A13, *Spill Prevention, Containment, and Control Measures for Monitoring Well Sampling*
  - SOP-A14, *Pore Water Sampling*
  - SOP-A16, *Access Routes*
  - SOP-A18, *Purging and Sampling of Groundwater Monitoring Wells, Minimal Drawdown Method*

- SOP-A19, *Sampling of Groundwater Monitoring Wells, Hydrasleeve No Purge Method*
- SOP-A23, *Sample Handling and Custody*
- SOP-C1, Solinst Pressure Transducers

REQUIRED EQUIPMENT AND SUPPLIES:

- 2 each decontamination vessels
- Potable water source
- Purified water source
- 120 volt power source
- 12 volt power source
- Alconox or Liquinox detergent
- Scrub brushes, nitrile gloves, and spray bottle
- Spill containment
- Pump specific submersible pump controllers

PREPARATION AND SET-UP:

- Acquire the existing field logbook for specific activity and initiate entries.
- Inspect all equipment necessary to carry out decontamination activities.
- Place spill containment in accordance with *SOP-A13 Spill Prevention, Containment, and Control Measures for Monitoring Well Development, Purging, and Sampling.*
- Fill a clean tub, bucket , PVC pipe, or similar vessel about 2/3 full of potable water and add the appropriate amount of Alconox or Liquinox detergent. If a new or clean vessel is not available a trash bag can be used to line the vessel prior to use.
- Fill a second tub, bucket, PVC pipe, or similar vessel about 2/3 full with clean potable water.
- Have purified water ready for final decon rinse use.

FIELD EQUIPMENT DECONTAMINATION PROCEDURES:

- Water-level Indicators: Any portion of a water-level indicator that contacts the groundwater must be decontaminated after use by rinsing with purified water, or wiping thoroughly with a paper towel moistened with purified water.
- Instrument probes: Water quality instrument probes (e.g., pH or specific ion electrodes, etc.) that come into contact with groundwater will be decontaminated by rinsing thoroughly with purified water.

- Submersible pumps - Grundfos Rediflo2: TransientRediflo2 submersible pumps will be decontaminated after each use with the following procedure:

  - If attached, detach the discharge tubing from the pump. Carefully drain any excess water to a bucket or the purge water tank. If dedicated, install the dedicated tubing cap to prevent leakage. Coil and store the dedicated tubing in a sealed and marked trash bag. If the tubing is not dedicated, discard.

  - Immerse the pump completely in an Alconox or Liquinox and potable water solution and run the pump at low to medium speed for one minute. A scrub brush will then be used to clean the outside of the pump body using the detergent solution.

  - Allow the pump to drain back into soapy water vessel, then immerse completely in clear potable water and run the pump at low to medium speed for one minute to rinse it. Ensure that the body of the pump is properly rinsed as well.

  - Allow the pump to drain back into clear water vessel, then rinse the pump body thoroughly by pouring purified or bottled water over the entire pump, ensuring that the purified water runs through the internal pump stages as well. Place the pump in a clean plastic bag and store in a plastic tub with the pump reel.

  - If the pump is not to be used immediately, or is to be stored, tag the pump or plastic tub as "decontaminated" with the date and team members initials.

  - If the decontamination vessels contain less than 2 gal. of volume each be sure to change all decontamination fluids for new solutions ***after each use***.

- Submersible pumps – 12V GeoSub, Typhoon, Mega-Monsoon: Transient DC-powered submersible pumps will be ***decontaminated*** after each use as above ***or*** using the following procedures. Pressurized gas powered bladder pumps will be decontaminated after each use using the following procedures:

  - If attached, detach the discharge tubing from the pump. Carefully drain any excess water to a bucket or the purge water tank. If dedicated, install the dedicated tubing cap to prevent leakage. Coil and store the dedicated tubing in a sealed and marked trash bag. If the tubing is not dedicated, discard.

  - Using the tools provided, disassemble the pump body to expose the pumping mechanism. Immerse all parts in an Alconox or Liquinox and potable water solution and scrub thoroughly with a clean scrub brush. Gently shake the pump parts to remove excess soapy water, taking care not to spill or splash any fluids outside of the decon. vessel. Immerse all pump parts in clean potable water and rinse thoroughly. Gently shake the pump parts to remove excess rinse water, taking care not to spill or splash any fluids outside of the decon. vessel. Carefully pour purified (or bottled) water over and through all pump parts. Gently shake the pump parts to remove excess purified rinse water, taking care not to spill or splash any fluids outside of the decon. vessel. Reassemble the pump and place in a clean plastic bag, then store in a plastic tub with the pump reel.

  - Bladder pumps do not typically include a reel and will be stored in a clean plastic bag only.

  - If the pump is not to be used immediately, or is to be stored, tag the pump or plastic tub as decontaminated with the date and team members initials.
  - If the decontamination vessels contain less than 2 gallons of volume each, be sure to change all decontamination fluids for new solutions ***after each use***.

- Water-level Indicators: Any portion of a water-level indicator that contacts the groundwater must be decontaminated after use by rinsing with purified water, or wiping thoroughly with a paper towel moistened with purified water.
- Instrument probes: Water quality instrument probes (e.g., pH or specific ion electrodes, etc.) that come into contact with groundwater will be decontaminated by rinsing thoroughly with purified water.
- Follow applicable SOPs, the Procedures Manual and O&M Manual for handling of investigation-derived waste (IDW) (O&M Manual Volume 1, Section 6 during O&M or Appendix R of the C/RAWP during construction).

SOP-A11

Total Depth Measurements
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) addresses the procedures and equipment to be used for manually measuring the total depth at groundwater monitoring wells and production wells.

REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan (SAP).
2) Applicable project work plan or monitoring plan. Refer to the Topock Program Sampling, Analysis, and Field Procedures Manual (Procedures Manual).
3) Construction/Remedial Action Work Plan (C/RAWP) during the construction phase.
4) Operation and Maintenance (O&M) Manual, and Quality Assurance Project Plan (QAPP; Appendix B of the O&M Manual Volume 2, Sampling and Monitoring Plan) as required during the O&M phase.
5) Topock Program Health and Safety Plan (HSP)
6) Well construction logs/specifications
7) Previous total depth data
8) Blank sampling logs and field notebook
9) Applicable SOPs may include:
   - SOP-A1, *Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method*
   - SOP-A2, *Purging and Sampling of 1-inch Diameter Groundwater Monitoring Wells, Modified Well-Volume Method*
   - SOP-A3, *Purging and Sampling of Active and Inactive Water Supply Wells*
   - SOP-A4, *Depth-Specific River Water Sampling*
   - SOP-A5, *Groundwater Sampling from Sonic Drilling Boreholes*
   - SOP-A6, *Field Filtration*
   - SOP-A7, *Water Level Measurements*
   - SOP-A8, *Field Water Quality Measurements Using a Flow-through Cell*
   - SOP-A9, *Calibration of Field Instruments*
   - SOP-A10, *Decontamination of Water Sampling Equipment*
   - SOP-A12, *Field Water Quality Measurements for Grab Samples*
   - SOP-A13, *Spill Prevention, Containment, and Control Measures for Monitoring Well Sampling*

- SOP-A14, *Pore Water Sampling*
- SOP-A16, *Access Routes*
- SOP-A18, *Purging and Sampling of Groundwater Monitoring Wells, Minimal Drawdown Method*
- SOP-A19, *Sampling of Groundwater Monitoring Wells, Hydrasleeve No Purge Method*
- SOP-A23, *Sample Handling and Custody*
- SOP-C1, *Solinst Pressure Transducers*

PREPARATION & SETUP

1) Review event-specific SAP or event-specific field instructions, previous sampling logs, Procedures Manual, O&M Manual, and HSP.

2) Ensure that the measurement probe (weighted tape measure) has been decontaminated (check for label/tag) or decontaminate as needed following SOP-A10 *Decontamination of Water Sampling Equipment.*

3) Ensure the tape measure is not crimped and that it will hang free and clear of any obstructions enabling it to fully extend to the bottom of the well.

4) Initiate field logbook for sampling activity.

5) If a transducer is present in the well and it is necessary to remove transducer to allow well access, refer to SOP-C1, *Solinst Pressure Transducers.*

6) Calibrate wrist-watch to the atomic clock at the Topock Compressor Station.

MEASUREMENT PROCEDURES

1) Prepare Total Depth measurement log (use attached form dated March 2005).

2) Decontaminate the entire length of the measuring tape before using, according to SOP-A10*, Decontamination of Water Sampling Equipment.*

3) Place measurement tape into well and lower until the bottom of the probe touches the bottom of the well. Note total depth (TD) measurement to mark on well casing, if there is no mark on casing measure to the north. Repeat 3 times and record final TD to the nearest hundredth of a foot on the log. Also note the condition of the well bottom (i.e. hard bottom, soft bottom). Record well identification, time, date, TD, and measurement tape identification.

4) Compare TD measurement with previous data and note discrepancies on the sampling form. Repeat step #8 if an unexpected discrepancy is noted.

5) Decontaminate the entirety of the measuring tape, or any portion of the instrument that came in contact with water, following SOP-A10, *Decontamination of Water Sampling Equipment*.

SOP-A12

Field Water Quality Measurements for Grab Samples
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) provides general guidelines for using the YSI-556 water quality (WQ) meter or similar device for field measurements of grab groundwater samples for pH, specific conductance, turbidity, dissolved oxygen, oxidation-reduction potential, and temperature. This SOP specifically covers collection of WQ measurements when a flow-through cell cannot be used (for example, surface water sample collection, active extraction well sampling, screening samples collected during drilling operations, grab samples from a well using a bailer, groundwater sample using a Hydrasleeve sampler, etc.). Instruments will be calibrated daily in accordance with the manufacturer's instructions and SOP-A9, *Calibration of Field Instruments*.

REQUIRED DOCUMENTS:

- Event-specific planned sample table
- Monitoring Plan for Groundwater and Surface Water Monitoring Program (current revision)
- Topock Program Sampling, Analysis, and Field Procedures Manual (Procedures Manual).
- Construction/Remedial Action Work Plan (C/RAWP) during the construction phase
- Operation and Maintenance (O&M) Manual, and Quality Assurance Project Plan and Addendum to the QAPP (Appendix B of the O&M Manual Volume 2, Sampling and Monitoring Plan) for site-wide groundwater monitoring requirements during the O&M phase
- Topock Program Health and Safety Plan
- Manufacturer's instructions for the YSI-556 WQ meter or equivalent
- Applicable SOPs may include:
  - SOP-A1, *Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method*
  - SOP-A2, *Purging and Sampling of 1-inch Diameter Groundwater Monitoring Wells, Modified Well-Volume Method*
  - SOP-A3, *Purging and Sampling of Active and Inactive Water Supply Wells*
  - SOP-A4, *Depth-Specific River Water Sampling*
  - SOP-A5, *Groundwater Sampling from Sonic Drilling Boreholes*
  - SOP-A6, *Field Filtration*
  - SOP-A7, *Water Level Measurements*
  - SOP-A8, *Field Water Quality Measurements Using a Flow-through Cell*
  - SOP-A9, *Calibration of Field Instruments*
  - SOP-A10, *Decontamination of Water Sampling Equipment*
  - SOP-A11, *Total Depth Measurements*
  - SOP-A13, *Spill Prevention, Containment, and Control Measures for Monitoring Well Sampling*

  - SOP-A14, *Pore Water Sampling*
  - SOP-A16, *Access Routes*
  - SOP-A18, *Purging and Sampling of Groundwater Monitoring Wells, Minimal Drawdown Method*
  - SOP-A19, *Sampling of Groundwater Monitoring Wells, Hydrasleeve No Purge Method*
  - SOP-A23, *Sample Handling and Custody*
  - SOP-C1, *Solinst Pressure Transducers*
- Well construction logs/specifications
- Previous sampling logs or tabular historic field data
- Current site access map
- Blank sampling logs
- Groundwater sampling field notebook

REQUIRED EQUIPMENT:

- YSI-556 WQ meter or equivalent
- YSI-556 storage cap or equivalent
- De-ionized water in a spray bottle
- Electronic data collection unit with a Topock-event-specific database
- Bucket and pouring lid

PREPARATION AND SETUP:

- Review event-specific planned sample table or event-specific field instructions, previous sampling logs, the Procedures Manual and O&M Manual, and the Health and Safety Plan.
- Acquire the existing field logbook for the specific field activity, and initiate entries documenting field activities.
- Inspect all equipment: YSI-556 WQ meter or similar device, de-ionized water in spray bottle, and electronic data collection unit.
- Prior to each day's use, calibrate the YSI-556 WQ, and clean the probes and storage cup of the field WQ meters according to SOP-A9, *Calibration of Field Instruments,* and the manufacturer's instructions. Document that instrument calibration has occurred and that parameters are calibrated to within the specifications in SOP-A9 in the field logbook.

MEASUREMENT PROCEDURES:

1. Transfer a small volume of sample water—enough to immerse all probes—into the WQ instrument storage cup or a small container. (The instrument storage cup is preferred as it can be sealed and will reduce risk for small volume water spills.)
2. Submerge the probes of the WQ meter into the water. Move the probe back and forth.
3. Allow instrument readings to stabilize, and collect WQ data in the electronic data collection unit and on the field data sheet. During operation of the WQ meter, the screen on the handheld portion should be shielded from direct sunlight.
4. Note in the field forms that the dissolved oxygen and oxidation-reduction potential results are approximate because a flow-through cell could not be used.

5. Water used for the WQ reading will be emptied into the purged wastewater tank.
6. When sampling is complete, rinse the instrument probes and the storage cup or small container with de-ionized water in accordance with SOP-A10, *Decontamination of Water Sampling Equipment,* catching the rinsate in the bucket.
7. Mount the specially cut "pouring lid" on the bucket, and carefully pour the contents into the purge water storage tank.
8. After sampling is complete, carefully clean and store the WQ instrument in accordance with the manufacturer's recommendations in preparation for the next use.

SOP-A13

Spill Prevention, Containment, and Control Measures for Monitoring Well Development, Purging, and Sampling Standard Operating Procedures for PG&E Topock Program

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This standard operating procedure (SOP) addresses the procedures and equipment to be used for spill prevention, containment, and control associated with monitor well activities at the Topock site. This SOP applies to containment and control of potential spills from purge and equipment decontamination water generated during the development, purging, and sampling of monitoring wells.

REQUIRED DOCUMENTS:

- Topock Program Health and Safety Plan (HSP)
- Emergency Notification Binder
- Construction/Remedial Action Work Plan (C/RAWP) during the construction phase
- Operation and Maintenance Manual (O&M Manual) during the O&M phase
- Applicable SOPs may include:
  - SOP-A1, *Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method*
  - SOP-A2, *Purging and Sampling of 1-inch Diameter Groundwater Monitoring Wells, Modified Well-Volume Method*
  - SOP-A3, *Purging and Sampling of Active and Inactive Water Supply Wells*
  - SOP-A4, *Depth-Specific River Water Sampling*
  - SOP-A5, *Groundwater Sampling from Sonic Drilling Boreholes*
  - SOP-A6, *Field Filtration*
  - SOP-A7, *Water Level Measurements*
  - SOP-A8, *Field Water Quality Measurements Using a Flow-through Cell*
  - SOP-A9, *Calibration of Field Instruments*
  - SOP-A10, *Decontamination of Water Sampling Equipment*
  - SOP-A11, *Total Depth Measurements*
  - SOP-A12, *Field Water Quality Measurements for Grab Samples*
  - SOP-A14, *Pore Water Sampling*
  - SOP-A16, *Access Routes*
  - SOP-A18, *Purging and Sampling of Groundwater Monitoring Wells, Minimal Drawdown Method*

- SOP-A19, *Sampling of Groundwater Monitoring Wells, Hydrasleeve No Purge Method*
- SOP-A23, *Sample Handling and Custody*
- SOP-C1, *Solinst Pressure Transducers*

REQUIRED EQUIPMENT:

- Large (10′ by 11′ by 4″ deep) bermed spill containment pad. This pad is to be placed on the ground beneath the truck or utility task vehicle (UTV)-mounted purge water tank. It will be placed so that the work area at the rear of the vehicle is covered and so that small spills or drips from the purge tank or work area are captured.
- Medium (4′ by 8′ by 4″ deep) bermed spill containment pad. This pad is used at the FLUTe wells, Blatypus wells, and peristaltic wells, or for additional work space at any well.
- Small (4′ by 4′ by 4″ deep) bermed spill containment. This pad fits inside the UTV beds beneath the purge tank when sampling using UTVs (flood plain and special access wells, see SOP-A16).
- Small (2′ by 4′ by 4″ deep) bermed "pizza cut" spill containment pad for placement around well heads.
- Additional spill containment pads as necessary or as directed by the field team leader.
- Purge water tanks as appropriate for the task.
- Extra spring clamps, fittings, paper towels, and tools, etc.
- Small trash bags for temporary storage of dedicated transducers removed from wells.
- Trash pump, for transferring purge and decon. water at IM-3.
- 4 or more 5-gallon buckets and specially cut "pouring lid"
- Hydrophilic sorbent material (absorbent pads, booms, or mats)
- Plastic sheeting
- Shovel and/or other hand tools
- Plastic bags or buckets for storage and disposal of used sorbent material

PREPARATION & SETUP:

- Review this and other applicable SOPs, as well as the Emergency Notification Binder.
- Inspect all required spill containment pads for holes or tears that would compromise their effectiveness. Report such damage to the CH2M HILL Topock site coordinator or field team leader. Repair or replace damaged spill containment pads before use.
- Load spill containment equipment onto appropriate vehicle(s) and secure.

GENERAL SPILL PREVENTION PRACTICES:

- Topock is a "No Spill" site. We have all the necessary spill containment equipment, ***use it!***
- Place all items exposed to purge or decon water on the spill containment pads, not directly on the ground.
- No drops of well or purge water should ever hit the ground. Use 5-gallon buckets and spill containment pads to prevent any water from sampling equipment reaching the ground.
- Double check all fittings and connections for tightness before activating any pump.
- Check all fittings and connections for leaks immediately after starting the pump.
- Place the flow through cell and associated fittings in a 5 gal. bucket. There is often a small amount of leakage from the cell.
- If a spill does occur, immediately stop the pump, or take such action as is necessary to safely mitigate the volume or severity of the spill.
- Report all spills to the CH2M HILL site coordinator or field team leader immediately, no matter how small.
- Only use restroom facilities at the CH2M HILL job trailer or the IM-3 facility.

SPILL RESPONSE ACTIONS:

In the event purge water is spilled outside of containment basins, the field team will take the following actions:

Procedures:

- Stop the pump or take what action is necessary to safely stop or mitigate the volume or severity of the spill.
- Notify the CH2M HILL Site Coordinator or field team leader immediately, no matter how small the spill, and follow their instructions. PG&E and CH2M HILL staff may want to photo document the incident, so do not proceed with any clean-up until cleared to do so.
- The CH2M HILL Site Coordinator will perform the notifications as required in the Emergency Notification Binder and complete the Notification Documentation Form provided in the Binder.
- When cleared to do so, use sorbent material and bermed spill containment to absorb and contain the spilled purge water if possible.
- Transfer any contained purge water into the purge water tank.
- When cleared to do so, manually dig up any saturated soil and place in 5-gallon bucket(s) or other appropriate containers for disposal.

- Dispose of containerized soil, used sorbent material, and gloves in accordance with O&M Manual Volume 1, Section 6 during O&M or Appendix R of the C/RAWP during construction.

CONTAINMENT SCENARIO 1: SAMPLING OF UTV ACCESS WELLS USING DEDICATED OR TRANSIENT PUMPS:

For monitor well sampling at UTV access wells with dedicated or transient pumps, purge water is pumped to a tank placed on 4′ X 4′spill containment pad in the back of the UTV. The UTV is parked on a 10′ X 11′ spill containment pad adjacent to the monitoring well to be sampled. Purge water is pumped directly to a YSI flow through cell contained in a 5 gal. bucket in the work area, and then into the purge tank through a discharge tube at the appropriate purge rate for that well. The small amount of leakage from the YSI flow cell is contained in a 5-gallon bucket and is manually transferred into the purge water tank using the special "pouring lid" to prevent spills.

Potential Spill Scenarios:

- Overfill of UTV-mounted purge water tank
- Failing to place lid on purge tank before mobilizing to next well
- Spills at time of tubing disconnection from tank or during manual transfer into tank from bucket
- Spills from tubing disconnection or leakage from flow cell
- Spills from tubing disconnection at well head between dedicated and non-dedicated tubing
- Spilled bucket of purge water from flow cell
- During removal of dedicated transducers from wells

Procedures:

- Before mobilization to any well, place appropriately sized tanks on small 4′ X 4′ bermed spill containment pads in UTV beds.
- Evaluate the remaining capacity of the tank prior to initiating well purging to ensure that there is sufficient capacity to hold the amount of purge water anticipated to be generated during purging of the well. Offload if needed following procedures under Containment Scenario 4.
- At the well, deploy the large 10′ X 11′ bermed spill containment pad adjacent to the well. Park the UTVs with purge water tanks on the spill pad and as close to the well head as possible, while still leaving room to work. Deploy a second or third spill containment pad as necessary to ensure adequate coverage. There should be no exposed soil between the work area and the well.
- Place the small 2′ X 4′ "pizza cut" bermed spill containment around well head.

- For a dedicated pump well: Attach the transfer tubing to the existing dedicated pump tubing at the top of the well so that the tubing connection is located ***inside*** the well protective casing and any leakage will be contained within the well head.
- Secure the transfer tubing to the bottom connection of the flow cell using hose clamps. Attach the flow through cell discharge tubing to the top fitting of the flow through cell and place the cell into a 5 gal. bucket to contain any leakage from the cell.
- Route the discharge tubing to the purge tank opening and secure using spring clamps.
- Stuff a large, unused trash bag into the top of the protective casing above the tubing connection so that any leakage or spray will be contained inside the protective casing.
- For a transient pump well: Attach the new or well specific dedicated discharge tubing to a decontaminated transient submersible pump and install into well following *SOP-A1 Purging and Sampling of Groundwater Monitoring Wells.* Transport the pump to the well head in a 5 gal. bucket to contain leakage of any residual water. With no tubing connections at the top of the well, no additional spill containment is necessary at the well head.
- All equipment is to be placed on the 10′ X 11′ bermed spill containment pad prior to the start of purging.
- Double check all tubing connections for tightness before activating the pump.
- Double check that discharge tubing is properly secured with spring clamp at purge water tank.
- Immediately after starting the pump, check all tubing connections for leakage.
- During purging, field staff will monitor the transfer of water into the purge water tank. When the tank reaches 80% full, discontinue purging to that tank. Depending on the situation, either stop the pump and properly dispose of the purge water according to the O&M Manual Volume 1, Section 6 during O&M or Appendix R of the C/RAWP during construction.
- At the completion of purging, stop the pump and carefully disconnect the discharge tubing from both ports of the flow through cell, working inside the bucket and over containment, and allow the tubing and flow cell to drain inside of the bucket.
- Working over containment, clamp the pump discharge tubing inside a 5 gal. bucket and start the pump at low speed. Collect the sample directly from the pump discharge line, allowing excess flow to pump into the 5 gallon bucket.
- When sampling is complete, stop the pump and carefully disconnect and drain all other tubing while working over spill containment to ensure that any drips of purge water are contained on the pad.
- If a transient pump was installed, double fold the end of the dedicated down-hole tubing and secure with wire-ties to prevent leakage during pump removal. Carefully remove the pump from the well while wiping the water and power lines as they emerge with a paper

towel, and coiling the tubing neatly. As the pump clears the well, place it immediately in a 5 gal. bucket, over containment, to drain.

- Disconnect the dedicated tubing from the pump and double fold the end of the tubing, securing with wire ties to prevent leakage of the residual water still contained in the tubing. Place the tubing in its designated storage bag. At the end of the day, use compressed air from the sampling truck to carefully push the residual water out of the dedicated tubing and into the purge tank.
- Place the specially cut "pouring lid" on any 5 gallon buckets containing purge water and carefully pour contents into the purge water tank.
- If any purge water is present on the containment pad, either wipe up the water using paper towels, or collect it a bucket and dump it to the purge tank. Dispose of the wet paper towels with the rest of the contaminated trash.
- Close purge water tank openings and ensure that the tank is well secured to the UTV.
- Before mobilization, check back of UTVs for any drips that may have occurred and wipe up with a paper towel if needed.
- Pull the UTV off of the spill containment pad, fold the pad, load, and secure.
- Mobilize to the next well to be sampled and repeat the preceding steps.
- When the UTV-mounted purge water tank is 80% full, continue with procedures under Containment Scenario 4 to dump the water at IM-3.

CONTAINMENT SCENARIO 2: SAMPLING UTV ACCESS WELLS USING A PERISTALTIC PUMP:

For monitor well sampling using a peristaltic pump, purge water is placed in a small UTV or truck mounted purge tank, or 5 gallon bucket with lid. The purge tank or bucket is situated adjacent to the monitoring well to be sampled. Purge water is pumped directly to a YSI flow cell in a 5 gal. bucket, then to a 5-gallon bucket with lid, or purge tank for storage. The purge water in the bucket is manually dumped to the purge tank using the specially cut "pouring lid" to prevent spills.

Potential Spill Scenarios:

- Spills at time of hose disconnection from pump mechanism
- Spills during manual transfer into purge tank from bucket
- Spills from leakage from flow cell
- During removal or placement of tubing
- Disrupted bucket of purge water

Procedures:

- Before mobilization to any well, place appropriately sized tank on small 4' X 4' bermed spill containment pad in UTV bed.

- Evaluate the remaining capacity of the tank prior to initiating well purging to ensure that there is sufficient capacity to hold the amount of purge water anticipated to be generated during purging of the well. Offload if needed following procedures under Containment Scenario 4.
- At the well, deploy the large 10′ X 11′ bermed spill containment pad adjacent to the well. Park the UTV with the purge water tank on the spill pad and as close to the well as possible, while still leaving room to work. Deploy a second or third spill containment pad as necessary to ensure adequate coverage. There should be no exposed soil between the work area and the well head.
- Place the small 2′ X 4′ "pizza cut" bermed spill containment around well head. With no tubing connections at the well, there is no need for additional spill containment at the well-head.
- Install the dedicated down-hole tubing. Take care to ensure that any residual water in the tubing is contained on spill pads. In the slant wells (MW-52's, 53's and 56's) the dedicated tubing is stored in the well itself.
- Attach the peristaltic pump-head tubing to both the dedicated down-hole tubing and the pump discharge tubing, and use a wire-tie to secure each. Clamp the pump-head tubing into the peristaltic pump, ensuring that it is not pinched in the clamp (this could wear a hole), and place the pump on the 10′ X 11′ bermed spill containment pad.
- Attach the pump discharge tubing to the bottom connection of the flow cell and secure with a wire-tie. Attach the flow cell discharge tubing to the top fitting of the cell, secure with a wire-tie and place the cell into a 5 gal. bucket to contain any leakage.
- Route the discharge tube to a 5-gallon bucket or purge tank and secure with a spring clamp. Make sure additional empty purge buckets are available.
- All equipment is to be placed on the 10′ X 11′ bermed spill containment pad prior to the start of purging.
- Double check all tubing connections for tightness before activating the pump.
- Double check that discharge tubing is properly secured with spring clamp at purge water tank or bucket.
- Immediately after starting the pump, check all tubing connections for leakage.
- During purging, field staff will monitor the transfer of water into the bucket or purge water tank. If purging to a 5 gallon bucket, briefly shut down the pump and move the discharge line to another 5 gal. bucket when the bucket reaches 50% full, then use the specially cut "pouring lid" to transfer the water from the purge bucket to the purge tank. If purging to the UTV mounted purge tank, discontinue purging to that tank when the tank reaches 80% full. Depending on the situation, either stop the pump and properly dispose of the purge water according to O&M Manual Volume 1, Section 6 during O&M or Appendix R of the C/RAWP during construction, or briefly stop the pump and switch to a different purge bucket or tank. Such investigation-derived waste (IDW) is typically

disposed of to the process stream at IM-3. Refer to Containment Scenario 4 below for instructions.

- At the completion of purging, stop the pump and carefully disconnect the discharge tubing from the flow through cell, working inside the bucket and over containment, and allow the tubing and flow cell to drain inside of the bucket.
- Working over containment, clamp the pump discharge tubing inside a 5 gal. bucket and start the pump. Collect the sample directly from the pump discharge line, allowing excess flow to pump into the 5 gallon bucket.
- When sampling is complete, stop the pump and carefully disconnect and drain all other tubing while working over spill containment to ensure that any drips of purge water are contained on the pad.
- Remove the dedicated tubing from the well and carefully drain any remaining water into purge tank. Working over containment, coil the tubing and place it into the marked ziplock bag from which it was removed.
- Place the specially cut "pouring lid" on any 5 gallon buckets containing purge water and carefully pour contents into the purge water tank.
- If any purge water is present on the containment pad, either wipe up the water using paper towels, or collect it a bucket and dump it to the purge tank. Dispose of the wet paper towels with the rest of the contaminated trash.
- Close purge water tank openings and ensure that the tank is well secured to the UTV.
- Before mobilization, check back of UTVs for any drips that may have occurred and wipe up with a paper towel if needed.
- Pull the UTV off of the spill containment pad, fold the pad, load, and secure.
- Mobilize to the next well to be sampled and repeat the preceding steps.
- When the UTV-mounted purge water tank is 80% full, continue with procedures under Containment Scenario 4.

CONTAINMENT SCENARIO 3: SAMPLING TRUCK ACCESS MONITOR WELLS:

For monitor well sampling in upland, truck accessed areas of the site, purge water is placed in a 400-gallon truck-mounted tank. Purge water is pumped directly into this tank via a transfer tube at rates up to 10 gpm. Purge water leakage from the YSI flow cell is contained in a 5-gallon bucket and is manually transferred into the purge water tank using the specially cut "pouring lid". For upland wells that are UTV access only, follow procedures under Containment Scenarios 1 or 2, as applicable.

Potential Spill Scenarios:

- Overfill of truck-mounted purge water tank
- Spills at time of hose disconnection from tank or during manual transfer into tank from bucket

- Spills from hose disconnection at well head between dedicated and non-dedicated tubing
- Spills from hose disconnection or leakage from flow cell
- During removal of dedicated transducers in wells
- Disrupted bucket of purge water
- During removal or placement of pump and/or tubing
- Spills or leaks from "splitter" if used at wells with higher velocity purge rates

Procedures:

- Evaluate the remaining capacity of the tank prior to initiating well purging to ensure that there is sufficient capacity to hold the amount of purge water anticipated to be generated during purging of the well. Offload if needed following procedures under Containment Scenario 4.
- At the well, deploy the large 10′ X 11′ bermed spill containment pad adjacent to the well. Park the sampling truck on the spill pad and as close to the well as possible, while still leaving room to work. Deploy a second or third spill containment pad as necessary to ensure adequate coverage. There should be no exposed soil between the work area and the well head.
- Place the small 2′ X 4′ "pizza cut" bermed spill containment around well head.
- For a dedicated pump well: Attach the transfer tubing to the existing dedicated pump tubing at the top of the well using the riser and valve provided.
- If a splitter is used to split the flow between the flow cell and the purge tank at high flow wells, wrap the splitter with a fresh trash bag such that any leakage or spray will be contained inside the well head or on containment. Route the high flow purge line to the purge tank and secure.
- For a transient pump well: Working over containment, attach the well specific dedicated discharge tubing to a decontaminated transient submersible pump and install into well following *SOP-A1 Purging and Sampling of Groundwater Monitoring Wells.* Transport the pump to the well head in a 5 gal. bucket to contain leakage of any residual water. With no tubing connections at the top of the well, no additional spill containment is necessary at the well head.
- Secure the transfer tubing to the bottom connection of the flow cell using hose clamps. Attach the flow through cell discharge tubing to the top fitting of the flow through cell and place the cell into a 5 gal. bucket to contain any leakage from the cell.
- Route the flow cell discharge tubing to the purge tank opening and secure using spring clamps.
- All equipment is to be placed on the 10′ X 11′ bermed spill containment pad prior to the start of purging.
- Double check all tubing connections for tightness before activating the pump.

- Double check that discharge tubing is properly secured with spring clamp at purge water tank.
- Immediately after starting the pump, check all tubing connections for leakage.
- During purging, field staff will monitor the transfer of water into the purge water tank. When the tank reaches 90% full, discontinue purging to that tank. Stop the pump and properly dispose of the purge water according to the O&M Manual Volume 1, Section 6 during O&M or Appendix R of the C/RAWP during construction. Such IDW is typically disposed of to the process stream at IM-3. Refer to Containment Scenario 4 below for instructions. Resume pumping to the empty tank.
- At the completion of purging, stop the pump and carefully disconnect the discharge tubing from the flow through cell, working inside the bucket and over containment, and allow the tubing and flow cell to drain inside of the bucket.
- Clamp the pump discharge line to the sink at the rear of the sampling truck and start the pump at low speed. Collect the sample over containment directly from the pump discharge line, allowing excess flow to pump into the sink.
- When sampling is complete, stop the pump and carefully disconnect and drain all other tubing while working over spill containment to ensure that any drips of purge water are contained on the pad.
- If a transient pump was installed, double fold the end of the dedicated down-hole tubing and secure with wire-ties to prevent leakage during pump removal. Carefully remove the pump from the well while wiping the water and power lines as they emerge with a paper towel, and coiling the tubing neatly. As the pump clears the well, place it immediately in a 5 gal. bucket, over containment, to drain.
- Disconnect the dedicated tubing from the pump and double fold the end of the tubing, securing with wire ties to prevent leakage of the residual water still contained in the tubing. Place the tubing in its designated storage bag. At the end of the day, use compressed air from the sampling truck to carefully push the residual water out of the dedicated tubing and into the purge tank.
- Place the specially cut “pouring lid” on any 5 gallon buckets containing purge water and carefully pour contents into the purge water tank.
- If any purge water is present on the spill containment pad, either wipe up the water using paper towels, or collect it a bucket and dump it to the purge tank. Dispose of the wet paper towels with the rest of the contaminated trash.
- Ensure that all water is pumped from sink into the truck-mounted tanks. Inspect back of truck and sink and wipe off any purge water drops with paper towel.
- Before mobilization, ensure that all tank openings are secure, and wipe up any drips that may have occurred in the work area.
- Mobilize to the next well to be sampled and repeat the preceding steps.

- When the truck mounted purge water tank is 90% full, continue with procedures under Containment Scenario 4 below.

CONTAINMENT SCENARIO 4: TRANSFER OF PURGE WATER FROM TRUCK MOUNTED TANK OR UTV MOUNTED TANK TO IM-3:

When the truck or UTV mounted purge water tank requires emptying, the following procedures will be used. Purge water is transferred into a 5,500-gallon storage tank at the IM-3 Treatment Plant, at rates up to 20 gpm. The 5,500-gallon tank is located within a permanent containment structure.

Potential Spill Scenarios:

- Overfill of tank at final storage location
- Pump or transfer hose leakage during pumping into tank or at time of hose disconnection.

Procedures:

- See an IM-3 plant operator for assistance in transferring purge water.
- Park the truck or UTV on the bermed spill containment pad at the IM-3 transfer location.
- Follow the instructions of the IM-3 plant operator and use the trash pump to transfer purge water from the purge tank to the receiving tank. The IM-3 plant operator and field staff will be present during the entire transfer to monitor the water level in the receiving tank and to ensure no leakage or spills occur. If the receiving tank approaches being full, discontinue transfer operations.
- At the completion of transfer operations, take care when removing the transfer hose from the truck or UTV mounted purge water tank opening, since some residual water will be present in the hose.
- Secure tank openings on the truck-mounted or UTV-mounted purge water tank.
- Proceed to the next well for sampling.

SOP-A16

Access Routes
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) addresses the procedures to be used when accessing wells or other sampling stations at the Topock site. This SOP should be used for all travel to collect data on site. All field personnel and subcontractors are required to read this SOP and sign on the Employee Signoff Form. Although no groundwater sampling is currently planned to be conducted at any SWFL habitat wells during SWFL nesting season, the procedures below will be used if such sampling does become necessary.

OVERVIEW:

Figure 1 at the end of this SOP shows the Topock project groundwater and surface water data collection locations. The map also shows the access routes used for sampling and transducer downloads. These lines indicate vehicle access on existing roads, and indicate where utility vehicle (UTV) or foot access is used at locations where pickup truck access is not allowed. Purple lines on the map indicate where either pickup trucks or UTVs are used. Blue lines indicate routes with allowed access by UTV but not by pickup truck. Black dotted lines indicate foot access routes. Where the black dots overlay the blue routes on the floodplain area, the access is on foot or by electric UTV during the southwestern willow flycatcher (SWFL) nesting season (May 1st through September 30th), and by any UTV outside of nesting season. The access routes with specific mitigation measures or access procedures discussed herein are highlighted in green.

There are 3 access procedures that are to be followed depending on when/where fieldwork is to occur:

A = Universal for the site

B = SWFL habitat during SWFL summer nesting season (May 1st through September 30th)

C = Upland close to cultural resources (Year-round)

A site sensitivity orientation is to be provided to all field personnel regarding cultural and biological resources and the spiritual importance of the geographic area and the river to local tribes. The orientation will emphasize the need to stay within the established, marked access routes and work areas, and to prevent enlargement of previously used areas. Although the C sites in the upland are close to cultural resources, it is important to note that cultural resources are a concern in all areas of the project.

A SITES ACCESS PROCEDURES – APPLIES TO ALL SITES:

Personnel must obey the following procedures when accessing all data collection sites (refer to Figure 1):

- Access by vehicles is restricted to established roads or tracks. For off-road access the number of vehicles used should be minimized.
- All vehicles are to observe a 10-mph speed limit on Historic Route 66 (H-66), drive in the center of H-66 to avoid wear on the H-66 shoulders, and not cut corners when exiting H-66 to access well locations.
- All vehicles are to travel slowly off-road (5 mph speed where possible) to give time to observe and avoid wildlife and minimize noise, dust, and vehicle rutting.
- Most off-road access is to be by low-impact utility vehicles (UTV's) which carry sampling or data collection equipment as well as purge water tanks.
- Access beyond the purple lines on the map is by UTV (blue lines). Dotted black lines indicate access by foot or electric UTV. Access follows consistent routes or paths.
- Minimize time near possible wildlife habitat.
- Coordinate with on-site field client representative (FCR) to prevent unauthorized access to site areas.

These minimum procedures are followed for all data collection locations. More rigorous procedures are to be used at locations where potential concerns have been identified.

B SITES ACCESS PROCEDURES:

Field crews are to follow the following mitigation measures for the floodplain wells listed below during the SWFL nesting season, May 1st through September 30th. The universal A sites measures that were outlined above will also apply at these locations. Site B locations include:

- Well clusters MW-27, MW-34, and shoreline location R-27 on the Bureau of Land Management (BLM) managed area
- Well clusters MW-22, MW-43, MW-52, MW-53, and shoreline location R-22 on the Havasu National Wildlife Refuge (HNWR) area

Well sampling, transducer data collection, and any other work activities will not occur during the biennial protocol survey for SWFL's. Upon completion of the surveys, the onsite biologist will approve/disapprove of work activities depending on the survey results. If a SWFL is not detected, then the biologist will permit the activities. If a SWFL is detected, then the biologist will not permit the work activities, and the regulatory agencies will be consulted.

Specialized Field Equipment:

An electric UTV will be utilized while accessing B sites on BLM and HNWR property during the nesting season. The electric UTV will minimize noise and enable the sampling crew to minimize the number of trips needed to transport equipment to a well cluster in SWFL habitat.

Power supply outlets have been installed at PE-1 and a leak detection vault north of MW-39. By using this power supply to power the groundwater pumps instead of a generator, the sampling operation is virtually noiseless when sampling the MW-34 monitor well cluster.

New ½" I.D. LDPE tubing will be used to connect the pumps at the well head to the purge tanks at the staging areas. Spill containment will be placed under any hose connections where multiple hose segments are required to reach more distant wells. The hose will be cleared of all water after sampling is completed. Clearing water from the hose will be accomplished by lifting the hose to shoulder height to drain the water into the purge water storage tank.

New dedicated pumps were installed in late 2005 in MW-27, MW-34, and MW-43 well clusters. Therefore, pumps and decontamination equipment will no longer need to be transported to these wells, decreasing the overall impact associated with sampling at these locations.

Access Procedures for Wells on BLM Property:

Well clusters MW-27, MW-30, MW-34, MW-36, MW-39, MW-42 and MW-45 will be accessed directly by UTV's from the south access, under the railroad tracks. For sampling the MW-34 cluster, an electric UTV will be used to carry equipment and access the wells, and a second UTV with the purge tank will park in the staging area at the PE-1 location. New or dedicated ½" ID LDPE tubing and a power cord will be stretched from the well heads to the purge tank and power source at PE-1. For sampling the MW-27 cluster and R-27 when necessary, the electric UTV will be used to carry equipment and access the wells, and a second UTV with the purge tank will park in the staging area just north of the railroad bridge between MW-42 and MW-27. New or dedicated ½" ID LDPE tubing and a power cord will be stretched from the well heads to the purge tank and generator at the staging area.

Access Procedures for Wells on HNWR Property:

Monitor well clusters MW-22, MW-43, MW-52, and MW-53 and shoreline station R-22 are located on HNWR property, south of the railroad bridge. UTV mounted equipment is to be staged at the cleared and graded area to the west of well cluster MW-32 (Figure 1). All power generation equipment and purge water storage tanks are staged at this location. The electric UTV will be used to carry equipment and access the wells, and a second UTV with the large purge tank will park in the staging area described above. New or dedicated ½" ID LDPE tubing and a power cord will be stretched from the well heads to the purge tank and power source at the staging area. For MW-22 and the MW-52 and MW-53 clusters, a peristaltic pump and battery are used for purging directly to a small tank on the electric UTV.

Sampling Procedures for B Site Wells:

The following list summarizes the modified "nesting season" sampling procedures for the B site monitoring wells with dedicated pumps. These modified procedures will be followed each year during May 1st through September 30th:

- A biologist or authorized individual will pre-survey the planned work area for the presence of nesting listed-bird species, and sampling will proceed if the survey results are negative. BLM and DTSC will be contacted and sampling will not proceed if the pre-survey finds nesting listed-bird species.
- New sampling procedures and biological resource sensitivity will be reviewed at each field event kickoff briefing.
- The UTVs will maintain low speeds and low revolutions per minute to minimize noise. The target speed will be 5 mph on the floodplain, per BLM direction. The UTVs will maintain a reduced speed to the extent possible while avoiding getting lodged or stuck.
- A biologist will accompany the sampling team upon startup of activities and will provide a reconnaissance "sweep" during the sampling event.
- A generator will be operated at the staging areas only when there is no nearby power supply (HNWR).
- Water level measurements are to be taken at the beginning and end of the purge only. No measurements will be taken during the purge.
- Spill prevention, containment, and control measures outlined in SOP-A13 will be implemented.
- At all times, conversation noise and abrupt or unnecessary movements will be avoided, and equipment noise will be minimized. Equipment will be muffled or padded during transport and setup to avoid clanging or other impact noises from bottles and metal components.
- A biologist's report of the sampling activities will be completed within a week of the sampling and submitted to DTSC and BLM.

C SITES ACCESS PROCEDURES:

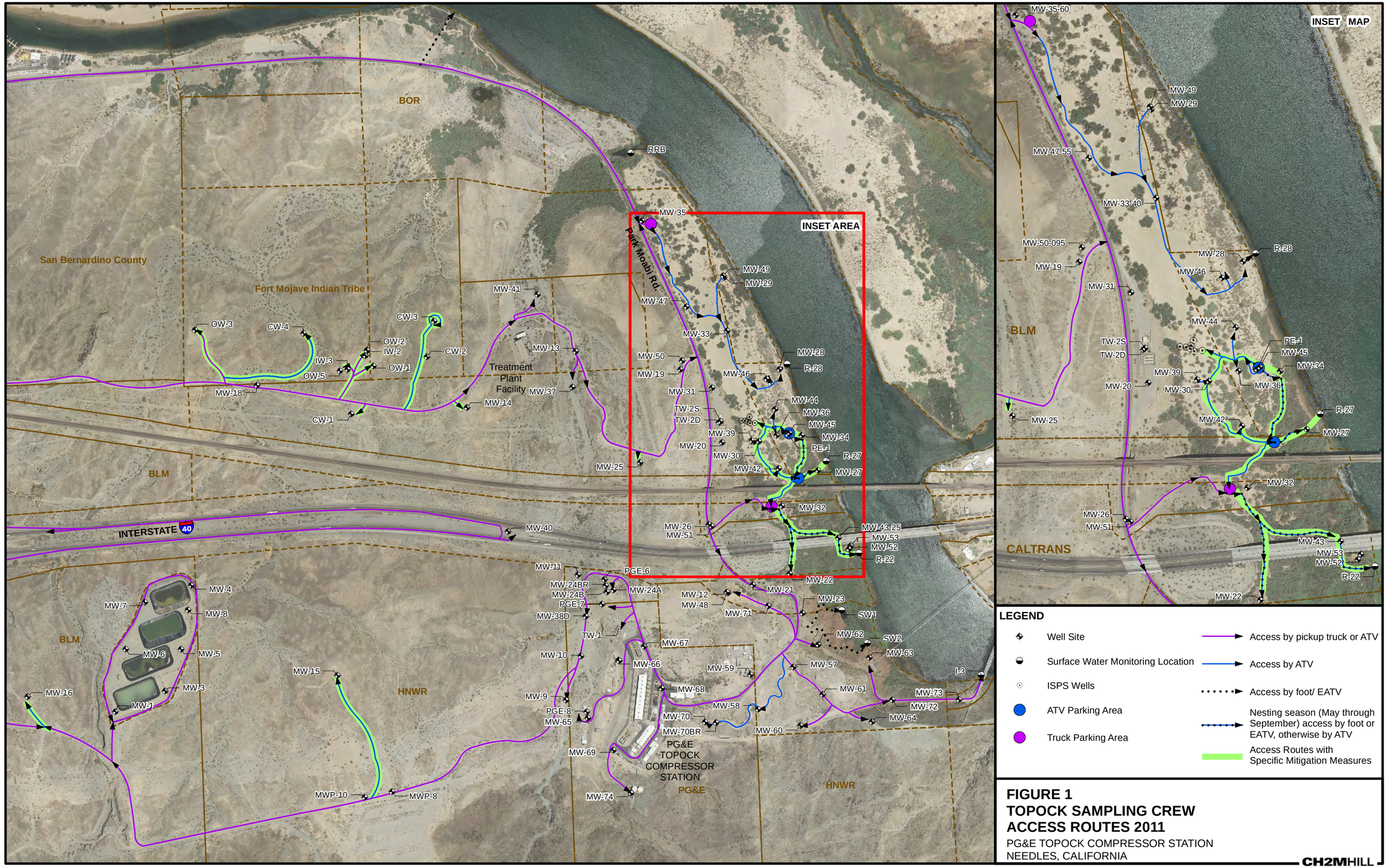
Field crews are to implement the following mitigation measures for the upland wells listed below to prevent impact from data collection on cultural or biological resources.

- East Mesa wells (IW-2, IW-3, OW-1, OW-2, and OW-5 well clusters)
- West Mesa wells (OW-3 well cluster)
- Compliance wells (CW-1, CW-2, CW-3, and CW-4 well clusters).
- Monitoring wells MW-14, MW-15, MW-16, MW-18, and MW-25.

The goal of these additional precautions is to prevent any excursion onto areas that were not previously disturbed and minimize the impact of field work. Unlike the B sites access procedures that were developed for use on the floodplain only during the summer SWFL nesting season, the precautions for these upland area C sites will be applied on a year-round

basis. The universal A sites measures that were outlined above will also apply at these locations year round.

- Personnel and vehicles are required to stay within the areas that were previously disturbed. The work areas are delineated where possible using straw "wattles", these barriers are not to be crossed with any vehicle.
- For the less frequent quarterly or semiannual access to wells MW-15, MW-16, MW-18, and MW-25, crews must stay on the clearly defined gravel access roads to each well.
- Use lathe stakes to mark boundaries during construction and well installation, rather than orange plastic fencing. These boundary stakes will be maintained, and if needed a similar marker for both access routes and work area boundaries may be substituted in the future. Any replacement should have limited visual impacts, such as straw wattles to prevent travel off existing designated work areas. Specific areas where these boundary markings are maintained include:
  - Access route on and off H-66 and edges of the East Mesa.
  - Access route from H-66 and a turnaround/work area near OW-3 on the West Mesa.
  - Access route from H-66 and a turnaround/work area near CW-4 in the unnamed wash.
  - Access routes past CW-2 and turnaround area at CW-3.
  - Defined access turn-off from H-66 to CW-1 and MW-14.
- Drive one-way on the CW-2 and CW-3 access track and turn vehicles only at the established turnaround at CW-3.
- Drive in only the active channel area of the wash when accessing CW-4. Follow the previous access path, marked where possible with straw wattles.
- Stay on established roads to access MW-15 and MW-16.



LEGEND

- Well Site
- Surface Water Monitoring Location
- ISPS Wells
- ATV Parking Area
- Truck Parking Area
- Access by pickup truck or ATV
- Access by ATV
- Access by foot/ EATV
- Nesting season (May through September) access by foot or EATV, otherwise by ATV
- Access Routes with Specific Mitigation Measures

FIGURE 1
TOPOCK SAMPLING CREW ACCESS ROUTES 2011

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Path: D:\Projects\Topock\MapFiles\2012\AccessRoutes.mxd Date Saved: 4/25/2012 10:47:40 AM

SOP-A17

Groundwater and Surface Water Mobile Integrated Sample Tracking Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) addresses the procedures and tools to be used for collecting and managing field data as well as managing analytical samples collected in the field associated with the Topock Monitoring Programs. This SOP is a guideline to be used during the collection of surface water and groundwater data. This includes the Groundwater Monitoring Program (GMP), Compliance Monitoring Program (CMP), and River Monitoring Program (RMP) samples.

REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan (SAP).
2) Applicable project work plan or monitoring plan. Refer to the Topock Program Sampling, Analysis, and Field Procedures Manual, and Operation and Maintenance (O&M) Manual, as required.
3) Mobile Integrated Sample Tracking (MIST) Operators Manual
4) PG&E Programs Data Management Plan
5) Topock Quality Assurance Program Plan (QAPP)

FIELD DATABASE PREPARATION & SETUP

This section describes the upfront planning a preparation steps necessary to properly set-up a groundwater or surface water sampling event using the Topock Field Database. This SOP provides the how-to information for properly entering information into the field database.

1) Ensure that you have the latest version of the Topock field database. This actually consists of two database files. The "Front end" that is the interface for information entry and management and the "backend" that stores the field data and sampling information.
2) Set up the "Project Name" in the field database using the established Topock Event nomenclature, year-program-event number. For example, if you are preparing the field database for the 144th GMP sampling event, which will occur in 2008, the event title will be 2008-GMP-144.
3) Sample IDs will be entered into the database using the following convention: well ID--event number. For example, well MW-34-100 sampled during event 2008-GMP-144 would be named MW-34-100-144.
4) Analyses will be entered into the field database in accordance with the most recent SAP and any modifying documents or correspondences. Modifying documents may include the most recent Contract Work Assignment, correspondences from the regulatory agencies and client, and additional direction from project managers.

QUALITY CONTROL PROCEDURES PRIOR TO SAMPLING EVENT

The following steps describe the QC procedures prior to the initiation of sampling activities necessary to ensure all the required samples are collected.

1) Prepare a planned sample table (PST) from the database including all locations and analyses for the sampling event to be performed. An example of the PST is included as an attachment to this SOP.

2) The PST is to be reviewed by the project manager (PM) responsible for the upcoming event and the designated QC manager. If the PM and the QC manager concur with the PST, both will sign the form indicating that the samples listed are complete in accordance with all guidance documents.

3) When the PST is reviewed and accepted, prepare the event paperwork from the field database. This includes sample labels, purge forms and blank chains of custody. In addition, a list of bottles can be generated to be used to order sample bottles from the analytical laboratories. Compare the forms against the approved PST for completeness and accuracy.

USING THE MIST HANDHELD UNIT AND FIELD DATABASE

The Topock monitoring program uses the CH2M HILL proprietary Mobile Integrated Sample Tracking (MIST) system for field data acquisition and analytical sample tracking. This SOP provides an outline of steps for using the system. Details for using the MIST system are provided in the MIST operator's manual.

1. Load the appropriate field database onto the computer that is to be used for sample tracking during the field sampling event. Follow the steps in the users manual to properly prepare the database for upload into the handheld unit (Recon).

2. Load the data for the upcoming sampling event(s) onto the MIST handheld computer. Boot the system and check to ensure that the complete sampling set is included.

3. Upon arrival at a monitoring well or other sample location select the correct sample location ID manually or scan the radio frequency identification (RFID) tag if the location is so equipped. The RFID tag is a black disc approximately the size of a quarter that is attached to the well casing. Upon scanning the RFID tag, the well ID and construction information will appear on the Recon screen. **Confirm that you are at the location you intend to sample. If the well cannot be properly identified via RFID tag and or clear marking, the location is to be identified by measuring the total depth of the well.** Wells sampled on a monthly sampling frequency are indicated by a colored band around the top of the well casing.

4. Purge and sample the location in accordance with the appropriate sampling SOP (see SOPs A-1 through A-4 for sampling procedures). Record the well and purge information in the MIST unit as directed by the MIST Operator's Manual. In addition, record all field data on a hardcopy purge form. The hardcopy forms will serve as backup in case the data on the handheld unit is lost.

5. When the necessary purge volume has been purged, use the MIST unit to confirm that the field parameters are stable in accordance with site SOPs. If the parameters are not stable, continue purge. If stabilization is achieved, collect the analytical samples.

6. The MIST handheld unit will provide a table of samples to be collected at the location. The table will also indicated required preservation and filtration. Confirm that the appropriate bottle, preservative and filtration is used for each analyte. Confirm the collection of the bottle for each analyte by entering the sample time and date. Doing so indicates that the sample has been collected and it will be recorded as such in the database.

7. After the completion of each sample location, run the "Sprite Backup" tool on the Recon unit to ensure that no data is lost in the event of power loss or other unforeseen mishap. Backup the Recon before changing battery units as well.

8. At the end of sampling each day, the data in the handheld unit is to be uploaded to the field database as directed by the MIST Operator's Manual. Once the upload is completed, run the automated COC forms from the field database.

POST SAMPLING QUALITY CONTROL

This section describes the quality control steps required at the end of each sampling day. In addition, proper sample packing and shipment are discussed.

1. After the field data has been collected and uploaded into the field database as described above, COCs forms are to be generated from the field database. Compare the COC forms to the sample bottles collected to confirm all samples are properly recorded in the COC forms.

2. Compare the COC forms to the PST to confirm that all samples were collected. Certain quality control samples may be required to be held by the lab and not analyzed unless there is a data discrepancy. Confirm that these samples are labeled "Hold" in the comments column of the COC form. If there are any deviations from the PST that are intentional record the reasons for the change on the appropriate purge form and daily log. **If there are any sampling inconsistencies that cannot be explained, the location that needs additional or other samples will need to be re-sampled. The Sampling coordinator, Project Chemist and Project Manager should be notified as soon as possible, at a minimum on each day of the sampling event, of any inconsistencies that are identified.**

3. The field database has an additional tool to compare planned samples versus samples that were actually collected. Run the Planned vs. Actual (PvA) at the end of each day to confirm that all samples were collected as planned. If there are any deviations from the PST that are intentional record the reasons for the change on the appropriate purge form and daily log. **If there are any sampling inconsistencies that cannot be explained, the location that needs additional or other samples will need to be re-sampled. The Sampling coordinator, Project Chemist and Project Manager should be notified as soon as possible, at a minimum on each day of the sampling event, of any inconsistencies that are identified.**

4. At the end of each day, forward the purge forms and COCs to the sampling task lead via email or fax. The sampling task lead is responsible for additional review of the purge and sampling information for the following:

    - Appropriate purge and sampling techniques were used.
    - The purge was complete.
    - The purge parameters are in-line with historic purge data.
    - The correct samples were collected from each location.

If there are discrepancies in the purge or sample the location may need to be re-sampled.

SOP-A18

Purging and Sampling of Groundwater Monitoring Wells
Minimal Drawdown Method
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) addresses the procedures and equipment to be used for purging and sampling all groundwater monitoring wells approved for the minimal drawdown sampling approach. This SOP will be used for sampling groundwater monitoring wells using an adjustable rate, positive displacement pump.

REQUIRED DOCUMENTS:

- Event-specific planned sample table (PST).
- Applicable project work plan or monitoring plan. Refer to the Topock Program Sampling, Analysis, and Field Procedures Manual (Procedures Manual).
- Construction/Remedial Action Work Plan (C/RAWP) during the construction phase.
- Operation and Maintenance (O&M) Manual, and Quality Assurance Project Plan (QAPP) (Appendix B of the O&M Manual Volume 2, Sampling and Monitoring Plan) as required during the O&M phase.
- Topock Program Health and Safety Plan (HSP)
- Applicable SOPs may include:
  - SOP-A1, *Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method*
  - SOP-A2, *Purging and Sampling of 1-inch Diameter Groundwater Monitoring Wells, Modified Well-Volume Method*
  - SOP-A3, *Purging and Sampling of Active and Inactive Water Supply Wells*
  - SOP-A4, *Depth-Specific River Water Sampling*
  - SOP-A5, *Groundwater Sampling from Sonic Drilling Boreholes*
  - SOP-A6, *Field Filtration*
  - SOP-A7, *Water Level Measurements*
  - SOP-A8, *Field Water Quality Measurements Using a Flow-through Cell*
  - SOP-A9, *Calibration of Field Instruments*
  - SOP-A10, *Decontamination of Water Sampling Equipment*
  - SOP-A11, *Total Depth Measurements*
  - SOP-A12, *Field Water Quality Measurements for Grab Samples*
  - SOP-A13, *Spill Prevention, Containment, and Control Measures for Monitoring Well Sampling*
  - SOP-A14, *Pore Water Sampling*

  - SOP-A16, *Access Routes*
  - SOP-A19, *Sampling of Groundwater Monitoring Wells, Hydrasleeve No Purge Method*
  - SOP-A23, *Sample Handling and Custody*
  - SOP-C1, *Solinst Pressure Transducers*
- Well construction logs/specifications
- Mobile Integrated Sample Tracking (MIST) handheld database
- Previous sampling logs or tabular historic field data tables
- Current site access map
- Blank sampling logs, maps, sample labels, chains of custody (COC's), and the designated groundwater sampling field notebook

REQUIRED EQUIPMENT:

- 2 or more (i.e. one is backup) WQ instruments with flow through cells, or equivalent.
- Hach 2100P turbidimeter or equivalent.
- 200 foot (or longer as needed) water level indicator (WLI).
- Trimble Rugged Reader hand held instrument for MIST data collection.
- Two, 200 gallon capacity purge tanks.
- Utility vehicles (UTVs) as necessary.
- Honda 2000 watt generator or alternate power source.
- Adjustable-rate, positive-displacement pump
- Sample containers, cooler and ice

PREPARATION & SETUP:

- Review event-specific PST or event-specific field instructions, previous sampling logs, Procedures Manual, O&M Manual, HSP, and groundwater sampling supplies and equipment check list. (NOTE: the PST should also be reviewed for required "non-analytical event activities" such as water level measurements or other data collection that is planned in association with the groundwater sampling event).
- Acquire the existing field logbook for groundwater sampling and initiate entries.
- Inspect all equipment and verify that the field water quality (WQ) meters have been calibrated prior to use according to the manufacturer's instructions and SOP-A9, *Calibration of Field Instruments*.
- Inventory sample bottles, build sample sets for the required analytes at each sample location, ensure a sufficient supply of lab de-ionized water for equipment blanks, and confirm the lab courier schedule.

- Field-check sampling equipment and supplies: water level indicator (WLI), WQ meters, flow-through cell, pump controller, power supply, pump discharge/sampling tubing, N-dex gloves, deionized water sprayers, 5 gallon buckets, paper towels, 0.45 micron in-line filters, etc.

FIELD PROCEDURES:

- **Prior to opening any monitor well, remove all pens, lighters, calculators, or any other loose items from vest pockets, or from any other location where they could fall into the well.**
- Upon arrival at the monitoring well, at least 2 members of the sampling team must confirm the well ID. Wells should be clearly marked on the well monument. If the well cannot be positively identified by the marking, measure total depth of the well and compare to the well installation details to confirm the correct location. Report worn or unclear well markings to the on-site field coordinator.
- Place spill containment according to SOP-A13 *Spill Prevention, Containment, and Control Measures for Monitoring Well Development, Purging, and Sampling.*
- If using a transient pump, collect an "EB", equipment blank, ***prior to pump installation*** if necessary according to the PST.
- Open the protective casing lid and, ***prior to moving it***, note the exact configuration of the transducer installation if present. Measure static WL according to SOP-A7, *Water level Measurements,* moving the transducer if necessary, and record WL value in MIST and on the sampling log.
- If the well is equipped with a transducer and does not have a dedicated pump installed, remove the transducer from the well according to SOP-C1, *Solinst Pressure Transducers*.
- If the well does not have a dedicated pump installed, but does have dedicated sample tubing, attach the dedicated tubing to the appropriate pump and install decontaminated pump at the same intake/sampling depth as used in prior events. There is a marking on the purge tubing which corresponds with the monitor well top of casing (TOC) to facilitate this requirement. Purge and sample the well as described below.
- If the well does not have a dedicated pump ***or*** tubing, or has not been previously sampled, use new low-density polyethylene tubing and install the pump with the intake at approximately the midpoint of the well screen. Purge and sample the well as described below.
- If the well ***does*** have a dedicated pumping system, connect the discharge tubing and purge and sample the well as described below.
- Collect daily equipment blanks and duplicate samples as required by the PST and instructed by the field team leader.

PURGING AND SAMPLING PROCEDURES:

- Install the pump in the well. Slowly lower the pump (with the attached tubing and safety line) into the well to the desired depth. The pump will be set near the middle of the well

screen, if possible. At a minimum, the pump intake will not be positioned lower than 2 feet from the bottom of the well. The depth to the pump intake will be recorded on the Groundwater Sampling Form. If there is less than 3 feet of available water, the groundwater well will be purged and sampled using a bottom-loading bailer.

- Measure the water level in the well after pump insertion. Leave the water level probe in the well to facilitate continued water level monitoring during purging activities.
- Start purging the well at a low flow rate between 0.2 and 0.5 liters per minute. Measure the purge rate using a container of known volume, and record this information on the Groundwater Sampling Form
- The water level should be monitored during purging, and ideally, the purge rate should equal the well recharge rate so there is limited drawdown in the well. (The water level should stabilize for the specific purge rate). The purge rate may be increased above 0.2 and 0.5 liters per minute as long as a constant water level in the well can be maintained, and the target drawdown of no more than 1 foot is being met. There should be at least 1 foot of water over the pump intake. This assures that there is no risk of the pump suction being broken, or of entrainment of air in the sample. Record adjustments in the purge rate and changes in depth to water on the field data sheet. If the target drawdown is not met, purge rates should be decreased to the minimum capabilities of the pump (0.1 to 0.2 liters per minute). If using a pulse style pump, measure the water level at the end of the pressure cycle when the water level has recovered as much as it will, before again filling the pump during the fill cycle. This method will generate consistent drawdown data.
- During purging, the water quality parameters will be measured periodically (every 3 to 5 minutes) until the parameters have stabilized as shown below. If parameter stabilization has not occurred after 4 hours, purging activities will be considered complete.

- pH	+/- 0.1 pH units
- Specific conductance	+/- 3%
- ORP	+/- 10 millivolts
- Turbidity	10% NTU units or less unless other parameters have stabilized during an extended purge and turbidity is trending flat if still over 10 NTU units. The target turbidity goal (but not a hard criterion) is 5 to 10 NTUs.
- Dissolved oxygen	+/- 0.3 mg/L
- Temperature	+/- 2° Celsius

- When the requirements above have been satisfied and the purge cycle is complete, disconnect the flow through cell and prepare to collect samples directly from the pump discharge tubing for analyses according to event-specific PST. Prepare sample containers and collect gas-sensitive analytes first. The preferred collection order will be volatile organic compounds (VOCs), semi-volatile organic compound (SVOCs), metals (including

hexavalent chromium [Cr(VI)] and total chromium [Cr(T)]; see SOP-A6), then general chemistry (cations, anions, stable isotopes).

- For filtered samples, attach a 0.45 micron in-line filter to the pump discharge and allow approximately 500 mL of sample to pass through the filter before beginning sample collection in accordance with SOP-A6 *Field filtration* and the QAPP.
- When sample collection is complete, record sample information, final WL, and purge volume data in MIST and on the field sampling log.
- If transient pump previously installed, remove the pump from the well, detach the dedicated tubing and carefully drain any residual water to the purge water tank. Fold both ends of the purge tubing and secure with wire ties as a further deterrent to leakage. Store the dedicated tubing in a sealed, labeled trash bag. Decontaminate the pump according to SOP-A10, *Decontamination of Water Sampling Equipment.*
- If well was equipped with a transducer, replace the transducer in exactly the same configuration in which it was found and in accordance with SOP-C1, *Solinst Pressure Transducers*.
- Close and secure well protection lid.
- Follow applicable SOPs, the Procedures Manual, and O&M Manual for sample handing and management, equipment decontamination, and investigation-derived waste (IDW) management (O&M Manual Volume 1, Section 6 during O&M or Appendix R of the C/RAWP during construction).

SOP-A19

Sampling of Groundwater Monitoring Wells
HydraSleeve No Purge Method
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) addresses the procedures and equipment to be used for sampling all groundwater monitoring wells approved for the HydraSleeve sampling approach.

REQUIRED DOCUMENTS:

- Event-specific planned sample table (PST).
- Applicable project work plan or monitoring plan. Refer to the Topock Program Sampling, Analysis, and Field Procedures Manual (Procedures Manual).
- Construction/Remedial Action Work Plan (C/RAWP) during the construction phase.
- Operation and Maintenance (O&M) Manual, and QAPP (Appendix B of the O&M Manual Volume 2, Sampling and Monitoring Plan) as required during the O&M phase.
- Topock Program Health and Safety Plan (HSP)
- Applicable SOPs:
  - SOP-A1, *Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method*
  - SOP-A2, *Purging and Sampling of 1-inch Diameter Groundwater Monitoring Wells, Modified Well-Volume Method*
  - SOP-A3, *Purging and Sampling of Active and Inactive Water Supply Wells*
  - SOP-A4, *Depth-Specific River Water Sampling*
  - SOP-A5, *Groundwater Sampling from Sonic Drilling Boreholes*
  - SOP-A6, *Field Filtration*
  - SOP-A7, *Water Level Measurements*
  - SOP-A8, *Field Water Quality Measurements Using a Flow-through Cell*
  - SOP-A9, *Calibration of Field Instruments*
  - SOP-A10, *Decontamination of Water Sampling Equipment*
  - SOP-A11, *Total Depth Measurements*
  - SOP-A12, *Field Water Quality Measurements for Grab Samples*
  - SOP-A13, *Spill Prevention, Containment, and Control Measures for Monitoring Well Sampling*
  - SOP-A14, *Pore Water Sampling*
  - SOP-A16, *Access Routes*

  - SOP-A18, *Purging and Sampling of Groundwater Monitoring Wells, Minimal Drawdown Method*
  - SOP-A23, *Sample Handling and Custody*
  - SOP-C1, *Solinst Pressure Transducers*
- Well construction logs/specifications
- Mobile Integrated Sample Tracking (MIST) handheld database
- Previous sampling logs or tabular historic field data tables
- Current site access map
- Blank sampling logs, maps, sample labels, chains of custody (COCs), and the designated groundwater sampling field notebook

REQUIRED EQUIPMENT:

- 2 or more (i.e. one is backup) YSI-556 WQ instruments, or equivalent.
- Hach 2100P turbidimeter or equivalent.
- 200 foot (or longer as needed) water level indicator (WLI).
- Trimble Rugged Reader hand held instrument for MIST data collection.
- HydraSleeve samplers (from supplier)
- Pointed plastic discharge tube (included with sampler)
- Polypropylene strapping (from supplier)
- Stainless steel weights
- Small cable ties
- String reel
- Utility knife
- Scissors (stainless steel)
- Well caps with small eyelet on bottom allowing a string to be tied off
- Sample containers, cooler and ice

PREPARATION & SETUP:

- Review event-specific PST or event-specific field instructions, previous sampling logs, Procedures Manual, HSP, and groundwater sampling supplies and equipment check list. (NOTE: the PST should also be reviewed for required "non-analytical event activities" such as water level measurements or other data collection that is planned in association with the groundwater sampling event).
- Acquire the existing field logbook for groundwater sampling and initiate entries.

- Inspect all equipment and verify that the field water quality (WQ) meters have been calibrated prior to use according to the manufacturer's instructions and SOP-A9, *Calibration of Field Instruments*.
- Inventory sample bottles, build sample sets for the required analytes at each sample location, ensure a sufficient supply of lab de-ionized water for equipment blanks, and confirm the lab courier schedule.
- Field-check sampling equipment and supplies: water level indicator (WLI), WQ meters, HydraSleeve supplies, N-dex gloves, D.I water sprayers, 5 gallon buckets, paper towels, 0.45 micron in-line filters, etc.
- Evaluate the required sample volume and well construction to select the appropriate size (2-inch or 4-inch diameter) and number of Hydrasleeve samplers for each well.

FIELD PROCEDURES:

- **Prior to opening any monitor well, remove all pens, lighters, calculators, or any other loose items from vest pockets, or from any other location where they could fall into the well.**
- Upon arrival at the monitoring well, at least 2 members of the sampling team must confirm the well ID. Wells should be clearly marked on the well monument. If the well cannot be positively identified by the marking, measure total depth of the well and compare to the well installation details to confirm the correct location. Report worn or unclear well markings to the on-site field coordinator.
- Place spill containment according to SOP-A13 *Spill Prevention, Containment, and Control Measures for Monitoring Well Development, Purging, and Sampling.*
- Open the protective casing lid and, ***prior to moving it***, note the exact configuration of the transducer installation if present. Measure static WL according to SOP-A7, *Water level Measurements,* moving the transducer if necessary, and record WL value in MIST and on the sampling log.
- If the well is equipped with a transducer and does not have a dedicated pump installed, remove the transducer from the well according to SOP-C1, *Solinst Pressure Transducers*.

PURGING AND SAMPLING PROCEDURES:

HydraSleeve Deployment

1. Remove HydraSleeve sampler from package and pinch the top to create an opening. See Attachment 1 for a representation of an unfilled HydraSleeve sampler.
2. Use a HydraSleeve Spring Clip to fasten the pre-looped string to the top of the HydraSleeve sampler. Fold the two holes at the bottom of the HydraSleeve together and attach a weight using a HydraSleeve Stainless Steel weight clip. Attach the weight clip to the pre-measured string.
3. If using two HydraSleeve samplers, follow steps 1 and 2 above for placing the second sampler below the first on the pre-measured string.

4. Lower the sampler into the well until the pre-marked hanging location is level with the ground surface.
5. Following placement in the well, fasten the end of the string to the locking tab on the well casing, secure with a cable tie and the well lock.
6. Place cap back onto well.
7. Secure monitoring well and area prior to demobilization.

HydraSleeve Sample Recovery

Once a sufficient period of time has elapsed so that re-equilibration of the water within the well with surrounding groundwater conditions has occurred (typically a minimum of 48 hours), the HydraSleeve samplers can be recovered and samples collected for analysis.

For standard HydraSleeve sampler recovery, the following procedures will be performed at each well:

1. Measure the depth to water to the nearest 0.01 foot.
2. Remove all securing cable ties and remove the sampler from the well. The best method is to pull the HydraSleeve sampler upward continuously from its starting point, at a rate of one to two feet per second or faster, until the sampler is full, which is a vertical distance of 36 to 72 inches for a 36-inch long sampler.
3. The condition of the sampler should be recorded in the field sampling sheets, including the presence of any headspace within the sampler.

HydraSleeve Sample Collection

Samples for chemical analysis will be collected from the HydraSleeve samplers immediately following removal from the well. The following sampling procedures will be used at each well:

1. Identification labels for sample bottles will be filled out for each sample.
2. Hang the filled HydraSleeve from the hanger device after removal from the well.
3. Squeeze the full sampler just below its top to expel water resting above the flexible check valve.
4. Push the pointed discharge tube perpendicularly through the outer polyethylene sleeve approximately three to four inches above the bottom of the HydraSleeve.
5. Transfer the sample from both HydraSleeve samplers into a 2.5 liter compositing container. Pinching the sample sleeve just above the discharge tube will control the flow of the sample. The sample sleeve can also be squeezed, forcing fluid up through the discharge tube, similar to squeezing a tube of toothpaste.
    - The preferred collection order will be volatile organic compounds (VOCs), semi-volatile organic compound (SVOCs), metals (including hexavalent chromium [Cr(VI)] and total chromium [Cr(T)]; see SOP-A6), then general chemistry (cations, anions, stable isotopes).

- For filtered samples, transfer the sample out of the compositing container using a peristaltic pump through a 0.45 micron in-line and allow approximately 250 mL of sample to pass through the filter beginning sample collection. The limited volume in the HydraSleeve sampler requires that less sample be run through the filter than is dictated in SOP-A6 *Field filtration* and the QAPP.

6. If sample volume allows, transfer water into a container to obtain field parameter readings with a YSI-556 WQ or equivalent instrument (note in the field forms the results are approximate because a flow-through cell could not be used). Field parameter readings are to be recorded on the groundwater sample form.
7. Excess sampler water will be emptied into the purged waste water tank.
8. Samples will be preserved and managed as detailed in the QAPP. Time of sampling will be recorded in the field logbook, field sample sheets, sample labels, MIST and chains of custody.
9. After the samples have been collected, immediately place the sample bottles in an ice-filled cooler. Before decontamination of field equipment, the well cap will be replaced and locked.
10. If redeployment of a new HydraSleeve sampler is not intended, sampling equipment, except for string, stainless steel weight and rubber stopper, will be discarded as with other PPE trash, and the blank string with weight will be Stored for later use. However, if deployment of a new sampler is required, the new sampler will be reattached to the existing string and stainless steel weight. The sampler can then be deployed in the well for the next sampling event.
11. If well was equipped with a transducer, replace the transducer in exactly the same configuration in which it was found and in accordance with SOP-C1, *Solinst Pressure Transducers*.
12. Prior to leaving the site, field documentation, including the chain-of-custody form, will be completed.
13. Secure monitoring well and area prior to demobilization.
14. Follow applicable SOPs, the Procedures Manual, and O&M Manual for sample handing and management, equipment decontamination, and investigation-derived waste (IDW) management (O&M Manual Volume 1, Section 6 during O&M or Appendix R of the C/RAWP during construction).

Attachment 1
Representation of HydraSleeve Sampler



SOP-A23

Sample Handling and Custody
Standard Operating Procedures for PG&E Topock Program

PURPOSE

The purpose of this standard operating procedure (SOP) is to delineate protocols for sample handling and custody for the PG&E Topock Program environmental monitoring activities associated with the Topock Compressor Station (TCS) in Needles, California. An example chain-of-custody (CoC) form and sample custody seals are provided as part of this procedure (see Attachment 1). Other formats with essentially identical information are acceptable.

SCOPE

This procedure applies to all PG&E personnel, contractors, and subcontractors engaged in collecting environmental samples related to the Topock investigation and remedial activities.

GENERAL

An essential part of the sampling activities of any environmental project is assuring the integrity of the sample from collection through data reporting. This SOP will address all sample custody issues up through sample relinquishment to the courier to deliver samples to the laboratory final destination. Sample labels, CoC forms and custody seals are used to document identification and handling/control (custody) of samples from the time of collection through the completion of chemical analysis. Accountability of the history of a sample must be available to demonstrate that the data are a true representation of the environment. The CoC record is used as evidence to demonstrate that a sample was not tampered with or altered in any way that might bias the analytical accuracy of the laboratory results since the time of its collection. It is extremely important that chain-of-custody records be complete, accurate, and consistent. In some projects, including this one, sample custody records and analytical data may be used in litigation. In all cases of custody, the accuracy and completeness of records is critical for evidentiary use whether as part of the normal data validation procedure or in a litigious project environment. All sampling activities for the Topock environmental program must adhere to the procedures in this SOP in order to ensure complete, accurate, and consistent project data.

DEFINITIONS

1. Custody: A sample is under custody if it is in physical possession or under control so as to prevent tampering or alteration of its characteristics. A sample is considered to be in an individual's custody if it is (1) in the physical possession of the responsible party, (2) in view of the responsible party after being in their possession, or (3) placed by the responsible party in a designated, secure area that is controlled with restricted access.

2. Sample Label: A record attached to samples to ensure legal documentation of traceability. Attachment 1 includes an example of the sample labels that are used.

3. Chain-of-Custody Record: Legal documentation of custody of sample materials and instructions for the analytical laboratory. Attachment 1 includes an example of a CoC form.

RESPONSIBILITIES

Project Manager

The *Project Manager* (PM) shall ensure that staff conducting these procedures are properly trained. Prior to the sampling event, the PM shall review and approve the planned sample table (PST). In addition, sampling staff must consult the PM if any complications arise with following these critical sample handling and custody procedures.

Project Chemist

The *Project Chemist* shall review and approve the PST. In addition the chemist shall be consulted in the event any questions surface concerning sample handling and custody procedures.

Field Team Leader/Sampling Coordinator

The *Field Team Leader/ Sampling Coordinator* (FTL/SC) shall assure that the systems are maintained to create CoC forms from the sample-tracking database. In addition, the FTL/SC is responsible for production of CoC forms and sample labels for the field crews. The FTL/SC shall also take responsibility for or delegate the packing of the sample shipping coolers, ensure that the CoC forms are correct, and ship the samples (or transfer to laboratory sample pickup) as described in this SOP. The FTL/SC shall determine or seek guidance as to which samples are potentially hazardous and the appropriate shipping method, if needed.

Sample Collector

The *Sample Collector* shall ensure that the samples are correctly collected (following the appropriate SOP), labeled, and stored until the FTL/SC takes custody of the samples for shipping to the laboratory. The Sample Collector shall maintain custody of the samples until said time that the FTL/SC takes custody. The Sample Collector shall be responsible for informing the FTL/SC of sampling conditions and recording sampling conditions on the groundwater sampling log. (Note: The FTL/SC, Sample Collector, and Sample Shipper may be the same person.)

Sample Custodian

The *Sample Custodian* is any individual who is responsible for the custody of samples and completion of associated documentation and may include the FTL/SC, Sample Collector, or on large events, a separate Sample Shipper.

PROCEDURE

Sample Custody

Sample custody procedures are designed to ensure that sample integrity is maintained from collection to the final receipt of the analytical report. A critical aspect of sound sample collection and analysis protocols is the maintenance of strict CoC procedures, as described in this SOP. CoC procedures include tracking and documentation during sample collection and shipment.

As noted above, a sample is considered to be in an individual's custody if it is (1) in the physical possession of the responsible party, (2) in view of the responsible party after being in their possession, or (3) placed by the responsible party in a designated, secure area that is controlled with restricted access.

Custody will be documented throughout all sampling activities by the electronic sample-tracking database or on the official CoC record for each day of sampling. The electronic data will be used to generate the official CoC if an electronic sample-tracking database program is used. In either case the official CoC will accompany the samples from the site to the laboratory. The sampling team member who relinquishes the samples to the courier or laboratory personnel is required to sign, date, and note on the CoC the time when relinquishing samples from his or her immediate custody. Once signed by the FTL/SC/Sample Collector and the laboratory courier, a copy of the CoC will be made and kept with the other sampling related paperwork. Any discrepancies in the custody procedure noted and corrected must be communicated to the PM and project chemist immediately to determine possible corrective action(s).

Samples will be shipped to subcontractor laboratories via laboratory courier. In some cases, samples may be hand-delivered to the laboratory; hand delivery will be noted on the CoC form. In the event the laboratory is not within driving distance, an overnight air courier will be used. Bills of lading will be used in addition to other custody documentation during this time and will be retained as part of the permanent sample custody documentation. The subcontractor laboratory is responsible for sample custody once samples are relinquished to their custody and at that point laboratory SOPs for custody must be followed. Final completed CoCs from the field and shipping efforts as well as internal laboratory custody records will be provided with the final laboratory data submission.

Sample Labels

A sample label must be attached to all sample containers prior to collecting the sample. (**Note**: Do not attach new labels to pre-weighed soil volatile organic compound or gasoline range organic vials; use the labels attached by the laboratory. Additional labels may be affixed to the recloseable plastic bag if needed). The label may be generated along with the CoC form using a sample-tracking database (use waterproof labels), or may be hand-generated using a blank sample label purchased or provided by the laboratory with the sample bottles. For certain types of samples (for example, Summa™ soil gas canisters), blank labels are provided by the laboratory when the lab provides sample containers. All sample labels generated will contain the following information in indelible ink:

- Unique Sample ID
- Analyses requested
- Preservative used
- Date and time of sample collection
- Sampler's initials

Once the sample has been collected and the sample labeling is complete, the Sample Collector will place the samples in recloseable plastic bags and place in a cooler on ice. Labeling for other types of containers (such as soil gas and air samples) will follow the same labeling procedure except that the labels are attached to the sample containers (summa canisters, filters or tubes) via a sample tag attached to the container by the laboratory.

Chain-of-Custody Record

CoC forms are legal documents that record the custody of the sample from collection through reporting. If the sampling event is using an electronic sample-tracking database, the CoC will be

generated at the end of the day; if not, CoC form(s) will be filled out for each sample at each sampling location to maintain a record of sample collection, shipment of samples, and receipt of samples by the laboratory.

The FTL/SC or Sample Collector will generate the CoC form. Information entered on the CoC includes:

- Project name and project number or task order
- PG&E/contractor address and contact information
- Name and address of laboratory to receive the samples
- Unique sample ID
- Matrix type
- Analyses requested
- Field quality control (QC) for matrix spike and matrix spike duplicate (MS/MSD) samples, if applicable
- Container type, size and number
- Preservatives used
- Turn-around-time for laboratory analysis
- Comments to Laboratory, if applicable
- Date of collection
- Time of collection (24-hour format)

The FTL/SC or Sample Collector shall verify that the CoC record is complete, accurate in all aspects, and consistent with all other sample documentation (for example, number of samples, sample labels, purge forms, field logs). The FTL/SC or Sample Collector will sign the "Relinquished By" fields on the CoC record, marking the date and time custody is transferred to the laboratory courier or other common carrier service (e.g., FedEx, UPS, U.S. Postal Service, Golden State).

If using a common carrier service, the Sample Shipper will perform the following duties:

- Obtain any required signatures from sampling team.
- Record the carrier service and airbill number on the CoC.
- Sign and enter the date and time relinquished to the common carrier service or courier.

Corrections: If there are any corrections to the CoC form needed, corrections will be made by a single-line strike mark through the incorrect item, and then entering the correct entry adjacent to the strikeout item. Corrections will be initialed and dated by the person making the change. After the form has been inspected and determined to be satisfactorily complete, the Sample Shipper will sign, date, and note the time of transfer and will reference a shipper tracking number on the form (if applicable). If the samples are being shipped by common carrier service, the CoC form will be placed in a recloseable plastic bag and placed inside the cooler after the

sample packer has detached or made an appropriate copy of the form. Field copies of the completed CoC forms are maintained in project files by on site personnel.

Overnight Sample Storage

In some cases, samples cannot be shipped immediately to a laboratory and must be temporarily stored in a secured onsite facility. There are two locations where secured refrigeration is available onsite.

The IM-3 field lab has limited space for samples in its refrigerator and can be used to temporarily store samples associated with the IM-3 operations. The facility is manned 24 hours a day 7 days a week and has restricted access.

The Topock field office trailer has a refrigerator that is dedicated to short-term sample storage, as well as two freezers that can be used for samples that require freezing. The field trailer is locked during non-business hours and the refrigerator is locked when staff are not present.

The samples placed in the refrigerators cannot be in coolers, but should be stored in recloseable plastic bags, grouped by sample location and laboratory. The refrigerators must be maintained at a temperature between 2° and 6°C.

Custody Seals

For normal shipping (samples sent via laboratory courier) no custody seals are required. For shipping via common carrier service, the shipping cooler must have two custody seals: one on the front and one on the side of the cooler, signed, dated, and marked with the time the cooler was sealed (the signed CoC should be in a recloseable plastic bag, taped to the inside of the cooler's lid). In addition, each custody seal will be covered with transparent packing tape.

RECORDS

The FTL is responsible for the distribution of the CoC record:

- Original: Sealed in plastic bag and taped inside the top of the shipping container (if shipped via common carrier service) or handed to the laboratory representative.
- Copies to Project Chemist and PM or Task Manager

Attachment 1
Sample Chain-of-Custody Form and Sample Custody Seal

CH2MHILL

CHAIN OF CUSTODY RECORD

Project Name PG&E Topock
Location Topock
Project Manager
QC Manager
Project Number
Project
Turnaround Time 10 Days
Shipping Date:

				Container:	8oz soil jar	8oz soil jar	8oz soil jar	8oz soil jar	3-40ml vials	8oz soil jar	8oz soil jar	8oz soil jar		
				Preservatives:	4°C	4°C	4°C	4°C	1-MEOH 2-DI H2O <0°C	4°C	4°C	4°C		
				Filtered:	NA	NA	NA	NA	NA	NA	NA	NA		
				Holding Time:	14	14	14	14	14	14	14	14		
	DATE	TIME	Matrix		Hexavalent Chromium (SW7199/3060A)	Title 22 Metals (SW6010B/SW7471A)	PH (SW9045)	Dioxins/Furans (SW8290)	TPH-Purgable (SW8015B)	TPH-Extractable (SW8015B)	SVOC (8270C)	PAHs (SW8270Sim)		Number of Containers	COMMENTS

Signatures	Date/Time
Approved by	
Sampled by	
Relinquished by	
Received by	
Relinquished by	
Received by	

Shipping Details

Method of Shipment: Lab Courier
On Ice: yes / no
Airbill No:
Lab Name: ADVANCED TECHNOLOGY LABORATO
Lab Phone: (702) 307-2659

ATTN:

Sample Custody
and
Marlon

Special Instructions:

Report Copy to

Shawn Duffy
530-229-3303
sduffy@ch2m.com

CH2MHILL CUSTODY SEAL

Date

Signature

CH2MHILL CUSTODY SEAL

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SOP-B3

Borehole Sampling and Logging of Soil Borings
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) provides guidance for sample collection from soil borings during the drilling process, and proper documentation necessary. Detailed guidance for sample collection, preservation and handling is provided in Section 4.0 of the site Quality Assurance Project Plan (QAPP) and in the Topock Program *Sampling, Analysis, and Field Procedures Manual* (Procedures Manual). SOP-B2 provides detailed guidance for soil characterization and logging.

REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan (SAP), work plan or event-specific field instructions. Planned borehole depth, proposed well construction/specifications, and field sampling summary table, if available.

2) Applicable project work plan or monitoring plan. Refer to the Procedures Manual and QAPP, as required.

3) Topock Program Health and Safety Plan (HSP).

4) Previous sampling, drilling, or well construction logs from other boreholes or wells in the vicinity, if available.

5) Blank sampling log and field notebook.

PREPARATION AND SETUP

1) Review event-specific work plan or event-specific field instructions, previous sampling logs, Procedures Manual, and HSP.

2) Initiate field logbook for sampling activity.

3) Review sampling procedures and equipment, and planned sample depths with drilling contractor and field crew.

Equipment List

- Field logbook
- Borehole log
- Blue or black waterproof or permanent ink pens
- Trash bags
- Plastic sandwich bags
- Paper towels

- Stainless steel sampling equipment (provided by driller)
- Decontamination equipment (Alconox® solution in spray bottle, brushes, buckets, rinse water spray bottle)
- Soil sample containers appropriate for sample analysis and preservation as called for in SAP and QAPP (glass jars, brass sleeves, Encore® containers, sandwich bags, etc.)
- Soil sampling equipment not provided by driller (spatula or putty knife, stainless steel compositing bowl, hand auger, etc.)
- Groundwater sample containers appropriate for sample analysis and preservation as called for in SAP and QAPP (glass jars, VOA vials, plastic jars, etc.)
- Groundwater sample equipment not provided by driller (pump, filters, tubing, power supply, etc.)
- Water quality meters
- Water level indicator
- Distilled water
- Coolers with ice
- Protective waterproof gloves (nitrile or latex)

GUIDELINES

Soil Boring Logs Documentation

Soil boring logs will be completed on the soil boring log forms during the drilling activities at the time of the logging and soil descriptions. Information collected will be consistent with the standard CH2M HILL form (See SOP-B2 attachment A). Sample data may also be documented in the comments section of the boring log.

Items documented on the borehole log include:

1) **Sample Interval:** The top and bottom depth of each sample run should be recorded on the borelog. Sampling includes samples collected for analysis as well as core retrieved for logging purposes.

2) **Sample Type and Number:** Enter the sample type and number consistent with the sampling and analysis plan at the correct depth intervals. An "x" should be placed across the vertical interval where the environmental soil, grab groundwater, or geotechnical sample was collected.

3) **Sample Recovery:** Enter the length of retrieved core to the nearest 0.1 foot of sample recovered, and record the value in feet. Do not count slough or caved material as part of the total recovered length of core. Record total length and percent of sample recovered. If using a 5-foot sample barrel, multiply the total length by 2 and 100 to get a percentage number. Similarly, if using a 2.5-foot sampler, multiply by 4 and 100 to get the percent recovery.

4) **Sampling:** Sampling difficulties shall be noted. Disturbed samples shall be noted on the log as well as the sample recovery. The top of the sample shall be marked on the container.

5) **Water Levels:** Water-level measurements, where groundwater is encountered, are required for each boring. Changes in soil moisture shall be noted and, if there is no water encountered, a note to that effect shall be included on the borehole log. The date and time of water-level measurements shall be documented.

At a minimum, sample identifiers (IDs) should be noted on boring logs at the depth collected. When time and space allows, a summary of analytical sample information can be included. When inclusion of these data prevents documentation of drilling information, sample data should be omitted in order to document drilling.

Borehole Sampling by Drilling—General Procedure

Split-spoon sampling procedures shall be executed in accordance with American Society for Testing and Materials (ASTM) D1586, "Standard Method for Penetration Test and Split-barrel Sampling of Soils" (ASTM 1984). California (2-inch) or Modified California (2.5-inch) split-barrel samplers may also be used.

1) The split-spoon or split-barrel sampler shall be advanced to the top of the sampling interval using a wire-line or sample rods such as A or AW. The larger-diameter samplers may be fitted with three 6-inch-long stainless-steel sleeves. The sampler shall be driven 18 inches or to refusal, with a 140-pound hammer dropping repeatedly 30 inches. Refusal shall be defined as requiring 50 blows with the hammer to advance the sampler less than 6 inches.

2) The number of blows required to drive the sampler each 6 inches shall be recorded on the borelog.

3) As the sample tubes are disassembled, an organic vapor monitor probe shall be inserted into the gap between two sample liners, and the liner exhibiting the highest reading shall be selected for analysis.

4) In general, the middle liner is collected for laboratory analysis, and 10 percent of the bottom liners are collected for quality assurance testing. A sample of the soil in the top liner typically is placed in a re-sealable plastic bag or 8-ounce clear glass jar and left in the sun for approximately 15 minutes to allow any volatile organic compounds (VOC) to volatilize.

5) After the 15 minute volatilization period, the soil vapor in the plastic bag is then measured for VOCs by taking a reading of the headspace. Background VOCs for the bag are determined by monitoring the air in an empty bag.

6) Results of the organic vapor monitoring are recorded on the boring log.

7) Small portions of soil at the ends of the sleeve are scraped off for classification.

Borehole Sampling by Drilling—Split Spoon Sampling

1) Samples collected for laboratory analysis using split spoon sampling device will be separated and transferred from the split-spoon halves into sample jars by clean stainless-steel utensils.

2) Samples for VOCs will be separated and collected first, followed by semivolatile organic compounds samples.

3) For VOC samples, avoid mixing the soil before sampling and sample directly from the split spoon. See SOPs for guidance on homogenizing soil samples and for VOC sampling using EnCore samplers, respectively.

Borehole Sampling by Drilling—Direct-push Sampling

1) Samples collected for laboratory analysis using a direct-push sampling drill rig will be handled by either opening the tube and placing the soil in sample jars or cutting the acetate tube and submitting it the laboratory directly.

2) For samples that will be removed from the acetate tube, the tube will be cut open longitudinally using a double-bladed razor knife.

   - Soil will be inspected and logged prior to removal of soil samples.
   - A short section of soil will be removed from the acetate sleeve using a stainless-steel utensil, homogenized in a clean stainless-steel bowl, and placed in sample jars.
   - Soil collected for VOC analysis will be sampled directly from the split acetate sleeve using EnCore samplers.

3) Alternatively, a short (6-inch) length of liner will be cut from the acetate sleeve and collected directly for laboratory analysis.

   - The section of acetate liner will be removed, capped with Teflon sheeting and plastic end caps at both ends, and taped with clear label or packing tape.
   - Labels shall be affixed to the liners with job designation, time, boring number, sample depth interval, sample number, date sampled, and the initials of the sampler clearly marked.
   - The samples shall then be enclosed in a plastic bag and stored in a cooler maintained at 4˚C.
   - Sample information shall be placed on the chain-of-custody, the borelog, and the field logbook. All samples shall be handled in accordance with *Chain of Custody Procedures*.

Borehole Sampling by Drilling—Split-barrel Sampling

Soil samples can also be collected using a 3-foot-long or 5-foot-long split-barrel sampler. The split-barrel sampler is similar to the split-spoon sampler that is used to hold steel or brass sampling sleeves, but the split-barrel sampler typically is not used to hold sample sleeves.

1) The sampler is lowered to the base of the drill bit and is advanced slightly ahead of the drill bit and augers (or conductor casing). The weight of the drill string and sample barrel along with the drilling and cutting action of the drill bit advances the face of the split-barrel sampler into the formation.

2) Once the desired depth interval is reached, the split-barrel sampler is retrieved using a cable or tool steel sections.

3) The retrieved sampler is unscrewed, and one or both halves are laid on the sample table. The soil typically will form a continuous column of soil in one of the split-barrel halves.

4) The soil column is split longitudinally for soil descriptions using a putty knife or spatula.

5) Samples for VOC analysis are collected immediately directly from the soil column.

6) Other soil samples are collected after the core section has been described and logged. The soil is described following the procedures in the following sections.

Groundwater Sampling

1) Groundwater samples can be collected by hydropunch by bailer or by pumping from an isolated zone. Collection of groundwater by bailing is not an accurate method of collection depth discrete groundwater samples, as the zone sampled is poorly isolated.

2) Hydropunch samples are collected below the bit of the drill stem, in relatively undisturbed soil zone. This method of sample collection may be difficult in fine-textured soils and in very rocky soils. To collect these samples, a point is driven below the depth of the drill bit, then a screen zone is opened within this point and water allowed to flow in. The hydropunch tool must be decontaminated between samples.

Groundwater can also be collected from the open or cased borehole with a bailer. A disposable or decontaminated stainless-steel bailer is lowered into the boring, and water is collected. This method is preferable for collection of groundwater from the water table. Attempts can be made to collect discrete groundwater samples beneath the water table; however, the boring must be cased with watertight, stainless-steel pipe, and the boring must be evacuated prior to collection of samples.

Alternatively, discrete groundwater samples can be collected by isolating a zone with casing and packers. To collect these samples, the borehole is first advanced to the depth at which a sample is required. Then casing is advanced to within 20 feet of the sample zone. Next, a pump and packers are lowered into the hole. The zone from which samples are to be collected is isolated with a packer, and water is pumped directly from the target zone.

Sample Handling

Sample preservation and sampling procedures are detailed in Section 4.0 of the QAPP. Additional information is provided in the Procedures Manual and in the appropriate SAP.

KEY CHECKS AND ITEMS

- Check entries to the soil boring log and field logbook in the field during sampling activities because the samples will be disposed at the end of the fieldwork, confirmation and corrections cannot be made later.

- Check that the sample numbers and intervals are properly specified.
- Ensure that drilling equipment is decontaminated prior to the beginning of work and between each borehole.
- All materials generated during sampling (debris, PPE, decontamination liquids, etc.) will be placed in 55-gallon drums or roll-off bins for storage pending analysis and disposal off site, as outlined in SOP 39, Standard of Practice H-83, and Appendix D of the project *Soil and Groundwater Management Plan*.

ATTACHMENT A

Examples of Soil Bore Logs

CH2MHILL

PROJECT NUMBER	BORING NUMBER SHEET OF

SOIL BORING LOG

PROJECT _____ LOCATION _____

ELEVATION _____ DRILLING CONTRACTOR _____

DRILLING METHOD AND EQUIPMENT _____

WATER LEVELS _____ START _____ FINISH _____ LOGGER _____

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION

SHEET 1 of 9	**PROJECT NUMBER:** 326128.01.16.EN	**BORING NUMBER:** *MW-47*

SOIL BORING LOG - DRAFT FOR DISCUSSION

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 288.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,450.05	**EASTING (CCS NAD 27 Z 5):** 7,615,629.49	**DATE STARTED:** 02/27/2006	**DATE COMPLETED:** 03/13/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** B. Moayyad, K. Ebel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	USCS CODE	SOIL DESCRIPTION SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
5			6	SP	**POORLY GRADED SAND (SP)** - very lt brn (10YR7/3), =2% fines, 98% f to m lithic quartz sand, subang to subrnd, dry - fine roots, iron staining, some iron oxide coating on grains	Hand augured to 5' bgs
10			10	SP	- slightly moist - dry	Rapid drill rate, no chatter
15						
20			16	SW	**WELL GRADED SAND w/ GRAVEL (SW)** - lt yellowish brn (10YR6/4), 45% gravel up to 7cm, 50% f to m sand, 5% fines, loose, met subang gravel, dry(moist@ 17') - cobble present in slough - one subrnd chert gravel - Possible Fluvially Reworked Alluvium - lt grey (10YR7/2), subang to rnd met gravel up to 9cm, 2% to 5% fines - dk yellowish brn (10YR4/4), mostly c sand subang to ang, met, some Miocene conglomerate gravel	
25				SW	- 65% sand, 30% gravel up to 4cm, 5% fines	
30				SW	**WELL GRADED SAND w/ GRAVEL (SW)** - dk yellowish brn (10YR3/6), 35% gravel up to 4cm, 55% m to c sand, 10% silty fines, met clasts are grain supported some mm siltstone - some oxide staining	
35				SW	**WELL GRADED SAND w/ GRAVEL AND CLAY (SW)** - dk yellowish brn (10YR3/6), 30% subang met gravel up to 7 cm, 55% subrnd to subang m to c sand, 15% clayey fines, m density, moist	Drill rate slowed to clean out 8" pipe

CH2MHILL

PROJECT NUMBER: 326128.01.16.EN

BORING NUMBER: *MW-47*

SOIL BORING LOG - DRAFT FOR DISCUSSION

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 288.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,450.05	**EASTING (CCS NAD 27 Z 5):** 7,615,629.49	**DATE STARTED:** 02/27/2006	**DATE COMPLETED:** 03/13/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** B. Moayyad, K. Ebel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	USCS CODE	SOIL DESCRIPTION SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
			2.5	SW	**WELL GRADED SAND w/ GRAVEL (SW)** - dr yellowish brn (10YR3/6), 30% gravel, 60% sand, 10% silty fines	Drilling smooth but preceeds less rapidly
40			10	SW	**WELL GRADED SAND w/ GRAVEL (SW)** - 40% subang met gravel up to 6cm, 55% subrnd to ang sand, 5% fines - more gravel below 38' - gravel is mostly fine	
45						
50			10	SW	**WELL GRADED SAND w/ GRAVEL (SW)** - Pale brn (10YR6/3), 30% subang met gravel up to 5cm, 60% subrnd to subang m to c met sand, 10% silty fines, wet	Soil sample collected
				SP	**POORLY GRADED SAND w/ GRAVEL (SP)** - pale brn (10TR6/3), 30% f subang gravel up to 2 cm, 65% mostly c sand, =2% fines	
55				SW	**WELL GRADED SAND w/ GRAVEL (SW)** - yellowish brn (10YR5/4), 40% subang met gravel up to 9cm, 55% f to c met sand, 5% silty fines, clast supported, m density, wet	
60			9.5	GW	**WELL GRADED GRAVEL w/ SILT AND SAND (GW)** - brn (7.5YR5/4), 55% subang to ang met gravel up to 4cm, 25% f to c sand, 20% silty fines, dense, moist to dry - soil dries out	Collected Isoflow sample
65					- lt grey (10YR7/2) and powder dry - moist sandy zone, 55% gravel, 35% sand, 10% fines - dry silty lt grey GW below 65'	Drill rate slows to 2' / min
70				SW	**WELL GRADED SAND w/ GRAVEL (SW)** - yellowish brn (10YR5/4), 35% subang met gravel up to 4cm, 60% subrnd sand, 5% silty fines, loose, moist to wet	Moderate Drill Rate

CH2MHILL

PROJECT NUMBER: 326128.01.16.EN

BORING NUMBER: *MW-47*

SOIL BORING LOG - DRAFT FOR DISCUSSION

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 288.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,450.05	**EASTING (CCS NAD 27 Z 5):** 7,615,629.49	**DATE STARTED:** 02/27/2006	**DATE COMPLETED:** 03/13/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** B. Moayyad, K. Ebel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	USCS CODE	SOIL DESCRIPTION SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
			6	SP	**POORLY GRADED SAND w/ SILT (SP)** - brn (7.5YR4/4), 5% subrnd to subang met gravel up to 4cm, 85% f to c sand, 10% fines, poorly graded, wet, no odor	
145			3	SM	**SILTY SAND W/ GRAVEL (SM)** - brn (7.5YR4/4), 20% subang to subrnd gravel up to 6cm, 60% f to c sand, 20% silty fines, well graded, m consolidated, met, wet, no odor	
150			5	SM	**SILTY SAND w/ GRAVEL (SM)** - dk yellowish brn (10YR4/4), 25% subang to subrnd up to 4cm met gravel, 60% well graded f to c sand, 15% fines, wet, no odor	
155			4	SW	**WELL GRADED SAND w/ SILT AND SAND (SW)** - dr yellowish brn (10YR4/4), 10% subang to subrnd up to 3cm met gravel, 75%well graded f to c sand, 15% fines, moist to wet	
			2	SW	**SILTY SAND (SM)** - brn (7.5YR4/4), 5% ang to subrnd met gravel up to 1.5cm increasing with depth, 85% poorly graded m to c sand, 10% fines, loose, wet	
			2	SM	**SILTY SAND w/ GRAVEL (SM)** - dk yellowish brn (10YR4/4), 15% subang to subrnd up to 2.5cm met gravel, 75% well graded f to c sand, 10% fines, mostly met, trace chert, loose, wet, no odor	Collected Isoflow sample
160			4	SM	**SILTY SAND W/ GRAVEL (SM)** - brn (7.5YR4/4), 25% subang to subrnd gravel up to 6.5cm, 60% m to c sand, 15% silty fines, well graded, m consolidated, met, wet, no odor	Drill rate = 0.75' to 1.5' / min
165			4	SW	**SILTY SAND (SW)** - mottled dk reddish brn (5YR3/4), 10% subang to subrnd gravel up to 2.5cm, 50% well graded f to m sand, 40% silt, metamorphic, dry to damp, no odor, interbedded sandy silt laminations	
170			5.5	SW	**SAND w/ GRAVEL (SW)** - dk reddish brn (5YR3/4), 20% subang to subrnd gravel up to 5cm, 75% f to c sand, 5% fines, well graded, loose, met, wet	
175			2.5	SM	**SILTY SAND w/ GRAVEL (SM)** - brn (7.5YR4/4), 15% subang to subrnd gravel, 70% f to m sand, 15% fines, poorly graded, met,increasingly consolidated, slightly to moderately calcareous, moist to wet	

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-47*

SOIL BORING LOG - DRAFT FOR DISCUSSION

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 288.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,450.05	**EASTING (CCS NAD 27 Z 5):** 7,615,629.49	**DATE STARTED:** 02/27/2006	**DATE COMPLETED:** 03/13/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** B. Moayyad, K. Ebel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	USCS CODE	SOIL DESCRIPTION SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
285			0	BR	**MIOCENE CONGLOMERATE BEDROCK (BR)** - 60% well graded subang to rnd gravel up to 10cm, 30% well graded sand, 10% fines, very calcareous, well consolidated to mostly hard, mod to very altered locally, mostly met, dry to moist	
					Boring Terminated at 288 ft	

ABBREVIATIONS

cc = continuous core run
brn = brown
lt = light
dk = dark
vf = very fine-grained
f = fine-grained
m = medium-grained
c = coarse-grained
vc = very coarse-grained
ang = angular
subang = subangular
subrnd = subrounded
rnd = rounded
br = bedrock formation
ss = sandstone
conglom = conglomerate
comptd = compacted
qtz = quartz

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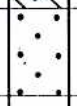
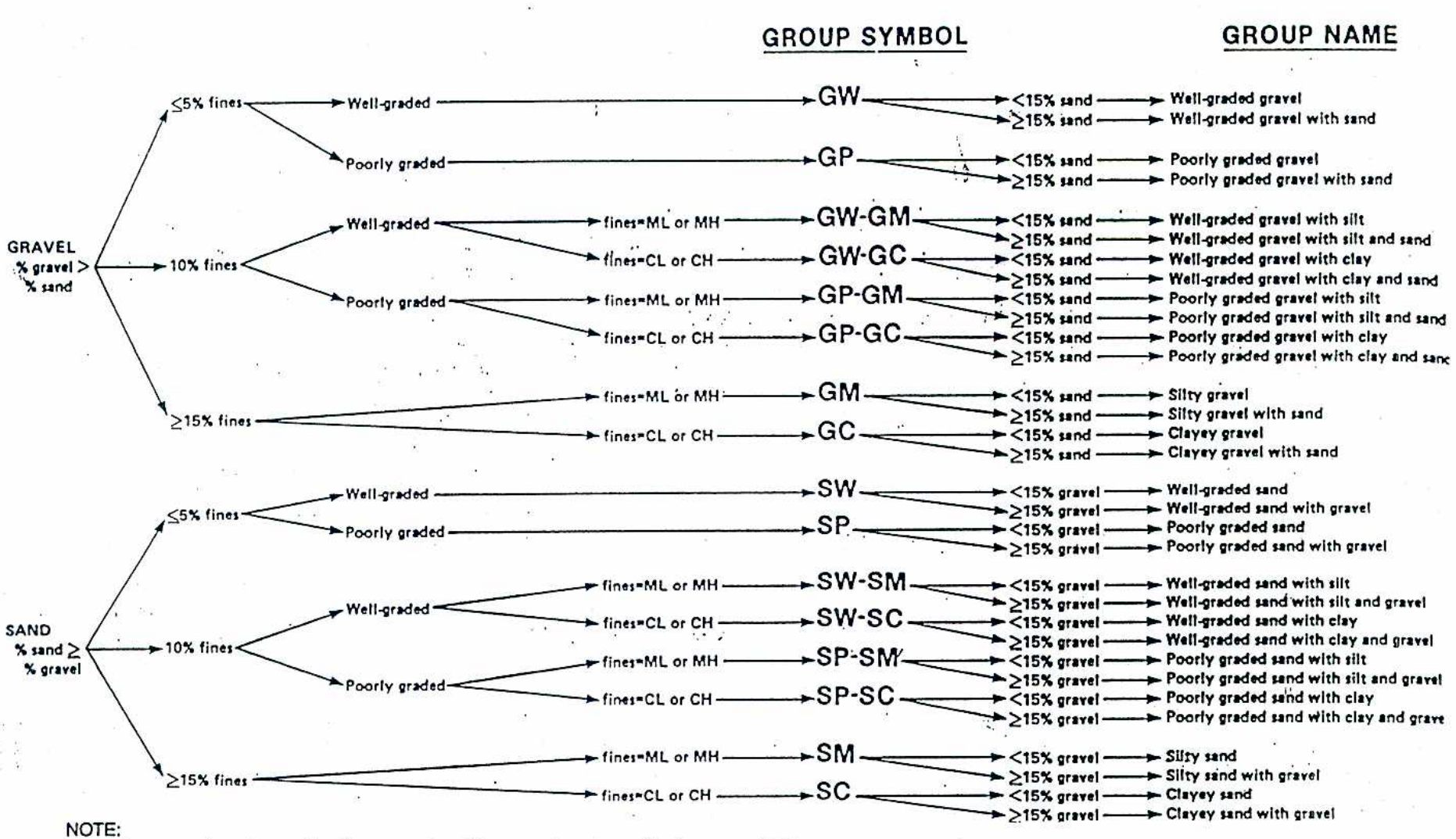
ATTACHMENT B

Unified Soil Classification System and Logging Criteria

GENERAL SOIL CATEGORIES			SYMBOLS		TYPICAL SOIL TYPES
COARSE GRAINED SOILS More than half is larger than No. 200 sieve	GRAVEL More than half coarse fraction is larger than No. 4 sieve size	Clean Gravel with little or no fines	GW		Well Graded Gravel, Gravel-Sand Mixtures
			GP		Poorly Graded Gravel, Gravel-Sand Mixtures
		Gravel with more than 12% fines	GM		Silty Gravel, Poorly Graded Gravel-Sand-Silt Mixtures
			GC		Clayey Gravel, Poorly Graded Gravel-Sand-Clay Mixtures
	SAND More than half coarse fraction is smaller than No. 4 sieve size	Clean sand with little or no fines	SW		Well Graded Sand, Gravelly Sand
			SP		Poorly Graded Sand, Gravelly Sand
		Sand with more than 12% fines	SM		Silty Sand, Poorly Graded Sand-Silt Mixtures
			SC		Clayey Sand, Poorly Graded Sand-Clay Mixtures
FINE GRAINED SOILS More than half is smaller than No. 200 sieve	SILT AND CLAY Liquid Limit Less than 50%		ML		Inorganic Silt and Very Fine Sand, Rock Flour, Silty or Clayey Fine Sand, or Clayey Silt with Slight Plasticity
			CL		Inorganic Clay of Low to Medium Plasticity, Gravelly Clay, Sandy Clay, Silty Clay, Lean Clay
			OL		Organic Clay and Organic Silty Clay of Low Plasticity
	SILT AND CLAY Liquid Limit Greater than 50%		MH		Inorganic Silt, Micaceous or Diatomaceous Fine Sandy or Silty Soils, Elastic Silt
			CH		Inorganic Clay of High Plasticity, Fat Clay
			OH		Organic Clay of Medium to High Plasticity, Organic Silt
HIGHLY ORGANIC SOILS			PT		Peat and Other Highly Organic Soils

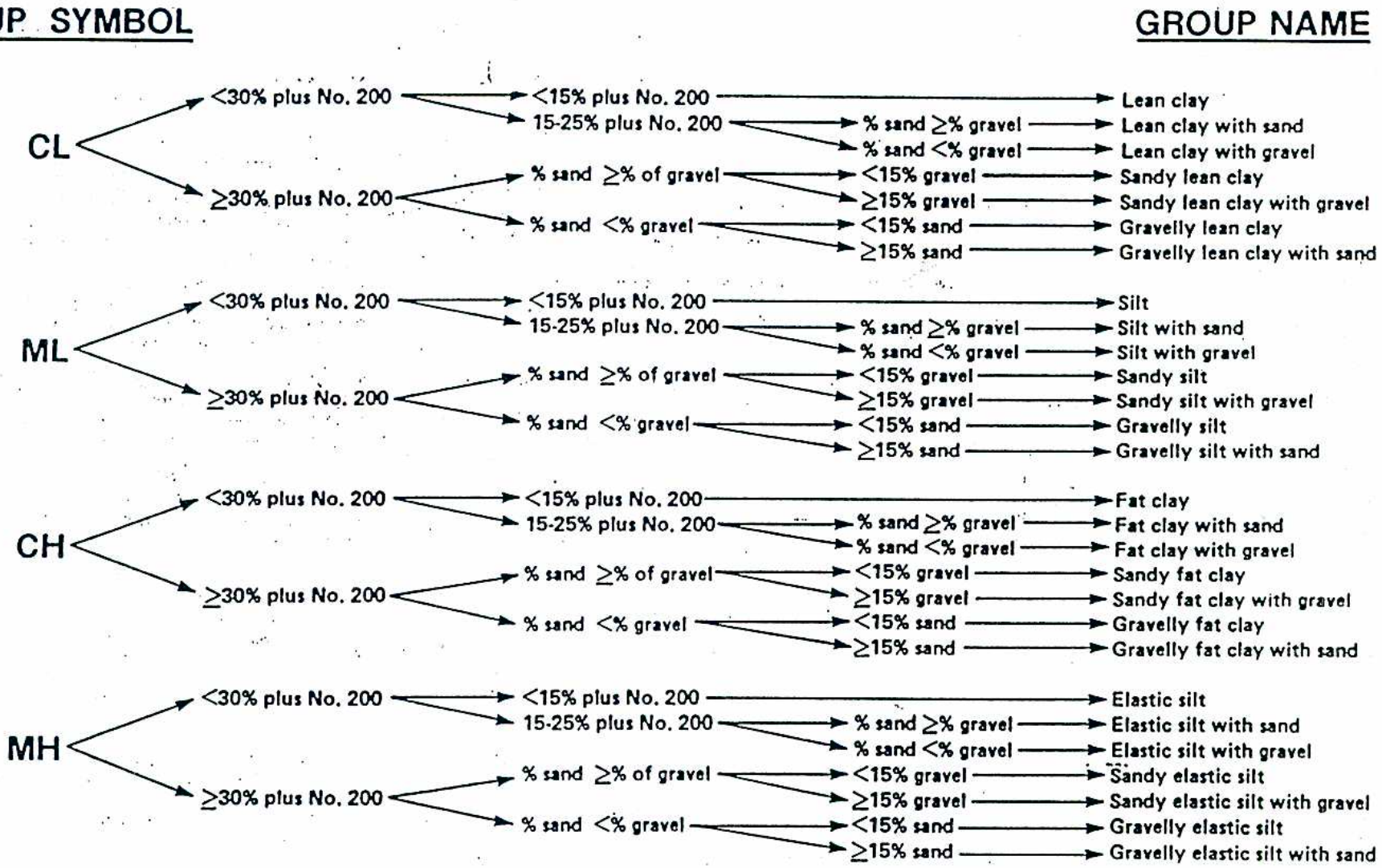
UNIFIED SOIL CLASSIFICATION SYSTEM

		PLATE
JOB NUMBER	DATE APPROVED	



NOTE:
Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5%
(After ASTM Designation D2488 Standard Test Method for Classification of Soils for Engineering Purposes)

Flow Chart for Classifying Coarse-grained Soil
(50% or more retained on No. 200 sieve)
Field Guide for Soil Classification and Logging Procedures



NOTE:
Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5%
(After ASTM Designation D2488 Standard Test Method for Classification of Soils for Engineering Purposes)

Flow Chart for Classifying Fine-grained Soil
(50% or more passing No. 200 sieve)
Field Guide for Soil Classification and Logging Procedures

similar, the material is classified as poorly graded or well sorted. If fines represent less than 5 percent of the total mass, the symbol SP is used for a poorly-graded sand and SW for a well graded sand. If silts and/or clays exceed 12 percent, the symbols GC, SC, GM, and SM are used, respectively.

If the silts and clays are between 5 to 12 percent of the total sample weight, a dual classification with two group symbols is used. The first symbol is GW, GP, SW, or, SP, and the second is GC, GM, SC, or SM. The group name corresponds to the first group symbol plus the modifying words "with clay" or "with silt" to indicate the plasticity characteristics. If the fines plot on the CL-ML range on the plasticity chart (Figure 2-2), possible dual classification group names are:

GW-GM	well graded gravel with silt
GW-GC	well graded gravel with clay
GP-GM	poorly graded gravel with silt
GP-GC	poorly graded gravel with clay
SW-SM	well graded sand with silt
SW-SC	well graded sand with clay
SP-SM	poorly graded sand with silt
SP-SC	poorly graded sand with clay

If silts and clays exceed 12 percent of the total weight of sample, the modifiers "M" and "C" are used, respectively. If a sand or gravel has more than 15 percent of the other coarse-grained constituent, the words "with gravel" or "with sand" are added to the group name. A flow chart for classifying coarse-grained soils is presented in Figure 2-3.

2.2 Fine-grained Soils

Particles passing the No. 200 sieve are silts (M) and clays (C). These soils must undergo testing in order to differentiate between them. Typical tests used are: dry strength, dilatancy, toughness, and plasticity. These terms are further discussed in Tables 2-2 through Table 2-6. Silts have little or no dry strength when dry, while clays have considerable dry strength. Dry strength, dilatancy, and toughness are also used to identify the fine-grained fraction of coarse-grained soils.

TABLE 2-2
Criteria for Describing Dry Strength

Description	Criteria
None	The dry specimen crumbles into powder with the mere pressure of handling.
Low	The dry specimen crumbles into powder with some finger pressure.
Medium	The dry specimen breaks into pieces or crumbles with considerable finger pressure.
High	The dry specimen cannot be broken with finger pressure. The specimen will break into pieces between the thumb and a hard surface.
Very high	The dry specimen cannot be broken between the thumb and a hard surface.

TABLE 2-3
Criteria for Describing Dilatancy

Description	Criteria
None	There is no visible change in the specimen.
Slow	Water appears slowly on the surface of the specimen during shaking, and does not disappear, or disappears slowly upon squeezing.
Rapid	Water appears quickly on the surface of the specimen during shaking, and disappears quickly upon squeezing.

TABLE 2-4
Criteria for Describing Toughness

Description	Criteria
Low	Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft.
Medium	Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness.
High	Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness.

TABLE 2-5
Identification of Inorganic Fine-grained Soils from Manual Tests

Soil Symbol	Dry Strength	Dilatancy	Toughness
ML	None to low	Slow to rapid	Low or thread cannot form
CL	Medium to high	None to slow	Medium
MH	Low to medium	None to slow	Low to medium
CH	High to very high	None	High

TABLE 2-6
Criteria for Describing Plasticity

Description	Criteria
Nonplastic	A 1/8-inch (3-mm) thread cannot be rolled at any water content.
Low	The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll, and not much time is required to read the plastic limit. The thread cannot be re-rolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be re-rolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier that the plastic limit.

Fine-grained soils are accurately determined in the laboratory using the Atterberg Limits test. This test include liquid limit, plastic limit, and plasticity index measurements. The liquid limit is the water content of a soil at the point of transition from a plastic to a liquid state. The plastic limit is the water content of a soil at the point of transition from a semisolid to a plastic state. The plasticity index is the difference between the liquid limit and the plastic limit.

As shown in the Figure 2-2, five fields have been identified. These include:

- Silty Clays (CL), Organic Silts (OL) or Organic Silty Clays (OL) of low plasticity
- Fat Clays (CH) and Organic Clays (OH)
- Inorganic Silts (ML) and Organic Silty Clays (OL) of low plasticity
- Silts (MH) and Organic Clays (OH) of a high plasticity
- Silty Clays to Clayey Silt (CL-ML) of low plasticity

Fine-grained soils with a liquid limit > 50 are modified by the symbol H (MH or CH), and those with a liquid limit < 50 are modified by the symbol L (ML or CL). Fine-grained soils containing 30 percent or more coarse-grained fraction should be modified by descriptive terms, such as "gravelly" or "sandy." If the coarse fraction is between 15 and 30 percent, the words" with sand and/or gravel" should be added to the group name. A flow chart for classifying fine-grained soils is presented in Figure 2-4.

2.3 Organic Soils

To classify organic soils, the percentage organic material present in the soil as well as the non-organic fines must be estimated. When the organic content ranges from 18 to 36 percent, the material is an organic clay or an organic silt, depending on the nature of the fine-grained constituents. When the organic content is between 36 and 90 percent, the material is designated a muck or peaty muck (OL or OH). A flow chart for classifying organic soil is presented in Figure 2-4. The term "peaty" is added if the organic remains are

SOP-B4

Boring Abandonment
Standard Operating Procedures for PG&E Topock Program

The purpose of this standard operating procedure (SOP) is to describe methods to abandon drill borings to the surface. The guideline covers all drilling methods and includes borings through surface casings.

REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan, work plan or event-specific field instructions. Planned borehole depth, proposed well construction/specifications, and field sampling summary table, if available.

2) Applicable project work plan or monitoring plan. Refer to Topock Program *Sampling, Analysis, and Field Procedures Manual* and *Quality Assurance Project Plan* (Procedures Manual), as required.

3) San Bernardino County Department of Health well abandonment (destruction) permit.

4) Topock Program Health and Safety Plan (HSP).

5) Blank sampling log and field notebook.

PREPARATION AND SETUP

1) Review event-specific work plan or event-specific field instructions, previous sampling logs, Procedures Manual, and HSP.

2) Initiate field logbook for sampling activity.

3) Review sampling procedures and equipment, and planned sample depths with drilling contractor and field crew.

4) Inspect all required field equipment.

Equipment List

- Truck-mounted drilling rig, skid rig, or barge-mounted tripod rig
- Hollow-stem augers and associated equipment or either rotary-drilling or sonic- drilling equipment
- Steel or Schedule 40 PVC casing, of appropriate diameter for required installations (at least 6.25-inch inside diameter if surface casing is required)
- Approved water source
- Cement
- Bentonite

GUIDELINES

California Department of Water Resources, June 1991, Bulletin 74-90 (Supplement to Bulletin 74-81) *California Well Standards*.

PROCEDURES

Abandonment

1) The borehole will be grouted from total depth to the surface with bentonite-cement grout. The cement-bentonite grout will be installed continuously in one operation from the bottom of the space to be grouted to the ground surface.

2) The grout mixture will consist of 94 pounds of cement (1 bag) per 6 gallons of water and 2 to 3 pounds of powdered bentonite per bag of cement to reduce shrinkage.

3) The source of the water used in the grout mixture must be from a pre-approved source.

4) If there is any risk of borehole collapse upon removal of the drill casing, then the grout will be added prior to the removal of the drill casing. The grouting can be completed in stages, grouting 50 to 100 feet at a time, removing 50 to 100 feet of drill casing, and then repeating until the grout has reached the surface and the final casing removed.

5) When installing grout in soil borings, the grout will be installed through a tremie pipe that is placed inside the drill casing to the bottom of the borehole.

6) The production of grout will be completed to eliminate the preparation of excess/waste grout.

Waste Disposal

1) The soil cuttings are to be drummed and managed as described in SOP *Disposal of Waste Fluids and Soils* and the investigation-derived waste management plan.

2) Minimal quantities of grout may be included in the water or soil waste streams. The quantity of grout will be limited to that produced during cleaning of grouting equipment or decontamination of drill casing.

KEY CHECKS AND PREVENTATIVE MAINTENANCE

- Check that the drilling rig or soil-coring rig is in working order.
- Check that the borehole is grouted to the ground surface at the completion of drilling and sampling.

SOP-B5

Decontamination of Personnel and Equipment, Well Drilling, and Subsurface Sampling and Investigations
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure provides general guidelines for the decontamination of personnel, sampling equipment, and monitoring equipment used in potentially-contaminated areas.

REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan (SAP).

2) Applicable project work plan or monitoring plan, which includes a health and safety plan. Refer to Topock Program *Sampling, Analysis, and Field Procedures Manual* and *Quality Assurance Project Plan*, as required.

PREPARATION AND SETUP

1) Initiate field log sampling book for activity.

2) Inspect all equipment necessary to carry out activities detailed in event-specific SAP.

3) Review decontamination guidelines for equipment necessary to carry out activities.

Equipment List

- Demonstrated analyte-free, deionized water (specifically, ASTM Type II water)
- Distilled water
- Potable water; must be from a municipal water supplier, otherwise an analysis must be run for appropriate volatile and semivolatile organic compounds and inorganic chemicals (e.g., Target Compound List and Target Analyte List chemicals)
- 2.5% (W/W) Liquinox® and water solution
- Large plastic pails or tubs for Liquinox® and water, scrub brushes, spray or squirt bottles for Liquinox® solution, and distilled or deionized water, plastic bags, and sheets
- Department of Transportation (DOT)-approved 55-gallon drum for disposal of waste
- Nitrile or latex gloves
- Decontamination pad and steam cleaner/high pressure cleaner for large equipment

GUIDELINES

Personnel Decontamination

Decontamination should be performed after completion of tasks whenever personnel come in contact with contaminated (or potentially-contaminated) soils or fluids. Full or emergency decontamination should be performed when contaminant concentrations are not known and when potentially-contaminated fluids come into contact with skin beneath clothing, eyes, nose, or ears.

Procedures for full/emergency decontamination are to:

1) Remove contaminated clothing.

2) Step into containment area (decontamination pad or large pail).

3) Rinse away fluids and soil.

4) Wash skin with Liquinox® solution in such a way as to not abrade skin. (Liquinox® solution should be made with potable water and sufficient detergent to create foamy suds.) Eyes and mucus membranes in contact with contaminants must be washed with eye wash or drinking water continuously for at least 15 minutes.

5) Rinse with potable water.

6) If no other clothes are available, wash affected clothes in Liquinox® solution prior to donning. If other clothes are available, contaminated clothes may be isolated for later wash or disposed of along with personal protective equipment (PPE).

7) Any PPE worn (including disposable latex booties, gloves, and disposable coveralls) should be discarded into DOT-approved 55-gallon drum located at the MW-20 bench.

8) Dispose of wash and rinseate water in an appropriate container with other chromium contaminated fluids. These fluids may be taken to the MW-20 bench for treatment or to a Baker® tank within the PG&E facility for containerization.

9) Replace all appropriate clothing and PPE before resuming work or departing site.

Moist soil or water containing known concentrations of hexavalent chromium less than 50 parts per billion that comes into contact with hands need not require full decontamination. Dry soil containing chromium that comes into contact with clothing can also be decontaminated in an abbreviated manner.

Daily decontamination and minor exposure contact decontamination procedures are to:

1) Wash hands and skin that comes in contact with soils or water that may contain small concentrations of chromium as soon as possible after contact. Wash with Liquinox® solution and rinse with potable water.

2) If contaminated soil or water contacts hands through hole or over lip of gloves, remove gloves and wash hands thoroughly before donning new gloves.

3) Discard gloves into DOT-approved 55-gallon drum located on the MW-20 bench at the end of the day or event.

4) Remove coveralls or dry soils from clothing before leaving site. Clothing contaminated by moist soil or water containing hexavalent chromium should be removed and promptly washed.

5) At the end of the work day, shower entire body, including hair, either at the work site or at hotel.

Sampling Equipment Decontamination—Groundwater Sampling Pumps

Sampling pumps are decontaminated after each use as follows:

1) Don waterproof (nitrile or latex) gloves.

2) Run pump and reusable tubing through with Liquinox® solution (made with potable water) so that the pump and all portions or the tubing have been flushed with the solution for at least 30 to 60 seconds. More time is required if water is present in the tubing. If unsure, run for 2.5 minutes. Outside of the tubing should also be submerged and washed in the solution.

3) Run pump and reusable tubing through first rinse (with potable or distilled water) so that the pump and all portions or the tubing have been flushed with the solution for at least 60 seconds. More time is required if any suds are present in the pump or tubing.

4) Run pump and reusable tubing through second rinse (with distilled water) so that the pump and all portions or the tubing have been flushed with the solution for at least 30 seconds. More time is required if water from first rinse is present in tubing.

5) Equipment blank samples may be taken at this point using ASTM Type II water or distilled water as required by laboratory.

Sampling Equipment Decontamination—Other Equipment

Reusable sampling equipment is decontaminated after each use as follows:

1) Don nitrile or latex gloves.

2) Wash all equipment surfaces that contacted the potentially contaminated soil/water with Liquinox® solution (made from potable water). Water quality meters that are not placed within wells should not be washed with detergent, as this will degrade sensors; these meters should be double-rinsed. Any portion of equipment that is placed inside wells (including cables and pipe) and that comes in contact with moisture should be washed with detergent.

3) Rinse equipment and supplies with potable water, if the equipment is not used to collect groundwater or soil samples. Equipment used to collect samples or take water quality parameters should be rinsed with distilled water.

4) Air dry or towel dry with paper towels.

5) Collect all rinseate and dispose of in Baker® tank within the PG&E facility or Denbeste® tank at the MW-20 bench.

6) Decontamination materials (e.g., plastic sheeting, tubing, etc.) that have come in contact with used decontamination fluids or sampling equipment will be disposed of in

DOT-approved 55-gallon drums if highly contaminated. If not contaminated, equipment can be washed and disposed of in trash.

7) Preserved bottles may need to be washed before being packed or handed without gloves. The outsides of filled bottles should be rinsed and toweled dry to prevent contact with strong acids or based.

Heavy Equipment and Tools

Heavy equipment such as drilling rigs, drilling rods/tools, and the backhoe will be decontaminated upon arrival at the site and between locations as follows:

1) Set up a decontamination pad in designated area.

2) Steam clean heavy equipment until no visible signs of dirt are observed. This may require wire or stiff brushes to dislodge dirt from some areas.

KEY CHECKS AND ITEMS

- Clean with solutions of Liquinox® and potable water. Rinse with distilled or deionized water if equipment is used to collect samples or water readings; otherwise, rinse with potable water.
- Equipment placed within wells should be thoroughly decontaminated and before being placed in a well. All potions of this equipment that come into contact with moisture should be decontaminated.
- Decontaminate filled sample bottles before relinquishing them to anyone.

SOP-B7

Homogenization of Soil and Sediment Samples
Standard Operating Procedures for PG&E Topock Program

The homogenization of soil and sediment samples is performed to minimize any bias of sample representativeness introduced by the natural stratification of constituents within the sample. Standard techniques for soil and sediment homogenization and equipment are provided in this SOP. These procedures do not apply to aliquots collected for volatile organic compounds (VOCs) or field gas chromography screening; samples for these analyses should NOT be homogenized.

REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan (SAP).

2) Applicable project work plan or monitoring plan. Refer to Topock Program *Sampling, Analysis, and Field Procedures Manual* and *Quality Assurance Project Plan,* as required.

3) Topock Program Health and Safety Plan (HSP).

4) Previous sampling logs.

5) Blank sampling logs and field notebook.

PREPARATION AND SETUP

1) Review event-specific SAP or event-specific field instructions, previous sampling logs, Procedures Manual, and HSP.

2) Initiate field logbook for sampling activity.

EQUIPMENT LIST

- Sample containers
- Stainless-steel spoons or spatulas
- Stainless-steel pans
- Phthalate-free gloves

PROCEDURES

Sample Homogenization

1) Soil and sediment samples to be analyzed for semivolatiles, pesticides, polychlorinated biphenyls, metals, cyanide, or field x-ray fluorescence screening should be homogenized in the field.

2) After a sample is taken, a stainless-steel spatula should be used to remove the sample from the split spoon or other sampling device. The sampler should not use fingers to do this, as gloves may introduce organic interferences into the sample.

3) Samples for VOCs should be taken immediately upon opening the spoon and should not be homogenized.

4) Prior to homogenizing the soil or sediment sample, any rocks, twigs, leaves, or other debris should be removed from the sample.

5) The sample should be placed in a decontaminated stainless-steel pan and thoroughly mixed using a stainless-steel spoon. The soil or sediment material in the pan should be scraped from the sides, corners, and bottom, rolled into the middle of the pan, and initially mixed.

6) The sample should then be quartered and moved to the four corners of the pan. Each quarter of the sample should be mixed individually, then rolled to the center of the pan and mixed with the entire sample again.

Equipment Decontamination

1) All stainless-steel spoons, spatulas, and pans must be decontaminated following procedures specified in SOP *Decontamination of Personnel and Equipment* prior to homogenizing the sample.

2) A composite equipment rinse blank of homogenization equipment should be taken each day it is used.

SOP-B9

Drilling--Sonic Method
Standard Operating Procedures for PG&E Topock Program

REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan (SAP), Work Plan or event-specific field instructions. Planned borehole depth, proposed well construction/specifications, and field sampling summary table, if available.

2) Applicable project work plan or monitoring plan. Refer to Topock Program Sampling, Analysis, and Field Procedures Manual and QAPP (Procedures Manual), as required.

3) Topock Program Health and Safety Plan (HSP)

4) Previous sampling, drilling, or well construction logs from other boreholes or wells in the vicinity, if available

5) Blank sampling log and field notebook

Equipment List:

- Drilling rig (Sonic)
- Drill rods and core barrel

GUIDELINES

PRIOR TO INTRUSIVE ACTIVITIES AT ANY DRILLING LOCATION THE AREA WILL HAVE BEEN CLEARED OF ALL UTILITIES AND THE CLEARANCE RECORDED IN THE FIELD LOGBOOK. It is also the field team leader's responsibility to confirm that all required access permits are in place.

Prior to the start of drilling, the area of site activity will be identified and delineated using stakes and/or flagging. The extent of impact will be mineralized at all times and the delineated area of activity decreased when possible. All sensitive vegetation or habitats will be delineated with stakes and/or flagging and no impact will occur in these areas.

Sampling depths and total depths of holes shall be determined by temporary marking of drill equipment, by reference to standard equipment dimensions (for example, 5-foot hollow-stem auger flights), or by measurement using a fiberglass tape. Final total depth measurements will be confirmed using a weighted fiberglass tape. Observations by the field geologist or engineer shall be recorded directly in the borehole log.

The field borehole log is the standard form used to document subsurface geologic conditions. The borehole log is divided into two areas. One portion contains spaces for noting information on the drilling and sampling methods. The second portion contains space for noting lithologic descriptions. All sheets shall be filled out completely, legibly, and in ink. The borehole log will be filled out in the field at the time of the drilling and sampling. The original logs shall be permanent records, and information on the logs may not be

erased. If corrections are needed, information shall be crossed out with a single line and the correction shall be initialed and dated.

The use of water and drilling fluid to assist in sonic drilling for monitoring well installation will be avoided, unless required for such conditions as running sands or drilling bedrock formations.

Temporary outer casing, drill rods, core barrels, and other downhole drilling tools will be properly decontaminated prior to the initiation of drilling activities and between each borehole location. Core barrels and other downhole soil sampling equipment will also be properly decontaminated before and after each use.

Sonic inner casing (sample tube) will have an inside diameter of at least 3.25 inches. Samples may be collected for chemical analysis. For sonic drilling, these samples are collected in a metal trough. A continuous core is collected and the sample interval is selected from the length of core run.

Surface casing may be installed where soil borings will penetrate a confining layer or when there is risk of eroding soil during the drilling process if water is used.

PROCEDURES

Instructions for Completing Soil Boring Logs

Soil boring logs will be completed in the field log books. Information collected will be consistent with that required for Form D1586 (attached), a standard CH2M HILL form or an equivalent form that supplies the same information. Procedures will follow the SOP "*Soil*

Non-Core Collection Drilling

At locations or depths from which core collection is not required, drilling may proceed without the recovery of soil cores. The drilling will include advancing the larger outer casing and the use of water to facilitate cuttings removal from the boring. The inner casing drill rods may or may not be used, depending on the cuttings recovery when drilling with the larger outer casing.

Continuous Core Drilling

At locations or depths when core collection is required, drilling will proceed using an outer casing and an inner core sample tube. The inner core sampling tube will be advanced first without the use of water. Before removal of the sampling tube, the outer casing will be advanced, using water only as needed for cuttings removal, to the same total depth as the inner casing. The outer casing will stabilize the boring when the sampling tube is removed. The process is repeated in 10 to 20 foot intervals, as the lithology of the boring permits.

The length of each drilling interval should be adjusted depending on the lithology and the quality and recovery percentage of the sample cores retrieved. At locations with very hard drilling (i.e. with large cobbles or hard materials) or when percent recovery decreases, the drilling interval should be decreased until such time that the conditions change.

After retrieval of the inner sampling core tube, the minimally disturbed sample cores will be collected into plastic liner sleeves in intervals of 2 to 3 feet. The plastic sleeves will be

immediately sealed on both ends. The cores will be used for visual descriptions and may be used for analysis for geochemical and geotechnical parameters.

KEY CHECKS AND ITEMS

- Check entries to the soil boring log and field logbook in the field during sampling activities because the cores will be disposed at the end of the fieldwork, confirmation and corrections cannot be made later.
- Check that the sample numbers and intervals are properly specified.
- Ensure that drilling equipment is decontaminated prior to the beginning of work and between each borehole.
- All materials generated during sampling (debris, PPE, decontamination liquids, etc.) will be placed in approved IDW storage containers pending analysis and disposal off site as outlined in SOP-B6, *Disposal of Waste Fluids and Solids (IDW)*.

SOP-B11

Site Clearance and Permitting
Standard Operating Procedures for PG&E Topock Program

This standard operating procedure (SOP) addresses the procedures for site clearance and permitting at the Topock site. This SOP should be used to obtain proper site clearance and permits before any work is performed at a site.

REQUIRED DOCUMENTS

1) Applicable project work plan, event-specific sampling and analysis plan (SAP), and/or Procedures Manual, if applicable.
2) Topock Program Health and Safety Plan (HSP).
3) Site map with work locations identified.

PREPARATION AND SETUP

1) Review applicable project work plan, event-specific SAP, Procedures Manual, and HSP.
2) Identify locations where work will be performed, determine if any subsurface work will be needed.
3) Before the start of any work obtain approval by the appropriate land agencies (such as BLM, USFWS, County of San Bernardino). Activities located on PG&E property fall under the jurisdiction of the County; however, approval may also be required from BLM and/or USFWS for activities such as access, waste management, etc. Work in Topock, Arizona falls under the jurisdiction of the Arizona Department of Water Resources.
4) Before the start of any work obtain appropriate approval by the regulatory agencies. These include at a minimum the DTSC if in California, and ADEQ is in Arizona. Other regulatory approvals that may be required include, but are not limited to CDFG, USFWS, USACE and RWQCB. Approval from the Arizona Land Department may also be required for wells drilled in Arizona.

If subsurface work will be involved, follow the following steps:

1) Follow the guidelines of the Southern California Underground Service Alert (USA) agency to mark the edges of the work location as outlined on their web page (http://www.digalert.org). If in Arizona, the Arizona Blue Stake should be contacted for location of buried facilities (www.azbluestake.com). Make sure to:
    - Identify delineated areas with white markings with the requesters company name or logo within the pre-marked zones
    - Delineate the exact area of excavation with white paint through the use of dots or dashes, or a continuous solid line. Limit the size of each dash to approximately 6" in length and 1" width with interval spacing not less that approximately 4 feet. Dots of

approximately 1" diameter are typically used to define arcs or radii and may be placed at closer intervals in lieu of dashes. Limit width of lines to 1".

- For point locations (such as a soil boring or well) mark the exact location in the USA or Blue Stake box with a stake. Make sure the delineated area around the stake is of adequate radius (50 to 100 feet is appropriate for drilling).

2) Call USA at 1-800-227-2600 or Arizona Blue Stake at 1-800-782-5348 at least three working days before the start of work at the identified location and provide them with the information requested on the location request form. Be ready to give the location in terms of feet relative to I-40 and to Park Moabi Road when calling. You will be assigned a Dig Alert Number, file this number until work at the delineated area is complete. (The number does expire after two weeks and a new number may need to be obtained if work has been delayed.)

3) Mark the Dig Alert Number in the delineated area using white paint as soon as possible after calling USA or Arizona Blue Stake.

4) If the location is in a developed area, contact a private utility locator and have them perform a sweep of the delineated work area. Util-Locate at (866) 421-5325 is typically used for this service.

5) In some cases the utility companies may need to be contacted directly by CH2M HILL. If the following companies do not respond to the USA or Blue Stake ticket or if we are working in their easements, use the following contact information and procedures:

Southwest Gas: Main contact is Jim Default/702-365-2097
(The required minimum clearance distance from gas pipelines is 18-inches**.** Potholing may need to be performed in advance of design completion Southwest Gas should be called prior to construction activities). If Southwest Gas does not come to the site after the USA call, contact them at their Bullhead City office at (928) 763-7766

Southern California Gas Co.: Main contact is Frank Castro/818-701-4566; secondary contact is Martin Woodsworth/818-701-4543. If we need to work in their easement, we must provide a letter from BLM giving us permission to be on the property. Southern California Gas Co. also requires advance notification of construction activities. They may also require a copy of the design drawing, potholing activities, and the issuance of a "Non-Interference" letter, if applicable, before work can proceed. One of their representatives may need to be in the field when digging is occurring near their pipeline.

TransWestern Pipeline Co.: Main contacts are Ron Westbrook (ROW Department)/713-345-3067 and Mike Baxter (Operations)/928-757-3620. They may require potholing if proposed construction activities are near their pipelines. Crossing pipeline requires filling out a simple form.

Burlington Northern Santa Fe Railroad: Main contact is Greg Rousseau (BNSF)/909-386-4079. Prior to work in their easements submit the proper application with the $250 fee to the Staubach Company.

City of Needles Utility Dept: Main contact is Ron Myers/760-326-5700 (ext. 7 for the utilities department). Work activities may need to be a minimum of 10 to 15 feet from their utility poles.

6) Do not start subsurface work at the site until the delineated area has been marked or cleared by the appropriate utility agencies.

If the work includes a performing a well installation or abandonment, or drilling a boring in California:

1) Apply for a San Bernardino County well permit two to three weeks before the start of drilling (one permit per well; cost is /$212.00 per well). Obtain a permit application by calling the Environmental Health Services Department at 1-909-387-4666 (open Monday through Friday, 8:00 a.m. to 5:00 p.m. The fee schedule for permits is located at http://www.sbcounty.gov/ dehs/FEESCHEDULE/feeschedule.htm#wateranchor. Fill out the appropriate permit form and provide it to the California-licensed driller contracted to perform the well installation. The driller is expected to review and file the permit with the San Bernardino County Department of Environmental Health Services (Steve Sesler), address below.

   Environmental Health Services
   385 N. Arrowhead, 2nd Floor
   San Bernardino, CA 92415-0160

2) A well permit needs to be obtained from San Bernardino County for well abandonment by the same procedure described in #11. Check the 'destruction' box on the same permit form used for well installation.

3) A permit also needs to be obtained from San Bernardino County for any boring that reaches to or below the water table, even if a well is not actually installed. The permit process is the same as described in #11.

If the work includes a performing a well installation or abandonment, or drilling a boring in Arizona:

1) Apply for an Arizona Department of Water Resources (DWR) well permit two to three weeks before the start of drilling (one permit per well; cost is /$150.00 per well). Obtain a permit application by calling the DWR at 1-(602) 771-8500 (open Monday through Friday, 8:00 a.m. to 5:00 p.m. MST). All ADW permits and instructions can be found at http://www.azwater.gov/dwr/Content/Find_by_Category/Permits_Forms_Applications/default.htm
   Fill out the appropriate permit form (55-44A) and provide it to the Arizona-licensed driller contracted to perform the well installation. The driller is expected to review and file the permit with the Arizona Department of Water Resources address below.

   Arizona Department of Water Resources
   3550 N. Central Avenue
   Phoenix, AZ 85012

   Upon completion of the well, the driller must submit a Driller Report and Well Log (Form 55-55) to the DWR within 30 days. The form and instructions can be found on the DWR webpage.

2) A well abandonment permit needs to be obtained from the Arizona Department of Water Resources prior to well abandonment (form 55-38). Exploratory wells that are abandoned before the drill rig leaves the site are exempt from the well abandonment permit requirements. The well abandonment form and instructions are included as Attachment 4 and can be found at the ADW webpage . No fee is required for filing this form.

   Within 30 days of well abandonment a Well Abandonment Completion Report (Form 55-58) must be filed with the DWR.

SOP-B16

Field-portable X-Ray Fluorescence Soil Sampling Standard Operating Procedures for PG&E Topock Program

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This SOP describes the analysis of *in-situ* and *ex-situ* soil samples using a field portable X-Ray Fluorescence instrument (XRF). SOP-B2 and SOP-B3 in the *Sampling, Analysis, and Field Procedures Manual, PG&E Topock Program* (Procedures Manual; CH2M HILL, 2005) provide additional guidance for soil characterization and logging.

Required Documents

1) Event-specific planned sample table (PST).
2) Applicable project work plan or monitoring plan. Refer to the Procedures Manual, Operation and Maintenance (O&M) Manual, and QAPP as required.
3) Topock Program Health and Safety Plan (HSP).
4) Field notebook.
5) Database generated chain-of-custody.
6) XRF Functional Check Log

Preparation and Setup

1) Review event-specific PST or event-specific field instructions, previous sampling logs, Procedures Manual, and HSP.
2) Coordinate with the Project Chemist for coolers, sample containers, and courier pickup of the samples.
3) Initiate field logbook for sampling activity.
4) Initiate electronic file for X-Ray Fluorescence (XRF) instrument download.
5) Review sampling procedures and planned sample depths with field crew.
6) Field-check and set up equipment for functional checks, sampling, decontamination, spill prevention, and health and safety.

Equipment List

- Niton XRF Meter and stand
- Spare battery chargers
- Field notebook
- Trowel for smoothing soil surfaces
- Reusable plastic bags or stainless steel tray

- Disposable Sample cups with X-ray film and lids
- X-Ray window film (Mylar, Kapton, Spectrolene, polypropylene, or equivalent; 2.5 – 6.0 micrometers (um) thick)
- Disposable scoops, stainless steel spoons or other appropriate mixing tools
- Appropriate quality control (QC)/quality assurance (QA) standards, and blank sand
- Chemwipes
- Decontamination equipment (Alconox® solution (or equivalent) in spray bottle, brushes, buckets, rinse water spray bottle) for mixing tools and trowels
- Protective waterproof gloves (nitrile or latex)

XRF SOIL ANALYSIS DOCUMENTATION

The XRF sample results will be recorded by the associated software in an excel format. The files will be downloaded at the end of each day and emailed to the project chemist for review. Any additional sample logging and sample collection should follow the protocol and procedures found in the *Sampling, Analysis, and Field Procedures Manual, PG&E Topock Program* (CH2M HILL,2005). Detailed notes should be recorded in the sampler's field notebook or in a log generated from the field database. Items to be documented on the sampling log include (note: include as much of the following information in the XRF software as possible):

1) Record type of boring or excavation equipment and the total boring or excavation depth.
2) If multiple samples are being collected at one location at a variety of depths, record all sample depths.
3) Record date and time of sample collection in addition to the full sample ID that is listed in the PST.
4) Sampling difficulties shall be noted (i.e. difficult slope or abnormal debris in sample location).
5) Analysis start time and the source count time (i.e. 60 sec, 90 sec, or 120 sec etc.) will be documented on sample collection sheet. Note: analysis and count time are automatically recorded in the XRF software.

Field-portable X-Ray Fluorescence Soil Sampling- COLLECTION OF SAMPLES FOR ANALYSIS

***In-Situ* Sample Preparation**

When the soil moisture is less than 20 percent, the error associated with moisture may be minimal. If areas are encountered where the moisture content is greater than 20 percent (moisture is visible), consult with the project chemist for options available for proceeding with field analysis.

For *in-situ* analysis:

1) Large or non-representative debris must be removed from the selected location. This debris includes rocks, gravel, vegetation and concrete.

2) The location chosen for analysis should be homogenized by mixing in place an area approximately 4" by 4" by 3" deep, using a clean (or decontaminated) stainless steel or disposable spoon. The location should then be smoothed and firmly tamped to provide as flat and smooth an area as possible.

3) A section of x-ray window film should be stretched over the area to be tested to maintain a dust free environment for the nose of the instrument. (Note: use in-situ analysis for metals only samples).

4) To initiate a reading, the nose of the XRF will be positioned against the x-ray film, squeezing the shutter release, and firmly pressing the instrument flat against the surface. Source count times for *in-situ* analysis usually range from one to two minutes, varying among instruments and depending on requirement detection limits.

5) After the *in-situ* field screening is performed, inspect the nose of the instrument for contamination, which may affect future analysis. If necessary, clean it with a soft cloth or tissue.

For confirmation samples, or where samples for organic analysis are to be collected the soil samples should be treated as ex-situ samples, below.

Ex-Situ Sample Preparation

For *ex-situ* analysis:

There are several possible correct methods for the ex-situ analysis of samples. The area that previously would have been homogenized for the in-situ analysis should be scooped out and placed into a clean (or decontaminated) stainless steel or disposable pan (do not use plastic if organic analysis will be performed on any of this homogenized sample), using a stainless steel or disposable spoon or spatula (do not use plastic if organic analysis are associated with the homogenized sample). The sample should then be thoroughly mixed (homogenized) using the same spoon or spatula.

1) The preferred method is to setup the portable field stand in an area where the XRF can be stationed and left in place for the day. Use the Niton software and a laptop computer to setup the method criteria and control the XRF instrument during the soil analysis.

    a) Starting with the previously homogenized sample, use the supplied soil sieves, bowl, and mortar to generate a finely ground well homogenized sample. (Note: This step is not required if the soil sample was passed through a sieve during the homogenization step.)

    b) Transfer the prepared sample into a new sample cup (order replacement supplies from Niton), place the X-ray film over the cup and snap the lid in place. Place the sample cup in the portable field test stand (The XRF points upward, the sample rests

on top of the XRF with the X-ray film directly in contact with the nose of the XRF - cup lid facing down).

c) Using the computer, start the analysis. The source count time should be at least two minutes for chromium. Consult previous analysis to determine if multiple scan frequencies are required (or contact the project chemist).

d) Prepare the next sample while the XRF is analyzing the current sample.

2) An alternative method to using the portable field stand is to identify the sample for XRF analysis and homogenize the sample (as described above).

a) Transfer the sample to a re-sealable plastic bag and firmly molded into a flat smooth surface.

b) Use the Niton software and a laptop computer or the included PDA to setup the method criteria.

c) To start the analysis, position the nose of the XRF against the flat smooth surface of the sample and squeeze the shutter release (or press the start button on the laptop or PDA). Be sure to maintain constant pressure against the sample. If contact is broken, the analysis will need to be restarted. The source count time for *ex-situ* analysis usually range from one to two minutes, depending on the required detection limits (see *c* above for count times).

d) After the ex-situ field screening is performed, inspect the nose of the instrument for contamination, which may affect future analysis. If necessary, clean it with a soft cloth or tissue.

3) Transfer the sample to a labeled glass jar for shipment to the confirmation laboratory (if applicable).

Sample Analysis

In today's modern XRF models:

1) An X-ray source is used for detection. Expose the sample to the X-ray source for a minimum of one minute. Longer exposure times may be needed depending on the media that is being analyzed and the required detection levels. The time needed for analysis will be determined in the field by analyzing standards that have concentrations of the metals of concern near the required detection levels. Better detection limits can usually be obtained by homogenizing the sample, increasing the exposure time, and using two or more scan frequencies (Use a minimum of a two minute exposure for Chromium analysis).

2) When the XRF instrument displays the results they include the analyte, the result, and a percent confidence (displayed as a ± value). The result is displayed as non-detect for analytes that do not meet the percent confidence established in the instrument. The lower the required detection levels, the longer the analysis time required to meet the percent confidence.

3) Download saved data from XRF instrument daily (if data is collected in PDA). Foreword the data files to the project chemist daily.

4) All samples collected for off-site confirmation will also be analyzed using the XRF and treated as *ex-situ* samples.

Using older models:

1) Expose the sample to the energy source for a minimum of one minute. Longer exposure times may be needed depending on the media that is being analyzed as well as the age of the detector (non X-ray detectors). The time needed for analysis will be determined in the field by analyzing standards that have concentrations of the metals of concern near the required detection levels. Better detection limits can usually be obtained by homogenizing the sample, increasing the exposure time. (Use a minimum of a two minute exposure for Chromium)
2) When the XRF instrument indicates the results for the suite of analyzed elements and their concentrations, it includes a standard deviation for the reported concentrations. An analyte concentration is considered **not detected** if the result value is **less than two times the standard deviation**. The lower the required detection levels, the longer the analysis time required to reduce the result's standard deviation.
3) Record the readings (electronically or documented on the sampling log). Review the standard deviations for the elements of interest and determine if a longer analysis time is needed to reduce the standard deviations, thereby allowing the desired accuracy and precision for the concentrations. The standards will be analyzed using increasingly longer times until the required detection level is achieved.
4) Record values in field notebooks.
5) Download saved data from XRF instrument daily.
6) Samples collected for off-site confirmation will also be analyzed using the XRF and will be treated as *ex-situ* samples.

Calibration

Two forms of calibration are important with XRF testing: an energy calibration and a sample matrix calibration.

Energy Calibration

The Niton XLi 702 automatically re-calibrates the energy scale when powered on. The energy scale can also be re-calibrated by pressing "Reset" on the instrument. The energy calibration should be performed every two hours.

Sample Matrix Calibration

Modern XRF instruments, such as the Niton Xli 702, do not require site specific calibrations to account for sample matrix effects. EPA Method 6200 allows both fundamental parameters and Compton normalization as two techniques to eliminate site specific calibrations. Niton uses the Compton normalization method to automatically correct for sample specific matrix effects. The XRF is calibrated internally at the factory on NIST standard reference soil samples. Ensure the annual factory calibration certification is on file. This internal calibration is used for subsequent field work, without need for adjustment or recalibration at other sites.

Quality Assurance and Quality Control (Functional Checks)

Even though no onsite calibration will be performed, the method does require QA/QC Functional check testing protocols. The QA/QC that will be used to document that the XRF is operating properly will have the following steps:

- A startup operations check
- Analysis of a blank sample (clean sand)
- Analysis of standard sample(s)
- Analysis of duplicate samples
- QA/QC procedures will be compliant with manufacture's instructions.

1) At the beginning of each day perform QA/QC functional check procedure or when the instrument is turned on after more than 2 hours of down time or if the operating environment changes, such as a temperature change of more than 20 degrees Fahrenheit.

2) Two types of blanks should be analyzed, an instrument blank and a method blank. An instrument blank sample (silicon dioxide, provided by Niton) will be analyzed at the start and end of each day and once every 20 samples, to confirm proper zero calibration of the XRF. The blank will be analyzed following the procedure for the *ex-situ* sample analysis. A method blank is used to monitor for any field induced contamination. The method blank should follow any preparation procedures performed on the samples, such as mixing or *exsitu* analysis. **A method blank will be analyzed each day**.

3) A set of three to ten QC samples will be collected from the site during the initial field activities. These samples will be well homogenized, and a portion sent to the off-site laboratory for characterization. The remaining sample will be collected in re-sealable bags, labeled and stored with the XRF for use as standards. Three to five of the on-site standards will be analyzed at the start of each day. The results of the standards will be plotted against the original XRF results and a correlation value calculated. A correlation coefficient of 0.90 or greater must be achieved to meet the project objectives. A running log of all on-site standards analyzed will be maintained. One of the standards will be analyzed after every 20 samples. The readout from the XRF **must be within 20 percent RPD of the known QC sample concentration**.

4) The last QA/QC step will be to analyze duplicate samples (two separate aliquots) at a rate of 1 in 10. These duplicate measurements must be within 35 percent of each other for the analysis to continue. If the sample results are not in agreement, then the reason for this discrepancy must be determined.

5) The Niton XL3t 600 displays both concentration and precision for each sample analyte measurement. The precision displayed by the Niton's 95% (2-sigma) confidence intervals; where as the precision calculated in EPA method 6200 is at a 68% (1-sigma) level. The Niton also calculates and displays detection limits for analytes if the concentration is below three standard deviations. This bypasses the need for replicate measurements on low level standards.

Note: VOC, SVOC, and other organic samples can not be collected from the homogenized soil if plastic is used for homogenizing or after XRF analysis, if contacted by plastic.

Standard Operating Procedure – Laboratory
PG&E Topock Program

Title: Hexavalent Chromium Analysis by Hach Method 1560
Number: SOP-L01_Rev4
Revision Date: 10/13/2015

Scope

Standard Operating Procedure (SOP) for the analysis of hexavalent chromium (Cr^{+6}).

Equipment and Supplies

- Safety glasses
- Latex gloves
- Hach DR 4000V spectrophotometer or equivalent.
- Vacuum filter apparatus: 47 mm magnetic filter funnels, 1,000 mL Erlenmeyer flask, and vacuum pump. Use a 0.45 µm, 47 mm diameter filter membrane.
- 0.45 µm filter disc fitted to a disposable 50 mL syringe (syringe filter).
- pH meter.
- Reaction vessel and cap or means of sealing the reaction vessel (Hach sample cell, 50 mL beaker, vial capable of holding 30 mL and parafilm if the vessel doesn't have a cap).
- 1 packet of ChromaVer® 3 Reagent per sample.
- 2.5 mg/L hexavalent chromium (Cr^{+6}) (working) standard.

Procedure

1. Collect the sample(s) following the appropriate SOP (see list below). Samples should be analyzed as soon as possible (within 24 hours). **Note: all samples must be filtered**.
    - SOP-A1 – Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method
    - SOP-A2 – Purging and Sampling of 1-inch-diameter Groundwater Monitoring Wells, Modified Well-Volume Method
    - SOP-A3 – Purging and Sampling of Active and Inactive Water Supply Wells
    - SOP-A4 – Depth-Specific Surface Water Sampling
    - SOP-A5 – Groundwater Sampling from Sonic Drilling Boreholes
    - SOP-A14 – Pore Water Sampling
    - SOP-A18 – Purging and Sampling of Groundwater Monitoring Wells Minimal Drawdown Method

- SOP-A19 – Sampling of Groundwater Monitoring Wells HydraSleeve No Purge Method
- Remedy-SOP-01 – Process Water Sampling

2. Filtering can be performed using an inline filter at the time of sampling (see SOP–A6, Sample Field Filtration and Preservation for Metals Analyses) or in the laboratory by vacuum filter:

   - Set up the vacuum filter apparatus.
   - Filter ~100 mL of sample.

3. Measure the pH of the raw sample (**Record the results in the Cr^{+6} bench log book**).

4. Verify the spectrophotometer is set for **Hexavalent Chromium (Cr^{+6})** (Hach DR/4000V program **1560)** and verify all reagents are for 25 mL sample size (or adjust accordingly).

5. Transfer 25 mL of filtered sample into a reaction vessel (sample cell, beaker, etc.)

6. Add one packet of ChromaVer® 3 Reagent to the sample.

7. Invert sample 4–5 times or swirl the sample until powdered reagent is dissolved.

8. Start timer (8 mins.).

9. Run a blank: Use a 25 mL aliquot of filtered sample to "zero" the spectrophotometer.

   - Transfer 25 mL of raw filtered sample into the pour-thru-cell funnel.
   - Allow the meter to stabilize and press the Zero button.

10. After 8 minute timer, pour the sample with the reagent added into a syringe filter to remove the excess reagent powder. Transfer the sample into the pour-thru-cell funnel (sample port of the Hach DR/4000V).

11. Record the instrument reading in the Cr^{+6} bench log book.

12. If the result is out of range for the spectrophotometer, reanalyze the sample using a dilution.

    Note: if a dilution is required, the spectrophotometer should be zeroed using sample from the same dilution.

    Common dilutions:

    - 1:2 dilution: 25 mL of sample are diluted with 25 mL of deionized (DI) water; multiply the instrument reading (result) by 2 for the adjusted value.

      Example: instrument reading is 0.304
      x 2
      = .608 mg/L (final result)

- 1:5 dilution: 10 mL of sample are diluted with 40 mL of DI water; multiply the instrument reading (result) by 5 for the adjusted value.

  Example: instrument reading is 0.304
  x 5
  = 1.52 mg/L (final result)

- 1:10 dilution: 10 mL of sample are diluted with 90 mL of DI water; multiply the instrument reading (result) by 10 for the adjusted value.
- 1:20 dilution: 5 mL of sample are diluted with 95 mL of DI water; multiply the instrument reading (result) by 20 for the adjusted value.

Quality Control (QC)

- With the first analysis of hexavalent chromium each shift, **analyze a CCV** (Continuing Calibration Verification) standard as a **Quality Control** check:
  - Carefully measure 24 mL of DI water into a reaction vessel (sample cell, beaker, etc.).
  - Add 1 mL of 2.5 mg/L hexavalent chromium (Cr^{+6}) standard.
  - Add the hexavalent chromium reagent pillow at the same time as your samples. (ChromaVer® 3 Reagent).
  - Invert the CCV sample 4–5 times, or swirl the sample, until powdered reagent is dissolved.
  - Use the same 8 minute timer for CCV and field samples. **Note:** The blank for the CCV should be DI water.
  - **Record the CCV results in the Cr^{+6} bench log book.** If the instrument reading is not between 0.075 mg/L and 0.125 mg/L, re-prepare the standard and reanalyze.
- Periodic **Matrix Spikes (MSs)** should be analyzed. Any time a sample result appears anomalous, consider analyzing an MS of that sample.
  - Determine what dilution if any is required for the matrix spike (note: you will be adding 0.1 mg/L to the sample concentration [the instrument reading]).
  - Carefully measure 24 mL of filtered sample (diluted if required) into a reaction vessel (sample cell, beaker, etc.)
  - Add 1 mL of 2.5 mg/L hexavalent chromium (Cr^{+6}) standard to the 24 mL of filtered sample (this solution is called the MS)**.**
  - Add ChromaVer® 3 Reagent to the MS.
  - Invert sample 4 – 5 times – or swirl the sample; until powdered reagent is dissolved.
  - Start timer (8 min)
  - Use a 25 mL aliquot of filtered sample to Zero the Spectrometer. (Blank)
    - Transfer 25 mL of raw filtered sample into the pour-thru-cell funnel.
    - Allow the meter to stabilize and press the Zero button.

- After 8 minute timer, pour the sample into a syringe filter to remove the excess reagent powder. Transfer the sample into the pour-thru-cell funnel (sample port of the Hach DR/4000V).
- Record the instrument reading in the Cr^{+6} bench log book.
- Check the recovery of the MS:

  Example: Matrix Spike (0.117 mg/L) - Sample (0.006 mg/L) = 0.111 mg/L

  Concentration of Spike Standard = 0.100 mg/L

  % recovery is = 0.111/0.100 = 111%

  MS % recovery must be between 75 – 125% or you will need to reanalyze.

- If the CCV or MS are still not between 0.075 mg/L and 0.125 mg/L after reanalyses, call the Project Chemist (Shawn Duffy) at 530-229-3303.

Known Interferences

- Iron may interfere at levels above 1 mg/L.
- Highly buffered samples or extreme sample pH may exceed the buffering capacity of the reagents.

Standard Operating Procedure – Laboratory
PG&E Topock Program

Title: Ferrous Iron Analysis by Hach Method 8146
Number: SOP-L02_Rev03
Revision Date: 10/13/2015

Scope

Standard operating procedure (SOP) for analysis of ferrous iron (Fe^{+2}). The practical range of the method is 0.02 mg/L to 3 mg/L.

Equipment and Supplies

- Safety glasses
- Latex gloves
- Hach DR 4000V spectrophotometer or equivalent.
- pH meter.
- Reaction vessel and cap or means of sealing the reaction vessel (Hach sample cell, 50 mL beaker, vial capable of holding 30 mL and parafilm if the vessel doesn't have a cap).
- 1 packet of Ferrous Iron Reagent per sample.
- 0.45 µm filter disc fitted to a disposable 50 mL syringe (syringe filter).

Procedure

1. Collect the sample(s) following the appropriate SOP (see list below). Ferrous iron samples should be analyzed as soon as possible (within 6 hours).
    - SOP-A1 – Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method
    - SOP-A2 – Purging and Sampling of 1-inch-diameter Groundwater Monitoring Wells, Modified Well-Volume Method
    - SOP-A3 – Purging and Sampling of Active and Inactive Water Supply Wells
    - SOP-A4 – Depth-Specific Surface Water Sampling
    - SOP-A5 – Groundwater Sampling from Sonic Drilling Boreholes
    - SOP-A14 – Pore Water Sampling
    - SOP-A18 – Purging and Sampling of Groundwater Monitoring Wells Minimal Drawdown Method
    - SOP-A19 – Sampling of Groundwater Monitoring Wells HydraSleeve No Purge Method
    - Remedy-SOP-01 – Process Water Sampling

2. Measure the pH of the raw sample. (Record the results in the Fe+2 bench log book.)
3. Verify the spectrophotometer is set for Ferrous Iron (Hach DR/4000V, program 2150) and verify all reagents are for 25 mL sample size (or adjust accordingly).
4. Transfer 25 mL of the sample into a reaction vessel (sample cell, beaker, etc.).
5. Add one packet of Ferrous Iron Reagent.
6. Invert sample 4–5 times or swirl the sample until powdered reagent is dissolved.
7. Start timer (3 mins.).
8. Run a blank: Use a syringe filter to filter 25 mL of the raw sample and use to "zero" the spectrophotometer.
   - Transfer 25 mL of raw filtered sample into the pour-thru-cell funnel.
   - Allow the meter to stabilize and press the Zero button.
9. After 3 minute timer, use a syringe filter to filter the sample with the reagent added and transfer the sample into the pour-thru-cell funnel (the sample port of the Hach DR/4000V).
10. Record the instrument reading in the Fe+2 bench log book.
11. If the result is out of range for the spectrophotometer, reanalyze the sample using a dilution.

    Note: if a dilution is required, the spectrophotometer should be zeroed using sample from the same dilution.

    If it's determined in step 11 that a dilution is required, select one of the common dilutions listed below and re-analyze (step 4 thru step 11) using the selected dilution (remember to multiply the instrument reading by the dilution factor as listed below).

    - 1:2 dilution: 25 mL of sample are diluted with 25 mL of deionized (DI) water; multiply the instrument reading (result) by 2 for the adjusted value.

      Example: instrument reading is 0.304
      x 2
      = .608 mg/L (final result)

    - 1:5 dilution: 10 mL of sample are diluted with 40 mL of DI water; multiply the instrument reading (result) by 5 for the adjusted value.

      Example: instrument reading is 0.304
      x 5
      = 1.52 mg/L (final result)

    - 1:10 dilution: 10 mL of sample are diluted with 90 mL of DI water; multiply the instrument reading (result) by 10 for the adjusted value.
    - 1:20 dilution: 5 mL of sample are diluted with 95 mL of DI water; multiply the instrument reading (result) by 20 for the adjusted value.

Standard Operating Procedure – Laboratory
PG&E Topock Program

Title: Total Chromium Analysis by Hach Method 8024
Number: SOP-L03_Rev02
Revision Date: 10/13/2015

Scope

Standard operating procedure (SOP) for analysis of total chromium (Cr^{+3}).

Equipment and Supplies

- Safety glasses
- Latex gloves
- Hach DR 4000V spectrophotometer or equivalent.
- Vacuum filter apparatus: 47 mm magnetic filter funnels, 1,000 mL Erlenmeyer flask, and vacuum pump. Use a 0.45 µm, 47 mm diameter filter membrane.
- 0.45 µm filter disc fitted to a disposable 50 mL syringe (syringe filter).
- pH meter.
- Hach sample cell or vial capable of holding 30 mL.
- 1 packet of ChromaVer® 3 Reagent per sample.
- 1 packet of Chromium 1 Reagent per sample.
- 1 packet of Chromium 2 Reagent per sample.
- 1 packet of Acid Reagent per sample.
- 2.5 mg/L Chromium, Total (Cr^{+3}) (working) standard.
- Hot plate and water bath or heating block.
- Ice bath (baking pan with water and ice - approximately 1" deep)

Procedure

1. Collect the sample(s) following the appropriate SOP (see list below). The samples should be analyzed within 24 hours if possible. Note: all samples must be filtered.
    - SOP-A1 – Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method
    - SOP-A2 – Purging and Sampling of 1-inch-diameter Groundwater Monitoring Wells, Modified Well-Volume Method
    - SOP-A3 – Purging and Sampling of Active and Inactive Water Supply Wells

- SOP-A4 – Depth-Specific Surface Water Sampling
- SOP-A5 – Groundwater Sampling from Sonic Drilling Boreholes
- SOP-A14 – Pore Water Sampling
- SOP-A18 – Purging and Sampling of Groundwater Monitoring Wells Minimal Drawdown Method
- SOP-A19 – Sampling of Groundwater Monitoring Wells HydraSleeve No Purge Method
- Remedy-SOP-01 – Process Water Sampling

2. Filtering can be performed using an inline filter at the time of sampling (see SOP–A6, Sample Field Filtration and Preservation for Metals Analyses) or in the laboratory by vacuum filter:
   - Set up the vacuum filter apparatus.
   - Filter ~100 mL of sample.
3. Turn on the hot plate and set to 390°F.
   - Make sure the water bath is ~ ½ inch below the top.
4. Measure the pH of the raw sample. (**Record the results in the Cr^{+3} bench log book.**)
5. Verify the spectrophotometer is set for **Chromium, Total (Cr^{+3})** (Hach DR/4000V program **1580)** and verify all reagents are for 25 mL sample size (or adjust accordingly).
6. Transfer 25 mL of filtered sample into a sample cell or vial.
7. Add Chromium 1 Reagent to each of the sample cells/vials.
8. Invert samples 4–5 times or swirl the sample until powdered reagent is dissolved.
9. Place the samples into the sample rack in the hot water bath (water should be boiling) and start the 5-minute "Heat" timer.
10. After 5 minutes, remove the sample cells/vials and cool to room temperature in an ice bath.
11. Add Chromium 2 Reagent to each of the sample cells/vials.
12. Invert samples 4–5 times or swirl the sample until powdered reagent is dissolved.
13. Add Acid Reagent to each of the sample cells.
14. Invert samples 4–5 times or swirl the sample until powdered reagent is dissolved.
15. Add ChromaVer® 3 Reagent to each of the sample cells/vials; invert samples 4–5 times or swirl the sample until powdered reagent is dissolved.
16. Start the 5-min. "wait" timer.
17. Run a blank: Use a 25 mL aliquot of filtered sample to "zero" the spectrophotometer:
    - Transfer 25 mL of raw filtered sample into the pour-thru-cell funnel.
    - Allow the meter to stabilize and press the Zero button.

18. After 5 minute "wait" timer, pour the sample with the reagent added into a syringe filter to remove the excess reagent powder. Transfer the sample into the pour-thru-cell funnel (sample port of the Hach DR/4000V).
19. Record the instrument reading in the Cr^{+3} bench log book.
20. If the result is out of range for the spectrophotometer, reanalyze the sample using a dilution.

    Note: if a dilution is required, the Spectrometer should be zeroed using sample from the same dilution.

    Common dilutions:

    - 1:2 dilution: 25 mL of sample are diluted with 25 mL of deionized (DI) water; multiply the instrument reading (result) by 2 for the adjusted value.

      Example: instrument reading is 0.304
      x 2
      = .608 mg/L (final result)

    - 1:5 dilution: 10 mL of sample are diluted with 40 mL of DI water; multiply the instrument reading (result) by 5 for the adjusted value.

      Example: instrument reading is 0.304
      x 5
      = 1.52 mg/L (final result)

    - 1:10 dilution: 10 mL of sample are diluted with 90 mL of DI water; multiply the instrument reading (result) by 10 for the adjusted value.
    - 1:20 dilution: 5 mL of sample are diluted with 95 mL of DI water; multiply the instrument reading (result) by 20 for the adjusted value.

Quality Control (QC)

- With the first analysis of Chromium, Total each shift, **analyze a CCV** (Continuing Calibration Verification) standard as a **Quality Control** check:
  - Carefully measure 24 mL of DI water into a reaction vessel (sample cell).
  - Add 1 mL of 2.5 mg/L Chromium, Total (Cr^{+3}) standard.
  - Add the Chromium 1 Reagent at the same time as your samples.
  - Follow the remaining procedures as listed above for the samples (hot water bath, cool with ice, add additional reagents, filter, and analyze). **Note:** The Blank for the CCV should be DI water.
  - **Record the CCV results in the Cr^{+3} bench log book.** If the instrument reading is not between 0.075 mg/L and 0.125 mg/L, re-prepare the standard and reanalyze.
- Periodic **Matrix Spikes (MSs)** should be analyzed. Any time a sample result appears anomalous, consider analyzing a matrix spike of that sample.
  - Determine what dilution, if any, is required for the matrix spike (note: you will be adding 0.1 mg/L to the sample concentration [the instrument reading]).

- Carefully measure 24 mL of filtered sample (diluted if required) into a reaction vessel (sample cell/vial).
- Add 1 mL of 2.5 mg/L Chromium, Total (Cr^{+3}) standard to the 24 mL of filtered sample (this solution is called the MS).
- Add the Chromium 1 Reagent at the same time as your samples.
- Follow the remaining procedures as listed above for the samples (hot water bath, cool with ice, add additional reagents, filter and analyze).
- Run a blank: Use a 25 mL aliquot of filtered sample to zero the spectrophotometer:
  - Transfer 25 mL of raw filtered sample into the pour-thru-cell funnel.
  - Allow the meter to stabilize and press the Zero button.
- After the 5-minute "wait" timer, pour the sample into a syringe filter to remove the excess reagent powder. Transfer the sample into the pour-thru-cell funnel (sample port of the Hach DR/4000V).
- Record the instrument reading in the **Cr^{+3}** bench log book.
- Check the recovery of the MS.

  Example: Matrix Spike (0.117 mg/L) - Sample (0.006 mg/L) = 0.111 mg/L

  Concentration of Spike Standard is = 0.100 mg/L

  % recovery is = 0.111/0.100 = 111%

  MS % recovery must be between 75 – 125% or you will need to reanalyze.
- If the CCV or MS are still not between 0.075 mg/L and 0.125 mg/L after reanalyses, call the Project Chemist (Shawn Duffy) at 530-229-3303.

Known Interferences

- High concentrations of organic material may inhibit complete oxidation of trivalent chromium.
- Highly buffered samples or extreme sample pH may exceed the buffering capacity of the reagents.

Standard Operating Procedure – Laboratory
PG&E Topock Program

Title: Conductivity Analysis by Hach Method 8160
Number: SOP-L04_Rev01
Revision Date: 10/13/2015

Scope

Standard operating procedure (SOP) for analysis of conductivity. The practical range of the method is 0.01 µS/cm to 200 mS/cm (0.01 to 200,000 µS/cm).

Conductivity is the measure of the ability of a solution to conduct an electric current and is dependent on temperature. The conductivity can then be multiplied by an empirically derived factor to calculate the approximate amount of total dissolved solids (TDS) in the sample.

Equipment and Supplies

- Safety glasses
- Latex gloves
- Hach sensION 378 Multiparameter Meter or equivalent
- Hach Quick Reference Guide booklet for the sensION156 and sensION378 Multiparameter Meters (54650-23)
- Conductivity Standards – 1000 µS/cm (Hach 14400-42) (Ensure that the conductivity standard solution is not expired.)
- Deionized (DI) water
- 100 mL beakers
- Calibration sheet
- Kimwipes
- Magnetic stir plate and magnetic stir bar.

Procedure

1. Collect the sample(s) following the appropriate SOP (see list below). Samples should be analyzed as soon as possible (within 24 hours).
    - SOP-A1 – Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method
    - SOP-A2 – Purging and Sampling of 1-inch-diameter Groundwater Monitoring Wells, Modified Well-Volume Method
    - SOP-A3 – Purging and Sampling of Active and Inactive Water Supply Wells
    - SOP-A4 – Depth-Specific Surface Water Sampling

- SOP-A5 – Groundwater Sampling from Sonic Drilling Boreholes
- SOP-A14 – Pore Water Sampling
- SOP-A18 – Purging and Sampling of Groundwater Monitoring Wells Minimal Drawdown Method
- SOP-A19 – Sampling of Groundwater Monitoring Wells HydraSleeve No Purge Method
- Remedy-SOP-01 – Process Water Sampling

2. Verify the meter is in COND mode.
3. Rinse the conductivity probe with DI water and shake it to remove excess water. (Check to make sure there are no bubbles in probe cell.) The meter should read below 10 µS/cm.
4. Confirm the calibration by checking the conductivity of the 1000 µS/cm standard at the beginning of each shift. (If a sample's conductivity is expected or measured between 10,000 µS/cm and 20,000 µS/cm, use a standard between 10,000 to 18,000 µS/cm to also verify the calibration. Likewise, if a sample's conductivity is, or expected to be, greater than 20,000 µS/cm, use a standard between 20,000 and 45,000 µS/cm to verify the calibration. Follow the steps below substituting the higher concentration standards.)
   a. Pour ~50 mL of 1000 µS/cm standard in a 100 mL beaker.
   b. Add a clean stir rod to the standard.
   c. Start the stir plate at a moderate rate (fast enough to stir the sample, but not fast enough to cause a vortex to form).
   d. Allow the meter to stabilize.
   e. After the reading stabilizes, record value on the calibration sheet.
5. If not within 10% of the true value (e.g., 900 to 1,100 µS/cm for the 1,000 µS/cm standard), recalibrate the meter following the steps on page 5 of the Hach **Quick Reference Guide** booklet for the **sensION156** and **sensION378** Multiparameter Meters (54650-23).

   Be sure to clean the probe cell first. If DI water does not clean the cell, try cleaning the cell as follows: Wash with warm water and laboratory soap and rinse with copious amounts of DI water before use. Alternatively a 3% HCl acid solution may be used. Solvents such as acetone or ethanol should only be used as a last resort, and the cell should not be immersed for longer than 5 minutes. Always completely rinse with DI water. Re-calibrate after these cleanings.
6. If the standard results are within 10% of the true value (e.g., 900 to 1,100 µS/cm for the 1,000 µS/cm standard), continue with analysis for each of the samples. (Ensure the temperature of the sample is between 20°C and 25°C.)
7. Pour a fresh portion (~ 50-mL) of the sample into a clean 100 mL beaker.
8. Add a clean stir rod to the sample.

9. Start the stir plate at a moderate rate (fast enough to stir the sample, but not fast enough to cause a vortex to form).
10. Place probe in sample.
11. Allow the meter to stabilize.
12. Record the conductivity result on the Conductivity bench sheet and include the units. (Note: The meter automatically changes the units from µS/cm to mS/cm above 1,999 µS/cm.) The result is automatically corrected to the reference temperature of 20°C.
13. Rinse the probe and cell with DI water after each sample.

Calculations

- To convert from mS/cm to µS/cm multiply the result by 1000.
- TDS, mg/L (ppm) ≅ Conductivity (µS/cm) * 0.63.

References

American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF). 1998. *Standard Methods for the Examination of Water and Wastewater.* 20th Edition. Method 2510.

Hach Company. 2003. *Water Analysis Handbook*. 4th Edition. Method 8160.

Standard Operating Procedure – Laboratory
PG&E Topock Program

Title: Spike Preparation
Number: SOP-L08_Rev01
Revision Date: 06/05/2014

Scope

Standard operating procedure (SOP) for preparing "working concentration" spike solutions for the analysis of reagent spikes (Continuing Calibration Verifications or CCVs) and sample matrix spikes (MSs).

Equipment and Supplies

- Safety glasses
- Latex gloves
- 100 mL or 1000 mL volumetric flask with cap
- 1 mL or 5 mL pipette
- Deionized (DI) water
- Glass standards bottle or 1 liter poly bottle and labels
- Chemical standard:

    a. Hexavalent Chromium: 50 mg/L hexavalent chromium standard; also see SOP-L01, Hexavalent Chromium Analysis by Hach Method 1560

    b. Total Chromium: 50 mg/L total chromium standard; also see SOP-L03, Total Chromium Analysis by Hach Method 8024

    c. Manganese: 25 mg/L manganese standard; also see SOP-L18, Manganese Analysis by Hach Method 8149

    d. Nitrate: 100 mg/L nitrate standard; also see SOP-L13, Nitrate Analysis by Hach Method 8171

    e. Sulfate: 1000 mg/L sulfate standard and 1 packet of SulfaVer® 4 Reagent; also see SOP-L14, Sulfate Analysis by Hach Method 8051

    f. Total Organic Carbon (TOC): 1000 mg/L TOC standard (potassium hydrogen phthalate [KHP]); also see SOP-L16, Total Organic Carbon Analysis by Hach Method 10129

Procedures

a. Hexavalent Chromium

1. Add ~50 mL of DI water to a 100 mL volumetric flask.
2. Add 5 mL of a 50 mg/L hexavalent chromium standard using a 1 mL pipette.
3. Bring the volume of the flask to 100 mL using DI water.

4. Cap, and mix thoroughly.
5. The resultant concentration of the standard is 2.5 mg/L. This standard solution can be used to prepare an MS and/or a CCV standard as outlined in SOP-L01, Hexavalent Chromium Analysis by Hach Method 1560.
6. Transfer the 2.5 mg/L working standard to a glass standards bottle and label.
7. Verify the concentration by following the CCV procedure as detailed in SOP-L01, Hexavalent Chromium Analysis by Hach Method 1560.

b. Total Chromium

1. Add ~50 mL of DI water to a 100 mL volumetric flask.
2. Add 5 mL of a 50 mg/L total chromium standard using a 1 mL pipette.
3. Bring the volume of the flask to 100 mL using DI water.
4. Cap, and mix thoroughly.
5. The resultant concentration of the standard is 2.5 mg/L. This standard solution can be used to prepare an MS and/or a CCV standard as outlined in SOP-L03, Total Chromium Analysis by Hach Method 8024.
6. Transfer the 2.5 mg/L working standard to a glass standards bottle and label.
7. Verify the concentration by following the CCV procedure as detailed in SOP-L03, Total Chromium Analysis by Hach Method 8024.

c. Manganese

1. Add ~25 mL of DI water to a 50 mL volumetric flask.
2. Add 2 mL of a 25 mg/L manganese standard using a 1 mL pipette.
3. Bring the volume of the flask to 50 mL using DI water.
4. Cap, and mix thoroughly.
5. The resultant concentration of the standard is 1 mg/L. This standard solution can be used to prepare an MS and/or a CCV standard as outlined in SOP-L18, Manganese Analysis by Hach Method 8149.
6. Transfer the 1 mg/L working standard to a glass standards bottle and label.
7. Verify the concentration by following the CCV procedure as detailed in SOP-L18, Manganese Analysis by Hach Method 8149.

d. Nitrate

1. Add ~50 mL of DI water to a 100 mL volumetric flask.
2. Add 25 mL of a 100 mg/L nitrate standard using a 5 mL pipette.
3. Bring the volume of the flask to 100 mL using DI water.

4. Cap, and mix thoroughly.
5. The resultant concentration of the standard is 25 mg/L. This standard solution can be used to prepare an MS and/or a CCV standard as outlined in SOP-L13, Nitrate Analysis by Hach Method 8171.
6. Transfer the 25 mg/L working standard to a glass standards bottle and label.
7. Verify the concentration by following the CCV procedure as detailed in SOP-L13, Nitrate Analysis by Hach Method 8171.

e. Sulfate

1. Add ~500 mL of DI water to a 1000 mL volumetric flask.
2. Add 70 mL of a 1000 mg/L sulfate standard using graduated cylinder.
3. Bring the volume of the flask to 1000 mL using DI water.
4. Cap, and mix thoroughly.
5. The resultant concentration of the standard is 70 mg/L. This working standard can be used at this concentration for a CCV standard as outlined in SOP-L14, Sulfate Analysis by Hach Method 8051.
6. Transfer the 70 mg/L working standard to a 1 liter poly bottle and label.
7. Verify the concentration by following the CCV procedure as detailed in SOP-L14, Sulfate Analysis by Hach Method 8051.

f. TOC

1. Add ~500 mL of DI water to a 1000 mL volumetric flask.
2. Add 10 mL of a 1000 mg/L TOC standard (KHP) using a 5 mL pipette.
3. Bring the volume of the flask to 1000 mL using DI water.
4. Cap, and mix thoroughly.
5. Transfer the 10 mg/L working standard to a glass standards bottle and label.
6. The resultant concentration of the standard is 10 mg/L. This standard solution can be used to prepare an MS and/or a CCV standard as outlined in SOP-L16, TOC Analysis.
7. Transfer the 10 mg/L working standard to a 1 liter poly bottle and label.
8. Verify the concentration by following the CCV procedure as detailed in SOP-L16, TOC Analysis by Hach Method 10129.

Standard Operating Procedure – Laboratory
PG&E Topock Program

Title: pH Measurement
Number: SOP-L09_Rev02
Revision Date: 10/13/2015

Scope

Standard operating procedure (SOP) for pH measurement.

Equipment and Supplies

- Safety glasses
- Latex gloves
- Hach sensION 378 Multiparameter Meter or equivalent

  Note: Store the pH electrode in the pH 4 or 7 buffer solution when it's not in use, or use the manufacturer's storage solution. Replace the storage solution every week.
- Hach Quick Reference Guide for sensION156 and sensION378 Multiparameter Meters (54650-23).
- pH buffer solutions for pH 4, 7 and 10. (Make sure the buffer solutions are not expired.)
- 100 mL beakers
- De-ionized (DI) water (squirt bottle)
- Calibration beakers. (Calibration beakers are provided by the instrument manufacturer and have sealable lids that allow the calibrations standards to be reused. Do not pour the calibration standards back into the original bottles. Replace the working buffer solution at least twice a week or if re-calibrating the meter is required.)
- Calibration sheet
- Kimwipes
- Magnetic stir plate and magnetic stir bar.

Procedure

1. Collect the sample(s) following the appropriate SOP (see list below). Samples should be analyzed as soon as possible (within 24 hours).
   - SOP-A1 – Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method
   - SOP-A2 – Purging and Sampling of 1-inch-diameter Groundwater Monitoring Wells, Modified Well-Volume Method

- SOP-A3 – Purging and Sampling of Active and Inactive Water Supply Wells
- SOP-A4 – Depth-Specific Surface Water Sampling
- SOP-A5 – Groundwater Sampling from Sonic Drilling Boreholes
- SOP-A14 – Pore Water Sampling
- SOP-A18 – Purging and Sampling of Groundwater Monitoring Wells Minimal Drawdown Method
- SOP-A19 – Sampling of Groundwater Monitoring Wells HydraSleeve No Purge Method
- Remedy-SOP-01 – Process Water Sampling

Notes prior to beginning calibration:

- The pH meter must be calibrated at the beginning of each day and any time the pH reading does not make sense.
- Make sure the electrode is rinsed well between samples.
- Make sure the buffers and samples are at a constant temperature before beginning the calibration or analysis procedure (pH is affected by temperature).

2. To start the calibration pour fresh portions (~ 50-mL) of the pH 4, 7 and 10 buffers into the calibration beakers (buffers should be replaced at least twice per week). Rinse each calibration beaker 3 times with small portions of buffer before filling the beaker with the portion to be analyzed.
3. Add a clean stir rod to each standard.
4. Start the stir plate at a moderate rate (fast enough to stir the sample, but not fast enough to cause a vortex to form).
5. Turn the pH meter on.
6. Make sure the meter is in pH mode.
7. Rinse the electrode with DI water.
8. Follow the calibration procedures on page 3 in the Hach **Quick Reference Guide** for **sensION156** and **sensION378** Multiparameter Meters (54650-23).
    - Be careful not to hit the electrode end against the sides of the beaker.
9. If the pH probe does not recognize the pH 4 buffer within 2 – 3 minutes, re-rinse the electrode with DI water, dry with a Kimwipe and try again. If you've cleaned the probe three times and the pH meter still doesn't recognize the pH 4 buffer, call the Project Chemist (Shawn Duffy) at 530-229-3303.
10. Rinse the electrode with DI water between each buffer solution.
11. After calibrating with the pH 4, 7 and 10 buffers, record the Slope value on the calibration sheet and press Enter to accept and return to the reading mode.

12. Rinse the electrode with DI water.
13. To analyze samples, pour a fresh portion (~ 50-mL) of the sample into a clean 100 mL beaker.
14. Add a clean stir bar.
15. Start the stir plate at a moderate rate (fast enough to stir the sample, but not fast enough to cause a vortex to form).
16. Place the pH meter electrode in the sample.
17. Allow the meter to stabilize, record the pH in the appropriate bench log book.
18. If the meter does not stabilize during a pH measurement a new calibration may be needed. Rinse the electrode with DI water and re-start the calibration.

Standard Operating Procedure
PG&E Topock Program

Title: Hach Model 2100P Turbidimeter Calibration and Analysis
Number: SOP-L10 Rev02
Revision Date: 10/13/2015

Scope

Standard Operating Procedure (SOP) for the analysis of turbidity. This SOP covers the calibration and operating procedures for the Hach Model 2100P turbidimeter.

Precautions/Hazards

- Operators should not attempt the full calibration task until they have been properly trained.
- Hazards include exposure to Formazin and silicone oil (please refer to material safety data sheets [MSDSs] for all chemicals).

Equipment and Supplies List

- Safety glasses
- Latex gloves
- Kimwipes
- Oiling cloths
- Hach Model 2100P portable turbidimeter
- Model 2100P Turbidimeter Instrument and Procedure Manual (Cat. No. 46500-88)
- Carrying case
- Four AA alkaline batteries
- Sample cells with caps
- Check and calibration log
- Turbidimeter kit
- Reagents:
  - Formazin Primary Standards: Hach Part # 26594-05, StablCal® Standards, <0.1, 20, 100, 800 NTU ampoules
  - Gelex Secondary Standards: Hach Part # 24641-05
  - Silicone oil: Hach Part # 1269-36

Daily Gelex Check Procedure

1. Turn on turbidimeter and select automatic range mode. You should see "AUTO RNG" on display.
2. Thoroughly clean the outside of all three Gelex vials with Kimwipes, apply one drop of silicone oil to each vial, and wipe with oiling cloth.
    - Dirty, scratched, or damaged cells can cause inaccurate readings. Handle cells only by the top to minimize dirt, scratches and fingerprints in the light path.
    - The silicone oil is used to eliminate the effects of fine scratches in the glass cell. If the vial has any large visible scratches, notify the supervisor so a replacement Gelex set can be ordered.
    - Avoid excess coating of oil. Oil is not needed if the sample cells are properly maintained.
3. Beginning with Gelex standard 0-10 NTU, place Gelex cell into compartment so that the diamond aligns with orientation mark on the turbidimeter. Close the lid.
4. When taking a reading, place the instrument on a level, stationary surface. It should not be held in the hand during measurement.
5. Press the Read button.
6. If 9.99 or 99.9 are flashing on display, press 'Range' button to change range of meter.
7. Record the displayed value in the check and calibration log.
8. Repeat steps 2 through 5 for remaining Gelex standards.

If any of the Gelex standards are +/- 5% from assigned value, the turbidimeter must be calibrated.

Turbidimeter Calibration Procedure

For expediency you will be referred to the instrument manual (Section 3.6, pages 35-54) to perform these procedures.

1. Prepare Formazin standards, located in the turbidimeter kit (small blue tool box located in cabinet under counter below mixer), according to procedure on page 37, **Section 3.6.1.3** of **Model 2100P Turbidimeter Instrument and Procedure Manual**.
2. Cap the sample cells to prevent spillage of Formazin into the instrument.
3. Begin calibration procedure on page 42, **Section 3.6.3** of **Model 2100P Turbidimeter Instrument and Procedure Manual**.
4. After the turbidimeter has accepted the calibration, assign new values to all Gelex standards using the Daily Gelex Check Procedure above.

Sample Analysis Procedure

1. Transfer sample into a vial dedicated to turbidity measurements "cell." **Do not dilute the samples.**
    - Always use clean sample cells in good condition. Properly clean cells between measurements. Do not use a brush on the sample cell, always use Kimwipes or equivalent optical wipes to dry the cells.
    - Dirty, scratched, or damaged cells can cause inaccurate readings. Handle cells only by the top to minimize dirt, scratches and fingerprints in the light path.
2. Cap the sample cell to prevent spillage of sample into the instrument.
3. Avoid settling of sample prior to measurement. Allow samples to degas but do not allow settling of solids.
4. Thoroughly clean the outside of cell with Kimwipes, apply one drop of silicone oil if needed, and wipe with oiling cloth. Oil is not needed if the sample cells are properly maintained.
    - The silicone oil is used to eliminate the effects of fine scratches in the glass cell. If the vial has any large visible scratches, discard and use another cell.
    - Avoid excess coating of oil.
5. Place the sample cell into the compartment so that the diamond aligns with orientation mark on the turbidimeter. Close the lid.
6. Place the instrument on a level, stationary surface. It should not be held in the hand during measurement.
7. Press the Read button.
8. If 9.99 or 99.9 are flashing on display, press 'Range' button to change range of meter.
9. Record the displayed value in the bench logbook.
10. Do not leave a sample cell in the cell compartment for extended periods of time. This may compress the spring in the cell holder.
11. Always close the sample compartment lid during storage. Remove sample cell and batteries from instrument if the instrument is stored for extended time period (more than a month).

Quality Control

- QC activities that will help ensure the accuracy and precision of this method include:
    - **Using optically matched (or single) cells for Low Level Turbidity** - Precise measurements of low turbidity (< 2 NTU) samples require using a single cell for all measurements or using optically matched cells – *see Hach instruction manual Section 2.3.3 pages 22-25*.
    - **Use dedicated cells –** The use of cells dedicated to turbidity measurement is recommended.

- **Removing trapped gases** - *See Hach instruction manual Section 2.3.3 pages 22-25.* This would only be a problem for samples that exhibit foaming or where gas bubbles are observed.
- **Do not dilute the samples**.
- The calibration of the turbidimeter must be verified, using the more convenient Gelex® secondary standards, at the beginning of each day and any time the turbidity reading does not make sense. The turbidimeter must be fully calibrated using Formazin primary standards every three months as per manufacturer standards, and also whenever the daily Gelex check standards fail to meet the +/- 5% quality control (QC) criteria.

Standard Operating Procedure – Laboratory
PG&E Topock Program

Title: Nitrate Analysis by Hach Method 8171
Number: SOP-L13_Rev01
Revision Date: 10/13/2015

Scope

Standard operating procedure (SOP) for analysis of nitrate (NO_3^--N).

Equipment and Supplies

- Safety glasses
- Latex gloves
- Hach DR 4000V spectrophotometer or equivalent
- pH meter
- Reaction vessel and cap or means of sealing the reaction vessel– (Hach sample cell, 50 mL beaker, vial capable of holding 30 mL, and parafilm if the vessel doesn't have a cap)
- 1 packet of NitraVer® 5 Reagent per sample
- 25 mg/L nitrate (NO_3^--N) (working) standard
- 0.45 µm filter disc fitted to a disposable 50 mL syringe (syringe filter)
- Deionized (DI) water
- Timer

Procedure

1. For each lot of reagents, analyze a reagent blank. Transfer 25 mL of DI water into a reaction vessel and follow steps 4 through 12 below. Sample concentration may need to be adjusted based on the reagent's contribution. If the concentration is greater than 0.25 mg/L call the Project Chemist (Shawn Duffy) at 530-229-3303.
2. Collect the sample(s) following the appropriate SOP (see below). Nitrate samples should be analyzed as soon as possible (within 24 hours).
    - SOP-A1 – Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method
    - SOP-A2 – Purging and Sampling of 1-inch-diameter Groundwater Monitoring Wells, Modified Well-Volume Method
    - SOP-A3 – Purging and Sampling of Active and Inactive Water Supply Wells
    - SOP-A4 – Depth-Specific Surface Water Sampling
    - SOP-A5 – Groundwater Sampling from Sonic Drilling Boreholes

- SOP-A14 – Pore Water Sampling
- SOP-A18 – Purging and Sampling of Groundwater Monitoring Wells Minimal Drawdown Method
- SOP-A19 – Sampling of Groundwater Monitoring Wells HydraSleeve No Purge Method
- Remedy-SOP-01 – Process Water Sampling

3. Measure the pH of the raw sample. Record the results in the NO_3^--N Bench Logbook.
4. Verify the spectrophotometer is set for Nitrate (Hach DR/4000V, program 2520) and verify all reagents are for 25 mL sample size (or adjust accordingly).
5. Transfer 25 mL of the sample into a reaction vessel. (Note: the sample cell or vessel must be able to be sealed with a cap or parafilm.)
6. Add 1 packet of NitraVer® 5 Reagent.
7. Start the 1 minute timer.
8. Shake the sample for the entire 1 minute, using a 90° rotation of the wrist and back to the original position with a timing of once per second.
9. After the 1 minute shake time set the sample down and start the 5 minute reaction timer.
10. Run a blank: Use a syringe filter to filter 25 mL of the raw sample, and then use the raw sample to "zero" the spectrophotometer. Note: if the sample needs dilution, then use the same dilution water for the blank.
    - Transfer 25 mL of raw filtered sample into the pour-through-cell funnel.
    - Allow the meter to stabilize and press the Zero button.
11. After 5 minute timer, use a syringe filter to filter the sample with the reagent added and transfer the sample into the pour-through-cell funnel (the sample port of the Hach DR/4000V). Analyze within 2 minutes.
12. Record the instrument reading in the NO_3^--N Bench Logbook.
13. If the result is out of range for the spectrophotometer, reanalyze the sample using a dilution.

    Note: if a dilution is required, the spectrophotometer should be zeroed using a sample from the same dilution.

    Common dilutions:

    - 1:2 dilution: 25 mL of sample are diluted with 25 mL of DI water; multiply the instrument reading (result) by 2 for the adjusted value.

      Example: instrument reading is 3.54
      x 2
      = 7.08 mg/L (final result)

- 1:5 dilution: 10 mL of sample are diluted with 40 mL of DI water; multiply the instrument reading (result) by 5 for the adjusted value.

  Example: instrument reading is 3.54
  x 5
  = 17.7 mg/L (final result)

- 1:10 dilution: 10 mL of sample are diluted with 90 mL of DI water; multiply the instrument reading (result) by 10 for the adjusted value.
- 1:20 dilution: 5 mL of sample are diluted with 95 mL of DI water; multiply the instrument reading (result) by 20 for the adjusted value.

Quality Control (QC)

- With the first analysis of Nitrate each shift, **analyze a Continuing Calibration Verification (CCV) standard** as a **Quality Control** check:
  - Carefully measure 24 mL of DI water into a sample cell.
  - Add 1 mL of 25 mg/L Nitrate (NO_3^--N) standard.
  - Add 1 packet of NitraVer® 5 Reagent at the same time you add the reagent to your samples.
  - Follow the remaining procedures as listed above for the samples (steps 7 through 12). The Blank for the CCV should be DI water.
  - **Record the CCV results in the NO_3^--N Bench Logbook.** If the instrument reading is not between 0.75 mg/L and 1.25 mg/L re-prepare the standard and reanalyze.
- Periodic **Matrix Spikes (MSs)** should be analyzed. Any time a sample result appears anomalous, consider analyzing an MS of that sample.
  - Determine what dilution, if any, is required for the MS (Note: you will be adding 1.0 mg/L to the sample concentration [the instrument reading]). If you have difficulty determining the dilution needed, call the Project Chemist (Shawn Duffy) at 530-229-3303.
  - Carefully measure 24 mL of filtered sample (diluted if required) into a reaction vessel (sample cell/vial).
  - Add 1 mL of 25 mg/L Nitrate (NO_3^--N) standard to the 24 mL of filtered sample—this is your MS**.**
  - Add 1 packet of NitraVer® 5 Reagent at the same time you add the reagent to your samples.
  - Follow the remaining procedures as listed above for the samples (steps 7 through 12), use a 25 mL aliquot of the same dilution water for the blank (use to zero the spectrophotometer).
  - Record the instrument reading in the NO_3^--N Bench Logbook.
  - Check the recovery of the MS:

Example: Matrix Spike (3.17 mg/L) - Sample (2.06 mg/L) = 1.11 mg/L

Concentration of MS Standard = 1.00 mg/L

% recovery is = 1.11/1.00 = 111%

Note: MS % recovery must be between 75 – 125% or you will need to reanalyze.

If the CCV or MS are still not between 0.075 mg/L and 0.125 mg/L after reanalyses, call the Project Chemist (Shawn Duffy) at 530-229-3303.

Known Interferences

- Chloride concentrations above 100 mg/L will cause low results.
- Ferric iron at all levels
- Highly buffered samples or extreme sample pH may exceed the buffering capacity of the Reagents.

Standard Operating Procedure – Laboratory
PG&E Topock Program

Title: Sulfate Analysis by Hach Method 8051
Number: SOP-L14_Rev1
Revision Date: 10/13/2015

Scope

Standard operating procedure (SOP) for analysis of sulfate (SO_4^{2-}).

Equipment and Supplies

- Safety glasses
- Latex gloves
- Hach DR 4000V spectrophotometer or equivalent
- Vacuum filter apparatus: 47 mm magnetic filter funnels, 1000 mL Erlenmeyer flask, and vacuum pump. Use a 0.45 µm, 47 mm diameter filter membrane.
- pH meter
- Reaction vessel and cap (Hach sample cell)
- 1 packet of SulfaVer® 4 Reagent per sample
- 70 mg/L Sulfate (SO_4^{2-}) (working) standard
- Timer
- Deionized (DI) water

Procedure

1. For each lot of reagent, analyze a reagent blank. Transfer 25 mL of DI water into a reaction vessel and follow steps 4 through 11 below. Sample concentration may need to be adjusted based on the reagents contribution. (Do not dilute or filter this sample.)
2. Collect the sample(s) following the appropriate SOP (see below). Sulfate samples should be analyzed within 24 hours. If the sample is held for more than 24 hours, store at 4°C and allow the sample to equilibrate to room temperature prior to analysis.
    - SOP-A1 – Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method
    - SOP-A2 – Purging and Sampling of 1-inch-diameter Groundwater Monitoring Wells, Modified Well-Volume Method
    - SOP-A3 – Purging and Sampling of Active and Inactive Water Supply Wells
    - SOP-A4 – Depth-Specific Surface Water Sampling
    - SOP-A5 – Groundwater Sampling from Sonic Drilling Boreholes

- SOP-A14 – Pore Water Sampling
- SOP-A18 – Purging and Sampling of Groundwater Monitoring Wells Minimal Drawdown Method
- SOP-A19 – Sampling of Groundwater Monitoring Wells HydraSleeve No Purge Method
- Remedy-SOP-01 – Process Water Sampling.

3. Measure the pH of the raw sample (record the results in the SO_4^{2-} Bench Logbook).
4. Verify the spectrophotometer is set for Sulfate (Hach DR 4000V, program 3450) and verify all reagents are for 25 mL sample size (or adjust accordingly).
   - **Note: Turbid or colored samples (e.g. noticeable by eye) must be filtered.**
     - Filtering can be performed using an inline filter at the time of sampling (see SOP–A6, Sample Field Filtration and Preservation for Metals Analyses) or in the laboratory by vacuum filter.
     - Set up the vacuum filter apparatus.
     - Filter ~100 mL of sample.
5. Due to the high concentration of sulfate, all samples will start with a 1:25 dilution.
   - Add 1 mL of sample to 24 mL of DI water.
   - Mix the sample by swirling or shaking the sample.
6. Add 1 packet of SulfaVer® 4 Reagent.
7. Swirl to mix until the reagent powder is dissolved. (Note that the reaction will generate a white particulate that can be confused with the Reagent powder so pay close attention to what the Reagent powder looks like.)
8. Start the 5-minute reaction timer. **Do not disturb the sample cell during this time.**
9. After the 5 minutes has elapsed, run a blank. If the sample was filtered, use the filtered sample to "zero" the spectrophotometer.
   - **Note: do not use flow-through cell or Sipper Cell Modules.**
   - Wait until the 5 minute timer beeps before placing the blank into the cell holder and zeroing the instrument.
10. Analyze the samples immediately. **Note: do not filter at this stage.**
11. Record the instrument reading in the Lab SO_4^{2-} Bench Logbook.
12. Multiply the instrument reading by the dilution factor (25) and record in the result column.

    If the result is out of range for the spectrophotometer, reanalyze; if still out of range call the Project Chemist (Shawn Duffy) at 530-229-3303.

    Note: if an additional dilution is required, the spectrophotometer should be zeroed using a sample from the same dilution.

Quality Control (QC)

- With the first analysis of sulfate each shift, **analyze a Continuing Calibration Verification (CCV) standard** as a **Quality Control** check:
  - Transfer 25 mL of 70 mg/L Sulfate standard into a sample cell.
  - Add 1 packet of SulfaVer® 4 Reagent at the same time you add the reagent to your samples.
  - Follow steps 7 through 11 listed above (swirl, timer, blank, analyze, record). **Note:** The Blank for the CCV should be DI water.
  - **Record the CCV results in the SO_4^{2-} Bench Logbook.** If the instrument reading is not between 52.5 mg/L and 87.5 mg/L, re-prepare the standard and reanalyze.

    If the CCV is still not between 52.5 mg/L and 87.5 mg/L after reanalyses, call the Project Chemist (Shawn Duffy) at 530-229-3303.

Known Interferences

- Calcium at concentrations greater than 20,000 mg/L as $CaCO_3$.
- Chloride at concentrations greater than 40,000 mg/L as Cl.
- Magnesium at concentrations greater than 10,000 mg/L as $CaCO_3$.
- Silica at concentrations greater than 500 mg/L as SiO_2.

Standard Operating Procedure – Laboratory
PG&E Topock Program

Title: Alkalinity Analysis
Number: SOP-L15_Rev1
Revision Date: 10/13/2015

Scope

Standard operating procedure (SOP) for analysis of alkalinity.

Equipment and Supplies

- Safety glasses
- Latex gloves
- pH meter
- Phenolphthalein Indicator Solution
- Bromcresol Green-Methyl Red Indicator Solution
- Sulfuric acid standard solution, 0.020 N (Titrant)
- Buret, buret clamp and stand
- 250-mL Erlenmeyer flask
- Graduated cylinder – 50-mL or 100-mL
- Magnetic stir plate and magnetic stir bar

Procedure

1. Collect the sample(s) following the appropriate SOP (see below). Alkalinity samples should be analyzed within 24 hours. If the sample is held for more than 24 hours, store at 4°C and allow the sample to equilibrate to room temperature prior to analysis.
    - SOP-A1 – Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method
    - SOP-A2 – Purging and Sampling of 1-inch-diameter Groundwater Monitoring Wells, Modified Well-Volume Method
    - SOP-A3 – Purging and Sampling of Active and Inactive Water Supply Wells
    - SOP-A4 – Depth-Specific Surface Water Sampling
    - SOP-A5 – Groundwater Sampling from Sonic Drilling Boreholes
    - SOP-A14 – Pore Water Sampling
    - SOP-A18 – Purging and Sampling of Groundwater Monitoring Wells Minimal Drawdown Method
    - SOP-A19 – Sampling of Groundwater Monitoring Wells HydraSleeve No Purge Method
    - Remedy-SOP-01 – Process Water Sampling

2. Measure the pH of the raw sample (record the results in the Alkalinity Bench Logbook).
3. Fill the buret to the zero mark with 0.020 N Sulfuric Acid standard solution (Titrant).
4. Use the graduated cylinder to transfer 50 mL of the sample into an Erlenmeyer flask.
5. Add a clean stir bar.
6. Start the stir plate at a moderate rate (fast enough to stir the sample, but not fast enough to cause a vortex to form).

If the pH of the raw sample was greater than 8.3, proceed to Phenolphthalein Step (step 7 below). If the pH was equal to or less than 8.3, proceed directly to the Total Alkalinity Step (step 10).

Phenolphthalein Step:

7. Add six drops of Phenolphthalein Indicator Solution. Allow to mix with sample. Sample will be pink if Phenolphthalein alkalinity is present. If the sample does not turn pink, proceed to Total Alkalinity Step (step 10).
8. Slowly open the stop-cock allowing the Titrant to drip into the sample and mix. Stop the flow of Titrant as soon as the sample color changes from pink to colorless. (Note: the end point has not been reached until the sample remains colorless.)

   Calculate:
   mg/L phenolphthalein alkalinity as $CaCO_3$ = mL Titrant used × 20.

9. Record the phenolphthalein alkalinity in the Alkalinity Bench Logbook. Proceed to Total Alkalinity Step.

Total Alkalinity Step:

10. Add six drops of Bromcresol Green-Methyl Red Indicator Solution. Allow to mix with sample. There is no color change at this stage.
11. Slowly open the stop-cock allowing the Titrant to drip into the sample and mix. Stop the flow of Titrant as soon as the sample color changes from colorless to a light pink. (Note: the end point has not been reached until the sample remains light pink.)

    Calculate:
    mg/L Total alkalinity as $CaCO_3$ = total mL Titrant used × 20.

12. Record the Total alkalinity in the Alkalinity Bench Logbook.

    Note: if the sample's pH was 8.3 or less, the Total Alkalinity = Bicarbonate Alkalinity. If the pH was greater than 8.3, use the table below[1] to calculate the Carbonate, Bicarbonate, and Hydroxide Alkalinity.

[1] Table source: Hach Water Analysis Handbook, Fourth Edition, Rev. 2. Alkalinity, Buret Titration Method 8221. DOC316.53.01151.

Total alkalinity primarily includes hydroxide, carbonate, and bicarbonate alkalinities. The concentration of these types in a sample may be determined when the phenolphthalein and total alkalinities are known (*Alkalinity relationship* table).

Table 35 Alkalinity relationship

Row	Result of Titration	Hydroxide Alkalinity Equals:	Carbonate Alkalinity Equals:	Bicarbonate Alkalinity Equals:
1	Phenolphthalein Alkalinity equal to 0	0	0	Total Alkalinity
2	Phenolphthalein Alkalinity equal to Total Alkalinity	Total Alkalinity	0	0
3	Phenolphthalein Alkalinity less than one-half of Total Alkalinity	0	Phenolphthalein Alkalinity times 2	Total Alkalinity minus two times Phenolphthalein Alkalinity
4	Phenolphthalein Alkalinity equal to one-half of Total Alkalinity	0	Total Alkalinity	0
5	Phenolphthalein Alkalinity greater than one-half of Total Alkalinity	2 times Phenolphthalein Alkalinity minus Total Alkalinity	2 times the difference between Total and Phenolphthalein Alkalinity	0

Use the *Alkalinity relationship* table with the following procedure:

1. Does the phenolphthalein alkalinity equal zero? If yes, use Row 1.
2. Does the phenolphthalein alkalinity equal total alkalinity? If yes, use Row 2.
3. Divide the total alkalinity by 2 to calculate one-half the total alkalinity.
4. Select Row 3, 4 or 5 based on comparing the result of step c (one-half total alkalinity) with the phenolphthalein alkalinity.
5. Perform the required calculations if any.
6. Check your results. The sum of the three alkalinity types will equal the total alkalinity.

If you have any questions, call the Project Chemist (Shawn Duffy) at 530-229-3303.

Known Interferences

- Highly colored or turbid samples may mask the color change at the end points.

Standard Operating Procedure – Laboratory
PG&E Topock Program

Title: Total Organic Carbon Analysis by Hach Method 10129
Number: SOP-L16_Rev01
Revision Date: 10/13/2015

Scope

Standard operating procedure (SOP) for analysis of total organic carbon (TOC).

Equipment and Supplies

- Safety glasses
- Latex gloves
- Hach DR 4000V spectrophotometer or equivalent
- Spectrophotometer manufacturer's manual
- Test 'N Tube™ adapter for the spectrophotometer
- pH meter and pH paper (capable of measuring down to pH 2)
- TOC Bench Logbook
- Chemical oxygen demand (COD) Reactor or similar digestion block
- Stir plate and magnet stir bar
- Low Range TOC Acid Digestion Solution vials (Acid Digestion vials)
- Low Range TOC Indicator Ampules (indicator ampules)
- Sulfate Buffer Solution
- TOC Persulfate Powder Pillow
- Pipet: 0.1 – 1.0 mL, and a 1 – 5 mL or 1 – 10 mL.
- 50 mL Erlenmeyer flask
- 0.45 µm filter disc fitted to a disposable 50 mL syringe (syringe filter)
- Deionized (DI) water
- Kimwipes
- Paper towels
- Timer
- Fine point Sharpie (indelible ink pen)
- Small funnel (comes with each batch of TOC Acid Digestion vials)
- Test tube rack
- 10 mg/L TOC Working Standard

Procedure

1. Collect the sample(s) following the appropriate SOP (see below). TOC samples should be analyzed as soon as possible (within 48 hours if possible).

    - SOP-A1 – Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method
    - SOP-A2 – Purging and Sampling of 1-inch-diameter Groundwater Monitoring Wells, Modified Well-Volume Method

- SOP-A3 – Purging and Sampling of Active and Inactive Water Supply Wells
- SOP-A4 – Depth-Specific Surface Water Sampling
- SOP-A5 – Groundwater Sampling from Sonic Drilling Boreholes
- SOP-A14 – Pore Water Sampling
- SOP-A18 – Purging and Sampling of Groundwater Monitoring Wells Minimal Drawdown Method
- SOP-A19 – Sampling of Groundwater Monitoring Wells HydraSleeve No Purge Method
- Remedy-SOP-01 – Process Water Sampling

2. Measure the pH of the raw sample. Record the results in the TOC Bench Logbook.
3. Turn on the COD reactor and make sure it's set at 105°C.
4. Transfer 10 mL of sample into a 50 mL Erlenmeyer flask containing a magnetic stir bar.
5. Add 0.4 mL of Sulfate Buffer Solution (use pH paper to verify the pH is 2.0 or below – if needed add additional buffer, 0.1 mL at a time until pH ≤2).
6. Place the flask on a stir plate and set at a moderate speed for 10 minutes (swirls the sample but does not form a vortex). Steps 7 through 10 may be performed while the flask is being stirred.
7. Remove the number of Low Range TOC Acid Digestion Solution vials you'll need from the manufacture's packaging and place in the test tube rack (remember one for the reagent blank).
8. Label the Acid Digestion vials for the samples, including the reagent blank.
9. Using the funnel provided with the Acid Digestion vials, add the contents of one TOC Persulfate Powder Pillow to each vial (labeled in step 7).
10. Using a pipet add 3 mL of organic-free water (use DI water) to the reagent blank vial.
11. After the 10 minutes for stirring the 50 mL Erlenmeyer flask have elapsed, use a pipet to transfer 3 mL of prepared sample (sample in the Erlenmeyer flask) to the labeled vial(s) with the persulfate powder already added.
12. Holding the blue Indicator Ampule by the top, carefully rinse with DI water and wipe dry with a Kimwipe.
13. Lower the unopened ampule into one of the labeled Acid Digestion vials. Align the score mark (the score mark is in the narrowed "neck" of the ampule) with the top of the vial and snap off the top of the ampule allowing the ampule to drop into the Acid Digestion vial.
    - **Do not** tip or tilt the vial after the ampule is in the vial. **You do not want the indicator solution mixing with the sample.**
14. Repeat steps 12 and 13 for each sample and the reagent blank.

15. Cap the vials tightly and place in the COD Reactor. Start the reactor timer (2 hours). Verify the reactor is at 105°C.
16. After the 2 hour timer, remove the vials from the COD Reactor and place in the test tube rack, being careful to handle the vials by their caps which will have remained cool.
17. Allow the vials to cool for one hour.
18. Verify the Test 'N Tube™ adapter is installed in the spectrophotometer (see the manufacturer's manual for instructions).
19. Verify that the spectrophotometer is set for Low Range TOC (Hach DR/4000V, program 3655).
20. Holding the vial by its cap wipe the reagent vial with a damp paper towel and then with a dry Kimwipe to remove any fingerprints or other marks.
21. Use the reagent blank to "zero" the spectrophotometer.
    - Place the vial in the adapter and close the light shield.
    - Allow the meter to stabilize and press the Zero button.
22. After the spectrophotometer has been zeroed, repeat step 20 for each vial, place the vial in the adapter, close the light shield, allow the meter to stabilize, and record the instrument reading in the TOC Bench Logbook.
23. If the result is out of range for the spectrophotometer, reanalyze the sample using a dilution.

    Common dilutions:

    - 1:2 dilution: 25 mL of sample are diluted with 25 mL of DI water; multiply the instrument reading (result) by 2 for the adjusted value.

      Example: instrument reading is 3.54
      x 2
      = 7.08 mg/L (final result)

    - 1:5 dilution: 10 mL of sample are diluted with 40 mL of DI water; multiply the instrument reading (result) by 5 for the adjusted value.

      Example: instrument reading is 3.54
      x 5
      = 17.7 mg/L (final result)

    - 1:10 dilution: 10 mL of sample are diluted with 90 mL of DI water; multiply the instrument reading (result) by 10 for the adjusted value.
    - 1:20 dilution: 5 mL of sample are diluted with 95 mL of DI water; multiply the instrument reading (result) by 20 for the adjusted value.

Quality Control (QC)

- With the first analysis of TOC each shift, **analyze a Continuing Calibration Verification (CCV) standard** as a **Quality Control** check:
  - Carefully measure 9 mL of the DI water into a 50 mL Erlenmeyer flask containing a magnetic stir bar.
  - Add 1 mL of 10 mg/L TOC Working Standard to the DI water—this is your CCV**.**
  - Follow steps 5 – 22 with your "other" samples.
  - Check the recovery of the CCV. The concentration should be between 0.75 and 1.25 mg/L.
- Periodic **Matrix Spikes (MSs)** should be analyzed. Any time a sample result appears anomalous, consider analyzing an MS of that sample.
  - Determine what dilution, if any, is required for the MS (Note: you will be adding 1.0 mg/L to the sample concentration [the instrument reading]). If you have difficulty determining the dilution needed, call the Project Chemist (Shawn Duffy) at 530-229-3303.
  - Carefully measure 9 mL of the sample (diluted if required) into a 50 mL Erlenmeyer flask containing a magnetic stir bar.
  - Add 1 mL of 10 mg/L TOC standard to the sample—this is your MS**.**
  - Follow steps 5 – 22 with your "other" samples.
  - Check the recovery of the MS:

    Example: Matrix Spike (1.60 mg/L) - Sample (0.36 mg/L) = 1.24 mg/L

    Concentration of MS Standard = 1.0 mg/L

    % recovery is = 1.24/1.00 = 124%

    Note: MS % recovery must be between 75 – 125% or you will need to reanalyze.

    If the CCV or MS are still not between 0.75 mg/L and 1.25 mg/L after reanalyses, call the Project Chemist (Shawn Duffy) at 530-229-3303.

Known Interferences

- Many metals can cause interference at concentrations above 10 mg/L.
- Manganese above 1 mg/L.
- Alkalinity greater than 600 mg/L (reduce the pH to <7 with sulfuric acid); call the Project Chemist (Shawn Duffy) at 530-229-3303 before proceeding.
- Chloride above 500 mg/L.

Standard Operating Procedure – Laboratory
PG&E Topock Program

Title: Orthophosphate Analysis by Hach Method 8048
Number: SOP-L17_Rev01
Revision Date: 10/13/2015

Scope

Standard operating procedure (SOP) for analysis of orthophosphate (PO_4^{3-}).

Equipment and Supplies

- Safety glasses
- Latex gloves
- Hach DR 4000V spectrophotometer or equivalent
- pH meter
- PO_4^{3-} Bench Logbook
- Reaction vessel and cap or means of sealing the reaction vessel– (Hach sample cell, 50 mL beaker, vial capable of holding 30 mL, and parafilm if the vessel doesn't have a cap)
- 1 packet of PhosVer 3 Reagent per sample
- 5 mg/L phosphate (PO_4^{3-}) (working) standard
- 0.45 µm filter disc fitted to a disposable 50 mL syringe (syringe filter)
- Deionized (DI) water

Procedure

1. Collect the sample(s) following the appropriate SOP (see below). Orthophosphate samples should be analyzed as soon as possible (within 24 hours).
    - SOP-A1 – Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method
    - SOP-A2 – Purging and Sampling of 1-inch-diameter Groundwater Monitoring Wells, Modified Well-Volume Method
    - SOP-A3 – Purging and Sampling of Active and Inactive Water Supply Wells
    - SOP-A4 – Depth-Specific Surface Water Sampling
    - SOP-A5 – Groundwater Sampling from Sonic Drilling Boreholes
    - SOP-A14 – Pore Water Sampling
    - SOP-A18 – Purging and Sampling of Groundwater Monitoring Wells Minimal Drawdown Method

- SOP-A19 – Sampling of Groundwater Monitoring Wells HydraSleeve No Purge Method
- Remedy-SOP-01 – Process Water Sampling

2. Measure the pH of the raw sample in accordance with SOP-L9—pH Measurement. Record the results in the PO43- Bench Logbook.
3. Verify that the spectrophotometer is set for Reactive Phosphoros (Hach DR/4000V, program 3025) and verify all reagents are for 25 mL sample size (or adjust accordingly).
4. Transfer 25 mL of the sample into a reaction vessel. (Note: the sample cell or vessel must be able to be sealed with a cap or parafilm.)
5. Transfer 25 mL of DI water into a reaction vessel (this will be the "Blank").
6. Add 1 packet of PhosVer 3 Reagent to the blank and to each sample.
7. Shake the blank and the sample(s), using a 90° rotation of the wrist and back to the original position with a timing of once per second; until the powder is dissolved.
8. Start the 2 minute reaction timer.
9. After the 2 minute timer, use a syringe filter to filter any reagent powder that has not dissolved from the blank and then use the blank to "zero" the spectrophotometer.
    - Transfer the blank into the pour-through-cell funnel.
    - Allow the meter to stabilize and press the Zero button.
10. After the spectrophotometer has been zeroed, use a syringe filter to filter any reagent powder that has not dissolved from the sample(s) and transfer the sample into the pour-through-cell funnel (the sample port of the Hach DR/4000V). Analyze as soon as possible.
11. Record the instrument reading in the PO_4^{3-} Bench Logbook.
12. If the result is out of range for the spectrophotometer, reanalyze the sample using a dilution.

    Common dilutions:

    - 1:2 dilution: 25 mL of sample are diluted with 25 mL of DI water; multiply the instrument reading (result) by 2 for the adjusted value.

        Example: instrument reading is 3.54
        x 2
        = 7.08 mg/L (final result)

    - 1:5 dilution: 10 mL of sample are diluted with 40 mL of DI water; multiply the instrument reading (result) by 5 for the adjusted value.

        Example: instrument reading is 3.54
        x 5
        = 17.7 mg/L (final result)

    - 1:10 dilution: 10 mL of sample are diluted with 90 mL of DI water; multiply the instrument reading (result) by 10 for the adjusted value.

- 1:20 dilution: 5 mL of sample are diluted with 95 mL of DI water; multiply the instrument reading (result) by 20 for the adjusted value.

Quality Control (QC)

- With the first analysis of orthophosphate each shift, **analyze a Continuing Calibration Verification (CCV) standard** as a **Quality Control** check:
  - Carefully measure 24 mL of DI water into a sample cell.
  - Add 1 mL of 5 mg/L Phosphate (PO_4^{3-}) standard.
  - Add 1 packet of PhosVer 3 Reagent (include the CCV with your other samples).
  - Follow the remaining procedures as listed above for the samples (steps 6 through 10).
  - **Record the CCV results in the PO_4^{3-} Bench Logbook.** If the instrument reading is not between 0.15 mg/L and 0.25 mg/L, re-prepare the standard and reanalyze.
- Periodic **Matrix Spikes (MSs)** should be analyzed. Any time a sample result appears anomalous, consider analyzing an MS of that sample.
  - Determine what dilution, if any, is required for the MS (Note: you will be adding 0.2 mg/L to the sample concentration [the instrument reading]). If you have difficulty determining the dilution needed, call the Project Chemist (Shawn Duffy) at 530-229-3303.
  - Carefully measure 24 mL of filtered sample (diluted if required) into a reaction vessel (sample cell/vial).
  - Add 1 mL of 5 mg/L Phosphate (PO_4^{3-}) standard to the 24 mL of filtered sample—this is your MS**.**
  - Add 1 packet of PhosVer 3 Reagent at the same time you add the reagent to your "other" samples.
  - Follow the remaining procedures as listed above for the samples (steps 6 through 10).
  - Record the instrument reading in the PO_4^{3-} Bench Logbook.
  - Check the recovery of the MS:

    Example: Matrix Spike (1.60 mg/L) - Sample (1.36 mg/L) = 0.24 mg/L

    Concentration of MS Standard = .20 mg/L

    % recovery is = 0.24/0.20 = 120%

    Note: MS % recovery must be between 75 – 125% or you will need to reanalyze.

    If the CCV or MS are still not between 0.075 mg/L and 0.125 mg/L after reanalyses, call the Project Chemist (Shawn Duffy) at 530-229-3303.

Known Interferences

- Metal concentrations above 100 mg/L.
- Highly buffered samples or extreme sample pH may exceed the buffering capacity of the Reagents (sample pH should be between 2 and 10).

Standard Operating Procedure – Laboratory
PG&E Topock Program

Title: Manganese Analysis by Hach Method 8149
Number: SOP-L18_Rev01
Revision Date: 10/13/2015

Scope

Standard Operating Procedure (SOP) for the analysis of manganese (Mn).

Equipment and Supplies

- Safety glasses
- Latex gloves
- Hach DR 4000V spectrophotometer or equivalent
- Fume hood
- Vacuum filter apparatus: 47 mm magnetic filter funnels, 1,000 mL Erlenmeyer flask, and vacuum pump (use a 0.45 µm, 47 mm diameter filter membrane)
- 0.45 µm filter disc fitted to a disposable 50 mL syringe (syringe filter)
- pH meter
- Reaction vessel and cap or means of sealing the reaction vessel (Hach sample cell and Parafilm if the vessel doesn't have a cap)
- Deionized (DI) water
- 1 packet of Ascorbic Acid Reagent powder per sample
- Rochelle Salt Solution
- Alkaline-Cyanide Reagent Solution
- 0.1% PAN Indicator Solution
- 1 mg/L Manganese (working) standard
- Manganese Bench Log Book
- HNO_3 pH<3 (preservative if the samples can't be analyzed within 24 – 48 hours)

Safety

Caution and special procedures must be maintained when performing this analysis. The alkaline cyanide solution contains cyanide so **the waste must be collected and disposed of as a Reactive waste**.

To prevent the release of hydrogen cyanide gas, the cyanide waste should be stored in a caustic solution with pH >11. The waste must be stored as a base until properly disposed of.

Because the analysis has the potential of releasing hydrogen cyanide gas, **all solutions/reagents must be added in a fume hood.**

Procedure

1. Collect the sample(s) following the appropriate SOP (see list below). Samples should be analyzed as soon as possible. If the samples can't be analyzed within 24 – 48 hours, preserve with HNO_3 pH<3 until ready to analyze. Before starting the analyzing adjust the pH to a pH 4 – 5. **Note: all samples must be filtered prior to preservation/analysis**.
    - SOP-A1 – Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method
    - SOP-A2 – Purging and Sampling of 1-inch-diameter Groundwater Monitoring Wells, Modified Well-Volume Method
    - SOP-A3 – Purging and Sampling of Active and Inactive Water Supply Wells
    - SOP-A4 – Depth-Specific Surface Water Sampling
    - SOP-A5 – Groundwater Sampling from Sonic Drilling Boreholes
    - SOP-A14 – Pore Water Sampling
    - SOP-A18 – Purging and Sampling of Groundwater Monitoring Wells Minimal Drawdown Method
    - SOP-A19 – Sampling of Groundwater Monitoring Wells HydraSleeve No Purge Method
    - Remedy-SOP-01 – Process Water Sampling
2. Filtering can be performed using an inline filter at the time of sampling (see SOP–A6, Sample Field Filtration and Preservation for Metals Analyses) or in the laboratory by vacuum filter:
    - Set up the vacuum filter apparatus.
    - Filter ~100 mL of sample.
3. Measure the pH of the raw sample in accordance with SOP-L9— pH Measurement (**Record the results in the Mn Bench Log Book**). Adjust the pH (see step #1 above).
4. Verify that the spectrophotometer is set for **Manganese (Mn) (Hach DR/4000V program 2260)** and verify all reagents are for 10 mL sample size (or adjust accordingly).
5. In the fume hood, transfer 10 mL of filtered sample into a reaction vessel. Use DI water for a blank.
6. Add one packet of Ascorbic Acid Reagent powder to each sample (including the blank). Swirl to mix.
7. Add ten drops of Rochelle Salt Solution to each sample (including the blank). Swirl to mix.

8. Add 15 drops of Alkaline-Cyanide Reagent Solution to each sample (including the blank). Swirl to mix.
9. Add 21 drops of PAN Indicator Solution, 0.1%, to each sample (including the blank). Swirl to mix.
10. Start the 2 minute reaction timer.
11. After the 2 minute timer has sounded, use the blank to "zero" the spectrophotometer.
12. After zeroing the spectrophotometer analyze each sample.
13. Record the instrument reading in the Mn Bench Log Book.
14. If the result is out of range for the spectrophotometer, reanalyze the sample using a dilution.

    Common dilutions:

    - 1:2 dilution: 25 mL of sample are diluted with 25 mL of DI water; multiply the instrument reading (result) by 2 for the adjusted value.

      Example: instrument reading is 0.304
      x 2
      = .608 mg/L (final result)

    - 1:5 dilution: 10 mL of sample are diluted with 40 mL of DI water; multiply the instrument reading (result) by 5 for the adjusted value.

      Example: instrument reading is 0.304
      x 5
      = 1.52 mg/L (final result)

    - 1:10 dilution: 10 mL of sample are diluted with 90 mL of DI water; multiply the instrument reading (result) by 10 for the adjusted value.
    - 1:20 dilution: 5 mL of sample are diluted with 95 mL of DI water; multiply the instrument reading (result) by 20 for the adjusted value.

Quality Control (QC)

- With the first analysis of manganese each shift, **analyze a CCV** (Continuing Calibration Verification) standard as a **Quality Control** check:
  - Carefully measure 9 mL of DI water into a reaction vessel.
  - Add 1 mL of 1 mg/L Mn Standard. Swirl to mix.
  - Analyze with the samples - follow steps 6 – 13 above.
  - **Record the CCV results in the Mn Bench Log Book.** If the instrument reading is not between 0.075 mg/L and 0.125 mg/L, re-prepare the standard and reanalyze.

- Periodic **Matrix Spikes (MSs)** should be analyzed. Any time a sample result appears anomalous, consider analyzing an MS of that sample.
  - Determine what dilution if any is required for the matrix spike (note: you will be adding 0.1 mg/L to the sample concentration [the instrument reading]).
  - Carefully measure 9 mL of filtered sample (diluted if required) into a reaction vessel.
  - Add 1 mL of 1 mg/L Mn Standard to the 9 mL of filtered sample. Swirl to mix (this solution is called the MS)**.**
  - Analyze with the other samples - follow steps 6 – 13 above.
  - Record the instrument reading in the Mn Bench Log Book.
  - Check the recovery of the MS:

    Example: Matrix Spike (0.117 mg/L) - Sample (0.006 mg/L) = 0.111 mg/L

    Concentration of Spike Standard = 0.100 mg/L

    % recovery is = 0.111/0.100 = 111%

    MS % recovery must be between 75 – 125% or you will need to reanalyze.
  - If the CCV or MS are still not between 0.075 mg/L and 0.125 mg/L after reanalyses, call the Project Chemist (Shawn Duffy) at 530-229-3303.

Standard Operating Procedure – Laboratory
PG&E Topock Program

Title: Total Dissolved Solids Analysis
Number: SOP-L19_Rev01
Revision Date: 10/13/2015

Scope

This Standard Operating Procedure (SOP) covers the determination of Total Dissolved Solids (TDS) in groundwater or process water samples. The practical range of the method is 10 mg/L to 20,000 mg/L. If TDS concentrations are greater than 20,000 mg/L, then the sample can be diluted. If the sample is suspected to have a TDS concentration greater than 100,000 mg/L, the site analyst will consult with the Project Chemist.

Summary

A sample is passed through a filter, weighed, and then placed in an oven at 180°C until dried. The sample is allowed to cool in a desiccator, and then weighed to determine the dry weight of the original sample.

Safety

Extreme caution should be used when working around the drying oven (risk of severe burns).

Because of the high temperature of the drying oven the associated glassware is more prone to break on impact (risk of broken glass).

Equipment and Supplies

- Safety glasses
- Latex gloves
- Drying oven (capable of 180°C)
- Analytical balance (capable of measuring weights of 0.1 mg)
- Vacuum pump or other source of applying a vacuum
- Vacuum filter apparatus and filters (glass fiber filter discs, 47 mm, without organic binder, Reeve Angel type 934-AH, Gelman type A/E, or equivalent)
- 250 mL Pyrex glass beakers or equivalent
- Deionized (DI) water
- Conductivity meter
- Desiccator (capable of holding 5 – 6 250 mL Pyrex glass beakers
- Oven mitt or metal tongs (to transfer the hot beakers from the drying oven to the desiccator)

- Graduated cylinder(s) 20 mL, 50 mL, 100 mL
- TDS Bench Log Book

Procedure

1. Preparation of the evaporation vessels (beaker) must be performed ahead of time:
   - Thoroughly clean and dry a 250 mL Pyrex glass beaker.
   - Heat the clean vessel to 180° +/- 2°C for one hour.
   - Carefully transfer the hot beaker to the desiccator with the oven mitt or tongs for cooling and storage until needed.
2. Collect the sample(s) following the appropriate SOP (see list below). The samples should be analyzed within 7 days.
   - SOP-A1 – Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method
   - SOP-A2 – Purging and Sampling of 1-inch-diameter Groundwater Monitoring Wells, Modified Well-Volume Method
   - SOP-A3 – Purging and Sampling of Active and Inactive Water Supply Wells
   - SOP-A4 – Depth-Specific Surface Water Sampling
   - SOP-A5 – Groundwater Sampling from Sonic Drilling Boreholes
   - SOP-A14 – Pore Water Sampling
   - SOP-A18 – Purging and Sampling of Groundwater Monitoring Wells Minimal Drawdown Method
   - SOP-A19 – Sampling of Groundwater Monitoring Wells HydraSleeve No Purge Method
   - Remedy-SOP-01 – Process Water Sampling
3. Measure the Conductivity using SOP-L4 – Conductivity Analysis by Hach Method 8160. Refer to Table 1 for sample volume.

Table 1
Conductivity vs. Sample Volume Table

Conductivity of Sample	Sample Volume to Use for TDS
<1,500 µS/cm	100 mL
≥1,500 µS/cm and <4,700 µS/cm	50 mL
≥4,700 µS/cm	20 mL

4. Filter the sample in the laboratory using a vacuum filter:
    - Assemble the vacuum filter holder/flask assembly using a clean vacuum flask.
    - Place a 47-mm filter disc (see Equipment and Supplies section above for type of filter) in the filter holder and add the funnel.
    - With vacuum applied to the flask, wash the filter with three separate 20-mL volumes of DI water.
    - Continue applying vacuum for two to three minutes after the water has passed through the filter to ensure that all traces of the water are removed from the filter.
    - Disconnect the vacuum and discard the water from the flask.
    - Reconnect the filter holder/flask assembly to the vacuum.
    - Shake the sample vigorously.
    - Use a clean graduated cylinder to transfer the volume of sample determined from Table 1 above to the filter apparatus. Record the volume used in the TDS Bench Log Book.
    - Filter the sample through the glass fiber filter.
    - Rinse the filter with three 10 mL portions of DI water and continue to apply vacuum for about 3 minutes after filtration is complete to remove as much water as possible.
5. Retrieve a clean 250 mL Pyrex glass beaker from the desiccator and weigh to the nearest tenth of a milligram (0.1 mg); record the weight in the TDS Bench Log Book.
6. Transfer the filtered sample from the vacuum flask to the beaker. Rinse the flask with three 10 mL portions of DI water and pour into the beaker with the sample.
7. Place the sample in the drying oven; verify the oven is set at 180° +/- 2°C.
8. Allow the sample to reach complete dryness (4 hours or more).
9. Cool in a desiccator to approximately room temperature, and weigh the beaker (record the weight in the TDS Bench Log Book).
10. Repeat steps 7 through 9 (drying, cooling, desiccating, and weighing until a constant weight is obtained or until the change in weight is less than 0.5 mg between the consecutive cycles) and record the final weight in the TDS Bench Log Book.
11. Calculate the TDS using the formula shown below and record in the TDS Bench Log Book.

$$\text{mg total dissolved solids/L} = \frac{(A - B) \times 1000}{\text{sample volume, mL}}$$

where:

A = final weight of dried sample + dish (mg)
B = weight of dish (mg).

Appendix C
PG&E Program Quality Assurance Project Plan and Addendum
(On CD-ROM Only)

Revision 2

PG&E Program Quality Assurance Project Plan

Prepared for

Pacific Gas and Electric Company

August 2012

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Appendices

Appendix A Reporting Limits, Accuracy, and Precession Limits

Acronyms and Abbreviations

%D	percent difference or drift
%R	percent recovery
°C	degrees Celsius
µg/L	microgram(s) per liter
µmhos/cm	micromhos per centimeter
AB	ambient blank
AFCEE	Air Force Center for Engineering and the Environment (formerly the Air Force Center for Environmental Excellence)
ASTM	American Society for Testing and Materials
AutoDV	automated data validation
BTEX	benzene, toluene, ethylbenzene, and xylene
CAS	Chemical Abstract Service
CF-IRMS	continuous-flow isotope ratio mass spectrometry
CHHSL	California Human Health Screening Levels
CoC	chain-of-custody
COPC	contaminate of potential concern
DOC	dissolved organic carbon
DQO	data quality objective
DTSC	California Department of Toxic Substance Control
EB	equipment rinsate blank
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
FB	field blank
FD	field duplicate
ICAL	initial calibration
ICP	inductively coupled plasma
ICP-MS	inductively coupled plasma/mass spectrometry
ID	identifier
IDW	investigation-derived waste
IPC	instrument performance check

LCS	laboratory control sample
MCT	matrix concentration threshold
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
ml	milliliter
MS	matrix spike
MSA	method of standard addition
MSD	matrix spike duplicate
MQO	method quality objective
PARCC	precision, accuracy, representativeness, completeness, and comparability
PCB	polychlorinated biphenyls
pCi/L	picocuries per liter
PDF	portable document format
PG&E	Pacific Gas and Electric Company
PNA	polynuclear aromatic hydrocarbon
PPE	personal protective equipment
PST	planned sample table
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RL	reporting limit
RPD	relative percent difference
RRF	relative response factor
RSD	relative standard deviation
RT	retention time
SAP	sampling and analysis plan
SIM	selected ion monitoring
SOP	standard operating procedure
STLC	soluble threshold limit concentration
SVOC	semivolatile organic compound
TB	trip blank

TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TOC	total organic carbon
TPH	total petroleum hydrocarbon
TSS	total suspended solids
TTLC	total threshold limit concentration
VOA	volatile organic analysis
VOC	volatile organic compound

SECTION 1

Introduction

This *Pacific Gas and Electric Company Program Quality Assurance Project Plan* (QAPP), Revision 2 was prepared to ensure that data of appropriate quality are collected and used for multiple sites for Pacific Gas and Electric Company (PG&E) projects that CH2M HILL supports. Each project will have a sampling and analysis plan (SAP), this QAPP, and QAPP addenda required to meet the project-specific requirements.

1.1 Background

CH2M HILL has been providing services to PG&E since the 1970s. Currently, CH2M HILL and affiliate companies are working at approximately 35 sites for PG&E. CH2M HILL provides services for the following:

- **Site management.** Projects include soil and groundwater monitoring, site characterization, and remediation design systems.
- **Remediation construction.** Projects include soil excavation, disposal, and treatment system construction.
- **Ecosystems and permitting.** Projects include proponent's environmental assessments, California Environmental Quality Act documentation, and other permitting and planning projects.
- **Engineering design.** Projects include computer-aided design and support and structural analysis.

1.2 PG&E Program Objectives

1.2.1 PG&E Program Objectives and Scope

This QAPP presents the quality assurance (QA) and quality control (QC) requirements designed to ensure that environmental data collected for the PG&E Program will be of the appropriate quality to achieve the objectives defined in the project-specific SAPs or QAPP addenda, unless otherwise defined. Specific protocols for sampling, sample handling and storage, chain-of-custody (CoC), laboratory analyses, data handling, and data evaluation and assessment are discussed. Requirements for performance evaluations, corrective actions, and preventive maintenance of equipment are specified. The elements included in this QAPP are consistent with those specified in the *EPA Requirements for Quality Assurance Project Plans* (U.S. Environmental Protection Agency [EPA], 2001a) and *EPA Requirements for Quality Management Plans* (EPA, 2001b) (note that the latter was reissued in March 2006). The objectives of this QAPP are as follows:

- Ensure that data collection and measurement procedures are standardized among all participants.

- Monitor the performance of the various measurement systems within the PG&E Program to maintain statistical control and provide rapid feedback so that corrective measures, if needed, can be implemented before data quality is compromised.
- Periodically assess the performance of these measurement systems and their components.
- Verify that reported data are sufficiently complete, comparable, representative, unbiased, and precise so that they are suitable for their intended use.

This QAPP is intended for use by CH2M HILL and its subcontractors that provide services associated with the environmental data collection effort. The QAPP supplements all SAPs and any other project-specific documents. The PG&E Program quality officer and the program chemist are primarily responsible for implementation of this QAPP.

1.2.2 PG&E Program QAPP versus SAPs and QAPP Addenda

Elements such as the general description, sources of contamination, information from previous investigations, and proposed investigations are addressed in project or site-specific SAPs or QAPP addenda. PG&E Project-specific QAPP addenda will cover items not included in this QAPP or any in conflict with it. The guidance set forth in this QAPP will be followed in the absence of site specific SAPs or QAPP addenda.

The PG&E project-specific SAPs or QAPP addenda should specify project-specific analytes and analytical methods that differ from the QAPP. The project manager or a designee will determine the reporting limit (RL) requirements, evaluate the QAPP specifications to make certain they meet those requirements, and address any differences in a QAPP addendum. The QAPP addendum will be included as part of the project-specific documents when project requirements dictate variance from the QAPP.

Project-specific preliminary cleanup goals or action levels will be included in the SAPs or QAPP addenda, if available. The project-specific documents will indicate sources for the preliminary cleanup goals or action levels. In cases where available technology does not offer analytical methods that are sufficiently sensitive to detect concentrations at or below the reference levels cited by the source, the method RLs will be used as the preliminary cleanup goals or action levels. All goals are subject to revision and will be documented.

Appendix A presents the analytical requirements for Reporting Limits, Accuracy, and Precession Limits.

1.2.3 Analytical Project Planning

The PG&E Program has a laboratory procurement process, modeled after the Air Force Center for Engineering and the Environment (AFCEE) (formerly the Air Force Center for Environmental Excellence), EPA, the U.S. Navy, and other federal programs. The process balances the PG&E Program quality, defensible data, and costs. The model has identified three steps in planning the analytical needs of a project:

1. **Determine the requirements.** To determine project-specific requirements, the program chemist should attend kick-off meetings (or equivalent) to understand the project goals and help develop the analytical scope of work.

2. **Determine the laboratory needs and select the laboratory.** Factors influencing the selection of analytical, geotechnical, radiochemistry laboratories include the matrices sampled; laboratory capabilities, recent performance, and location; and price. The program chemist ensures that the laboratory selected is appropriate to meet project objectives. The more information regarding the project objectives given to the chemists, the better chance they have to control liabilities related to analytical work.
3. **Decide what level of data validation is required to provide defensible data at the appropriate level of QC.** See Section 6.3 for descriptions of the data validation process. When a request for proposal is received from PG&E, there is a kickoff meeting of key people, including the project manager, the responsible contract administrator, the program chemist (or sometimes a project-specific chemist), a representative from project delivery, and others, depending on the type of project. Laboratory scope is discussed and a plan is determined that will provide the appropriate analytical services.

1.2.4 Data Quality Objectives

The specific needs for the data collected during each activity will be examined to ensure that project objectives for each investigation will be optimally achieved. A graded approach will be used in developing the project data quality objectives (DQO) to ensure that the DQO process will be appropriate for the nature, size, cost, and risk associated with the task or project. All projects will begin by examining EPA's seven-step DQO process (EPA, 2000); based on the level of project complexity and intended use of the data, the level of detail and applicability of the seven-step process will be assessed. The DQO process should consider the following steps (if applicable):

1. **State the problem.** Concisely describe the problem to be investigated. This determines the need for data collection. Review existing information to define the problem.
2. **Identify the decision**. Identify the decision that will solve the problem by using the data to be collected.
3. **Identify the inputs to the decision**. Identify the information and environmental measurements that are needed to support the decision.
4. **Define the study boundaries**. Specify the times, spatial areas, and other conditions (e.g., target analytes) that determine when and where data should be collected.
5. **Develop a decision rule**. For each decision, define the conditions that would cause the decision maker to choose between alternate actions (the decision rule is usually in the form of an "if…then" statement).
6. **Specify tolerable limits for decision errors**. Define how much uncertainty can be tolerated by the decision maker. Determine the acceptable error rates based on the consequences of making an incorrect decision.
7. **Optimize the design**. Evaluate information from the previous steps and choose the most resource-efficient design for data collection that will support a reliable decision.

SECTION 2

PG&E Program Organization and Responsibility

2.1 PG&E Program Organization

The PG&E Program management team has been structured with a program manager, program quality control manager, program health and safety manger and a program chemist to ensure that the goals of the PG&E Program are met.

2.2 Project/Task Organization

The organization chart and descriptive text identifying task managers and individuals charged with specific responsibilities for each project can be found in project-specific SAPs. Lines of authority and the scope of authority given to each key member of the project team, including the authority to initiate and approve corrective actions, are discussed in the SAPs. All subcontractors and scopes of work are also identified in the project- or site-specific SAPs.

2.3 Training and Certification Requirements

All personnel engaged in field activities will have completed the Occupational Safety Health Administration, 40-hour health and safety training that meet the requirements of Title 29 Code of Federal Regulations Section 1910.120 and Title 8 Code of California Regulations Section 5192. All CH2M HILL personnel working on the PG&E Program will read applicable project-specific health and safety plans. Documentation will be maintained to demonstrate that all requirements of the plan are followed.

All laboratories contracted for analytical services will be certified under the California Department of Health Environmental Laboratory Accreditation Program, when appropriate and where accreditation is afforded under the California program. No analyses may be performed or reported if accreditation is revoked. Any loss or suspension of accreditation must be communicated to CH2M HILL within 24 hours of notification. Laboratory managers will ensure that all laboratory personnel have been properly trained and are qualified to perform the assigned tasks.

SECTION 3

Sampling Procedures

3.0 Standard Operating Procedures

All sample collection and related activities will follow the appropriate standard operating procedure (SOP). SOPs are located in the project work plan, SAP, QAPP addendum, or other project documents.

3.1 Sampling Design

The number and location of samples are specific to each site and are discussed in the project-specific SAPs. The rationale for the sampling design is also described in the SAPs as part of the project DQOs. The sampling design is a function of the medium sampled, information about the sampling site, the type of data to be collected, and how the data are to be used.

All projects should use the field database and provide a planned sample table (PST), CoC forms, and other database-generated paperwork whenever possible. All samples collected for offsite laboratories will be documented on a CoC form.

The procedures described in the following sections may be superseded or supplemented by the project-specific SAPs or QAPP addenda.

3.2 Sampling Method Requirements

This section addresses the requirements for soil and groundwater sampling. Many projects will require site-specific SOPs because of unique conditions that should be addressed in the project-specific work plan, SAP, QAPP addenda or other project-specific documents. Small projects will need to have sampling SOPs, but may find an existing SOP that can be adopted for the specific needs of the project.

3.2.1 Field Calibration

Field equipment will be calibrated before the start of work and recorded in the field notebook or daily calibration log. Any instrument drift from prior calibration should be noted. Calibration will be in accordance with procedures and schedules in the particular instrument's operations manual.

Calibrated equipment will be uniquely identified by using the manufacturer's serial number or other means. A label with the identification number and the date when the next calibration is due (scheduled calibrations) will be physically attached to the equipment. If this is not possible, records traceable to the equipment (e.g., showing the equipment identification) will be readily available for reference. Instrument identification and the results of calibrations and records of repairs will also be recorded in the logbook or daily calibration log.

Scheduled periodic testing equipment calibration does not relieve field personnel of the responsibility of using properly functioning equipment. If equipment malfunction is suspected, the device shall be removed from service, tagged so that it is not inadvertently used, and the appropriate personnel notified so that a recalibration can be performed or substitute equipment can be obtained. Equipment that fails calibration or becomes inoperable during use will be removed from service and either segregated to prevent inadvertent use or tagged to indicate it is out of calibration. Such equipment will be repaired and satisfactorily recalibrated. Equipment that cannot be repaired will be replaced.

3.2.2 Soil Sampling

Sampling locations will be specified in the project-specific SAPs, but the exact locations will be determined in the field based on such factors as accessibility and topography. The exact locations will be recorded in the field logbook or on the field sampling form when sampling is completed. A sketch of the sampling location will be entered into the logbook, if necessary, with reference points labeled including distances to the sampling location. Location of the sampling point by a global positioning system may be required.

Soil sampling using decontaminated equipment will be performed as described in the following sections. Each sample container will be closed as soon as it is filled; it will be chilled and processed for shipment to an offsite laboratory to allow laboratory analysis within the applicable holding time.

ALL SOILS SAMPLE RESULTS WILL BE REPORTED IN DRY WEIGHT UNLESS OTHERWISE SPECIFIED IN THE SAP.

3.2.2.1 Surface Soil Sampling

Surface soil sampling will follow the project-specific SOPs, but generally, samples will be collected as grab samples at the depth interval specified in the project-specific SAP for each location. Samples will be collected using a decontaminated stainless steel or nonmetallic hand trowel or equivalent equipment (sampling equipment should be chosen based on the analyte of concern for the specific sample). A Terra Core sampler, EasyDraw Syringe, cutoff disposable syringe or equivalent equipment will be used for volatile organic compounds (VOC), as described in Section 3.2.1.4. Samples to be analyzed for VOCs will be collected first. Samples to be analyzed for all other analytes should be placed in a sample-dedicated, 1-gallon, disposable pail or a decontaminated stainless steel bowl. The samples will be homogenized (using the trowel), and transferred to the appropriate containers. To prevent potential contaminant migration from the sample, sample containers will be filled to the top, taking care to prevent soil from remaining in the lid threads prior to being sealed.

3.2.2.2 Subsurface Soil Sampling

Subsurface soil sampling will follow the project-specific SOPs, but generally, samples will be collected by boring to the depth specified in the project-specific SAP using an appropriately sized hand auger or equivalent equipment. Once the specified depth is reached, the hand auger will be removed, and accumulated soil will be set aside in a sample-dedicated disposable pail or tarp. A different, clean hand auger will be inserted into the hole to collect the sample (decontamination of the boring implement is sufficient if multiple boring implements are not available). Other sampling devices, such as push tubes or split-spoon

samplers, may be used. A Terra Core sampler, EasyDraw Syringe, cutoff disposable syringe, or equivalent equipment will be used for VOCs, as described below. Samples to be analyzed for VOCs will be collected first. Samples to be analyzed for all other analytes should be placed in a sample-dedicated, 1-gallon, disposable pail or a decontaminated stainless steel bowl. The samples will be homogenized (using the trowel) and transferred to the appropriate containers. To prevent potential contaminant migration from the sample, sample containers will be filled to the top, taking care to prevent soil from remaining in the lid threads prior to being sealed.

3.2.2.3 Confirmation Sampling for Soil Excavation

This procedure is outlined in the project-specific SOPs. Confirmation sampling will be performed prior to closure of any excavation. Confirmation samples are usually collected from the bottom and sides of the excavation. The number and type of samples collected should be of sufficient quantity to be representative of the excavated site. The project- or site-specific SAP should address the number, type, and quantity of samples to be collected. All confirmation samples should be analyzed by the analytical methodology specified herein or in the project-specific QAPP addendum (collection of soil samples for determination of VOCs shall be in accordance with Section 3.2.1.4.). Field or laboratory screening data should not be used to verify that contamination has been removed below project action levels unless specifically approved by the overseeing regulatory agency.

3.2.2.4 Soil Sampling for Volatile Organic Compounds

See project-specific SOP for procedure. Guidelines for collecting soil samples for VOC analysis are provided in Method SW5035B. These sampling techniques are applicable to analysis by methods SW8260B or C and SW8015B or D (volatile parameters). Sampling for VOCs may be accomplished by using an EasyDraw Syringe, a Terra Core sampler, a cutoff plastic syringe, or any equivalent sampling device.

VOC samples will be collected into pre-tarred vials with or without preservatives. Preserved samples will be chilled and sent to the lab in accordance with the appropriate SOP. Unpreserved VOC samples will be frozen or chilled in the field. If chilled to 4 degrees Celsius (°C) (±2°C), the samples will be shipped by overnight express delivery (or courier) the same day they are collected. If frozen, appropriate measures should be taken to ensure that frozen samples remain frozen until receipt by the laboratory. If samples remain frozen, the laboratory has 14 days from date of collection to analyze the samples. If samples thaw to temperatures higher than 4°C (±2°C), they must be analyzed within 48 hours of collection. If the temperature does not exceed 4°C (±2°C), the laboratory may (1) freeze the samples between -7 and -20°C within 48 hours of collection and keep them frozen or (2) preserve them in sodium bisulfate or methanol within 48 hours of collection. Either of these procedures will extend the holding time to 14 days.

Sampling Using Cutoff Syringe. A disposable syringe capable of measuring 1 to 5 milliliters (ml) (±0.5 ml) is required. Calibration in the field will be needed for the specific soil type and the type of syringe to determine the proper setting on the syringe to collect the samples. For example, the plunger is set to 5 ml, and the sample is collected and weighed; if 5 grams (±0.5 gram) are not obtained, the process is repeated until the correct plunger setting is identified. The same procedure is repeated for the 1-gram sample. Once the volume setting

is identified, all soils of similar type will be collected at this volume. Samples can be collected with or without field preservation. When field preservation is chosen, the samples are collected into vials pre-preserved with methanol or sodium bisulfate. Otherwise, samples can be collected into vials without preservative, and preservation can be performed by the laboratory upon receipt of the samples within 48 hours of collection.

Sampling with Terra Core Sampler or EasyDraw Syringe. The sample is collected into the Terra Core or equivalent sampler following the manufacturer's instructions. A minimum of three samples will be collected. Two aliquots are needed for low-level analysis and reanalysis if necessary. The third aliquot is needed for extraction in methanol by the laboratory in case high-concentration analysis is indicated. Exposure to air must be minimized.

Sampling with Field Preservation. Before using this option, determine if the soil is amenable to the sodium bisulfate preservative. Soil samples that contain carbonate minerals may effervesce upon contact with the preservative. If the amount of gas generated is small (little if any effervescence with the preservative), field preservation may be used. If rapid or vigorous gas generation is observed, the sample should be collected without field preservation. If the sample is amenable to field preservation, it is collected using one of the methods listed above and quickly transferred into a VOC vial with preservative. The vial should be quickly sealed to avoid significant loss of volatiles components. The laboratory will supply a minimum of three preweighed VOC vials with 5 ml of aqueous sodium bisulfate preservative as described in Method SW5035B, as well as a single preweighed VOC vial without the preservative for each sample to be analyzed for VOCs. Two 5-gram aliquots in bisulfate are required for low-concentration analysis and reanalysis, when necessary. One 5-gram aliquot without sodium bisulfate is required for extraction in methanol by the laboratory in case high-concentration analysis is indicated by a low-concentration or screening analysis of the sample. One 1-gram sample in bisulfate is needed because the possibility exists that neither the 5-gram sample intended for low-concentration analysis, nor the 5-gram sample intended for high-concentration analysis, will have all target analyte concentrations within the calibration range. Exposure of the sample to air must be minimized.

If VOC analyses are the only analyses being performed for samples collected from any location; an additional 2- or 4-ounce soil sample must also be collected to analyze for percent moisture.

Sampling without Field Preservation. The samples will be collected using one of the methods listed above and quickly transferred into a minimum of three preweighed, vials without preservative supplied by the laboratory. These preweighed vials may be empty, they may contain reagent water, or they may be preserved with methanol, depending on whether the contaminant concentration is at low- or high-level concentration. Two 5-gram aliquots are needed for low-concentration analysis and reanalysis, when necessary. In addition, one 5-gram aliquot is required for extraction in methanol by the laboratory in case high-concentration analysis is indicated by a low-concentration or screening analysis of the sample. One 1-gram sample is also recommended because the possibility exists that neither the 5-gram sample intended for low-concentration analysis, nor the 5-gram sample intended for high-concentration analysis, will have all target analyte concentrations within the calibration range. Exposure of the sample to air must be minimized. Freezing the samples

between -7 and -20° C within 48 hours and keeping them frozen until analysis allows a 14-day holding time.

If VOC analyses are the only analyses being performed for samples collected from any location; an additional 2- or 4-ounce soil sample must also be collected to analyze for percent moisture.

3.2.3 Groundwater Sampling

3.2.3.1 Water Level Measurement

See project specific SOP for procedure. Field meter probes and water level sounding equipment will be decontaminated before and after each use at each well. Water levels in wells that are known or suspected to be least contaminated will be measured first. Water levels in wells that are known or suspected to have the highest contamination will be measured last.

If well heads are accessible, all wells will be sounded from the top of the casing to determine the depth to water and total well depth prior to purging. An electronic sounder, accurate to ±0.01 foot, will be used to measure depth to water in each well. Annual calibration documentation shall be maintained on file. The serial number of the meters shall be recorded in the sampling logbook. When using an electronic sounder, the probe will be lowered down the casing to the top of the water column, and the graduated markings on the probe wire or tape will be used to measure the depth to water from the surveyed point on the rim of the well casing. (Typically, the measuring device emits a constant tone when the probe is submerged in standing water. Most electronic level sounders have a visual indicator consisting of a small light bulb or diode that turns on when the probe encounters water.) The total well depth will be sounded from the surveyed top of the casing by lowering the weighted probe to the bottom of the well. The weighted probe will sink into silt, if present, at the bottom of the well screen. The total well depth will be measured by recording the depth to the nearest 0.1 foot.

3.2.3.2 Well Purging

See project specific SOPs for procedure. All wells will be purged prior to sampling. All equipment that will contact the sample during purging and sampling will be decontaminated prior to each use.

Low-flow Purge. One option for well sampling is low-stress (low-flow) purging using a pump capable of a purge rate of 1 liter per minute or less. Typically, a pneumatic or small electric submersible pump is used. The water level should be monitored approximately every 5 minutes. The flow rate should be started at the minimum flow capacity of the pump, then gradually increased until initial drawdown is observed. The flow rate should then be reduced slightly to achieve a stabilized pumping level. This reduced rate should become the maximum purge rate for the well. Each adjustment to the flow rate and the water level measured after each adjustment should be recorded. The flow rate should not exceed 1 liter per minute. Care should be taken to maintain pump suction and avoid entrapment of air in the tubing.

Casing Volume Purge. Another option for well sampling is three casing volume (macro-purging) using a pump capable of purging 1 to 5 gallons per minute, usually an electrical

submersible pump. Purging will be conducted at a flow rate sufficient to remove water from the entire screened interval of the well. However, the purge rate should not result in substantial drawdown, which is defined as 5 percent of the water column or the top of the screened interval. Purging will consist of the removal of a minimum of three casing volumes of water.

For low-yield wells (wells that exhibit less than 80 percent recovery [%R], within 2 hours), one casing volume of water shall be removed. If pump capability allows, the well will be purged at a rate of less than 1 gallon per minute. The well will then be allowed to recover to 80 percent and sampled within 24 hours of purging.

Water Quality Parameter Stabilization. To ensure representative sampling, water quality parameters (dissolved oxygen, pH, redox potential, specific conductance, and turbidity) must be stable before samples are collected, regardless of purge technique. Parameters will be measured approximately every 3 to 5 minutes, depending on the rate and duration of the purge. Purging is considered complete when the following water quality parameters are stable (i.e., for three consecutive readings):

- The pH varies by no more than 0.1 pH unit.
- Specific conductance readings are within 10 percent of the average.
- The redox potential varies by no more than 10 millivolts.
- The dissolved oxygen readings are within 10 percent of the average.

The water used to make measurements will not be used to fill sample bottles.

If the macro-purge technique is used, three casing volume well purges must be complete **and** the water quality parameters must be stable before the sample is collected. The total amount of water purged will be recorded in the field logbook or well-specific purge and sample collection form.

Grab-sample Collection. In some instances, it is appropriate to collect a grab sample from a monitoring well. For example, when a low-yield well has been purged and allowed to recharge. A bailer can be used to collect the sample without additional purge, eliminating the need to deploy a well pump for sample collection.

If a bailer is used to collect samples, a sufficient volume of water must be collected to fill the sample bottles and perform one measurement of water quality parameters. The water quality parameters will be recorded in the field logbook or well-specific purge and sample collection form.

3.2.3.3 Well Sampling

See project specific SOPs for procedure. Prior to sampling each well, the water level will be measured and the well purged, as previously described. All wells will be sampled within 24 hours of purging. Wells without a dedicated pump will be sampled using a bailer of appropriate material, such as Teflon or stainless steel. Wells with a dedicated pump will be sampled directly from the tap closest to the well head. All aerators, strainers, and hoses will be removed from the tap prior to sample collection. The flow will be adjusted so that a gentle stream is obtained. To minimize volatilization, a flow rate of less than 100 milliliters per minute is recommended for samples to be analyzed for VOCs.

At each sampling location, sample bottles designated for a particular analysis will be filled sequentially before bottles designated for other analyses are filled. Vials for VOCs will be filled first to minimize aeration of water in the well. All vials for VOCs will be provided, pre-preserved by the subcontract laboratory. The vials will be filled directly from the tap. Each vial will be inverted and checked for air bubbles and checked for headspace. If a pea-size or larger air bubble appears, the cap can be removed and additional sample added to eliminate the air space. If there is any likelihood of contamination being introduced into the sample, the vial contents will be emptied into the container used to measure purge volumes, the vial discarded, and a new sample collected in a new vial.

If a duplicate sample is to be collected, all sample bottles designated for a particular analysis for both duplicates will be filled sequentially before bottles for another analysis are filled. For example, duplicate samples will be collected sequentially for semivolatile organic compounds (SVOC), followed by duplicate samples collected sequentially for metals. EPA recommends the following collection order:

1. Volatile organic compounds and total organic compounds
2. Dissolved gasses and total organic carbon
3. Semivolatile compounds – Acid/Base extractables, pesticides, and PCBs
4. Metals and general chemistry
5. Radionuclides

It is considered good management practice to plan sample collection from the least to the most contaminated area of the site to decrease the risk of cross contamination (assuming no other factors that drive the priority of sampling location order).

Groundwater samples will be transferred from the bailer, tap, or pump tubing directly into the appropriate pre-preserved sample containers, if required. When transferring samples, care must be taken not to touch any nondedicated equipment to the sample container. The containers will be chilled and processed for shipment to the laboratory.

3.3 Equipment Decontamination

See project specific SOPs for procedure. Sampling equipment must be consistently decontaminated to ensure the quality of the samples collected. All equipment that comes into contact with potentially contaminated soil or water samples will be decontaminated. Disposable equipment intended for one use will not be decontaminated but will be packaged for appropriate disposal. In addition, equipment that is dedicated for repeated use at only one location does not need to be decontaminated. Equipment decontamination will occur prior to each use.

The following decontamination sequence is recommended:

1. Nonphosphate detergent and tap water wash, using a brush if necessary
2. Tap water rinse
3. Two rinses with deionized/distilled water

4. Organic-free water rinse (high-performance liquid chromatography grade) for organic samples

Large and bulky sampling equipment might need to be steam cleaned. Equipment will be decontaminated in a predesignated area on pallets or plastic sheeting. The cleaned equipment will be wrapped or covered to prevent contamination and stored in an uncontaminated area.

3.4 Disposal of Investigation-derived Wastes

The disposal of investigation-derived waste (IDW) should be addressed in the project-specific SAP. Each project or task can have different IDW disposal requirements, depending on site-specific conditions and the work performed. The following potentially contaminated IDW might be generated during field activities:

- **Used personal protective equipment (PPE) and disposable equipment.** Used PPE will be double-bagged and placed in a municipal refuse dumpster onsite. PPE and disposable equipment that is still serviceable will be rendered unusable before disposal into the dumpster.
- **Decontamination fluids.** Decontamination fluids include dilute nitric acid, deionized water, residual contaminants, and water with nonphosphate detergent. These fluids will be collected and disposed of in accordance with site requirements and applicable regulatory requirements
- **Soil cuttings.** Soil cuttings generated during subsurface sampling will be collected and disposed of in accordance with site requirements and applicable regulatory requirements.
- **Purged groundwater and excess groundwater collected for sample container filling.** These wastes will be collected and disposed of in accordance with site requirements and applicable regulatory requirements.

Each project SAP should address IDW. Any samples collected for waste characterization should include IDW in the sample identifier (ID).

3.5 Field Quality Control Samples

QC samples will be collected to monitor accuracy, precision, and the potential presence of field contamination for analytical methods to be performed in the offsite laboratory. All field QC samples, except matrix spike/matrix spike duplicates (MS/MSD), will be sent blind to the laboratory along with regular field samples. These blind samples will be labeled similar to regular field samples to disguise them. Sampling frequencies may vary according to the project needs, as defined in the project-specific SAP or QAPP addendum. The recommended frequency of collection for QC samples is discussed in the following sections and should be reviewed and updated to achieve project-specific DQOs.

3.5.1 Field Duplicate Samples

A field duplicate (FD) is an independent sample collected as close as possible to the original sample, from the same source, and under identical conditions. FDs are used to document sampling and analytical precision. FDs will be collected at a minimum frequency of 10 percent or one per sampling event, whichever is more frequent, for each matrix and type of analysis. The sampling procedures described in Section 3.2 will be followed. The sampling locations for FD samples will be recorded in the field logbook or field sampling form, or both.

3.5.2 Equipment Blanks

Equipment blanks (EB) will be collected to evaluate field sampling and decontamination procedures by pouring deionized or organic free water over the decontaminated equipment. EBs will be collected at a frequency of one EB per day for each non-dedicated equipment type per sampling team. The EBs will be preserved, packaged, and shipped in the same manner described for the environmental samples. A separate sample ID will be assigned to each EB sample, and the sample will be submitted blind to the laboratory. EBs will be analyzed in the offsite laboratory for the same parameters specified for the corresponding matrix or for the main contaminate of potential concern (COPC).

3.5.3 Field Blanks

Field blanks (FB) (also known as ambient blanks [AB]) are collected to evaluate (or to monitor) whether contaminants have been introduced during sampling because of ambient conditions. FBs will be collected by pouring deionized water (or organic free water for organic samples) into a sample container at the sampling location and leaving the sample exposed to the atmosphere during the time a sample is collected. FBs will be collected at a frequency of one per location that warrants concern because of environmental conditions or project-specific QC concerns, as determined by the project chemist or project manager. Generally, FBs need to be collected if the analyte concentrations are high enough to allow mobile contaminants to affect the sample results and field conditions such as upwind environments cannot be controlled. FB will be analyzed for the same parameters specified for the associated samples.

3.5.4 Trip Blanks

Trip blanks (TB) are used to monitor contamination during sample shipping and handling and for cross contamination through VOC migration among the collected samples. They are prepared in the laboratory by pouring American Society for Testing and Materials (ASTM) Type II or organic-free water into a VOC sample container. They are then sealed, transported to the field, stay sealed while VOC samples are taken, and transported back to the laboratory in the same cooler as the VOC samples. One TB should accompany each VOC sample cooler.

3.5.5 Matrix Spike/Matrix Spike Duplicate

A MS/MSD consists of duplicate field sample aliquots spiked by the laboratory with analytes of concern to evaluate the effects of the matrix on the recoveries of these analytes. For every 20 field samples of each matrix collected at each site, additional duplicate aliquots

of one of the samples should be collected for each analysis and designated on the CoC form for use as an MS/MSD by the laboratory. Separate line entries are not required for matrix spikes. The increased number of sample containers should be noted. The duplicate aliquots for MS/MSD analyses should be collected simultaneously or in immediate succession with the parent sample. They will be treated in exactly the same manner as the parent sample during storage and shipment. The sampling locations for the MS/MSD will be documented in the field logbook or the field sampling form, or both if the MS/MSD are specifically requested by the project; if not, document the extra volume on the CoC and in the field logbook or on the field sampling form.

3.5.6 Split Samples

Split samples may be collected periodically for comparison of data between analytical laboratories. A split sample is collected from a thoroughly homogenized original sample and is used to document analytical precision. Split samples will be collected for each matrix and for each analytical method, except those for volatiles when project objectives dictate the need. The sampling procedures described in Section 3.2 or those described in the project- or site-specific SAPs or QAPP addenda will be followed. The sampling locations will be recorded in the field logbook or field sampling form, or both. Split samples will be sent to a second certified laboratory, and results will be compared with those from the primary laboratory.

SECTION 4

Sample Handling and Custody

4.1 Sample Documentation and Tracking

Projects with large sampling events should take advantage of the field database to provide a PST, CoCs, and sample container labels. The use of Mobil Integrated Sample Tracking (MIST) and the field database are recommended. All projects must keep sample documentation.

The laboratories will provide pre-preserved sample containers with labels identifying the preservative, unless approved by the project chemist. Laser-printed labels and indelible ink pens will be used whenever possible to complete sample labels. Immediately prior to sample collection, the sample ID, date, time of sampling and sampler's initials will be recorded onto the waterproof label. Samples will be placed into resealable bags, and ice used in shipping containers double bagged. Vital information regarding the collection of each sample will be recorded into a field logbook, field sampling form, or CoC form.

A separate logbook will be used for each project. It will be bound with consecutively numbered pages. All entries will be legibly written in black ink and signed and dated by the individual making the entries. Factual and objective language will be used. All entries will be complete and accurate to allow reconstruction of each field activity. A line will be placed through any portion of a field notebook that is unused. One line strike-through will be used to show corrections to entries. The strike-through will be initialed and dated. No correction fluid will be used. The following information for each sample will be recorded into the field logbook, field sampling form, or CoC form, whichever is appropriate:

- Sampling location and description. (Sketch and measured distances from reference points will be recorded if there is no established identification for the sample location.)
- Sample ID.
- Sampler's name.
- Date and time of sampling.
- Sample designation as composite or grab.
- Sample matrix.
- Type and ID of sampling equipment.
- Field measurement data (e.g., pH, temperature, conductivity).
- Field observations that may be relevant to the analysis or sample integrity (e.g., odor, color, and weather conditions).
- Associated QC blanks.

- Preservative used.
- CoC form number, custody seal number, and lot numbers of sample containers (when appropriate).
- Shipping details. (If the laboratory is providing courier service, the courier must sign and date the CoC forms. Copies of the signed CoC forms should be transmitted to the office as soon as practical. If Federal Express, United Parcel Service, or other courier is used, include shipping information for each shipment.)
- Destination laboratory.

4.2 Containers and Preservatives

The contracted analytical laboratory will provide the required sample containers for all samples including QC samples. All sample containers for PG&E projects will be pre-cleaned and certified to EPA standards. No sample containers will be reused. The contracted laboratory will add preservatives, if required, prior to shipping the sample containers to the field or supply the preservative as appropriate. The laboratory, upon receipt of the samples, will verify and record the adequacy of preservation and will add additional preservative, if necessary. For VOCs, the sample label or CoC will indicate the presence of preservative and the laboratory will verify and record the pH after the analysis. The containers, minimum sample quantities, required preservatives, and maximum holding times for many parameters are shown in Table 4-1 (tables appear at the end of the section in which they are first referenced). The project- or site-specific SAP or QAPP addendum will contain the specific containers required for each project if they differ from the containers listed in Table 4-1.

4.3 Chain-of-Custody

Collecting data of known quality begins at the point of sample collection. Legally defensible data are generated by using proven evidentiary procedures. These procedures are described in the following sections and must be followed to preserve and ensure the integrity of all samples from the time of collection through analysis. Sample custody records must be maintained in the field and subcontractor laboratory. A sample is considered to be in custody if it is either in physical possession or view, locked up, or kept in a secured and restricted area. Until the samples are shipped, custody will be the responsibility of the sampling team leader.

CoC forms document sample collection and shipment to the laboratory. CoC form(s) will be completed for each sampling event. The original copy will be provided to the laboratory with the sample shipping cooler, and a copy will be retained in the field documentation files. The CoC form will identify the contents of each shipment and maintain the custodial integrity of the samples. All CoC forms will be signed and dated by the responsible sampling team personnel, as applicable. The “Relinquished By” field will be signed by the responsible sampling team personnel, with the date, time, and air bill number noted on the CoC form. The laboratory will provide a PDF copy of the CoC forms, with the sample login information included, within 48 hours of sample receipt, along with information related to

the condition of receipt of the samples. The laboratory will also include the original or a copy with the final hardcopy report (the final "hardcopy" can be in a paper or PDF format or both, depending on project-specific requirements).

A self-adhesive custody seal will be placed across the lid and side of each sample to maintain its integrity until the laboratory opens it. The shipping coolers containing the samples will be sealed with a custody seal any time they are not in an individual's possession or view before shipping. All custody seals will be signed and dated by the responsible sampling team personnel.

At a minimum, the CoC form must include the following information:

- Project information such as project number or identification of investigation monitoring program, Project Manager, etc.
- Unique sample ID
- Date and time of sample collection
- Source of sample (including name, location, sample type, and matrix)
- Number of containers
- Designation of MS/MSD (if applicable)
- Preservative used
- Analyses required
- Name of sampler
- Custody transfer signatures, dates, and times of sample transfers from the field to transporters and to the laboratories
- Bill of lading or transporter tracking number (if applicable)

4.4 Laboratory Responsibilities

After the samples reach the laboratory, they shall be checked against information on the CoC form for anomalies. The condition, temperature, and appropriate preservation of samples shall be checked and documented on the CoC form or a sample receipt checklist. Checking an aliquot of each sample container, at the time of receipt, using litmus paper is an acceptable procedure to determine the pH of all sample containers received, except VOCs. The pH check should be conducted in the sample receiving area or in the appropriate laboratory department. Samples for VOC analysis require that the pH check be performed after the vial has been opened for analysis; the pH shall be recorded at the time of analysis in the department log books. Anomalies in the received samples and their resolution shall be documented in laboratory records and summarized in the final analytical report case narrative. All sample information shall then be entered into a tracking system, and unique analytical sample IDs shall be assigned. A copy of this information shall be reviewed by the laboratory for accuracy. Sample holding time tracking begins with the collection of samples and continues until the analysis is complete.

Samples not preserved or analyzed in accordance with the requirements in this QAPP or the project-specific SAP or QAPP addendum may be resampled and analyzed at no additional cost to CH2M HILL. Any subcontracted analyses shall be documented on a CoC form by the laboratory and noted in the case narrative. Internal laboratory CoC procedures shall also be documented and implemented by the laboratory. Sample custody within the laboratory will, at a minimum, include storage of samples in a secure, restricted access area when not in use; samples must be checked out and checked back in by the analysts who use them. Internal custody records must be maintained by the laboratory as part of the documentation file for each sample. Specific instructions concerning the analysis specified for each sample shall be communicated to the analysts. Analytical batches shall be created, and laboratory QC samples shall be introduced into each batch.

While in the laboratory; samples shall be stored in controlled-access, temperature-applicable areas. Refrigerators, coolers, and freezers shall be monitored for temperature 7 days a week. Acceptance criterion for the temperatures of the refrigerators and coolers is 4°C ±2°C. Acceptance criterion for the temperatures of the freezers shall be between -7°C and -20°C. All of the cold-storage areas shall be monitored by using thermometers that have been calibrated with a National Institute of Standards and Technology approved traceable thermometer. As indicated by the calibration results, correction factors shall be applied to each thermometer.

Records that include acceptance criteria shall be maintained. Samples for volatile organics analysis shall be stored separately from other samples, standards, and sample extracts. Samples shall be stored after analysis until disposed of in accordance with applicable local, state, and federal regulations. Disposal records shall be maintained by the laboratory.

The following information shall be documented on the CoC form, the sample receipt form, or the sample login form (or on more than one of these forms, as applicable):

- Date samples received
- CH2M HILL sample ID
- Laboratory sample ID
- Analytical tests requested for the sample batch
- Sample matrix
- Number of samples in the batch
- Container description and location in the laboratory
- Verification of sample preservation

All of the information must be retained and traceable in the laboratory sample tracking system, with summary information provided in the analytical reports.

SOPs describing sample control and custody shall be maintained by the laboratory.

4.5 Sample Packaging and Transport

The following sections provide guidelines for sample packaging and transport that may be superceded, amended, or replaced in the project- or site-specific SAPs or QAPP addenda.

4.5.1 Sample Container Preparation

The following procedures shall be implemented:

- Labels will be checked for completeness and comparability with the COC.
- Container lids will be checked for tightness; if the container is not full, the sampler will note the COC, field notebook, or field sampling form.
- Sample bottles will be double-bagged in heavy-duty plastic. Glass sample containers will be covered with bubble wrap to prevent breakage.

4.5.2 Shipping Cooler Preparation

The following procedures shall be implemented:

- All previous labels and broken custody seals used on the sample shipping cooler will be removed.
- Drain plugs will be sealed with fiberglass or similar tape (outside and inside) to prevent melting ice from leaking.
- A cushioning layer of packing material, such as bubble wrap (approximately 1 inch thick), will be placed at the bottom of the cooler to prevent breakage during shipment.
- The cooler will be lined with a large plastic bag (same type used to contain samples).
- All ice will be double-bagged in zip-lock plastic bags.

4.5.3 Placing Samples in the Cooler

The following procedures shall be implemented:

- The CoC form will be placed in a zip-lock bag and taped inside the top of the cooler if shipment is to be made through commercial carrier.
- Samples will be placed in an upright position in the cooler. Sample containers will never be placed onto their side, except for a soil VOC that is to be frozen.
- Ice will be placed on top of samples and between samples. Ideally, ice will be placed in resealable plastic bags in duplicate to minimize leakage of ice melt into the cooler.
- Void space between samples should be filled with packing material or ice packs (vermiculite is not acceptable packing material unless required by DOT).

4.5.4 Closing the Cooler

The following procedures shall be implemented if the cooler is to be shipped by commercial carrier:

- The cooler lid will be taped with strapping tape, encircling the cooler several times.
- Custody seals should also be affixed to the cooler lid to further ensure the integrity of the samples. Custody seals should be initialed and dated.

4.5.5 Transport

Sample coolers will be transported to the laboratory immediately after sample collection. An overnight courier may be used to transport the samples. Intermediate stops should be avoided, except for emergencies, in which case, the situation should be noted in the field notebooks. The laboratory should be notified that samples are being shipped.

TABLE 4-1
Sample Containers, Preservation, and Holding Times
PG&E Program Quality Assurance Project Plan

Analyte	Method	Container and Minimum Quantity		Preservation	Holding Time
		Water	Soil/Sediment		
Metals (except hexavalent chromium)	SW6010B or C, SW6020A, EPA200.7, EPA200.8, SM3120B, EPA245.1, SW7000 series methods	1-liter P or G	8-oz/P, G, or T	Water: Add HNO_3 to pH<2; soil/sediment: None	28 days for mercury; 180 days for all others
Hexavalent Chromium	SW7199		4-oz/P, G, or T	Soil/sediment: Chill to 4°C (±2°C)	Soil: 30 days to extraction, 7 days to analysis
Hexavalent Chromium	EPA218.6	250-ml P	Not applicable	chill to ≤6°C Laboratory or field filtration within 24 hours. After filtration adjust the pH to 9–9.5 by adding $(NH_4)_2SO_4$/ NH_4OH buffer solution	28 days
Hexavalent Chromium	SM3500-Cr B	250-ml P	Not applicable	chill to ≤6°C Laboratory or field filtration within 24 hours. After filtration adjust the pH to 9–9.5 by adding $(NH_4)_2SO_4$/ NH_4OH buffer solution	28 days
Purgeable TPH	SW8015B, C or D Preparation methods: SW5035B (soil) SW5030B (water)	Three 40-ml G-TLC	Three 40-ml G-TLC	Water: Add HCl to pH<2; chill to 4°C (±2°C) Soil/sediment: Chill to 4°C (±2°C) or: • Frozen in 48 hours • Frozen onsite • Sodium bisulfate • Methanol	Water: 14 days (preserved); 7 days (unpreserved) Soil: 48 hours unless preserved within 48 hours 14 days if solid samples preserved by the following methods: • 4ºC/frozen in 48 hours • Frozen onsite • Sodium bisulfate • Methanol

TABLE 4-1
Sample Containers, Preservation, and Holding Times
PG&E Program Quality Assurance Project Plan

Analyte	Method	Container and Minimum Quantity		Preservation	Holding Time
		Water	Soil/Sediment		
Extractable TPH	SW8015B, C or D	Two 1-liter G	8-oz/G or T	Chill to 4°C (±2°C)	Water: 7 days to extraction; 40 days to analysis Soil: 14 days to extraction; 40 days to analysis
Pesticides	SW8081A or B	Two 1-liter G	8-oz/G or T	Chill to 4°C (±2°C)	Water: 7 days to extraction; 40 days to analysis Soil: 14 days to extraction; 40 days to analysis 90 days to extraction if frozen to -10°C (±2°C)
PCB	SW8082 or SW8082A	Two 1-liter G	8-oz/G or T	Chill to 4°C (±2°C)	Water: 7 days to extraction; 40 days to analysis Soil: 14 days to extraction; 40 days to analysis 90 days to extraction if frozen to -10°C (±2°C)
VOCs	SW8260B or C Preparation methods: SW5035B (Soil) SW5030B (Water)	Three 40-ml G-TLC	Three 40-ml G-TLC	Water: Add HCl to pH<2; chill to 4°C (±2°C) Soil/sediment: Chill to 4°C (±2°C) or: • Frozen in 48 hours • Frozen onsite • Sodium bisulfate • Methanol	Water: 14 days (preserved); 7 days (unpreserved) Soil: 48 hours unless preserved with 48 hours 14 days if solid samples preserved by the following methods: • 4ºC/frozen in 48 hours • Frozen onsite • Sodium bisulfate • Methanol
SVOC	SW8270C or D	Two 1-liter G	8-oz G or T	Chill to 4°C (±2°C)	Water: 7 days to extraction; 40 days to analysis Soil: 14 days to extraction; 40 days to analysis
Herbicides	SW8151A	Two 1-liter G	8-oz G or T	Chill to 4°C (± 2°C)	Water: 7 days to extraction; 40 days to analysis Soil: 14 days to extraction; 40 days to analysis

TABLE 4-1
Sample Containers, Preservation, and Holding Times
PG&E Program Quality Assurance Project Plan

Analyte	Method	Container and Minimum Quantity		Preservation	Holding Time
		Water	Soil/Sediment		
PNA	SW8270SIM	Two 1-liter G	8-oz G or T	Chill to 4°C (±2°C)	Water: 7 days to extraction; 40 days to analysis Soil: 14 days to extraction; 40 days to analysis
Carbon Dioxide, Methane, Ethane, and Ethane	RSK-175	Three 40-ml G-TLC	Not applicable	Add HCl to pH<2; chill to 4°C (±2°C)	Water: 14 days
Carbon Dioxide	SM5400-CO2	1-liter P or G		≤6°C	14 days
Ammonia	EPA350.1 Revision 2 or SM4500-NH3	1-liter P or G	4-oz P, G, or T	Water: Add H_2SO_4 to pH<2; chill to ≤6°C Soil/sediment: 4°C (±2°C)	Water: 28 days Soil: Not available
Anions	EPA300.0 or SM4500	500-ml P or G	4-oz P, G, or T	Chill to ≤6°C (none required for chloride and fluoride) ortho-Phosphate requires filtering within 15 minutes after sample collection	Bromide, chloride, fluoride, sulfate, and iodide in 28 days Nitrate and ortho-Phosphate in water 48 hours
Metabolic Acids	EPA300.M	500-ml P or G		Chill to ≤6°C	Water: 28 days
Alkalinity (total, bicarbonate, carbonate, hydroxide)	EPA310.2 or SM2320 B	500-ml P or G		Chill to ≤6°C	14 days
TDS	SM2540 C	500-ml P or G		Chill to ≤6°C	7 days
TSS	SM2540 D	500-ml P or G		Chill to ≤6°C	7 days
Turbidity	EPA180.1 Revision 2 or SM2130	500-ml P or G		Chill to ≤6°C	48 hrs
Color	SM2120 E	125-ml P or G		Chill to ≤6°C	48 hours
Specific Conductance	EPA120.1 Revision 1, or SM2510 SW9050	500-ml P or G	4-oz P, G, or T	Chill to ≤6°C Soil/sediment: Chill to 4°C (±2°C)	28 days
Hardness	SM2340 B or C	500-ml P or G		Chill to ≤6°C	6 months
pH	SM4500H+B or SW9040	500-ml P or G	4-oz P, G, or T	Chill to ≤6°C	15 minutes
BOD	SM5210 B	500-ml P or G		Chill to ≤6°C	48 hours

TABLE 4-1
Sample Containers, Preservation, and Holding Times
PG&E Program Quality Assurance Project Plan

Analyte	Method	Container and Minimum Quantity		Preservation	Holding Time
		Water	Soil/Sediment		
TOC/DOC	SM 5310 C	500-ml G or 40-ml VOA	4-oz P, G, or T	Water: For 500-ml: Add H_2SO_4 to pH<2; chill to ≤6°C For 40-ml VOA: Add H_2PO_4 to pH<2; chill to ≤6°C	28 days
TOC	Walkley Black	Not applicable	4-oz P, G, or T	Chill to ≤6°C	28 days
Perchlorate	EPA314.0	500-ml P or G	4-oz P, G, or T	Chill to ≤6°C	28 days
Sulfide	SM4500-S²	500-ml P or G		Add zinc acetate and NaOH to pH>9, chill to ≤6°C	7 days
Acid Volatile Sulfide	E821/R-91-100	Check with Laboratory prior to sample collection			
TKN	EPA351.1/2 or SM4500	500-ml P or G	4-oz P, G, or T	Add H_2SO_4 to pH<2; chill to Chill to ≤6°C	28 days
Ferrous Iron (Fe +2)	SM3500D	500-ml P or G		Chill to ≤6°C	24 hours
Dissolved Silica	EPA200.7 or SM4500-Si or SM3120 B	500-ml P only		Chill to ≤6°C	28 days
18 O and deuterium	Laboratory SOP (continuous flow mass spectrometer – CF-IRMS)	100-ml P or 40-ml VOA		Chill to ≤6°C	6 months
Cyanide	EPA335.4 (R1) or SM4500-CN C/D/E (water) SW9010B, SW9012, or SW9014 (soil)	500-ml P or G	4-oz P, G, or T	Water: Add NaOH to pH>12; chill to ≤6°C Soil/sediment: Chill to 4°C (±2°C)	Water and soil: 14 days
Gross Alpha	SM7110C	500 ml P or G		Add HNO_3 to pH<2	6 months
Gross Beta	E900.0	500-ml P or G		Add HNO_3 to pH<2	6 months
Radium-226	E903.1	500-ml P or G	4-oz P, G, or T	Add HNO_3 to pH<2; soil/sediment: None	6 months
Radium-228	E904.0	500-ml P or G	4-oz P, G, or T	Add HNO_3 to pH<2; soil/sediment: None	6 months
Strontium	E905.0	500-ml P or G	4-oz P, G, or T	Add HNO_3 to pH<2; soil/sediment: None	6 months
Tritium	E906.0	500-ml P or G	4-oz P, G, or T	Add HNO_3 to pH<2; soil/sediment: None	6 months
Uranium	R908.0 or 200.8	500-ml P or G	4-oz P, G, or T	Add HNO_3 to pH<2; soil/sediment: None	6 months

TABLE 4-1
Sample Containers, Preservation, and Holding Times
PG&E Program Quality Assurance Project Plan

Analyte	Method	Container and Minimum Quantity		Preservation	Holding Time
		Water	Soil/Sediment		
Dioxins and furans	SW8290	Two 1-liter Amber G	8-oz G	Chill to 4°C (±2°C)	Water and Soil: 30 days to extraction; 45 days after extraction to analysis Soils: 365 days to extraction if frozen to -10°C (±2°C)
Dioxins and furans (Drinking water)	EPA1316B	Two 1-liter Amber G		Chill to 4°C (±2°C)	7 Days to extraction 40 days after extraction to analysis
Asbestos	Water: EPA 100.1/100.2-TEM	1-liter sonicated P		Chill to 4°C (±2°C)	Water: 48 hour holding time
	Soil: PLM/BULK (present/absent); CARB435/PLM; TEM		4-oz G	Chill to 4°C (±2°C)	Soil: I year

TABLE 4-1
Sample Containers, Preservation, and Holding Times
PG&E Program Quality Assurance Project Plan

Analyte	Method	Container and Minimum Quantity: Water	Container and Minimum Quantity: Soil/Sediment	Preservation	Holding Time

Notes:

>	=	greater than
<	=	less than
≤	=	less than or equal to
BTEX	=	benzene, toluene, ethylbenzene, and xylene
CF-IRMS	=	continuous-flow isotope ratio mass spectrometry
DOC	=	dissolved organic compounds
G	=	glass
G-TLC	=	glass with teflon-lined cap
H_2PO_4	=	phosphoric acid
H_2SO_4	=	sulfuric acid
HCl	=	hydrochloric acid
HNO_3	=	nitric acid
NaOH	=	sodium hydroxide
NH_4	=	ammonium
NH_4OH	=	ammonium hydroxide
$(NH_4)_2SO_4$	=	ammonium sulfate
oz	=	ounce
P	=	polyethylene
PCB	=	polychlorinated biphenyls
PLM	=	Polarized light microscopy
PNA	=	polynuclear aromatic hydrocarbons
SIM	=	selected ion monitoring
SO_4	=	sulfate
T	=	brass sleeves in the sample barrel (sometimes called California brass)
TDS	=	total dissolved solids
TEM	=	Transmission Electron Microscopy
TKN	=	total kjeldahl nitrogen
TLC	=	teflon lined closure
TOC	=	total organic compounds
TPH	=	total petroleum hydrocarbons
TSS	=	total suspended solids

SECTION 5

Method Quality Objectives and Quality Assurance Program

Programmatic method quality objectives (MQOs) are defined in this section but may differ in individual projects, as specified in the project-specific QAPP addenda. MQOs are the basis for ensuring that the quality of the data collection meets the project-specific DQOs of the plan. They specify the type, quality, and quantity of QA/QC data to be collected and how the data are to be used to make the appropriate decisions for the project. The final output of the data must meet the qualitative and quantitative needs of the project.

5.1 Data Categories

Both screening and definitive data may be generated. Screening data are generated by rapid analytical methods, and calibration and QC requirements are less rigid than those required for definitive data. Quantitation from a screening method is usually imprecise. Definitive data are generated by rigorous analytical methods using standardized calibration and QC and are reported on specified deliverables. The data are analyte-specific, and both identification and quantitation are confirmed.

In general, screening data will be confirmed by definitive data for use in decision making for the PG&E Program. However, screening data may be used for decision making purposes on a project-specific basis, depending upon the DQOs. The project-specific documents will describe the advantages of collecting screening data that might be less precise but will more adequately define the characteristics of the site by increasing the number of samples collected. This approach can reduce overall error in the data collection process.

5.2 Precision, Accuracy, Representativeness, Completeness, and Comparability

Data quality will be evaluated for precision, accuracy, representativeness, completeness, and comparability (PARCC). Both definitive and screening data will be subject to PARCC requirements. PARCC objectives for screening methods may be identical to those for definitive data, or they may be less stringent depending on the project-specific objectives. Sampling frequencies may vary according to the project needs, as defined in the project-specific SAPs or QAPP addenda.

5.2.1 Precision

Precision is a measure of reproducibility of analytical results. It can be defined as the degree of mutual agreement among individual measurements obtained under similar conditions. Total precision is a function of the variability associated with both sampling and analysis. Precision will be evaluated as the relative percent difference (RPD) between field duplicate

sample results or between the MS and MSD results. Field duplicates will comprise 10 percent of the sampling effort. MS/MSD samples will be analyzed at a 5-percent frequency. The MS/MSD samples will be field designated, if so required by project specific requirements. Laboratory-generated precision control limits can be used for data evaluation; however, all precision control limits listed in Appendix A and Tables 5-3 through 5-15 must be met.

5.2.2 Accuracy

Accuracy is the degree of agreement between a measured value and the "true" or expected value. It represents an estimate of total error from a single measurement, including both systematic error, or bias, and random error that may reflect variability due to imprecision. Accuracy is evaluated in terms of percent recovery (%R) determined from results of MS/MSD and laboratory control sample (LCS) analyses. Surrogate recoveries from samples analyzed for organic parameters are also used to assess accuracy. Laboratory-generated accuracy control limits can be used for data evaluation; however, the accuracy control limits listed in Appendix A and Tables 5-3 through 5-15 must be met.

5.2.3 Representativeness

Representativeness is the degree to which sample data accurately reflect the characteristics of a population of samples. It is achieved through a well-designed sampling program and by using standardized sampling strategies and techniques and analytical procedures. Factors that can affect representativeness include site homogeneity, sample homogeneity at a single point, and available information around which the sampling program is designed.

5.2.4 Completeness

Completeness is the number of valid measurements compared with the total number of measurements generated. Completeness will be determined for each method, matrix, and analyte combination. The completeness goals of each project are optimized to meet the DQOs. The goals for the PG&E Program are 95 percent for aqueous samples and 90 percent for soil samples.

5.2.5 Comparability

Comparability is the confidence with which one data set can be compared to another. It is achieved by maintaining standard techniques and procedures for collecting and analyzing samples and reporting the analytical results in standard units. Results of performance evaluation samples and systems audits will provide additional information for assessing comparability of data among subcontracting laboratories.

5.3 Method Detection Limits, Reporting Limits, and Instrument Calibration Requirements

5.3.1 Method Detection Limits

The method detection limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater

than zero. Each participating laboratory will determine the MDL for each method, matrix, and analyte for each instrument that will be used to analyze samples. The MDLs will be initially determined prior to analyzing samples and again at least once every 12 months; a quarterly MDL verification can be substituted for the annual MDL study. The following steps should be followed:

1. Estimate the MDL using one of the following:
   - The concentration value that corresponds to an instrument signal/noise ratio in the range of 2.5 to 5
   - The concentration equivalent of three times the standard deviation of replicate measurement of the analyte in reagent water
   - The region of the standard curve where there is a significant change in sensitivity (i.e., a break in the slope of the standard curve)
2. Prepare (e.g., extract and digest) and analyze seven samples of an MS (ASTM Type II water for aqueous methods; Ottawa sand for soil methods; 1-mm glass beads, or smaller, for metals) containing the analyte of interest at a concentration three to five times the estimated MDL.
3. Determine the variance for each analyte by using Equations 1 and 2:

$$S^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2\right] \quad (1)$$

where:

S^2 = variance
x_i = the nth measurement of the variable x and
$\bar{x}$ = the average value of x

$$\bar{X} = \frac{1}{n}\sum_{i=1}^{n} x_i \quad (2)$$

4. Determine the standard deviation(s) for each analyte by using Equation 3:

$$s = (S^2)^{1/2} \quad (3)$$

5. Determine the MDL for each analyte by using Equation 4:

$$MDL = 3.14(s) \quad (4)$$

   Note: 3.14 is the one-sided t-statistic at the 99-percent confidence level appropriate for determining the MDL using seven samples.

6. If the spike level used in Step 2 is more than 10 times the calculated MDL, repeat the process using a smaller spiking level.

CH2M HILL requires a verification check be performed on the calculated MDLs for each target compound (AFCEE, 2006). The MDL check standard shall be spiked at approximately two times the current reported MDL. The MDL is verified if the check standard produces a

response at least 3 times above the instrument's noise level and greater than the blank associated with the MDL verification study. If the verification response is too low, spike at a successively higher concentration until verification criteria are met, and use the first successful concentration as the reported MDL. The MDL verification check will be sent to CH2M HILL for review and approval.

5.3.2 Reporting Limits

In general, RLs must be greater than two times the calculated MDL. RLs used by the laboratory should not be greater than the reporting limit objectives listed in Appendix A.

When calibrating instruments, a standard at a concentration equal to or less than the RL must be included. In the project-specific SAP or QAPP addendum, reporting of analytical data will be addressed. One of the following options will be selected when establishing reporting requirements for each project:

- Analytes at concentrations greater than the laboratory MDL but less than the RL will be flagged "J" and reported as an estimate. Analytes that are not detected at or above the laboratory MDL will be flagged "U" and reported as not detected at the RL.
- Only analytes at a concentration greater than the project-specific RL will be reported. Analytes detected at less than the RL will be flagged "U" and reported as not detected at the RL.

For consistency, RLs and sample results shall be reported to two significant figures if less than 10 micrograms per liter (µg/L) (parts per billion) and to three significant figures otherwise.

RLs shall be reported on a dry-weight basis for soil samples.

5.3.3 Instrument Calibration

Laboratory instruments shall be calibrated by qualified personnel prior to sample analysis according to the procedures specified for each method. Calibration shall be verified at method-specified intervals throughout the analysis sequence. The frequency and acceptance criteria for calibration are specified for each analytical method in Tables 5-3 through 5-15, with supplemental requirements defined in the following sections for organic methodologies. When multipoint calibration is specified, the concentrations of the calibration standards should bracket those expected in the samples. Samples should be diluted, if necessary, to bring analyte responses within the calibration range. Data that exceed the calibration range cannot be reported by the laboratory. The initial calibration (ICAL) curve shall be verified as accurate with a standard purchased or prepared from an independent second source. ICAL verification involves the analysis of a standard containing all the target analytes, typically in the middle of the calibration range, each time the ICAL is performed. Quantitation based on extrapolation is not desirable.

Calibration requirements

In the initial calibration (for all instruments), a standard at a concentration equal to or less than the RL must be included.

Initial calibration must be re-established if the following conditions exist:

- The last calibration was established more than 1 year prior to the start of a sample's analysis [gas chromatography, gas chromatography-mass spectrometry, inductively coupled plasma, and inductively coupled plasma-mass spectrometry (ICPMS)]
- The last calibration was established more than 2 weeks prior to the start of a sample's analysis for hexavalent chromium by ion chromatography.
- Two consecutive continuing calibration standards fail
- The operating conditions change; for example, any of the following:
  - Major maintenance is performed
  - The fluid or gas "carrier" type changes
  - The instrument requires relocation
  - The analytical column is replaced

5.3.3.1 Initial Calibration Models for the Determination of Organic Compounds

Organic methodologies often provide multiple options for ICAL curve fits and associated acceptance criteria for use. The following sections describe the required laboratory practices that will be employed by the laboratory. The hierarchy that the laboratory will use when selecting the calibration curve fit for use in quantitation of sample results is described in the following section.

Calibration Techniques. The following procedures will be implemented:

- The analyst will verify that correct instrument operating conditions and routine maintenance as specified in the method and laboratory SOP are employed. All maintenance activities will be documented in a laboratory notebook for troubleshooting and scheduling of future routine, periodic maintenance.
- Ensure that the instrument is free of contamination prior to calibration. **Do not** perform any blank subtraction.
- The entire ICAL must be performed and meet method performance criteria prior to sample analyses. The calibration standards must be analyzed in sequential order from the lowest to highest concentration. If **one** calibration standard fails to meet criteria, it may be reanalyzed at the end of the calibration sequence. Justification for removing a calibration point from the selected curve fit includes circumstances such as, improper purge, injection failure, nonspiked level, or other obvious failures. The failure of multiple standards suggests an instrument problem or operator error and corrective action is required.
- Only the lowest or the highest calibration points can be removed from the calibration curve without justification. If the lowest calibration point is removed, the RL for that compound increases to the level of the next lowest calibration point. Approval to elevate RLs greater than the project-specific objectives **must** be approved by the program or project chemist. If the highest calibration point is removed, the linear range is shortened for that compound.

- The lowest calibration point in the calibration curve must be at or below the required RL.
- The other standard concentrations must define the working range of the instrument or the expected range of concentrations found in the samples.
- Either external or internal calibration can be employed for methods not involving mass spectrometry detectors. Internal calibration must be used when a mass spectrometry detector is employed.
- A minimum of five calibration points must be used for the calibration curve for gas chromatography/mass spectrometry and gas chromatography methods.
- Most compounds tend to be linear, and a linear approach should be favored when linearity is suggested by the calibration data. Nonlinear calibration should be considered only when a linear approach cannot be applied. It is not acceptable to use an alternate calibration procedure when a compound fails to perform in the usual manner. When this occurs it is indicative of instrument issues or operator error.
- If a nonlinear calibration curve fit is employed, a minimum of six calibration levels must be used for second-order (quadratic) curves, and a third order polynomial requires a minimum of seven calibration levels.
- When more than five levels of standards are analyzed in anticipation of using second- or third-order calibration curves, all calibration points **must** be used regardless of the calibration option employed. The highest or lowest calibration point may be excluded to narrow the calibration range and meet the requirements for a specific calibration option. Otherwise, unjustified exclusion of calibration data is expressly forbidden.
- Using the average (mean) relative standard deviation (RSD) of all analytes to meet ICAL criteria is **not** acceptable.

Calibration Options. This section describes the acceptable calibration options and the hierarchy that the laboratory should use when selecting a specific option. The choice of calibration option may also be based on previous experience or prior knowledge of detector response.

The following are calibration options:

- **Linear calibration using average calibration or response factors.** Calibration factors for external calibrations or response factors for internal calibrations must have RSDs not exceeding 20 percent or 15 percent, respectively, for quantitation. A minimum response factor of 0.05 for most target analytes or 0.01 for the least responsive target analytes must be achieved to ensure detectability.
- **Linear calibration using a linear regression equation (y=mx+b).** The correlation coefficient must equal 0.995 or better. The line should **not** be forced through the origin. The equation and a plot of the linear regression must be included in the raw data generated by the laboratory and made available in the data package upon request.
- **Nonlinear calibration.** This model may be a second-order or third-order polynomial. The model must be continuous without a break in the function and should **not** be forced through the origin. The coefficient of determination of the nonlinear regression must be

0.99 or better. The equation and a plot of the nonlinear regression must be included in the raw data generated by the laboratory and made available in the data package upon request. This method of calibration **must** be approved by the program or project chemist prior to analysis and is intended for nonlinear responding compounds only.

5.3.3.2 Continuing Calibration

Periodic verification of the ICAL is essential in generating analytical data of known quality. The continuing calibration verification analyses ensure that the instrument has not been adversely affected by the sample matrix or other instrument failures that would increase or decrease the sensitivity or accuracy of the method. The laboratory will perform continuing calibration for all methods in accordance with the specific requirements in the method and laboratory SOP.

Method SW8000B allowed the use of the average of all analytes percent difference or drift (%D) to meet the continuing calibration requirements for the method. Method SW8000B will not be allowed for the PG&E Program QAPP. Using the average (mean) %D to meet continuing calibration criteria is **not** acceptable. All analytes must meet the continuing calibration criteria for %D (see Method SW8000C).

5.4 Elements of Analytical Quality Control

Laboratory QC checks indicate the state of control that prevailed at the time of sample analysis. QC checks that involve field samples, such as matrix and surrogate spikes and field duplicates, also provide an indication of the presence of matrix effects. Field-originated blanks (see Section 3.5) provide a way to monitor potential contamination that field samples are subjected to. The QAPP specifies requirements for method blanks, LCSs, surrogate spikes, and MS/MSD that must be followed by subcontracting laboratories.

A laboratory QC batch is defined as a method blank, LCS, MS/MSD, or a sample duplicate (depending upon the method) and 20 or fewer environmental samples of similar matrix that are extracted or analyzed together. For gas chromatography/mass spectrometry volatile analyses, a method blank, LCS, and MS/MSD must be analyzed in each 12-hour calibration period. The number of environmental samples allowed in the laboratory QC batch is defined by the remaining time in the method-prescribed 12-hour calibration period divided by the analytical run time. Each preparation or analytical batch should be identified in a way that will associate environmental samples with the appropriate laboratory QC samples.

5.4.1 Method Blanks

Method blanks are used to monitor each preparation or analytical batch for interference or contamination from glassware, reagents, and other potential contaminant sources in the laboratory. A method blank is an analyte-free matrix (laboratory reagent water for aqueous samples or Ottawa sand for soil samples) to which all reagents are added in the same amount or proportions as are added to samples. It is processed through the entire sample preparation and analytical procedures along with the samples in the batch. There should be at least one method blank per preparation or analytical batch. If a target analyte is found at a concentration that exceeds the RL, corrective action must be performed to identify and eliminate the contamination source. **All** associated samples must be re-prepared or

reanalyzed, or both, after the contamination source has been eliminated if the compounds detected in the associated blank are also present in the field samples. No analytical data may be corrected for the concentration found in the blank (no blank correction).

5.4.2 Laboratory Control Sample

An LCS consists of an analyte-free matrix (laboratory reagent water for aqueous samples and Ottawa sand or glass beads for soil samples) spiked with known amounts of analytes that come from a source different than that used for calibration standards. A **complete target analyte list** for each method specified in the QAPP will be spiked into the LCS. The spike levels should be less than or equal to the midpoint of the calibration range. If LCS results are outside the specified control limits, corrective action must be taken, including sample re-preparation or reanalysis, or both, if appropriate. Documentation of the re-preparation or reanalysis, or both, must be provided in the analytical report. If more than one LCS is analyzed in a preparation or analytical batch, the results for each of the LCSs analyzed must be reported. Any LCS recoveries that are above or below the QC limits affect the accuracy for the entire batch and require corrective action.

5.4.3 Surrogates

Surrogates are organic analytes that behave similarly as the analytes of interest but are not expected to occur naturally in the samples. They are spiked into the standards, the samples, and QC samples prior to sample preparation. Surrogate recoveries are used as an indicator of accuracy, method performance, and extraction efficiency. If surrogate recoveries are outside the specified control limits, corrective action must be taken, including sample re-preparation or reanalysis, or both, if appropriate. Documentation of the re-preparation or reanalysis, or both, must be provided in the analytical report.

5.4.4 Matrix Spike/Matrix Spike Duplicate

An MS is a sample matrix fortified with known quantities of specific compounds; it is subjected to the same preparation and analytical procedures as the native sample. Target analytes are spiked into the sample. MS recoveries are used to evaluate the effect of the sample matrix on the recovery of the analytes of interest. An MSD is a second fortified sample matrix. The RPD between the results of duplicate MSs measures the precision of sample results. One MS/MSD (MSD where appropriate) per 20 project-specific samples will be analyzed. A complete target analyte list for each method specified in the QAPP will be spiked into the MS/MSD (with the exception of PCBs; see Appendix A -notes). Project-specific samples designated on the CoC form will be spiked. The spike levels will be less than or equal to the midpoint of the calibration range. Exceedances of control limits should be flagged in the analytical report.

5.4.4.1 Matrix Spike for Hexavalent Chromium Analyses

Interference from groundwater is known to reduce the sensitivity of MethodEPA218.6. This can result in an incorrect assessment of the analyte identification or the specific RL if the "Matrix Spike and Dilution Protocol" is not followed. Samples being analyzed by Method EPA218.6 may be required to follow the protocol in the following section.

Matrix Spike and Dilution Protocol. Matrix interference has been encountered that affects the sensitivity for hexavalent chromium by ion chromatography methods. CH2M HILL shall direct the laboratories to perform an additional QA/QC analyses to aid in assessing any effect on method sensitivity for each project due to the sample matrix.

For nondetect sample results, the laboratory will analyze an MS by spiking the samples with 1 µg/L of hexavalent chromium to ensure that identification is accurate and verify that false negatives are detected. For samples with detected results, the laboratory will analyze an MS by spiking the sample with hexavalent chromium at a level not less than 25 percent of the sample concentration. Laboratories will follow the standard protocol of 1 MS and 1 laboratory sample duplicate per 20 samples, unless directed by the project chemist to analyze the MS more frequently.

If the MS is not recovered or the peak is outside of the established retention time window for either detected or nondetect results, the laboratory will make a fivefold dilution of two aliquots of the sample. The first aliquot will be analyzed without the spike; the second aliquot will be spiked with hexavalent chromium at a concentration consistent with the concentrations previously listed and the recovery and peak retention times evaluated. If this MS recovery is not within laboratory QC limits or the peak is not within the laboratory retention time window, the laboratory will dilute two additional aliquots of the sample tenfold, spike one of the aliquots, and analyze the sample/MS. This procedure will be performed at successively greater dilutions of 25:1, 50:1, or 100:1 until the peak identified in the post spike analysis is within the established retention time window for hexavalent chromium and the recovery of the spike is within the laboratory QC limits listed in Appendix A.

The detected result that is reported by the laboratory on the final data package will be chosen from the dilution where both the peak detected in the unspiked and the spiked sample are within the appropriate retention time and the MS is recovered within the QC control limits. The RLs will be raised to the level of the appropriate dilution.

For nondetect results, the dilution selected by the laboratory for reporting will be taken from the smallest dilution that yields an MS recovery within QC control limits and within the appropriate retention time window.

5.4.5 Internal Standards

Internal standards are compounds that have similar properties as the analytes of interest but are not expected to occur naturally in the samples. Some methods require the use of internal standards to compensate for losses during injection or purging or losses due to viscosity. A measured amount of the internal standard is added to the standards, the samples, and QC samples following preparation. When the internal standard results exceed the control limits, corrective action must be taken, including sample reanalysis, if appropriate. Corrective action must be documented in the analytical report.

5.4.6 Laboratory Sample Duplicate

For some methods, a laboratory duplicate is performed instead of a matrix spike duplicate. A laboratory sample duplicate is a sample duplicate selected by the laboratory. It is subjected to the same preparation and analytical procedures as the native sample. The RPD

between the results of the native sample and laboratory sample duplicate measures the precision of sample results. The data collected may also yield information regarding whether the sample matrix is homogenous or heterogeneous.

5.4.7 Interference Check Samples

Interference check samples are used in inductively coupled plasma (ICP) analyses to verify background and interelement correction factors. They consist of two solutions, A and AB. Solution A contains the interfering analytes, and Solution AB contains the analytes of interest and the interfering analytes. Both solutions are analyzed at the beginning and at the end of each analytical sequence. When the interference check sample results exceed the control limits, corrective action must be taken, including sample reanalysis, if appropriate.

5.4.8 Retention Time Windows

Retention time windows for gas and liquid chromatographic analyses must be established by replicate injections of the calibration standard over multiple days as described in SW846 8000B, analytical method, or appropriate laboratory SOP. The absolute retention time of the calibration verification standard at the start of each analytical sequence will be the centerline of the window. For an analyte to be reported as positive, its elution time must be within the retention time window.

5.5 Additional Quality Control Requirements

5.5.1 Holding Time

The holding time requirements specified in this QAPP (see Table 4.1) must be met. For methods requiring both sample preparation and analysis, the preparation holding time will be calculated from the time of sampling to the completion of preparation. The analysis holding time will be calculated from the time of completion of preparation to the time of completion of the analysis, including required dilutions, confirmation analysis, and reanalysis. For methods requiring analysis only, the holding time is calculated from the time of sampling to completion of the analysis, including required dilutions, confirmation analysis, and reanalysis.

5.5.2 Confirmation

Confirmation analysis must be performed as specified for specific organic methods when the result is at or above the RL. Both the primary and confirmation results will be reported. Unless one of the analysis is specifically designated as the confirmation by the method, the more concentrated result will be reported as the sample result and the lesser concentration result as the confirmation. All calibration and QC requirements must be met when confirmation analysis is performed.

5.5.3 Cleanup Procedures to Minimize Matrix Effects

To maintain the lowest possible RLs, appropriate cleanup procedures should be employed when it is indicated by the method to remove or minimize matrix interference. Methods for sample cleanup include, but are not limited to, gel permeation chromatography, silica gel,

alumna, florisil, mercury (sulfur removal), sulfuric acid, and acid/base partitioning. Method blanks, MS/MSDs, and LCSs must be subjected to the same cleanup procedures performed on the samples to monitor the efficiencies of these procedures.

5.5.4 Sample Dilution

Dilution of a sample results in elevated RLs and ultimately affects the usability of the data related to potential actions at the sampling site. It is important to minimize dilutions and maintain the lowest possible RLs. When dilutions are necessary because of high concentrations of target analytes, lesser dilutions should also be reported to fully characterize the sample for each analyte. The level of the lesser dilution should be such that it will provide the lowest possible RLs without having a lasting deleterious effect on the analytical instrumentation.

When a sample exhibits characteristics of matrix interference that are identified through analytical measurement or visual observation, appropriate cleanup procedures specified in Section 5.5.3 must be proven ineffective or inappropriate prior to proceeding with dilution and analysis. Any analyses conducted at a dilution where all analytes will be reported as non-detect above the QAPP RL, must be discussed with the project chemist prior to finalizing the report.

5.5.5 Standard Materials and Other Supplies and Consumables

Standard materials must be of known high purity and traceable to an approved source. Pure standards must not exceed the manufacturer's expiration date or 1 year after receipt if no expiration date is provided. Solutions prepared by the laboratory from the pure standards must be used within the expiration date specified in the laboratory's SOP.

All other supplies and consumables must be inspected prior to use to ensure that the supplies meet the requirements specified in the appropriate SOP. The laboratory's inventory and storage system should ensure their use within the manufacturer's expiration date and storage under proper conditions.

5.5.6 Manual Integration

The laboratory is required to provide all analysts performing methods that rely on interpretation of chromatographic data with training on appropriate software or manual integration practices. The laboratory also will make every effort to minimize the use of manual integration of data. If the need arises to use manual integration to correct a software autointegration error, the manual integration will be clearly identified in the instrument data. Before and after enlargements of the region of the chromatogram where the manual integration was performed will be provided on an appropriate scale that allows an independent reviewer to evaluate the need and quality of the manual integration. The analyst will also document the reason for the manual integration on the chromatogram along with their date and initials. The laboratory manager or designee will approve the manual integration by dating and initialing the chromatogram.

5.5.7 Laboratory Quality Assurance Program

The laboratory will maintain a quality assurance manual or equivalent document. The manual must include all of the requirements provided in the California Environmental Laboratory Accreditation Program (ELAP), and, if applicable, the National Environmental Laboratory Accreditation Program (NELAP). The manual will define the laboratory's internal procedures for QA/QC as follows:

- QA policies, objectives, and requirements
- Organization and personnel
- Document control
- SOPs (analytical methodology and administrative)
- Data generation
- Software verification
- Quality assurance
- Quality control
- Nonconformance/corrective action procedures
- Data review

5.5.7.1 Laboratory Standard Operating Procedures

The laboratory will maintain SOPs for all analytical methods and laboratory operations. The format for SOPs will conform with the following:

- *Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, SW-846, Third Edition, Update III, Section 1* (EPA, 1996)
- "Good Laboratory Practices" in *Principles and Guidance to Regulations for Ensuring Data Integrity in Automated Laboratory Operations* (EPA, 1995)

All SOPs must have a unique identification number that is traceable to previous revisions of the same document. SOP review must be completed annually.

5.5.7.2 Demonstration of Capability

Laboratory QA department personnel will maintain records documenting the ability of each analyst to perform applicable method protocols. Documentation will include annual checks for each method and analyst. In addition, internal, blind performance evaluation samples for each method and matrix demonstrating overall laboratory performance must be submitted annually. The laboratory may receive additional blind performance evaluation samples in conjunction with the PG&E Program.

5.6 Analytical Procedures

The allowed sample preparation methods are presented in Table 5-2. Any changes or alternatives to this list will be included in site-specific SAPs or QAPP addenda. Analytical and preparation methods for SW7000 series are provided in Table 5-2 as alternate methods to SW6020 (with the exception of mercury and soil hexavalent chromium, the SW 7000 series must be approved by the project chemist). These methods will be allowed, provided the RL

objectives are met. After a method is chosen, it must be used throughout the duration of a specific project to maintain data comparability.

This QAPP includes common analytical procedures that may be required for the PG&E Program. Appendix A, Tables A -1 through A -3 contain representative lists of the analytes of concern, the methods to be used, and the RL objectives. Some of the listed analytes may not necessarily be of concern for a particular project; project-specific SAPs or QAPP addenda will list the analytes of concern. The RLs included herein reflect quantifiable levels that are attainable with a specified degree of confidence using the specified methods. The RLs should meet most preliminary cleanup goals or action levels. If changes to the methods or RLs are necessary to meet cleanup goals, the QAPP will be updated or amended by addendum.

General QC requirements are discussed in Section 5.3.3. The calibration and QC requirements specified for each method will be followed and are included in Appendix A and Tables 5-3 through 5-15. Appropriate corrective action will be taken when acceptance criteria are not met. If corrective action is not effective, and data quality is potentially degraded, the occurrence must be documented in a corrective action report and in the data package case narrative. The laboratory manager or a designated person must notify the project chemist.

Analytical services will be provided by laboratories contracted by CH2M HILL or its subcontractors. Analytical laboratories will be accredited, in accordance with the California ELAP, for all parameters where accreditation is available. Subcontract laboratories will be required to follow the SAP and QAPP addenda that are applicable to specific projects or activities and must be approved by the CH2M HILL project chemist.

Field measurements will be performed or supervised directly or indirectly by CH2M HILL field personnel.

5.7 Title 22 Metals

The California Code of Regulations - Title 22, Division 4.5 – Environmental Health Standards for the Management of Hazardous waste has a waste characterization protocol that specifies the following stepped procedure for determining hazardous waste disposal:

1. If the sample is suspected of containing high levels of metals, analyze for the Title 22 metals – total threshold limit concentration (TTLC) (see Appendix A, Table A-3).
2. Compare the TTLC sample results with column G of Appendix A, Table A-3.
3. If the TTLC sample results are greater than the concentrations listed in column G of Appendix A, Table A-3, extract and analyze the samples using the waste extraction test (WET) [only required for analytes that exceed the concentrations listed in column G of Appendix A, Table A-3].
4. If the soluble threshold limit concentration (STLC) sample result, from the waste extraction test extraction, is greater than the concentration listed in column H of Appendix A, Table A-3 for any of the Resource Conservation and Recovery Act metals listed in column E of Appendix A, Table A-3., extract the sample by toxicity

characteristic leaching procedure (TCLP) Method 1311 and analyze for the specific metals that exceeded the STLC threshold.

TABLE 5-1
Maximum Concentrations for Title 22 – Organic Compounds – SW8000 Series
PG&E Program Quality Assurance Project Plan

Constituent	CAS	Method
Mirex	2385-85-5	SW8081
Methyl chloromethyl ether (Chloromethyl methyl ether)	107-30-2	SW8021B
2-Acetylaminofluorene (2-AAF)	53-96-3	SW8270C
Acrylonitrile	107-13-1	SW8260B
4-Aminodiphenyl (4-Aminobiphenyl)	92-67-1	SW8270C
Benzidine and its salts	92-87-5	SW8270C
bischloromethyl ether (BCME)	542-88-1	SW8270C
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	SW8270C
4-Dimethylaminoazobenzene (DAB)	60-11-7	SW8270C
Ethyleneimine (EL)	151-56-4	
ALPHA-NAPHTHYLAMINE (1-NA)	134-32-7	SW8270C
BETA-NAPHTHYLAMINE (2-NA)	91-59-8	SW8270C
4-Nitrobiphenyl (4-NBP)	92-93-3	SW8270C
N-Nitrosodimethylamine (DMN)	62-75-9	SW8270C
beta-Propiolactone (BPL)	57-57-8	SW8260B

Note:

If the sample contains any of the compounds listed in this table at a single or combined concentration equal to or exceeding 0.001 percent by weight, the sample is considered to be toxic under CA Title 22 Section 66261.24 (Characteristic of Toxicity)

TABLE 5-2
Extraction and Digestion Methods
PG&E Program Quality Assurance Project Plan

Analytical Method	Parameter	Preparatory Methods
SW6010B	Trace metals by ICP	SW3005A, SW3010A, SW3015, SW3050B, SW3051
SW6020	Trace metals by ICP-MS	SW3005A, SW3010A, SW3015, SW3050B, SW3051
SW7000 Series[a]	Various elements (unless specified separately) Does Not include Mercury or soil Hexavalent chromium	SW3015, SW3020A, SW3050B, SW3051
EPA200.7 and EPA200.8	Trace metals by ICP/ICP-MS	See analytical method
SW7470A, SW7471A, and EPA245.1	Mercury by cold vapor atomic adsorption	See analytical method
SW7196A, SW7199, and EPA218.6	Hexavalent chromium	See analytical method for water, Use SW3060A for soil preparation prior to SW7199
SW8015B or D	TPH volatile and extractable (water and soil)	Volatiles: SW5030BB, SW5031, SW5035 Extractables: SW3510C, SW3520C, SW3545C, SW3541, SW3545, SW3550B
SW8081A	Organochlorine pesticides (water and soil)	SW3510C, SW3520C, SW3540C, SW3541, SW3545, SW3550B
SW8082	PCBs (water and soil)	SW3510C, SW3520C, SW3540C, SW3541
SW8151A	Chlorinated herbicides (water and soil)	SW3510C, SW3520C, SW3540C, SW3541, SW3550B
SW8260B	Volatile organics (water and soil)	SW3585, SW5021, SW5030B, SW5031, SW5032, SW5035
SW8270C and SW8270C SIM	Semivolatile organics (water and soil)	SW3510C, SW3520C, SW3535, SW3540C, SW3541, SW3545, SW3550B
Laboratory SOP (CF-IRMS)	Stable isotopes	See laboratory SOP
Various[b]	General chemistry	See analytical method

[a]Must be approved by the project chemist.

[b]EPA120.1/SW9050, EPA150.1/SW9040, EPA160.1, EPA160.2, EPA180.1, EPA300.0/SW9056, EPA310.1, EPA350.3, EPA354.1, EPA365.1, EPA370.1, EPA376.1/2, SM3500, EPA335.2, SW9010B, SW9014, and EPA415.2.

Note:

ICP-MS = inductively coupled plasma/mass spectrometry

TABLE 5-3
Surrogate Recovery for Organic Compounds – SW8000 Series
PG&E Program Quality Assurance Project Plan

	Liquid Matrix % Recovery		Solids Matrix % Recovery	
Compound	**Lower Limit**	**Upper Limit**	**Lower Limit**	**Upper Limit**
SW8015-E[a]				
Benzo (a) pyrene	70	125	60	125
Bromobenzene	50	140	50	150
Hexacosane	60	140	60	140
Octacosane	26	152	25	162
Triacontane	40	140	30	150
Ortho-Terphenyl	57	132	47	142
Fluorobenzene	75	125	65	135
SW8015-P				
Bromofluorobenzene	70	130	64	148
Chlorobenzene[b]	74	138	64	148
Trifluorotoluene	70	130	70	130
SW8021				
Trifluorotoluene	65	125	65	125
SW8082[c]				
Decachlorobiphenyl	29	133	26	125
Tetrachloro-m-xylene	50	120	48	121
SW8260B[d]				
1,2-Dichloroethane-d4	72	119	52	149
4-Bromofluorobenzene	76	119	65	135
Dibromofluoromethane	85	115	65	135
Toluene-d8	81	120	75	125
SW8270C				
1,2-Dichlorobenzene-d4[e, f]	27	100	25	110
2,4,6-Tribromophenol[g]	42	124	36	126
2-Chlorophenol-d4[e, g]	34	98	30	100
2-Fluorobiphenyl[f]	48	120	43	125
2-Fluorophenol[g]	20	120	37	125
Nitrobenzene-d5[f]	41	120	37	125
Phenol-d5[g]	20	120	40	125
Terphenyl-d14[f]	51	135	32	125
SW8270SIM				
1,2-Dichlorobenzene-d4	27	100	25	110
2-Fluorobiphenyl	34	135	34	135
Nitrobenzene-d5	25	135	25	135
Terphenyl-d14	34	167	14	129

TABLE 5-3
Surrogate Recovery for Organic Compounds – SW8000 Series
PG&E Program Quality Assurance Project Plan

	Liquid Matrix % Recovery		Solids Matrix % Recovery	
Compound	**Lower Limit**	**Upper Limit**	**Lower Limit**	**Upper Limit**
SW8081A				
Decachlorobiphenyl	29	135	26	125
Tetrachloro-m-xylene	33	138	36	124
SW8151A				
2,4-dichlorophenylacetic acid	50	130	51	146

[a]Choose two from the list
[b]Required by method
[c]Use tetrachloro-m-xylene as a surrogate if DCBP is used as an IS.
[d]Choose three from the list
[e]Approved alternatives
[f]Base fraction
[g]Acid fraction

TABLE 5-4
Calibration and QC Requirements for Metals – SW6010B and EPA200.7
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
ICAL (a blank and at least one standard)	When modifications are made to the system, or when continuing calibration verification fails.	If more than one standard is used, correlation coefficient must be >0.995.	Not applicable.
Second-Source Calibration Verification	Immediately following each ICAL.	All analytes within ±10% of expected value for SW6010B and within ±5% of expected value for EPA200.7.	Correct problem and repeat ICAL.
Calibration Blank	After every second-source or continuing calibration verification analysis.	No analytes detected at or above the RL.	Correct the problem and reanalyze previous 10 samples.
Continuing Calibration Verification	After every 10 samples and at the end of the analysis sequence.	All analytes within ±10% of expected value for SW6010B and within ±10% of expected value for EPA200.7.	Recalibrate and reanalyze all samples since the last acceptable continuing calibration verification.
Method Blank	At least one per analytical batch.	No analytes detected at or above the RL.	Correct the problem, re-prepare, and reanalyze all associated samples.
Interference Check Standard	At the start and end of each analytical sequence or twice during an 8-hour period, whichever is more frequent.	All analytes within ±20% of expected value.	Correct the problem, recalibrate, and reanalyze ICS and all affected samples.

TABLE 5-4
Calibration and QC Requirements for Metals – SW6010B and EPA200.7
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
MS/MSD	One set per 20 project-specific samples. MSD is optional if a laboratory sample duplicate is performed.	All analytes within limits specified in Appendix A.	None.
Laboratory Sample Duplicate	Once per analytical batch if MSD not performed.	Concentration of reported analytes are >5 times the RL in either sample and RPD >20%. One sample result <RL and a difference of ±2 times the RL.	None.
LCS	At least one per analytical batch.	All analytes within limits specified in Appendix A.	Correct the problem, re-prepare and reanalyze the LCS and all samples in the analytical batch.
Postdigestion Spike Addition	When MS/MSD fails.	Recovery within 75 to 125% of expected value.	None.
Dilution Test	Each new sample matrix. Or when the PDS fails	Result from 1:5 dilution must be within ±10% of the undiluted sample result (applies only if undiluted sample result is at least 25 times the RL).	Perform postdigestion spike addition.
Linear Range Calibration Check Standard	Once per quarter.	All analytes within +10% of expected value.	Correct problem and reanalyze or reset linear range.

TABLE 5-5
Calibration and QC Requirements for Metals – SW6020 and EPA200.8
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
ICAL (a blank and at least one standard)	Before initial sample analysis, when modifications are made to the analytical system, or when continuing calibration verification fails.	Not applicable	Not applicable
Second-source Calibration Verification	Immediately following each ICAL.	All analytes within ±10% of expected value.	Correct problem and repeat ICAL.
Calibration Blank	After every Second-source or Continuing calibration verification analysis.	No analytes detected at or above the RL.	Correct the problem and reanalyze previous 10 samples.

TABLE 5-5
Calibration and QC Requirements for Metals – SW6020 and EPA200.8
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
Continuing Calibration Verification	After every 10 samples and at the end of the analysis sequence.	All analytes within ±10% of expected value.	Recalibrate and reanalyze all samples since the last acceptable continuing calibration verification.
Method Blank	At least one per analytical batch.	No analytes detected at or above the RL.	Correct the problem, re-prepare, and reanalyze all associated samples.
Interference Check Standard	At the start and end of each analytical sequence or twice during an 8-hour period, whichever is more frequent.	All analytes within ±20% of expected value.	Correct the problem, recalibrate and reanalyze ICS and all affected samples.
MS/MSD	One set per 20 project-specific samples. MSD is optional if a laboratory sample duplicate is performed.	All analytes within limits specified in Appendix A.	None.
Laboratory Sample Duplicate	Once per analytical batch if MSD not performed.	Concentration of reported analytes are >5 times the RL in either sample and RPD >20%. One sample result <RL and a difference of ±2 times the RL.	None.
LCS	At least one per analytical batch.	All analytes within limits specified in Appendix A.	Correct the problem, re-prepare, and reanalyze the LCS and all samples in the analytical batch.
Postdigestion Spike Addition	When MS/MSD fails.	Recovery within 75 to 125% of expected value.	None.
Dilution Test	Each new sample matrix. Or when the PDS fails	Result from 1:5 dilution must be within ±10% of the undiluted sample result (applies only if undiluted sample result is at least 25 times the RL).	Perform postdigestion spike addition.

TABLE 5-6
Calibration and QC Requirements for Metals – SW7000 Series and EPA245.1
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
Multipoint ICAL (a blank and at least five standards)	Before initial sample analysis, when modifications are made to the analytical system, or when continuing calibration verification fails.	Correlation coefficient of linear regression is ≥0.995.	Correct the problem and repeat the ICAL.
Second-source Calibration Verification	Immediately following each ICAL.	All analytes within ±20% of expected value.	Correct the problem and repeat ICAL.
Calibration Blank	After every second-source or continuing calibration verification analysis.	No analytes detected at or above the RL.	Correct the problem, then reanalyze previous 10 samples.
Continuing Calibration Verification	After every 10 samples and at the end of the analysis sequence.	All analytes within ±20% of expected value.	Recalibrate and reanalyze all samples since the last accept-able continuing calibration verification.
Method Blank	At least one per analytical batch.	No analytes detected at or above the RL.	Correct the problem, re-prepare, and reanalyze all associated samples.
MS/MSD	One set per 20 project-specific samples. MSD is optional if a laboratory sample duplicate is performed.	All analytes within limits specified in accuracy and precision table.	None.
Laboratory Sample Duplicate	Once per analytical batch if MSD not performed.	Concentration of reported analytes are >5 times the RL in either sample and RPD >20%. One sample result <RL and a difference of ±2 times the RL.	None.
LCS	At least one per analytical batch.	All analytes within limits specified Appendix A.	Correct the problem, re-prepare, and reanalyze the LCS and all samples in the analytical batch.
Recovery Test (PDS)	When MS/MSD fails.	Recovery within 85 to 115% of expected value.	Analyze all samples by MSA.
Dilution Test	Each new sample matrix. Or when the PDS fails	Result from 1:5 dilution must be within ±10% of the undiluted sample result (applies only if undiluted sample result is at least 25 times the RL).	Perform recovery test.

Note:
MSA = method of standard addition

TABLE 5-7
Calibration and QC Requirements for General Chemistry and Other Parameters[a]
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
Multipoint ICAL (a blank and at least five standards); Does Not Apply to Titrimetric Method	Before initial sample analysis, when modifications are made to the analytical system, or when continuing calibration verification fails.	Correlation coefficient of linear regression is ≥0.995.	Correct the problem and repeat the ICAL.
Second-source calibration verification	Immediately following each ICAL.	Analytes within ±15% of expected value (±10% for SW9056/EPA300.0).	Correct the problem and repeat ICAL.
Calibration blank; does not apply to titrimetric method	After every second-source or continuing calibration verification analysis.	No analytes detected at or above the RL.	Correct the problem, then reanalyze previous 10 samples.
Continuing calibration verification	After every 10 samples and at the end of the analysis sequence.	Within ±15% of expected value (±10% for SW9056/EP300.0).	Recalibrate and reanalyze all samples since the last acceptable continuing calibration verification.
Method blank	At least one per analytical batch.	No analytes detected at or above the RL.	Correct the problem, re-prepare, and reanalyze all associated samples.
MS/MSD	One set per 20 project-specific samples. MSD is optional if a laboratory sample duplicate is performed.	All analytes within limits specified in Appendix A.	None.
Laboratory Sample Duplicate	Once per analytical batch if MSD not performed.	Concentration of reported analytes are >5 times the RL in either sample and RPD >20%. One sample result <RL and a difference of ±2 times the RL.	None.
LCS	At least one per analytical batch.	All analytes within limits specified in Appendix A.	Correct the problem, re-prepare, and reanalyze the LCS and all samples in the analytical batch.
IPC (EPA314.0 only)	Daily, before sample analysis.	Conductance within 10% of original value (original value within ±10% of MCT). $PD_{A/H}$ <25%, instrument response within ±20% of expected response. Retention time shifts <5%, or overall retention time <80% of original recorded value.	Prepare fresh IPC solution. Redetermined MCT or correct problem and reanalyze IPC. Correct problem, clean or replace column.

TABLE 5-7
Calibration and QC Requirements for General Chemistry and Other Parameters[a]
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
ICAL Verification (ICCS) (EPA314.0 only)	Daily, before sample analysis or when eluent is changed.	Instrument response within ±25% of expected value using a standard at or below the RL.	Correct problem then repeat ICAL.
Pretreated Laboratory Reagent Blank (EPA314.0 only)	Required in any analytical batch which includes samples that have been pretreated to reduce the common anion levels.	Perchlorate must be ≤½ RL.	Correct problem, re-prepare, and analyze method blank and all samples processed with the contaminated blank.
Low-level MDL Check Standard (EPA314.0 only)	Weekly and with ICAL.	Must meet QC acceptance criteria, 50 to 150% of its true concentration.	Reanalyze low-level MDL check standard, if still out of criteria, repeat ICAL.

[a]Unless calibration and QC requirements are specified for an individual method.

Notes:

ICCS = initial calibration check standard

IPC = instrument performance check

MCT = matrix conductivity threshold

TABLE 5-8
Calibration and QC Requirements for Hexavalent Chromium – SW7199 and EPA218.6
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
Multipoint ICAL (a blank and at least five standards)	Before initial sample analysis, when modifications are made to the analytical system, or when continuing calibration verification fails.	Correlation coefficient of linear regression is ≥0.999.	Correct the problem and repeat the ICAL.
Second-source Calibration Verification	Immediately following each ICAL.	All analytes within ±10% of expected value.	Correct the problem and repeat ICAL.
Calibration Blank	After every second-source or continuing calibration verification analysis.	No analytes detected at or above the RL.	Correct the problem, then reanalyze previous 10 samples.
Continuing Calibration Verification	After every 10 samples and at the end of the analysis sequence.	All analytes within ±10% of expected value for SW7199 and within ±5% of expected value for EPA218.6.	Recalibrate and reanalyze all samples since the last accept-able continuing calibration verification.
Low-level Calibration verification at the RL of 0.2µg/L	Immediately following each ICAL.	Result within ±20% of expected value.	Correct the problem and repeat ICAL.
Duplicate Sample Injections (SW7199 only)	Every sample.	RPD between injections must be <20%.	Correct the problem, re-prepare, and reanalyze all associated samples.

TABLE 5-8
Calibration and QC Requirements for Hexavalent Chromium – SW7199 and EPA218.6
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
Method Blank	At least one per analytical batch.	No analytes detected at or above the RL.	Correct the problem, re-prepare, and reanalyze all associated samples.
MS	One per 20 project-specific samples.	All analytes within limits specified in Appendix A.	None.
Laboratory Sample Duplicate	Once per analytical batch if MSD not performed.	Concentration of reported analytes are >5 times the RL in either sample and RPD >20%. One sample result <RL and a difference of ±2 times the RL.	None.
LCS	At least one per analytical batch.	All analytes within limits specified in Appendix A.	Correct the problem, re-prepare, and reanalyze the LCS and all samples in the analytical batch.
pH Buffer Solution Modification	As needed because of sample matrices that cause the analytical column to overload. All QC samples and analyses will use the modified buffered solution when needed.	A modified pH-adjustment buffer that contains 10 times less ammonium sulfate (33 g/L) but the same concentration of ammonium hydroxide as the buffer prescribed in SW7199/ EPA218.6.	None.
MS Dilute and Spike (see Section 5.3.3.1)	As directed in Section 5.3.3.1.	Spike recovery 85 to 115% and peak within RT window.	Dilute two aliquots 1:5, spike one with 1 μg/L of hexavalent chromium and analyze the other unspiked. Continue the procedure using successively greater dilutions of two aliquots until RT and recovery criteria are met.

Note:
RT = retention time

TABLE 5-9
Soil Preparation Method SW3060A for Method SW7199
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
2.5 grams sample to a final volume of 100 ml must be used for each sample	Each sample in the preparation batch.	Follow method preparation for all samples, method blank, and QC samples.	
Method Blank	One per preparation batch.	No analytes detected at or above the RL.	Correct the problem, re-prepare, and reanalyze all associated samples.
LCS	One per preparation batch.	Spike at concentration specified in method. Recovery range 80 to 120%.	Correct the problem, re-prepare, and reanalyze the LCS and all samples in the analytical batch.
Soluble Matrix Spike	One per preparation batch.	Spike at concentration specified in method. Recovery range 75 to 125%.	None.
Insoluble Matrix Spike	One per preparation batch.	Spike at concentration specified in method. Recovery range 75 to 125%.	None.
Post Digestion Spike	One per preparation batch.	Spike at concentration specified in method. Recovery range 85 to 115%.	None.

TABLE 5-10
Calibration and QC Requirements for Stable Isotopes[a]
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
Instrument Standardization	Daily, prior to sample analysis.	Laboratory SOP.	Perform instrument maintenance.
Laboratory Sample Duplicate	Every sample analyzed five times.	Laboratory SOP.	Perform instrument maintenance and reanalyze samples.

[a] ^{18}O and deuterium

TABLE 5-11
Calibration and QC Requirements for TPH, BTEX, Herbicides, and Dissolved Gases – SW8015B, SW8021B, SW8151A, and RSK-175S
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
Multipoint ICAL (minimum 5 points)	Prior to sample analysis, or when calibration verification fails.	If the %RSD is ≤20%, the average RRF may be used for quantitation; otherwise use calibration curve with coefficient of correlation or determination ≥0.99.	Correct the problem and repeat the ICAL.
Continuing Calibration Verification	At the start of each analytical sequence and after every 10 samples, and at the end of the sequence.	Analytes within ±15% of expected value.	Correct the problem, recalibrate, and reanalyze all samples since the last acceptable continuing calibration verification.
Method Blank	At least one per analytical batch.	No analytes detected at or above the RL.	Correct the problem, re-prepare, and reanalyze all associated samples.
Surrogate Spike	Every standard, sample, method blank, MS/MSD, and LCS.	All surrogates in samples, method blank, MS/MSD, and LCS within limits specified in Appendix A.	Correct the problem and reanalyze (re-prepare if necessary).
MS/MSD	One set per 20 samples.	Full target list spike required within limits specified in Appendix A. Not applicable for RSK-175.	None.
LCS	At least one per analytical batch.	Full target list spike required within limits specified in Appendix A.	Correct the problem, re-prepare, and reanalyze the LCS and all samples in the analytical batch.
Second Detector or Second Column Confirmation (does not apply to SW8015B or RSK-175)	All samples with results above the RL objectives must be confirmed within the holding time.	Confirmation to be done using a second detector, or second column of dissimilar phase and retention characteristics (or gas chromatography/mass spectrometry if sample concentration is sufficiently high). All calibration and QC acceptance criteria specified for primary analysis must be met in the confirmation analysis.	Failure to perform confirmation will result in potential resampling and analysis at no cost to the project.

Note:
RRF = relative response factor

TABLE 5-12
Calibration and QC Requirements for Pesticides and PCBs – SW8081A and SW8082
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
Multipoint ICAL (minimum 5 points) for single-response pesticides; single-point calibration for toxaphene and chlordane; multipoint calibration for Aroclors 1016 and 1260 only, but include midpoint standard for all other Aroclors for pattern recognition; if a specific Aroclor is found in any sample, quantitation for that Aroclor must be done using 5-point calibration	Prior to sample analysis or when calibration verification fails.	To use average RRF for quantitation of any analyte, % RSD must be ≤20%; otherwise use calibration curve with coefficient of correlation or determination ≥0.99.	Correct the problem and repeat the ICAL.
Second-source calibration verification – pesticides and Aroclors 1016 and 1260 (or Aroclors identified in samples)	Once for each multipoint ICAL.	All analytes within ±15% of expected value.	Correct the problem, then recalibrate and reanalyze all samples since the last acceptable continuing calibration verification.
Continuing calibration verification – pesticides and Aroclors 1016 and 1260 (or Aroclors identified in samples)	At the start of each analytical sequence; after every 12 hours or 10 samples, whichever is more frequent; and at the end of the sequence.	All analytes within ±15% of expected value.	Correct the problem, then recalibrate and reanalyze all samples since the last acceptable continuing calibration verification.
Endrin/DDT breakdown check (not applicable when analyzing for Aroclors/PCBs only)	At start of each 12-hour period.	Breakdown of either endrin or DDT ≤15%.	Evaluate injector port and take corrective action; recalibrate and reanalyze affected samples if necessary.
Method Blank	At least one per analytical batch.	No analytes detected at or above the RL.	Correct the problem, re-prepare, and reanalyze all associated samples.
Surrogate Spike	Every standard, sample, method blank, MS/MSD, and LCS.	At least one of the surro-gates in samples, method blank, MS/MSD, and LCS within limits specified in Appendix A.	Correct the problem and reanalyze (re-prepare if necessary).
MS/MSD	One set per 20 project-specific samples.	Full target list spike required within limits specified in corresponding Appendix A.	None.
LCS	At least one per analytical batch.	Full target list spike required within limits specified in corresponding Appendix A.	Correct the problem, re-prepare, and reanalyze the LCS and all samples in the analytical batch.

TABLE 5-12
Calibration and QC Requirements for Pesticides and PCBs – SW8081A and SW8082
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
Second Column Confirmation	All samples with results above the RL objectives must be confirmed within the holding time.	Confirmation to be done using second column of dissimilar phase and retention characteristics (or gas chromatography/mass spectrometry if sample concentration is sufficiently high). All calibration and QC acceptance criteria specified for primary analysis must be met in the confirmation analysis.	Failure to perform confirmation will result in potential resampling and analysis at no cost to the project.

Note:

DDT = dichloro-diphenyl-trichloroethane

TABLE 5-13
Calibration and QC Requirements for VOCs – SW8260B
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
BFB Tuning	Prior to ICAL and calibration verification (every 12 hours).	Refer to criteria listed in the method.	Retune instrument and verify.
Multipoint ICAL (minimum 5 points)	Prior to sample analysis, or when calibration verification fails.	SPCCs average RRF ≥0.30a and %RSD for RRFs for CCCs ≤30% and one of the following options: Option 1 Linear – RSD for each analyte <15%. Use of the mean %RSD for all analytes ≤15% may **not** be used. Option 2 Linear – least squares regression r ≥0.995. Option 3 Nonlinear – coefficient of determination ≥0.99 (6 standards to used for a second order; 7 standards to be used for a third order).	Correct the problem and repeat the ICAL.
Second-source Calibration Verification	Once for each multipoint ICAL.	All analytes within ±25% of expected value.	Correct the problem and repeat ICAL.

TABLE 5-13
Calibration and QC Requirements for VOCs – SW8260B
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
Continuing Calibration Verification	At the start of each analytical sequence and every 12 hours thereafter.	SPCCs average RF ≥0.30c and %D for RFs for CCCs ≤20%. All other analytes within ±20% of expected value.	Correct the problem, recalibrate, and reanalyze all samples since the last acceptable continuing calibration verification.
Retention Time Window Calculated for Each Analyte	Each analyte.	Relative retention time of each analyte within ±0.06 relative retention time units of the ICAL.	Not applicable (used for identification of analyte).
Internal Standards	Each sample and QC sample, method blank, MS/MSD and LCS.	Continuing calibration verification retention time within ±30 seconds from retention time of the ICAL midpoint standard. Sample retention time within ±30 seconds from retention time of the daily continuing calibration verification. Continuing calibration verification EICP area within –50% to +100% of the internal standard responses in the ICAL midpoint standard. Sample EICP area within –50% to +100% of the daily continuing calibration verification.	Inspect mass spectrometer and gas chromatography for malfunctions; reanalyze all affected samples.
Method Blank	At least one per analytical batch.	No analytes detected at or above the RL.	Correct the problem, re-prepare, and reanalyze all associated samples.
Surrogate Spike	Every standard, sample, method blank, MS/MSD and LCS.	All surrogates in samples, method blank and LCS within limits Appendix A.	Correct the problem and reanalyze (re-prepare if necessary).
MS/MSD	One set per 20 project-specific samples.	Full target list spike required within limits specified in Appendix A.	None.
LCS	At least one per analytical batch.	Full target list spike required within limits specified in Appendix A.	Correct the problem, re-prepare, and reanalyze the LCS and all samples in the analytical batch.

[a]SPCC average RRF ≥0.10 for bromoform, chloromethane, and 1,1-dichloroethane.

Notes:
BFB = bromofluorobenzene
CCC = calibration check compounds
EICP = extracted ion current profile SPCC

TABLE 5-14
Calibration and QC Requirements for Semivolatile Organic Compounds – SW8270C
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
DFTPP Tuning	Prior to ICAL and calibration verification (every 12 hours).	Refer to criteria listed in the method.	Retune instrument and verify.
Multipoint ICAL (minimum 5 points)	Prior to sample analysis, or when calibration verification fails.	SPCCs average RF ≥0.050 and %RSD for RFs for CCCs ≤30% and one of the following options: Option 1: Linear – RSD for each analyte <15%. Use of the mean %RSD for all analytes ≤15% may **not** be used. Option 2: Linear – least squares regression r ≥0.995. Option 3: Nonlinear – coefficient of Determination ≥0.99 (6 standards to used for a second order; 7 standards to be used for a third order).	Correct the problem and repeat the ICAL.
Second-source Calibration Verification	Once for each multipoint ICAL.	All analytes within ±25% of expected value.	Correct the problem and repeat ICAL.
Continuing Calibration Verification	At the start of each analytical sequence and every 12 hours thereafter.	SPCCs average RF ≥0.050 and %D for RFs for CCCs ≤20%. All other analytes within ±20% of expected value.	Correct the problem, recalibrate, and reanalyze all samples since the last acceptable continuing calibration verification.
Retention Time Window Calculated for Each Analyte	Each analyte.	Relative retention time of each analyte within ±0.06 relative retention time units of the ICAL.	Not applicable (used for identification of analyte).
Internal Standards	Each sample and QC sample, method blank, MS/MSD and LCS.	Continuing calibration verification retention time within ±30 seconds from retention time of the ICAL midpoint standard. Sample retention time within ±30 seconds from retention time of the daily continuing calibration verification. Continuing calibration verification EICP area within -50% to +100% of the internal standard responses in the ICAL midpoint standard.	Inspect mass spectrometer and gas chromatography for malfunctions; reanalyze all affected samples.

TABLE 5-14
Calibration and QC Requirements for Semivolatile Organic Compounds – SW8270C
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
		Sample EICP area within -50% to +100% of the daily continuing calibration verification.	
Method Blank	At least one per analytical batch.	No analytes detected at or above the RL.	Correct the problem, re-prepare, and reanalyze all associated samples.
Surrogate Spike	Every standard, sample, method blank, MS/MSD and LCS.	At least two surrogates per fraction in samples, method blank and LCS within limits specified in Appendix A.	Correct the problem and reanalyze (re-prepare if necessary).
MS/MSD	One set per 20 project-specific samples.	Full target list spike required within limits specified in Appendix A.	None.
LCS	At least one per analytical batch.	Full target list spike required within limits specified in Appendix A.	Correct the problem, re-prepare, and reanalyze the LCS and all samples in the analytical batch.

Note:
DFTPP = decafluorotriphenylphosphene

TABLE 5-15
Calibration and QC Requirements for Polynuclear Aromatic Hydrocarbons – SW8270C SIM
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
DFTPP Tuning	Prior to ICAL and calibration verification (every 12 hours).	Refer to criteria listed in the method.	Retune instrument and verify.
Multipoint ICAL (minimum 5 points)	Prior to sample analysis, or when calibration verification fails.	SPCCs average RF $\geq$0.050 and %RSD for RFs for CCCs $\leq$30% and one of the following options: Option 1 RSD for each analyte <15%. Option 2 Least squares regression r $\geq$0.990. Option 3 Nonlinear – Coefficient of Determination ≥0.99 (6 standards to used for a second order; 7 standards to be used for a third order).	Correct the problem and repeat the ICAL.

TABLE 5-15
Calibration and QC Requirements for Polynuclear Aromatic Hydrocarbons – SW8270C SIM
PG&E Program Quality Assurance Project Plan

QC Check	Frequency	Criteria	Corrective Action
Second-source Calibration Verification	Once for each multipoint ICAL.	All analytes within ±30% of expected value.	Correct the problem and repeat ICAL.
Continuing Calibration Verification	At the start of each analytical sequence and every 12 hours thereafter.	All analytes within ±20% of expected.	Correct the problem, recalibrate, and reanalyze all samples since the last acceptable continuing calibration verification.
Retention Time Window Calculated for Each Analyte	Each analyte.	Relative retention time of each analyte within ±0.06 relative retention time units of the ICAL.	Not applicable (used for identification of analyte).
Internal Standards	Each sample and QC sample, method blank, MS/MSD, and LCS.	Continuing calibration verification retention time within ±30 seconds from retention time of the ICAL midpoint standard. Sample retention time within ±30 seconds from retention time of the daily continuing calibration verification. Continuing calibration verification EICP area within -50% to +100% of the internal standard responses in the ICAL midpoint standard. Sample EICP area within -50% to +100% of the daily continuing calibration verification.	Inspect mass spectrometer and gas chromatography for malfunctions; reanalyze all affected samples.
Method Blank	At least one per analytical batch.	No analytes detected at or above the RL.	Correct the problem, re-prepare, and reanalyze all associated samples.
Surrogate Spike	Every standard, sample, method blank, MS/MSD and LCS.	At least two surrogates in samples, method blank and LCS within limits specified in Appendix A.	Correct the problem and reanalyze (re-prepare if necessary).
MS/MSD	One set per 20 project-specific samples.	Full target list spike required within limits specified in Appendix A.	None.
LCS	At least one per analytical batch.	Full target list spike required within limits specified in Appendix A.	Correct the problem, re-prepare, and reanalyze the LCS and all samples in the analytical batch.

SECTION 6

Data Reduction, Validation, and Reporting

6.1 Laboratory Data Management

Data reduction will be performed manually or by using appropriate computer software. Quantitation procedures specified for each method must be followed. If data reduction is performed manually, the documentation must include the formulas used. Computer software used for data reduction must have been previously verified by the laboratory for accuracy. Documentation of the software verification must be maintained in the laboratory. All data reduction documentation must allow re-creation of the calculations.

All data will undergo a minimum of three levels of review at the laboratory prior to release. The analyst performing the tests shall initially review 100 percent of the data. After the analyst's review has been completed, 100 percent of the data shall be reviewed independently by a senior analyst or by the section supervisor for accuracy, completeness and compliance with calibration, QC requirements, and holding times. Analyte identification and quantitation must be verified. Calibration and QC results will be compared with the applicable control limits. RLs should be reviewed to make sure they meet the project objectives. Results of multiple dilutions should be reviewed for consistency. Any discrepancies must be resolved and corrected. Laboratory qualifiers will be applied when there are nonconformances that could potentially affect data usability. These qualifiers must be properly defined as part of the deliverables. All issues that are relevant to the quality of the data must be addressed in a case narrative. The laboratory QC manager will review a minimum of 10 percent of data or deliverables generated for the PG&E Program against the project-specific requirements. A final data review will be conducted by the laboratory manager or client services representative to ensure that all required analyses were performed and that all documentation is complete.

The hardcopy and electronic data deliverable (EDD) laboratory reports for all samples and analyses will contain the information necessary to perform data evaluation.

The PG&E Program will request four types of deliverables from the laboratory, depending upon the DQOs of the individual project. The following is a synopsis of when it is appropriate to use each type deliverable:

- **Level 1.** Appropriate for screening-level sampling results. Noncritical project decisions are made using this data.
- **Level 2.** Appropriate for investigative sampling results that will be replaced with confirmatory data or results used for disposal purposes. Less critical project decisions are made using this data.

- **Level 3.** Appropriate for investigative, confirmatory, or closure results. Critical project decisions may be made using this data.
- **Level 4.** Appropriate for investigative, confirmatory, or closure results. Critical decisions may be made using this data and should be used for projects that require a high degree of confidence in the accuracy of the data.

Hardcopy deliverables (and a electronic copy in portable document format [PDF]), in summary format, equivalent to those specified in the latest versions of EPA *Contract Laboratory Program Statements of Work for Organics and Inorganics Analyses* are preferred. The laboratory data report should be organized in a format that facilitates identification and retrieval of data. Alternate reporting formats require approval from the program chemist or project chemist.

A Level 1 report will include, at a minimum, the following information (when applicable):

- Cover letter with the following information:
  - Title of report and laboratory unique report identification (e.g., sample delivery group number)
  - Project name and site location
  - Name and location of laboratory and second-site or subcontracted laboratory
  - Client name and address
  - Statement of authenticity and official signature and title of person authorizing release of the report
- Table of contents
- Summary of samples received that correlates field sample IDs with the laboratory IDs
- Laboratory qualifier flags and definitions
- Field identification number
- Date received
- Date prepared
- Date analyzed (and time of analysis if the holding time is less than or equal to 48 hours)
- Preparation and analytical methods
- Result for each analyte (dry-weight basis for soils)
- Percent solids results for soil samples
- Dilution factor (provide both diluted and undiluted results when available)
- Sample-specific RL adjusted for sample size, dilution/concentration

- Sample-specific MDL adjusted for sample size, dilution/concentration (when project objectives require reporting less than the RL)
- Units of measure
- Applicable flags for data associated with QC that are outside of control limits
- CoC forms

A Level 2 report will consist of all the elements included in a Level 1 deliverable plus the following:

- Case narrative that addresses the following:
  - Sample receipt discrepancies (e.g., bubbles in VOA samples or temperature exceedances)
  - Descriptions of all nonconformances in the sample receipt, handling, preparation, analytical and reporting processes, and the corrective action taken for each occurrence
  - Identification and justification for sample dilution
  - Serial dilution recoveries, if applicable (required in hardcopy format only)
  - Postdigestion spike recoveries, if applicable (required in hardcopy format only)
- Surrogate %Rs
- MS/MSD and LCS spike concentrations, native sample results, spiked sample results, %R, and RPDs between the MS and MSD results; associated QC limits must also be provided
- Method blank results
- Analytical batch reference number that cross references samples to QC sample analyses
- Completed sample receipt checklist

A Level 3 report will consist of all the elements included in Level 1 and 2 reports plus the following:

- Analytical sequence or laboratory run log that contains sufficient information to correlate samples reported in the summary results to the associated method QC information, such as initial and continuing calibration analyses
- Confirmation results
- Calibration blank results for inorganic analyses (required in hardcopy format only)
- ICP and ICP/MS interference check sample results that include true concentrations, measured concentrations, and the calculated %R of the elements included (required in hardcopy format only)
- Method of standard addition results, if applicable (required in hardcopy format only)

- Internal standard recovery and retention time information, as applicable
- ICAL summary, including standard concentrations, response factors, average response factors, RSDs or correlation coefficients, and calibration plots or equations, if applicable (required in hardcopy format only)
- Continuing calibration verification summary, including expected and recovered concentrations and percent differences (required in hardcopy format only)
- Instrument tuning and mass calibration information for gas chromatography/mass spectrometry and ICP/MS analyses
- Any other method-specific QC sample results

A Level 4 report will include all elements for Levels 1 through 3 and all of the associated raw data. It is imperative that the relative scale used for all chromatographic and other instrument data be supplied in a scale that facilitates review from hardcopy. Enlargements of sufficient size and clarity for complex areas of sample chromatograms will be provided. Additional information to be supplied includes the following:

- Sample preparation logs that include the following:
  - Preparation start and end times
  - Beginning and ending temperatures (e.g., water baths and digestion blocks)
- Each algorithm and an example calculation for at least one sample for each matrix analyzed
- Reconstructed total ion chromatograms or selected ion current profiles for each sample (or blank) analyzed and mass spectra(s) for each compound identified including the following:
  - Raw compound spectra
  - Enhanced or background spectra
  - Laboratory generated library spectra (for tentatively identified compounds, provide the reference mass spectra from software spectra library)
- Ion ratio information for dioxin/furan methods

6.2 Hardcopy and Electronic Deliverables

Within the timeframe specified in the laboratory statement of work, contract, or purchase order from sample receipt, the laboratory shall deliver two hardcopies and one PDF of documentation, as specified in this QAPP. In addition, the laboratory shall deliver one electronic copy of the data (i.e., EDD), as specified in the format described in Table 6-1 (or as directed in the project-specific addendum), on CD-ROM or by e-mail (in ASCII format) within the same timeframe (LabSpec-7 format [see Table 6-1]).

All electronic data files shall match the final hardcopy results. CH2M HILL requires receipt of final hardcopy results with electronic files.

All raw data will be maintained in the laboratory and will be available upon request, if not required by the project-specific deliverable. Complete documentation of sample preparation and analysis and associated QC information will be maintained in a manner that allows easy retrieval if additional validation or information is required. Appropriate back-up procedures must be implemented by the laboratory for data that are stored electronically. All data generated using gas chromatography/mass spectrometry must be maintained on COD-ROM or equivalent format and provided to CH2M HILL upon request. All documentation must be retained for a minimum of 5 years after data acquisition.

The primary responsibility for implementing these procedures in the laboratory will reside with the laboratory manager or equivalent. The laboratory manager will approve laboratory reports before submittal.

6.3 Data Validation and Verification

Depending on the project-specific objectives, the analytical results of the data collection effort will be validated by CH2M HILL. In general, there will be different levels of validation employed for the PG&E Program that correspond to the reports described in Section 6.1. In some instances a Level 3 or Level 4 data package may be obtained from the laboratory, but only a Level 1 or Level 2 validation may be conducted. Specific validation levels will be identified in the site-specific SAP or QAPP addendum. Validation of Levels 1 through 4 will always be performed by the project chemist or designee. The levels are summarized as follows:

Level 1 Import the laboratory results into the project database; use automated data validation (AutoDV), as applicable, to the project database. Verify that samples were analyzed by the methods requested, and review the data for outliers and anomalies. Prepare a brief summary validation report.

Level 2 Import the laboratory results into the project database; use AutoDV as applicable, to the project database. Verify that samples were analyzed by the methods requested, review the laboratory case narrative for events in the laboratory that affect the accuracy or precision of the data, review QC indicator data, and perform a cursory review of the data. Prepare a summary validation report.

Level 2B Import the Laboratory results into the project database; use AutoDV, as applicable, to the project database. Verify that samples were analyzed by the methods requested, review the laboratory case narrative for events in the laboratory that affect the accuracy or precision of the data, review QC indicator data, and perform a cursory review of the data. Review specific raw data, as specified in the QAPP addendum, and compare the current data with historical data. Prepare a summary validation report.

Level 3 Import the laboratory results into the project database; use AutoDV, as applicable, to the project database. Validate the analytical data, as described in the following sections, without reviewing any raw data or analyte verification. Prepare a summary validation report.

Level 3B Import the laboratory results into the project database; use AutoDV, as applicable, to the project database. Validate the analytical data as described in the following sections with review of specific raw data, as specified in the QAPP addendum, and compare the current data with historical data. Prepare a summary validation report.

Level 4 Import the laboratory results into the project database; use AutoDV, as applicable, to the project database. Validate analytical data as described in the following sections, including a review of the analytical raw data, and compare the current data with historical data. Prepare a summary validation report.

6.4 Level 3 and 4 Validation Procedures

Personnel involved in the data validation function will be independent of any data generation effort. The project chemist will have responsibility for oversight of the data validation effort. Data validation will be performed when the final data packages are received from the laboratory. Data validation will be performed on an analytical batch basis within each analytical report using the summary results of calibration and laboratory QC and the results from associated field samples. Data packages will be reviewed for all constituents of concern. Raw data will be reviewed when deemed necessary by the project chemist or as specified in QAPP addenda. Data validation procedures will include the following:

- Review of the data package for completeness
- Review of CoC records for discrepancies that might degrade data quality
- Review for compliance with holding time and QC frequency requirements
- Evaluation of all calibration and QC summary results against the project requirements
- Verification of analyte identification and calculations for at least 10 percent of the data
- Qualification of the data using appropriate qualifier flags, as necessary, to reflect data usability limitations
- Initiation of corrective actions, as necessary, based on the data review findings

Data validation will be patterned after the *Contract Laboratory National Functional Guidelines for Inorganic Data Review* (EPA, 2002) and *Contract Laboratory National Functional Guidelines for Organic Data Review* (EPA, 1999), substituting the calibration and QC requirements specified in this QAPP for those specified in the guidelines. The national functional guidelines will primarily be used as a guidance document for the application of data qualification criteria. The level of validation will be defined in the SAP or QAPP addendum.

The flagging criteria presented in Tables 6-2 and 6-3 will be used; the qualifier flags are defined in Table 6-4. Qualifier flags, if required, will be applied to the electronic sample results. A summary table of the data qualifications will be provided in the validation report. If multiple flags are required for a result, the most severe flag will be applied to the electronic result. The hierarchy of flags, from the most severe to the least severe, will be as follows: R, UJ, J, U.

A validation report will be generated for each method and sample delivery group. A copy of the validation report will be retained with the data package in the project chemistry file. The project chemist will be notified of any significant data quality problems.

TABLE 6-1A
Data Guidelines for Electronic Data Deliverables
PG&E Program Quality Assurance Project Plan

Field Number	Field Name	Data Type	Data Length	Requirement	Valid Values[a]	Description and Comments
1	VersionCode	Text	15	R	Yes	Code identifying the version of the EDD deliverable.
2	LabName	Text	10	R	Yes	Identification code for the laboratory performing the work. This value is used to distinguish between different facilities.
3	SDG	Text	15	R	No	Sample delivery group designation; always populated for all samples, including QC.
4	FieldID	Text	30	R	No	Client sample ID as appears on CoC forms with optional laboratory-assigned suffixes or prefixes to make it unique. If the sample ID on the CoC form and the prefix or suffix is more than 20 characters, abbreviate the value but make it unique. For laboratory QC samples (e.g., method blanks and laboratory control samples), use a unique laboratory sample ID.
5	NativeID	Text	30	R	No	Client sample ID, **exactly** as on CoC forms. **No prefix or suffix allowed** in client sample IDs. Used to identify the native sample from which other samples are derived (e.g., QAQCType = LR, MS, or SD). For laboratory QC samples (i.e., method blanks and laboratory control samples), use the FieldID value that was assigned. However, for laboratory blank spike duplicate samples, use the FieldID value that was assigned to the associated laboratory blank spike sample.
6	QAQCType	Text	2	R	Yes	The code for the sample type. Any field sample that is not used as laboratory QC and is not otherwise marked on the CoC forms should have the designation of “N” (normal field sample). No suffix allowed (i.e., do not add numbers as suffixes to the QAQCType values as called for in the ERPIMS guidelines). If all analyses for a given sample are diluted, the first dilution should be designated as the normal sample. If more dilutions are required, the next dilution should be designated as the first true dilution with a QAQCType value of “LR” and a LRType value of “DL” (see LRType,).

TABLE 6-1A
Data Guidelines for Electronic Data Deliverables
PG&E Program Quality Assurance Project Plan

Field Number	Field Name	Data Type	Data Length	Requirement	Valid Values[a]	Description and Comments
7	LRType	Text	3	C	Yes	This is the code for laboratory replicate sample type. Values are as follows: • Blank (if QAQCType value is not LR) • DL (dilution) • RE (re-analysis) • D (inorganic duplicate) • CF (confirmation) For multiple dilutions or reanalyses of the same sample, append the replicate number after the LRType value (e.g., RE, RE2, and RE3).
8	Matrix	Text	5	R	Yes	Sample matrix code. Valid values are as follows: “AIR”, “WATER”, or “SOIL” unless otherwise provided by the project data manager and marked on CoC forms. The use of other terms (e.g., “liquid” or “solid”) for laboratory QC is not allowed.
9	LabSampleID	Text	12	R	No	Laboratory sample ID assigned by the laboratory. Prefix or suffix is allowed. Dilutions or re-extractions are noted here. For example, “D97-11111RE” is acceptable.
10	AnalysisMethod	Text	20	R	Yes	Analysis method code. This is the ID of the analytical method performed on the sample. For example, “SW8260A.” Generic names such as “EPA” should not be used.
11	ExtractionMethod	Text	20	R	Yes	Preparation method code. A value in this field is required. If the preparation is described in the method, use “METHOD”. If there is no separate preparation required, use “NONE”. Total and dissolved metal analyses are differentiated by the value in this column. Total, TCLP, and SPLP analyses are differentiated by the value in the LeachMethod column (see below).
12	SampleDate	Date		C	No	Date of sample collection. A value is required for all samples sent to the laboratory and samples derived from those samples. Format = mm/dd/yyyy.
13	SampleTime	Time		C	No	Time of sample collection. A value is required for all samples sent to the laboratory and samples derived from those samples. Twenty-four-hour format (hh:mm).
14	ReceiveDate	Date		C	No	Date of sample receipt in the laboratory. A value is required for all samples sent to the laboratory and samples derived from those samples. Format = mm/dd/yyyy.

TABLE 6-1A
Data Guidelines for Electronic Data Deliverables
PG&E Program Quality Assurance Project Plan

Field Number	Field Name	Data Type	Data Length	Requirement	Valid Values[a]	Description and Comments
15	ExtractDate	Date		C	No	Date of sample preparation (extraction or digestion). A value is required if the ExtractionMethod field value is other than “NONE”. Format = mm/dd/yyyy
16	ExtractTime	Time		C	No	Time of sample preparation. A value is required if the ExtractionMethod field value is other than “NONE”. Twenty-four-hour format (hh:mm).
17	AnalysisDate	Date		R	No	Date of sample analysis. A value is required for all records. Format = mm/dd/yyyy
18	AnalysisTime	Time		R	No	Time of sample analysis. A value is required for all records. Twenty-four-hour format (hh:mm).
19	PercentSolids	Number		R	No	Percent solids within the sample; should be zero for water samples.
20	LabLotCtlNum	Text	10	C	No	ID for an autonomous group of environmental samples and associated QC samples prepared together. For example, the value can be a digestion or extraction batch ID. If there is no separate extraction or preparation performed, the field is left blank.
21	CAS	Text	20	R	No	CAS registry number of analyte, if available.
22	ParamID	Text	12	R	Yes	Parameter ID code for the parameter listed in the Analyte field.
23	Analyte	Text	60	R	No	Name of analyte, chemical name.
24	Result	Text	10	R	No	Result of the analysis. Surrogate analytes are reported in units of percent. All others are reported in sample concentration units. If undetected, report the adjusted MDL or adjusted RL, depending on the project. (Reported as a text field to preserve significant figures.)
25	ExpectedValue	Number		C	No	Report “100” for surrogates; report “0” for blanks; spike level plus parent result for LCS, and MS/MSD; parent value for laboratory duplicate.
26	Units	Text	10	R	Yes	Units of measure used in the analysis. Report “PERCENT” for surrogate analytes; report concentration units for all others.
27	Dilution	Number		R	No	Total dilution reported in the analysis. Default value is “1”. This value reflects changes to sample preparation amounts as defined by the method (e.g., less sample used for standard VOC analysis).

TABLE 6-1A
Data Guidelines for Electronic Data Deliverables
PG&E Program Quality Assurance Project Plan

Field Number	Field Name	Data Type	Data Length	Requirement	Valid Values[a]	Description and Comments
28	MDL	Number		C	No	Minimum detection limit adjusted for preparation and dilution. This value may be the method detection limit or the instrument detection limit, depending on the method and the project requirements. This value is **not** adjusted for percent moisture.
29	RL	Number		C	No	Reporting limit adjusted for preparation and dilution. Value is **not** adjusted for percent moisture. Equivalent to PQL.
30	LabQualifier	Text	6	R	No	Laboratory qualifier for the results, as reported on the hardcopy. Use "=" as first (or only) qualifier value for detected results if there are no other qualifiers for the result.
31	Surrogate	Text	1	R	Yes	If the chemical is a surrogate = Y; if not = N.
32	Comments	Text	240	O	No	Comment field.
33	ParValUncert	Text	16	C	No	Radiological parameter value uncertainty.
34	Recovery	Number		C	No	Percent recovery for MS, SD, LCS, LCSD, and surrogate compounds.
35	LowerControlLimit	Number		C	No	Lower control limit value for spiked compounds, expressed in units of percent. A value in this field is required if there is a value in the Recovery field (Field 34).
36	UpperControlLimit	Number		C	No	Upper control limit value for spiked compounds, expressed in units of percent. A value in this field is required if there is a value in the Recovery field (Field 34).
37	Basis	Text	1	R	Yes	Weight basis for soil (or solid) sample analysis; D = dry-weight basis, W = wet-weight basis, and X = not applicable.
38	ConcQual	Text	1	R	Yes	Concentration qualifier. Use "=" for detects, "J" for estimated value (value between detection limit and reporting limit), "U" for undetected result, and "E" for exceeded result.
39	MDLAdjusted	Number		C	No	Minimum detection limit adjusted for preparation, dilution **and percent moisture**. See the description of the MDL field (Field 28) for an explanation of the contents of this field.
40	RLAdjusted	Number		C	No	Reporting limit adjusted for preparation, dilution **and percent moisture**. Equivalent to PQL

TABLE 6-1A
Data Guidelines for Electronic Data Deliverables
PG&E Program Quality Assurance Project Plan

Field Number	Field Name	Data Type	Data Length	Requirement	Valid Values[a]	Description and Comments
41	SampleDescription	Text	30	C	No	Full sample ID as it appears on CoC forms. In some cases, this may be the name of the sampling location instead of the sample. Required for all samples that are either collected in the field and specified on CoC forms, or derived from samples that are collected in the field and specified on COC forms.
42	LeachMethod	Text	20	R	Yes	Analytical method used for leaching the sample; applies to TCLP, SPLP, or other leaching or pre-extraction leaching procedures. Use “NONE” if the sample was not leached.
43	LeachDate	Date		C	No	Date that the leaching method was performed (use the start date for multidate leaching procedures). Value is required if the LeachMethod field value is other then “NONE”. Format = mm/dd/yyyy.
44	LeachTime	Time		C	No	Time that the leaching procedure started. Value is required if the LeachMethod field value is other then “NONE”. Twenty-four-hour format (hh:mm).
45	LeachLot	Text	10	C	No	ID of an autonomous group of environmental samples and associated QC samples **leached** at the same time. Value is required if the LeachMethod field value is other then “NONE”. If the sample was not leached, the field is left blank.
46	AnalysisLot	Text	10	R	No	ID of an autonomous group of environmental samples and associated QC samples **analyzed** together. A value in this field is required (i.e., it should not be blank).
47	CalRefID	Text	10	C	No	ID of a group of environmental and QC samples linked by a common set of calibration records. All results with the same CalRefID value will have had the same initial calibration run.

[a]For a list of valid values see Table 6-1B.

Notes:
The EDD file from the laboratory will be a comma-delimited ASCII file in the format listed above. There will be one EDD file per hardcopy report and the filename of the EDD file will be in the format REPORTID.csv, where REPORTID is the hardcopy report ID of sample delivery group.
C = Conditionally Required
EPRIMS = Environmental Restoration Program Information Management System
R = Required

TABLE 6-1B
Values for Data Guidelines for Electronic Data Deliverables
PG&E Program Quality Assurance Project Plan

Field Name	Valid Values	Meaning
VersionCode	4.20AFCEE3	Format 4.20, AFCEE data values. LabQualifier field contains the laboratory qualifier values defined in the AFCEE QAPP, Version 3.0.
VersionCode	4.20EPACLP	Format 4.20, EPA data values. LabQualifier field contains the standard EPA CLP laboratory qualifiers.
QAQCType	N	Normal, environmental sample
QAQCType	LB	Laboratory method blank
QAQCType	MS	Laboratory matrix spike sample
QAQCType	SD	Laboratory matrix spike duplicate
QAQCType	LR	Laboratory replicate (dilution, re-analysis, duplicate)
QAQCType	BS	Laboratory method blank spike
QAQCType	BD	Laboratory method blank spike duplicate
LRType	DL	First dilution sample
LRType	DL2	Second dilution sample
LRType	DL3	Third dilution sample
LRType	RE	First re-analysis/re-extraction sample
LRType	RE2	Second re-analysis/re-extraction sample
LRType	RE3	Third re-analysis/re-extraction sample
LRType	D	Inorganic duplicate sample
LRType	CF	First confirmation analysis sample
LRType	CF2	Second confirmation analysis sample
LRType	CF3	Third confirmation analysis sample
AnalysisMethod	SW8260A	Volatiles by method 8260A in EPA SW846.
AnalysisMethod	SW8270	Semivolatiles by method 8270 in EPA SW846.
AnalysisMethod	SW6010	ICP metals by method 6010 in EPA SW846.
AnalysisMethod	SW7060	GFAA arsenic by method 7060 in EPA SW846.
ExtractionMethod	FLDFLT	Field filtration for dissolved metals analysis
ExtractionMethod	C3050	CLP-modified SW3050 acid digestion for metals analysis in soil samples.
ExtractionMethod	SW1311	TCLP extraction
ExtractionMethod	DISWAT	Distilled water extraction for analytes in soil samples.
ExtractionMethod	SW3510	Separatory funnel extraction
ExtractionMethod	SW3540	Soxhlet extraction
ExtractionMethod	TOTAL	Digestion of unfiltered waters for total metals analysis

TABLE 6-1B
Values for Data Guidelines for Electronic Data Deliverables
PG&E Program Quality Assurance Project Plan

Field Name	Valid Values	Meaning
ParamID	ACE	Acetone
ParamID	AS	Arsenic
ParamID	BHCGAMMA	gamma-BHC (Lindane)
ParamID	BZ	Benzene
ParamID	CDS	Carbon disulfide
ParamID	PB	Lead
ParamID	PHENOL	Phenol
ParamID	SE	Selenium
ParamID	TCE	Trichloroethene

TABLE 6-2
Flagging Conventions for Organic Methods
PG&E Program Quality Assurance Project Plan

Quality Control Check	Evaluation	Flag	Samples Affected
Holding Time	Holding time exceeded for extraction or analysis	J = positive results; UJ = nondetects	Sample
	Holding time exceeded by a factor of two	J = positive results; R = nondetects	
Sample Preservation SW8260B	Sample not preserved	J = positive results; UJ = nondetects	Sample
Sample Integrity SW8260B	Bubbles in VOA vial used for analysis	J = positive hits; UJ = nondetects	Sample
Temperature	>6°C	J = positive results; UJ = nondetects	All samples in same cooler
ICAL	RRF <0.050, <0.010 for poor responders (SW8260B and SW8270C)	J = positive results, R = nondetects	All associated samples in analysis batch
	%RSD >20.0% (SW8260B and SW8270C), or >20% (SW8015B, SW8081A, SW8082, and SW8151A), **AND** calibration curve not used; **OR** calibration curve used, but with coefficient of correlation or determination <0.99	J = positive results, UJ = nondetects	
Calibration Verification (second-source and continuing calibration verification)	RRF <0.050, <0.010 for poor responders (SW8260B and SW8270C)	J = positive results, R = nondetects	All associated samples in analysis batch
	%D >25.0% (SW8260B and SW8270C) or >15% (SW8015B, SW8081A, SW8082, SW8151A	J = positive results, UJ = nondetects	
	%R >UT	J = positive results	All associated samples in analytical batch
	%R <LT	J = positive results, UJ = nondetects	
Laboratory Control Sample	%R >UT	J = positive results	All samples in preparation batch
	%R< LT	J = positive results, UJ = nondetects	
	%R <10%	J = positive results; R = nondetects	
Calibration Blank Method Blank	Convert blank concentration to soil units, if applicable; multiply the highest blank concentration by five	U = positive sample results <5x highest blank concentration	All samples in preparation batch or analytical batch, whichever one applies, associated with method blank or calibration blank

TABLE 6-2
Flagging Conventions for Organic Methods
PG&E Program Quality Assurance Project Plan

Quality Control Check	Evaluation	Flag	Samples Affected
Equipment Blank Field Blank Ambient Blank			All samples, same site, matrix and date (water) or all samples, same site, matrix (soil) associated with equipment blank
Trip Blank			All samples shipped in the same cooler as the trip blank
MS/MSD			
%R	%R >UT	J = positive results	MS analytes in parent sample and field duplicate, if any.
	%R <LT	J = positive results; UJ = nondetects	
	%R <10%	J = positive results; R = nondetects	
RPDs	RPD >UT	J = positive results	MS analytes in parent sample and field duplicate, if any.
Surrogates			
SW8260B; SW8015B; SW8015B SW8081 SW8082; SW8151A; SW8310, SW8270CSIM	%R >UT	J = positive results	All analytes in sample
	%R <LT and none <10%	J = positive results; UJ = nondetects	
	%R <10%	J = positive results; R = nondetects	
SW8270C	2 or more surrogates in same fraction with %R >UT	J = positive results	All analytes in same fraction in sample
	2 or more surrogates in same fraction with %R <LT but not <10%	J = positive results; UJ = nondetects	
	2 or more surrogates in same fraction with %R <LT and <10%	J = positive results; R = nondetects	
Internal Standards (SW8260B; SW8270C, SW8270CSIM)	Area >UT	J = positive results; UJ = nondetects	Associated analytes in sample
	Area <LT but not <10%	J = positive results;	
	Area <10%	J = positive results; R = nondetects	

TABLE 6-2
Flagging Conventions for Organic Methods
PG&E Program Quality Assurance Project Plan

Quality Control Check	Evaluation	Flag	Samples Affected
Field Duplicates	Concentration of reported analytes are >5 times the RL in either sample and RPD >UT (30% for water samples; 50% for soil samples)	J = positive results	Field duplicate pair
	One or both sample results <5 times the RL and a difference of ±2 times the RL for water (±4 times for soil).	J = positive; UJ = nondetect	
Confirmation (SW8015B; SW8021B,SW8081A; SW8151A;)	RPD between primary and confirmation results > 25%	J = positive results	Sample

Notes:

All QA/QC criteria are included in Tables 5-3 through 5-15 and Appendix A and will be used for validation criteria.

Organic methods include SW8015B, SW8081A, SW8082, SW8151A, SW8260B, SW8270C, and SW8270C SIM.

Spike recovery limits do not apply when sample concentration exceeds the spike concentration by a factor of four or more.

For methods requiring confirmation, the qualifications apply to primary analysis results (either of the two columns/detectors may be designated as the primary column/detector).

Where one MS recovery meets acceptance criteria and the other MS of the pair does not, professional judgment may be used to determine if the parent sample should be qualified for matrix effects by comparing the MS recoveries to other QC results within the batch or sample site.

Qualifier may not apply in cases where a surrogate coelutes with a nontarget analyte.

Qualifier may not apply in cases where low surrogate recoveries are due to sample dilution.

< = less than
> = greater than
%R = percent recovery
LT = lower tolerance
UT = upper tolerance

TABLE 6-3
Flagging Conventions – Minimum Data Evaluation Criteria for Inorganic Methods
PG&E Program Quality Assurance Project Plan

Quality Control Check	Evaluation	Flag	Samples Affected
Holding Time	Holding time exceeded for extraction, digestion, or analysis	J = positive results; R = nondetects for mercury; UJ = nondetects for all other analytes	Sample
	Holding time for digestion or analysis exceeded by a factor of two	J = positive results; R = nondetects	
Sample Preservation	Sample preservation requirements not met (If sample preservation was not done in the field, but was performed at the laboratory upon sample receipt, no flagging is required)	J = positive results; R = nondetects	Sample
Temperature	>6°C (not applicable to metals except mercury)	J = positive results; UJ = nondetects	Samples in same cooler
ICAL (Multipoint only)	Correlation coefficient ≤0.995	J = positive; UJ = nondetects	All associated samples in analytical batch
Calibration verification (ICAL verification, continuing calibration verification)	%R >UT	J = positive results	All associated samples in analytical batch
	%R <LT	J = positive results, UJ = nondetects	
Interference check sample (SW6010B/SW6020 only)	%R >UT	J = positive results	All associated samples in analytical batch
	%R <LT	J = positive results; UJ = nondetects	
Laboratory Control Sample	%R >UT	J = positive results	All samples in preparation batch
	%R <LT	J = positive results; UJ = nondetects	
	%R <10%	J = positive results; R = nondetects	
Calibration Blank (ICB,CCB) Method Blank	Multiply the highest blank concentration by five	U = positive sample results <5x highest blank concentration	All samples in preparation batch or analytical batch, whichever one applies, associated with method blank or calibration blank
Equipment Blank			All samples, same site, matrix and date
MS/MSD	%R >UT	J = positive results	MS analytes in parent sample and field duplicate if applicable
	%R <LT	J = positive results; UJ = nondetects	
	%R <10%	J = positive results; R = nondetects	
	RPD >UT	J = positive results	

TABLE 6-3
Flagging Conventions – Minimum Data Evaluation Criteria for Inorganic Methods
PG&E Program Quality Assurance Project Plan

Quality Control Check	Evaluation	Flag	Samples Affected
MS Dilute and Spike for hexavalent chromium by Methods SW7199 or EPA218.6 (see Section 5.3.3.1)	Spike recovery 85-115% and peak within recovery time window. If criteria are not met, the laboratory is required to dilute two aliquots 1:5, spike one with 1 μg/L of hexavalent chromium and analyze the other unspiked. Continue the aforementioned procedure using successively greater dilutions of two aliquots until recovery time and recovery criteria are met.	Choose the dilution where the RT/recovery criteria are met. If RT/recovery criteria are met at a 1:1 dilution, data qualification is not required for detected or nondetected results. If RT/recovery criteria met at dilution greater than a 1:1, elevate the RL for nondetected results and qualify the data U at a level equal to the RL multiplied by the dilution factor of the acceptable analysis (apply ValAdj validation reason). If RT/recovery criteria are not met: a) Analysis performed only at a 1:1 dilution: J positive results (apply LabA&P validation reason) UJ or R nondetects determined in conjunction with Project Chemist (apply LabA&P validation reason) b) Analysis performed at subsequent dilutions and criteria are still not met: J flag positive apply LabA&P validation reason) Elevate RL - UJ or R nondetects, determined in conjunction with project chemist (apply LabA&P validation reason)	Sample
Post digestion Spikes/Recovery Test (Metals only) (Step 1 - following MS/MSD, only required if the MS/MSD fails)	Spike results indicate performance of Dilution Test required (i.e. MS/MSD Failed), but Dilution Test not done.	J = positive results, UJ = nondetects	All samples in digestion batch if Dilution test not performed
	%R >UT	J = positive	
	%R <LT	J = positive results, UJ = nondetects	

TABLE 6-3
Flagging Conventions – Minimum Data Evaluation Criteria for Inorganic Methods
PG&E Program Quality Assurance Project Plan

Quality Control Check	Evaluation	Flag	Samples Affected
Dilution Test (Step 2 - following Post digestion spike, only required if the PDS fails)	If concentration is >25 times the RL and percent difference >UT	J = positive results UJ = nondetects	Analytes in parent sample if analytical spike not performed
MSA (GFAA only) for samples where postdigestion spike (performed as a result of unacceptable serial dilution) fails	r <0.995	J = positive results	Sample
Field Duplicates Laboratory Sample Duplicates	Concentration of reported analytes are >5 times the RL in either sample and RPD >20%	J = positive results	Field duplicate pair
	One or both sample results <5 times the RL and a difference of ±2 times the RL	J = positive results; UJ = nondetects	

Notes:

< = less than

> = greater than

All QA/QC criteria are included in Tables 5-3 through 5-15 and Appendix A and will be used for validation criteria.

Spike recovery limits do not apply when sample concentration exceeds the spike concentration by a factor of four or more.

CCB = continuing calibration blank

ICB = Initial calibration blank

LabA&P = laboratory accuracy and precision criteria not met

LT = lower tolerance

MSA = method of standard addition

UT = upper tolerance

ValAdj = Value reported by laboratory adjusted because of matrix issues.

TABLE 6-5
Qualifier Flag Definitions
PG&E Program Quality Assurance Project Plan

Flag	Definition
J	Analyte was present but reported value may not be accurate or precise.
R	The result has been rejected.
U	Analyte was analyzed for but not detected at the specified detection limit.
UJ	Analyte was not detected above the detection limit objective; however, the reported detection limit is approximate and might not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

SECTION 7

Performance Evaluations

To assess sample and data collection procedures, performance evaluations will be conducted that include of technical systems audits and performance audits.

7.1 Technical Systems Audits

7.1.1 Laboratory Audits

The laboratories participating in the data collection effort will be prequalified by the project management teams. A surveillance audit program that requires routine technical system audits will be instituted. Laboratory prequalification and the surveillance audits may also be undertaken by regulatory agencies. Laboratory prequalification audits may be performed as onsite audits, desk audits, or a combination of both, depending on the scale and sensitivity of the project.

7.1.1.1 Onsite Laboratory Prequalification Audit

An onsite laboratory prequalification audit in conjunction with a desk audit (see Section 7.1.1.2) is the preferred audit when using a new laboratory. The onsite laboratory audit will start with a pre-audit meeting during which the auditor will discuss with the laboratory staff the purpose of the audit, the schedule and areas to be audited, and the procedures that will be followed. The meeting may include a brief tour of the laboratory. The audit will then be conducted. The auditor will assemble the findings at the conclusion of the audit and discuss the findings with laboratory staff.

Critical items that will be addressed in a technical system audit include, but may not be limited to, the following:

- Calibration procedures and documentation
- Treatment and handling of standards
- Completeness of data forms, notebooks, and other reporting requirements
- Data review and verification procedures
- Data storage, filing, and recordkeeping procedures
- Sample custody procedures
- QC procedures, tolerances, and documentation
- Operating conditions of facilities and equipment
- Documentation of staff training and instrument maintenance activities
- Systems and operations overview

A written audit report will be sent to the laboratory within a specified time. A copy of the audit report will be sent to the project manager, and a copy will be retained in the project files.

The need for follow-up action will be determined based on the laboratory's responses. If an audit identifies an unacceptable condition or unacceptable data, the laboratory will be responsible for developing and initiating corrective action to resolve the situation. The project manager will be notified if the nonconformance impacts the project and requires resources not normally available to the project team. In such cases, the project manager will decide whether resources to pursue corrective action will be made available.

7.1.1.2 Desk Prequalification Audit

In part, a prequalification audit is performed to provide a perspective of the laboratory operations and the internal auditing and data review processes. Noncritical samples, split samples, or performance evaluation samples will be sent to the laboratory as part of the prequalification audit to ascertain the laboratory's ability to produce quality data. Generally, this process starts by sending guidance documents (e.g., QAPP, SAP, and SOW) to the laboratory for review. After a review and confirmation, the laboratory will follow the guidance documents to the best of their ability and to the project chemist's satisfaction. The auditor will request copies of accreditation audits (e.g., ELAP, NELAP, or AFCEE), SOPs, an example data package, and the laboratory's quality assurance manual. After a review of the laboratory's documentation (including instrument output, analytical reports, and other documentation specific to a batch of samples), samples can be sent to the laboratory. The data will be validated by using the Level 4 protocol described in Section 6.3 and reviewing the laboratories QC documentation. The corrective actions described in Section 7.1.1.1 may also apply.

7.1.2 Field Audits

Field audits will be performed annually to verify the performance of field procedures. The audit will evaluate the following:

- Sample containers and preservatives
- Sample collection and identification procedures
- Sample custody, handling, and shipping procedures
- Equipment decontamination procedures
- Calibration of field instruments and performance of field tests
- Documentation of field activities, maintenance of field records, and document control

7.2 Performance Audits

7.2.1 Performance Evaluations

Laboratories are required to participate in a performance evaluation program, in accordance with the California ELAP. Any method or analyte failure in a performance evaluation that affects the certification status of the laboratory with the National Environmental Laboratory Accreditation Program or the state of California must be immediately communicated to the program chemist.

Blind performance evaluation samples will be submitted to the laboratories as deemed necessary by the project chemist or project team.

7.2.2 External Audits

Announced and unannounced audits of the field operations and laboratories may be conducted by CH2M HILL during any stage of the project.

7.2.3 Internal Audits

Annual audits of the laboratory shall be conducted by the laboratory's quality assurance officer. The audits shall verify, at a minimum, that written SOPs are being followed; standards are traceable to certified sources; documentation is complete; data review is being done effectively and is properly documented; and data reporting, including electronic and manual data transfer, is accurate and complete. All audit findings shall be documented in QA reports to management. Necessary corrective actions shall be taken within a reasonable timeframe. The quality assurance office shall verify that such actions are effective and complete and document their implementation in an audit closeout report to management.

SECTION 8

Preventive Maintenance

The primary objective of preventive maintenance is to promote the timely and effective completion of a data collection effort. The maintenance program should be designed to minimize the downtime of crucial sampling and analytical equipment caused by component failures. The maintenance program should establish the following:

- Maintenance responsibilities
- Maintenance schedules
- An adequate inventory of critical spare parts and equipment

8.1 Maintenance Responsibilities

Laboratory instrument maintenance is the responsibility of the participating laboratory. Generally, the laboratory manager or supervisor is responsible for the instruments in their work areas; they will establish maintenance procedures and schedules for each instrument. Laboratories should maintain service agreements with instrument manufacturers or a reputable service company to minimize downtime if there is an instrument malfunction.

Maintenance responsibilities for field equipment are assigned to the field team leader for specific sampling tasks. However, the field team using the equipment is responsible for checking the status of the equipment prior to use and reporting any problems encountered. The field team is also responsible for ensuring that critical spare parts are included as part of the field equipment checklist. Nonoperational field equipment should be removed from service and a replacement obtained. All field instruments will be properly protected against inclement weather conditions during the field investigation.

8.2 Maintenance Schedules

The effectiveness of any maintenance program depends, to a large extent, on adherence to specific maintenance schedules for each piece of equipment. Nonroutine maintenance activities are conducted as needed. Manufacturers' recommendations should provide the primary basis for establishing maintenance schedules. Service contracts may be used to implement maintenance schedules.

Each analytical instrument should be assigned an instrument logbook; all maintenance activities for will be the documented instrument in the logbook. Logbooks should contain the following information:

- Date of service
- Person performing the service
- Type of service performed and the reason for service
- Replacement parts installed, if appropriate
- Date of next scheduled service
- Any other useful information

8.3 Spare Parts

An adequate inventory of spare parts is required to minimize equipment down time. The inventory will include the following:

- Parts and supplies that are subject to frequent failure
- Parts and supplies that have limited useful lifetimes
- Parts and supplies that cannot be obtained in a timely manner should failure occur

Field managers and laboratory managers are responsible for maintaining an adequate inventory of spare parts. In addition to spare parts and supply inventories, an in-house source of backup equipment and instrumentation should be available.

SECTION 9

Data Assessment

9.1 Data Quality Assessment

All laboratory data will be evaluated according to the QA acceptance criteria specified in Tables 5-3 through 5-15 and Appendix A Limitations regarding data usability will be assigned, if appropriate, in accordance with the validation process described in Section 7. Field data will be evaluated according to the appropriate SOP.

9.2 Reconciliation with Project Objectives

The PG&E Program includes projects and sites with varying tasks and objectives. The procedure for data reconciliation will be a function of the project-specific objectives and will be addressed in the project-specific documents.

SECTION 10

Corrective Action

Corrective action may be required as a result of deviations from field or analytical procedures. Deficiencies identified in audits and data quality evaluations may also call for corrective action. All project personnel have the responsibility to identify, report, and solicit approval for corrective actions to resolve conditions that are adverse to data quality.

Tables 5-3 through 5-15 specify the corrective actions to be taken when deviations from calibration and QC acceptance criteria occur. Field and laboratory staff may encounter conditions requiring immediate corrective action that are not addressed in this QAPP, the SAPs, or QAPP addenda. These staff will document conditions and the results of corrective actions in a field logbook or laboratory nonconformance report and communicate their actions as soon as feasible to the appropriate people (field team leader, laboratory supervisor, project chemist, project manager, and if necessary, the PG&E Program quality manager) for immediate input. A mechanism must be in place to allow for supervisory review or client input, or both, for all deviations or deficiencies. A corrective action reporting system that requires immediate documentation of deviations or deficiencies and for supervisory review of the actions taken to correct them will be established. At a minimum, the corrective action report should include the following information:

- The type of deviation or deficiency
- The date of occurrence
- The impact of the deviation or deficiency, such as samples affected
- The corrective action taken
- Documentation that the process has been returned to control

The only time that a corrective action report may be waived is when a deviation or deficiency is immediately corrected and its impact is precluded. An example would be an unacceptable ICAL that is repeated before samples are analyzed.

Each corrective action report must be reviewed and approved by a person of authority, such as the field team leader or laboratory supervisor. The ultimate responsibility for the laboratory corrective action process is the QC manager, who must ensure that proper documentation, approval, and close out of all out-of-control or nonconformance events is performed. A nonconformance report will summarize each nonconformance condition. Corrective action reports that could potentially affect data quality must be brought to the attention of the project chemist. Report disposition will be the responsibility of the project chemist. The project manager may be notified about a particular report at the project chemist's discretion. Copies of corrective action reports must be maintained in the laboratory or field project files.

SECTION 11

Quality Assurance Reports

Where specified in the SAP, work plan, or QAPP addendum, a QA report or data quality evaluation will be submitted by the project chemist to the project manager on a predetermined interval established in the SAP or QAPP addendum. The report will summarize the results of the data validation and the data assessment. The results should be presented in a manner that facilitates decision making. For example, temporal data may be more effectively presented if supplemented by a time plot. Any significant quality problems and recommended solutions should be included in the report. Limitations on data usability identified during data validation should be highlighted. Results of the data assessment should be reconciled with the project objectives.

SECTION 12

Data Management

Electronic data associated with CH2M Hill projects will be used to generate validation reports, risk assessment calculations, modeling results, data summary tables, maps, and other figures. The data management will follow CH2M HILL standard procedures for environmental data collection. Other consultants or contractors may use other electronic data management programs, which will be described in the SAP or QAPP addendum. However, any system used must be capable of storing and managing the information as follows:

- Simple procedures to get rapid access to stored data
- Data entry methods of known accuracy and efficiency
- Well-documented validation procedures for electronic databases
- Sampling data management using unique sample IDs
- A sampling inventory of newly collected data and methods of sample inventory reconciliation
- Sample-specific attributes, including location IDs, sample type and media, and sample date
- Reporting and delivery formats to support data analysis and reduction

12.1 Archiving

Hardcopy and electronic versions will be archived in project files and on electronic archive tapes for the duration of the project, as specified in contractual agreements, or for a minimum of 5 years. All electronic data will be subject to routine back-up until it is archived for long-term retention.

12.2 Data Flow and Transfer

The data flow from the laboratory and field to the project staff and data users will be sufficiently documented to ensure that data are properly tracked, reviewed, and validated.

12.3 Record Keeping

In addition to the data management procedures for analytical data provided in Section 6.1, the laboratory will maintain electronic and hardcopy records sufficient to re-create each analytical event. At a minimum, laboratory will maintain the following records:

- Raw data, including instrument printouts, bench work sheets, and chromatograms, with compound identification and quantitation reports
- Laboratory-specific, written SOPs for each analytical method and QA/QC function implemental during the analysis of project samples

SECTION 13

References

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Table A-1
Reporting Limits, Accuracy, and Precession Limits for Soil
PG&E Program Quality Assurance Project Plan

Method	Constituent	CAS	Units	QAPP RL	EPA Regional Screening Levels - May 2012		EPA Regional Screening Levels - 2008		DTSC CHHSL		Most Stringent Screening Level[1]	Does RL Exceed Screening Level?	LCS Accuracy Control Limits (%R)		MS/MSD Accuracy Control Limits (%R)		Precision Soil
					Residential	Commercial	Residential	Commercial	Residential	Commercial			Lower Limit	Upper Limit	Lower Limit	Upper Limit	% RPD
SW 9012 or SW 9014	Cyanide	57-12-5	mg/kg	0.25	47	610	1,600	20,000	--	--	0,047	NO	*	*	*	*	30
Walkley-Black	Total organic carbon	TOC	mg/kg	50	--	--	--	--	--	--	--	NO	75	125	75	125	35
SW 9050	Specific conductance	Conductance	µmhos/cm	5	--	--	--	--	--	--	--	NO	75	125	75	125	20
SW 9045	pH	pH	pH units	0.1	--	--	--	--	--	--	--	NO	--	--	--	--	20
SM 2540 B/EPA 160.3	percent moisture	Moist	Percent	--	--	--	--	--	--	--	--	NO	--	--	--	--	20
EPA 300.0	Fluoride	Fluoride	mg/kg	2	--	--	4,700	61,000	--	--	4,700	NO	70	130	70	130	35
EPA 300.0	Chloride	Chloride	mg/kg	2	--	--	--	--	--	--	--	NO	70	130	70	130	35
EPA 300.0	Sulfate	Sulfate	mg/kg	2	--	--	--	--	--	--	--	NO	70	130	70	130	35
EPA 821/R-91-100	Sulfide, acid volatile	18496-25-8	mg/kg	80	--	--	--	--	--	--	--	NO	70	130	70	130	30
SW 7199	Chromium, hexavalent	18540-29-9	mg/kg	0.4	0.29	5.6	230	1,400	17	17	0.29	YES	85	115	85	115	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Aluminum	7429-90-5	mg/kg	10	77,000	990,000	77,000	990,000	--	--	77,000	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Antimony	7440-36-0	mg/kg	2	31	410	31	410	30	380	30	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Arsenic	7440-38-2	mg/kg	0.5	0.39	1.6	0.39	1.6	0.07	0.42	0.07	YES	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Barium	7440-39-3	mg/kg	1	15,000	190,000	15,000	190,000	5,200	63,000	5,200	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Beryllium	7440-41-7	mg/kg	0.5	160	2,000	160	2,000	150	1,700	150	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Cadmium	7440-43-9	mg/kg	0.5	70	800	70	810	1.7	7.5	1.7	NO	85	115	75	125	20
SW 6010B or C/EPA 200.7	Calcium	7440-70-2	mg/kg	100	--	--	--	--	--	--	--	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Chromium	7440-47-3	mg/kg	1	--	--	280	1,400	*	*	280	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Cobalt	7440-48-4	mg/kg	1	23	300	23	300	660	3,200	23	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Copper	7440-50-8	mg/kg	1	3,100	41,000	3,100	41,000	3,000	38,000	3,000	NO	85	115	75	125	20
SW 6010B or C/EPA 200.7	Iron	7439-89-6	mg/kg	10	55,000	720,000	55,000	720,000	--	--	55,000	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Lead	7439-92-1	mg/kg	1	400	800	400	800	150	3,500	150	NO	85	115	75	125	20
SW 6010B or C/EPA 200.7	Magnesium	7439-95-4	mg/kg	100	--	--	--	--	--	--	--	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Manganese	7439-96-5	mg/kg	1	--	--	1,800	23,000	--	--	1,800	NO	85	115	75	125	20
SW 7471A/EPA 245.5	Mercury	7439-97-6	mg/kg	0.1	10	43	6.7	28	18	180	6.7	NO	75	125	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Molybdenum	7439-98-7	mg/kg	1	390	5,100	390	5,100	380	4,800	380	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Nickel	7440-02-0	mg/kg	1	1,500	20,000	1,600	20,000	1,600	16,000	1,500	NO	85	115	75	125	20
SW 6010B or C/EPA 200.7	Potassium	7440-09-1	mg/kg	100	--	--	--	--	--	--	--	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Selenium	7782-49-2	mg/kg	1	390	5,100	390	5,100	380	4,800	380	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Silver	7440-22-4	mg/kg	1	390	5,100	390	5,100	380	4,800	380	NO	85	115	75	125	20
SW 6010B or C/EPA 200.7	Sodium	7440-23-5	mg/kg	100	--	--	--	--	--	--	--	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Thallium	7440-28-0	mg/kg	2	0.78	10	5.1	66	5	63	0.78	YES	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Vanadium	7440-62-2	mg/kg	1	--	--	550	7,200	530	6,700	530	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Zinc	7440-66-6	mg/kg	2	23,000	310,000	23,000	310,000	23,000	100,000	23,000	NO	85	115	75	125	20
SW 8015B or C or D	Motor Oil	TPH-motor oil	mg/kg	10	--	--	--	--	--	--	--	NO	60	120	60	120	50
SW 8015B or C or D	TPH-Diesel	TPH-diesel	mg/kg	10	--	--	--	--	--	--	--	NO	51	153	51	153	50
SW 8015B or C or D	TPH-Gasoline	TPH-gasoline	mg/kg	1	--	--	--	--	--	--	--	NO	57	146	57	146	50
SW 8081A or B	4,4'-DDD	72-54-8	ug/kg	4	2,000	7,200	2,000	7,200	2,300	9,000	2,000	NO	50	139	50	139	50
SW 8081A or B	4,4'-DDE	72-55-9	ug/kg	4	1,400	5,100	1,400	5,100	1,600	6,300	1,400	NO	68	126	68	126	50
SW 8081A or B	4,4'-DDT	50-29-3	ug/kg	4	1,700	7,000	1,700	7,000	1,600	6,300	1,600	NO	46	135	46	135	50
SW 8081A or B	Aldrin	309-00-2	ug/kg	4	29	100	29	100	33	130	29	NO	47	120	47	120	50
SW 8081A or B	alpha-HCH	319-84-6	ug/kg	4	77	270	77	270	--	--	77	NO	62	125	62	125	50
SW 8081A or B	alpha-Chlordane	5103-71-9	ug/kg	4	--	--	--	--	430	1,700	430	NO	63	121	63	121	50
SW 8081A or B	beta-HCH	319-85-7	ug/kg	4	270	960	320	1,300	--	--	270	NO	62	127	62	127	50
SW 8081A or B	delta-HCH	319-86-8	ug/kg	4	--	--	--	--	--	--	--	NO	57	130	57	130	50
SW 8081A or B	Dieldrin	60-57-1	ug/kg	4	30	110	30	110	35	130	30	NO	67	125	67	125	50
SW 8081A or B	Endosulfan I	959-98-8	ug/kg	4	--	--	--	--	--	--	--	NO	41	147	41	147	50
SW 8081A or B	Endosulfan II	33213-65-9	ug/kg	4	--	--	--	--	--	--	--	NO	37	141	37	141	50
SW 8081A or B	Endosulfan sulfate	1031-07-8	ug/kg	4	--	--	--	--	--	--	--	NO	62	135	62	135	50
SW 8081A or B	Endrin	72-20-8	ug/kg	4	18,000	180,000	18,000	180,000	21,000	230,000	18,000	NO	61	133	61	133	50
SW 8081A or B	Endrin aldehyde	7421-93-4	ug/kg	4	--	--	--	--	--	--	--	NO	37	147	37	147	50
SW 8081A or B	gamma-HCH (Lindane)	58-89-9	ug/kg	4	520	2,100	520	21,000	500	2,000	500	NO	59	123	59	123	50
SW 8081A or B	gamma-Chlordane	5103-74-2	ug/kg	4	--	--	--	--	430	1,700	430	NO	48	124	48	124	50
SW 8081A or B	Heptachlor	76-44-8	ug/kg	4	110	380	110	380	130	520	110	NO	51	140	51	140	50
SW 8081A or B	Heptachlor epoxide	1024-57-3	ug/kg	4	53	190	53	190	--	--	53	NO	66	130	66	130	50
SW 8081A or B	Methoxychlor	72-43-5	ug/kg	20	310,000	3,100,000	310,000	3,100,000	340,000	3,800,000	310,000	NO	57	143	57	143	50
SW 8081A or B	Toxaphene	8001-35-2	ug/kg	100	440	1,600	440	1,600	460	1,800	440	NO	31	136	31	136	50
SW 8082 or A	Aroclor-1016	12674-11-2	ug/kg	50	3,900	21,000	3,900	21,200	--	--	3,900	NO	41	138	41	138	50
SW 8082 or A	Aroclor-1221	11104-28-2	ug/kg	50	140	540	170	620	--	--	140	NO	45	136	45	136	50
SW 8082 or A	Aroclor-1232	11141-16-5	ug/kg	50	140	540	170	620	--	--	140	NO	45	136	45	136	50
SW 8082 or A	Aroclor-1242	53469-21-9	ug/kg	50	220	740	220	740	--	--	220	NO	43	150	43	150	50
SW 8082 or A	Aroclor-1248	12672-29-6	ug/kg	50	220	740	220	740	--	--	220	NO	44	136	44	136	50
SW 8082 or A	Aroclor-1254	11097-69-1	ug/kg	50	220	740	220	740	--	--	220	NO	41	141	41	141	50
SW 8082 or A	Aroclor-1260	11096-82-5	ug/kg	50	220	740	220	740	--	--	220	NO	61	131	61	131	50
SW 8082 or A	Total PCB	Total PCB	ug/kg	50	220	740	220	740	89	300	89	NO	--	--	--	--	--
SW 8151A	2,4-D	94-75-7	ug/kg	200	690,000	7,700,000	690	7,700	690	550	550	NO	32	121	32	121	50

Table A-1
Reporting Limits, Accuracy, and Precession Limits for Soil
PG&E Program Quality Assurance Project Plan

Method	Constituent	CAS	Units	QAPP RL	EPA Regional Screening Levels - May 2012		EPA Regional Screening Levels - 2008		DTSC CHHSL		Most Stringent Screening Level[1]	Does RL Exceed Screening Level?	LCS Accuracy Control Limits (%R)		MS/MSD Accuracy Control Limits (%R)		Precision Soil
					Residential	Commercial	Residential	Commercial	Residential	Commercial			Lower Limit	Upper Limit	Lower Limit	Upper Limit	% RPD
SW 8151A	2,4-DB	94-82-6	ug/kg	500	490,000	4,900,000	490	4,900	--	--	490	YES	42	145	42	145	50
SW 8151A	2,4,5-T	93-76-5	ug/kg	500	610,000	6,200,000	610	6,200	7,700	6,100	610	NO	43	139	43	139	50
SW 8151A	2,4,5-TP	93-72-1	ug/kg	200	490,000	4,900,000	490	4,900	--	--	490	NO	46	128	46	128	50
SW 8151A	Dalapon	75-99-0	ug/kg	100	1,800,000	18,000,000	1,800	18,000	--	--	1,800	NO	22	125	22	125	50
SW 8151A	Dicamba	1918-00-9	ug/kg	500	1,800,000	18,000,000	1,800	18,000	--	--	1,800	NO	56	120	56	120	50
SW 8151A	Dichloroprop	120-36-5	ug/kg	500	--	--	--	--	--	--	--	NO	72	142	72	142	50
SW 8151A	Dinoseb	88-85-7	ug/kg	100	61,000	620,000	61	620	--	--	61	YES	20	131	20	131	50
SW 8151A	MCPA	94-74-6	ug/kg	1,000	31,000	310,000	31	310	--	--	31	YES	65	120	65	120	50
SW 8151A	MCPP	7085-19-0	ug/kg	1,500	--	--	61	620	--	--	61	YES	60	118	60	118	50
SW 8260B or C	1,1,1,2-Tetrachloroethane	630-20-6	ug/kg	5	1,900	9,300	2,000	9,800	--	--	1,900	NO	74	125	74	125	30
SW 8260B or C	1,1,1-Trichloroethane (TCA)	71-55-6	ug/kg	5	8,700,000	38,000,000	9,000,000	39,000,000	--	--	8,700,000	NO	68	130	68	130	30
SW 8260B or C	1,1,2,2-Tetrachloroethane	79-34-5	ug/kg	5	560	2,800	590	2,900	--	--	560	NO	59	140	59	140	30
SW 8260B or C	1,1,2-Trichloroethane	79-00-5	ug/kg	5	1,100	5,300	1,100	5,500	--	--	1,100	NO	62	127	62	127	30
SW 8260B or C	1,1,2-Trichlorotrifluoroethane (Freon 113)	76-13-1	ug/kg	5	43,000,000	180,000,000	43,000,000	180,000,000	--	--	43,000,000	NO	65	135	65	135	30
SW 8260B or C	1,1-Dichloroethane	75-34-3	ug/kg	5	3,300	17,000	3,400	17,000	--	--	3,300	NO	73	125	73	125	30
SW 8260B or C	1,1-Dichloroethylene	75-35-4	ug/kg	5	240,000	1,100,000	250,000	1,100,000	--	--	240,000	NO	65	136	65	136	30
SW 8260B or C	1,1-Dichloropropene	563-58-6	ug/kg	5	--	--	--	--	--	--	--	NO	70	135	70	135	30
SW 8260B or C	1,2,3-Trichlorobenzene	87-61-6	ug/kg	5	49,000	490,000	--	--	--	--	49,000	NO	62	133	62	133	30
SW 8260B or C	1,2,3-Trichloropropane	96-18-4	ug/kg	5	5	95	91	410	--	--	5	NO	63	130	63	130	30
SW 8260B or C	1,2,4-Trichlorobenzene	120-82-1	ug/kg	5	22,000	99,000	87,000	400,000	--	--	22,000	NO	65	131	65	131	30
SW 8260B or C	1,2,4-Trimethylbenzene	95-63-6	ug/kg	5	62,000	260,000	67,000	280,000	--	--	62,000	NO	65	135	65	135	30
SW 8260B or C	1,2-Dibromo-3-chloropropane	96-12-8	ug/kg	5	5.4	69	5.6	73	--	--	5.4	NO	49	135	49	135	30
SW 8260B or C	1,2-Dibromoethane (EDB)	106-93-4	ug/kg	5	34	170	34	170	--	--	34	NO	70	124	70	124	30
SW 8260B or C	1,2-Dichlorobenzene	95-50-1	ug/kg	5	1,900,000	9,800,000	2,000,000	10,000,000	--	--	1,900,000	NO	74	120	74	120	30
SW 8260B or C	1,2-Dichloroethane (EDC)	107-06-2	ug/kg	5	430	2,200	450	2,200	--	--	430	NO	72	137	72	137	30
SW 8260B or C	1,2-Dichloropropane	78-87-5	ug/kg	5	940	4,700	930	4,700	--	--	930	NO	71	120	71	120	30
SW 8260B or C	1,3,5-Trimethylbenzene	108-67-8	ug/kg	5	780,000	10,000,000	47,000	200,000	--	--	47,000	NO	65	133	65	133	30
SW 8260B or C	1,3-Dichlorobenzene	541-73-1	ug/kg	5	--	--	--	--	--	--	--	NO	72	124	72	124	30
SW 8260B or C	1,3-Dichloropropane	142-28-9	ug/kg	5	1,600,000	20,000,000	1,600,000	20,000,000	--	--	1,600,000	NO	76	123	76	123	30
SW 8260B or C	1,4-Dichlorobenzene	106-46-7	ug/kg	5	2,400	12,000	2,600	13,000	--	--	2,400	NO	72	125	72	125	30
SW 8260B or C	2,2-Dichloropropane	594-20-7	ug/kg	5	--	--	--	--	--	--	--	NO	67	134	67	134	30
SW 8260B or C	2-Butanone (MEK)	78-93-3	ug/kg	50	28,000,000	200,000,000	28,000,000	190,000,000	--	--	28,000,000	NO	40	135	40	135	30
SW 8260B or C	2-Chlorotoluene	95-49-8	ug/kg	5	1,600,000	20,000,000	1,600,000	20,000,000	--	--	1,600,000	NO	69	128	69	128	30
SW 8260B or C	4-Chlorotoluene	106-43-4	ug/kg	5	1,600,000	20,000,000	5,500,000	72,000,000	--	--	1,600,000	NO	73	126	73	126	30
SW 8260B or C	4-Isopropyltoluene	99-87-6	ug/kg	6	--	--	--	--	--	--	--	NO	75	133	75	133	30
SW 8260B or C	4-Methyl-2-pentanone	108-10-1	ug/kg	50	5,300,000	53,000,000	5,300,000	52,000,000	--	--	5,300,000	NO	65	135	65	135	30
SW 8260B or C	Acetone	67-64-1	ug/kg	50	61,000,000	630,000,000	61,000,000	610,000,000	--	--	61,000,000	NO	40	141	40	141	30
SW 8260B or C	Acrolein	107-02-8	ug/kg	100	150	650	160	680	--	--	150	NO	65	135	65	135	30
SW 8260B or C	Acrylonitrile	107-13-1	ug/kg	50	240	1,200	240	1,200	--	--	240	NO	65	135	65	135	30
SW 8260B or C	Benzene	71-43-2	ug/kg	5	1,100	5,400	1,100	5,600	--	--	1,100	NO	73	126	73	126	30
SW 8260B or C	Bromobenzene	108-86-1	ug/kg	5	300,000	1,800,000	94,000	410,000	--	--	94,000	NO	66	121	66	121	30
SW 8260B or C	Bromochloromethane	74-97-5	ug/kg	5	160,000	680,000	--	--	--	--	160,000	NO	71	127	71	127	30
SW 8260B or C	Bromodichloromethane	75-27-4	ug/kg	5	270	1,400	10,000	46,000	--	--	0,270	NO	72	128	72	128	30
SW 8260B or C	Bromoform	75-25-2	ug/kg	6	62,000	220,000	61,000	220,000	--	--	61,000	NO	66	137	66	137	30
SW 8260B or C	Bromomethane	74-83-9	ug/kg	5	7,300	32,000	7,900	35,000	--	--	7,300	NO	45	141	45	141	30
SW 8260B or C	Carbon disulfide	75-15-0	ug/kg	5	820,000	3,700,000	670,000	3,000,000	--	--	670,000	NO	65	135	65	135	30
SW 8260B or C	Carbon tetrachloride	56-23-5	ug/kg	5	610	3,000	250	1,300	--	--	250	NO	67	133	67	133	30
SW 8260B or C	Chlorobenzene	108-90-7	ug/kg	5	290,000	1,400,000	310,000	1,500,000	--	--	290,000	NO	75	123	75	123	30
SW 8260B or C	Chloroethane	75-00-3	ug/kg	5	15,000,000	61,000,000	15,000,000	62,000,000	--	--	15,000,000	NO	41	141	41	141	30
SW 8260B or C	Chloroform	67-66-3	ug/kg	2	290	1,500	300	1,500	--	--	290	NO	72	124	72	124	30
SW 8260B or C	Chloromethane	74-87-3	ug/kg	5	120,000	500,000	1,700	8,400	--	--	1,700	NO	51	129	51	129	30
SW 8260B or C	cis-1,2-Dichloroethene	156-59-2	ug/kg	5	160,000	2,000,000	780,000	10,000,000	--	--	160,000	NO	67	125	67	125	30
SW 8260B or C	cis-1,3-Dichloropropene	10061-01-5	ug/kg	5	--	--	--	--	--	--	--	NO	72	126	72	126	30
SW 8260B or C	Dibromochloromethane	124-48-1	ug/kg	5	680	3,300	5,800	21,000	--	--	0,680	NO	66	130	66	130	30
SW 8260B or C	Dibromomethane	74-95-3	ug/kg	5	25,000	110,000	780,000	10,000,000	--	--	25,000	NO	73	128	73	128	30
SW 8260B or C	Dichlorodifluoromethane	75-71-8	ug/kg	5	94,000	400,000	190,000	780,000	--	--	94,000	NO	34	136	34	136	30
SW 8260B or C	Ethylbenzene	100-41-4	ug/kg	5	5,400	27,000	5,700	29,000	--	--	5,400	NO	74	127	74	127	30
SW 8260B or C	Hexachlorobutadiene	87-68-3	ug/kg	5	6,200	22,000	6,200	22,000	--	--	6,200	NO	53	142	53	142	30
SW 8260B or C	Isopropylbenzene (Cumene)	98-82-8	ug/kg	5	2,100,000	11,000,000	2,200,000	11,000,000	--	--	2,100,000	NO	77	129	77	129	30
SW 8260B or C	Methylene Chloride	75-09-2	ug/kg	5	56,000	960,000	1,100	5,400	--	--	1,100	NO	63	137	63	137	30
SW 8260B or C	Naphthalene	91-20-3	ug/kg	5	3,600	18,000	3,900	20,000	--	--	3,600	NO	51	135	51	135	30
SW 8260B or C	n-Butylbenzene	104-51-8	ug/kg	5	3,900,000	51,000,000	--	--	--	--	3,900,000	NO	65	138	65	138	30
SW 8260B or C	n-Propylbenzene	103-65-1	ug/kg	5	3,400,000	21,000,000	--	--	--	--	3,400,000	NO	63	135	63	135	30
SW 8260B or C	sec-Butylbenzene	135-98-8	ug/kg	5	--	--	--	--	--	--	--	NO	63	132	63	132	30
SW 8260B or C	Styrene	100-42-5	ug/kg	5	6,300,000	36,000,000	6,500,000	38,000,000	--	--	6,300,000	NO	74	128	74	128	30
SW 8260B or C	tert-Butyl Methyl Ether (MTBE)	1634-04-4	ug/kg	20	43,000	220,000	39,000	190,000	--	--	39,000	NO	50	135	50	135	30

Table A-1
Reporting Limits, Accuracy, and Precession Limits for Soil
PG&E Program Quality Assurance Project Plan

Method	Constituent	CAS	Units	QAPP RL	EPA Regional Screening Levels - May 2012		EPA Regional Screening Levels - 2008		DTSC CHHSL		Most Stringent Screening Level[1]	Does RL Exceed Screening Level?	LCS Accuracy Control Limits (%R)		MS/MSD Accuracy Control Limits (%R)		Precision Soil
					Residential	Commercial	Residential	Commercial	Residential	Commercial			Lower Limit	Upper Limit	Lower Limit	Upper Limit	% RPD
SW 8260B or C	tert-Butylbenzene	98-06-6	ug/kg	5	--	--	--	--	--	--	--	NO	65	132	65	132	30
SW 8260B or C	Tetrachloroethene	127-18-4	ug/kg	5	22,000	110,000	570	2,700	--	--	570	NO	67	139	67	139	30
SW 8260B or C	Toluene	108-88-3	ug/kg	5	5,000,000	45,000,000	5,000,000	46,000,000	--	--	5,000,000	NO	71	127	71	127	30
SW 8260B or C	trans-1,2-Dichloroethene	156-60-5	ug/kg	5	150,000	690,000	110,000	500,000	--	--	110,000	NO	66	134	66	134	30
SW 8260B or C	trans-1,3-Dichloropropene	10061-02-6	ug/kg	5	--	--	--	--	--	--	--	NO	65	127	65	127	30
SW 8260B or C	Trichloroethene	79-01-6	ug/kg	5	910	6,400	2,800	14,000	--	--	0,910	NO	77	124	77	124	30
SW 8260B or C	Trichlorofluoromethane (Freon 11)	75-69-4	ug/kg	5	790,000	3,400,000	800,000	3,400,000	--	--	790,000	NO	49	139	49	139	30
SW 8260B or C	Vinyl Chloride	75-01-4	ug/kg	5	60	1,700	60	1,700	--	--	60	NO	58	126	58	126	30
SW 8260B or C	Xylenes, Total	1330-20-7	ug/kg	15	630,000	2,700,000	600,000	2,600,000	--	--	600,000	NO	65	125	65	125	50
SW 8260B or C	m-Xylene	108-38-3	ug/kg	10	590,000	2,500,000	4,500,000	19,000,000	--	--	590,000	NO	79	126	79	126	30
SW 8260B or C	p-Xylene	106-42-3	ug/kg	10	600,000	2,600,000	4,700,000	20,000,000	--	--	600,000	NO	79	126	79	126	30
SW 8260B or C	o-Xylene	95-47-6	ug/kg	5	690,000	3,000,000	5,300,000	23,000,000	--	--	690,000	NO	77	125	77	125	30
SW 8270C or D	1,2,4-Trichlorobenzene	120-82-1	ug/kg	330	22,000	99,000	87,000	400,000	--	--	22,000	NO	44	125	44	125	30
SW 8270C or D	1,2-Dichlorobenzene	95-50-1	ug/kg	330	1,900,000	9,800,000	2,000,000	10,000,000	--	--	1,900,000	NO	45	125	45	125	30
SW 8270C or D	1,3-Dichlorobenzene	541-73-1	ug/kg	330	--	--	--	--	--	--	--	NO	39	125	39	125	30
SW 8270C or D	1,4-Dichlorobenzene	106-46-7	ug/kg	330	2,400	12,000	2,600	13,000	--	--	2,400	NO	35	125	35	125	30
SW 8270C or D	2,4,5-Trichlorophenol	95-95-4	ug/kg	700	6,100,000	62,000,000	6,100,000	62,000,000	--	--	6,100,000	NO	49	125	49	125	30
SW 8270C or D	2,4,6-Trichlorophenol	88-06-2	ug/kg	330	44,000	160,000	44,000	160,000	--	--	44,000	NO	43	125	43	125	30
SW 8270C or D	2,4-Dichlorophenol	120-83-2	ug/kg	330	180,000	1,800,000	180,000	1,800,000	--	--	180,000	NO	45	125	45	125	30
SW 8270C or D	2,4-Dimethylphenol	105-67-9	ug/kg	330	1,200,000	12,000,000	1,200,000	12,000,000	--	--	1,200,000	NO	32	125	32	125	30
SW 8270C or D	2,4-Dinitrophenol	51-28-5	ug/kg	700	120,000	1,200,000	120,000	1,200,000	--	--	120,000	NO	25	132	25	132	30
SW 8270C or D	2,4-Dinitrotoluene	121-14-2	ug/kg	330	1,600	5,500	120,000	1,200,000	--	--	1,600	NO	48	125	48	125	30
SW 8270C or D	2,6-Dinitrotoluene	606-20-2	ug/kg	330	61,000	620,000	61,000	620,000	--	--	61,000	NO	48	125	48	125	30
SW 8270C or D	2-Chloronaphthalene	91-58-7	ug/kg	330	6,300,000	82,000,000	6,300,000	82,000,000	--	--	6,300,000	NO	45	125	45	125	30
SW 8270C or D	2-Chlorophenol	95-57-8	ug/kg	330	390,000	5,100,000	390,000	5,100,000	--	--	390,000	NO	44	125	44	125	30
SW 8270C or D	2-Methylnaphthalene	91-57-6	ug/kg	330	230,000	2,200,000	310,000	4,100,000	--	--	230,000	NO	47	125	47	125	30
SW 8270C or D	2-Methylphenol (o-Cresol)	95-48-7	ug/kg	330	3,100,000	31,000,000	3,100,000	31,000,000	--	--	3,100,000	NO	40	125	40	125	30
SW 8270C or D	2-Nitroaniline	88-74-4	ug/kg	700	610,000	6,000,000	--	--	--	--	610,000	NO	44	125	44	125	30
SW 8270C or D	2-Nitrophenol	88-75-5	ug/kg	700	--	--	--	--	--	--	--	NO	42	125	42	125	30
SW 8270C or D	3,3'-Dichlorobenzidine	91-94-1	ug/kg	1,300	1,100	3,800	1,100	3,800	--	--	1,100	YES	25	128	25	128	30
SW 8270C or D	3-Nitroaniline	99-09-2	ug/kg	700	--	--	18,000	82,000	--	--	18,000	NO	27	125	27	125	30
SW 8270C or D	4,6-Dinitro-2-methylphenol	534-52-1	ug/kg	1600	4,900	49,000	6,100	62,000	--	--	4,900	NO	29	137	29	137	30
SW 8270C or D	4-Bromophenyl phenyl ether	101-55-3	ug/kg	330	--	--	--	--	--	--	--	NO	46	125	46	125	30
SW 8270C or D	4-Chloro-3-methylphenol	59-50-7	ug/kg	600	6,100,000	62,000,000	--	--	--	--	6,100,000	NO	46	125	46	125	30
SW 8270C or D	4-Chloroaniline	106-47-8	ug/kg	700	2,400	8,600	9,000	32,000	--	--	2,400	NO	10	125	10	125	30
SW 8270C or D	4-Chlorophenyl phenyl ether	7005-72-3	ug/kg	330	--	--	--	--	--	--	--	NO	47	125	47	125	30
SW 8270C or D	4-Methylphenol (p-Cresol)	106-44-5	ug/kg	330	6,100,000	62,000,000	310,000	3,100,000	--	--	310,000	NO	41	125	41	125	30
SW 8270C or D	4-Nitroaniline	100-01-6	ug/kg	700	24,000	86,000	23,000	82,000	--	--	23,000	NO	34	125	34	125	30
SW 8270C or D	4-Nitrophenol	100-02-7	ug/kg	700	--	--	--	--	--	--	--	NO	25	138	25	138	30
SW 8270C or D	Acenaphthene	83-32-9	ug/kg	330	3,400,000	33,000,000	3,400,000	33,000,000	--	--	3,400,000	NO	46	125	46	125	30
SW 8270C or D	Acenaphthylene	208-96-8	ug/kg	330	--	--	--	--	--	--	--	NO	44	125	44	125	30
SW 8270C or D	Anthracene	120-12-7	ug/kg	330	17,000,000	170,000,000	17,000,000	170,000,000	--	--	17,000,000	NO	53	125	53	125	30
SW 8270C or D	Benzo (a) anthracene	56-55-3	ug/kg	330	150	2,100	150	2,100	--	--	150	YES	52	125	52	125	30
SW 8270C or D	Benzo (a) pyrene	50-32-8	ug/kg	330	15	210	15	210	38	130	15	YES	50	125	50	125	30
SW 8270C or D	Benzo (b) fluoranthene	205-99-2	ug/kg	330	150	2,100	150	2,100	--	--	150	YES	45	125	45	125	30
SW 8270C or D	Benzo (g,h,i) perylene	191-24-2	ug/kg	330	--	--	--	--	--	--	--	NO	38	126	38	126	30
SW 8270C or D	Benzo (k) fluoranthene	207-08-9	ug/kg	330	1,500	21,000	1,500	21,000	--	--	1,500	NO	45	125	45	125	30
SW 8270C or D	Benzoic acid	65-85-0	ug/kg	5,000	240,000,000	2,500,000,000	240,000,000	2,500,000,000	--	--	240,000,000	NO	25	125	25	125	30
SW 8270C or D	Benzyl alcohol	100-51-6	ug/kg	330	6,100,000	62,000,000	31,000,000	310,000,000	--	--	6,100,000	NO	25	125	25	125	30
SW 8270C or D	bis (2-chloroethoxy) methane	111-91-1	ug/kg	330	180,000	1,800,000	180,000	1,800,000	--	--	180,000	NO	43	125	43	125	30
SW 8270C or D	bis (2-chloroethyl) ether	111-44-4	ug/kg	330	210	1,000	190	900	--	--	190	YES	38	125	38	125	30
SW 8270C or D	bis (2-chloroisopropyl) ether	108-60-1	ug/kg	330	4,600	22,000	3,500	17,000	--	--	3,500	NO	25	125	25	125	30
SW 8270C or D	bis (2-ethylhexyl) phthalate	117-81-7	ug/kg	330	35,000	120,000	35,000	120,000	--	--	35,000	NO	47	127	47	127	30
SW 8270C or D	Butyl benzylphthalate	85-68-7	ug/kg	1000	260,000	910,000	260,000	910,000	--	--	260,000	NO	49	125	49	125	30
SW 8270C or D	Chrysene	218-01-9	ug/kg	330	15,000	210,000	15,000	210,000	--	--	15,000	NO	53	125	53	125	30
SW 8270C or D	Dibenzo (a,h) anthracene	53-70-3	ug/kg	330	15	210	15	210	--	--	15	YES	41	125	41	125	30
SW 8270C or D	Dibenzofuran	132-64-9	ug/kg	330	78,000	1,000,000	--	--	--	--	78,000	NO	51	125	51	125	30
SW 8270C or D	Diethyl phthalate	84-66-2	ug/kg	330	49,000,000	490,000,000	49,000,000	490,000,000	--	--	49,000,000	NO	50	125	50	125	30
SW 8270C or D	Dimethyl phthalate	131-11-3	ug/kg	330	--	--	--	--	--	--	--	NO	49	125	49	125	30
SW 8270C or D	Di-n-butylphthalate	84-74-2	ug/kg	330	6,100,000	62,000,000	6,100,000	62,000,000	--	--	6,100,000	NO	56	125	56	125	30
SW 8270C or D	Di-n-octylphthalate	117-84-0	ug/kg	1000	--	--	--	--	--	--	--	NO	41	132	41	132	30
SW 8270C or D	Fluoranthene	206-44-0	ug/kg	330	2,300,000	22,000,000	2,300,000	22,000,000	--	--	2,300,000	NO	54	125	54	125	30
SW 8270C or D	Fluorene	86-73-7	ug/kg	330	2,300,000	22,000,000	2,300,000	22,000,000	--	--	2,300,000	NO	49	125	49	125	30
SW 8270C or D	Hexachlorobenzene	118-74-1	ug/kg	330	300	1,100	300	1,100	--	--	300	YES	47	125	47	125	30
SW 8270C or D	Hexachlorobutadiene	87-68-3	ug/kg	330	6,200	22,000	6,200	22,000	--	--	6,200	NO	40	125	40	125	30
SW 8270C or D	Hexachloroethane	67-72-1	ug/kg	330	12,000	43,000	35,000	120,000	--	--	12,000	NO	34	125	34	125	30

Table A-1
Reporting Limits, Accuracy, and Precession Limits for Soil
PG&E Program Quality Assurance Project Plan

Method	Constituent	CAS	Units	QAPP RL	EPA Regional Screening Levels - May 2012		EPA Regional Screening Levels - 2008		DTSC CHHSL		Most Stringent Screening Level[1]	Does RL Exceed Screening Level?	LCS Accuracy Control Limits (%R)		MS/MSD Accuracy Control Limits (%R)		Precision Soil
					Residential	Commercial	Residential	Commercial	Residential	Commercial			Lower Limit	Upper Limit	Lower Limit	Upper Limit	% RPD
SW 8270C or D	Indeno (1,2,3-c,d) pyrene	193-39-5	ug/kg	330	150	2,100	150	2,100	--	--	150	YES	38	125	38	125	30
SW 8270C or D	Isophorone	78-59-1	ug/kg	330	510,000	1,800,000	510,000	1,800,000	--	--	510,000	NO	43	125	43	125	30
SW 8270C or D	Naphthalene	91-20-3	ug/kg	330	3,600	18,000	3,900	20,000	--	--	3,600	NO	40	125	40	125	30
SW 8270C or D	Nitrobenzene	98-95-3	ug/kg	330	4,800	24,000	31,000	280,000	--	--	4,800	NO	41	125	41	125	30
SW 8270C or D	n-Nitrosodi-n-propylamine	621-64-7	ug/kg	330	69	250	69	250	--	--	69	YES	40	125	40	125	30
SW 8270C or D	n-Nitrosodiphenylamine	86-30-6	ug/kg	330	99,000	350,000	99,000	350,000	--	--	99,000	NO	49	125	49	125	30
SW 8270C or D	Pentachlorophenol	87-86-5	ug/kg	700	890	2,700	3,000	9,000	4,400	13,000	0,890	NO	25	125	25	125	30
SW 8270C or D	Phenanthrene	85-01-8	ug/kg	330	--	--	--	--	--	--	--	NO	50	125	50	125	30
SW 8270C or D	Phenol	108-95-2	ug/kg	330	18,000,000	180,000,000	18,000,000	180,000,000	--	--	18,000,000	NO	39	125	39	125	30
SW 8270C or D	Pyrene	129-00-0	ug/kg	330	1,700,000	17,000,000	1,700,000	17,000,000	--	--	1,700,000	NO	46	125	46	125	30
SW 8270SIM	1-methylnaphthalene	90-12-0	ug/kg	5	16,000	53,000	22,000	99,000	--	--	16,000	NO	30	111	30	111	30
SW 8270SIM	2-methylnaphthalene	91-57-6	ug/kg	5	230,000	2,200,000	310,000	4,100,000	--	--	230,000	NO	30	111	30	111	30
SW 8270SIM	Acenaphthene	83-32-9	ug/kg	5	3,400,000	33,000,000	3,400,000	33,000,000	--	--	3,400,000	NO	28	110	28	110	30
SW 8270SIM	Acenaphthylene	208-96-8	ug/kg	5	--	--	--	--	--	--	--	NO	23	126	23	126	30
SW 8270SIM	Anthracene	120-12-7	ug/kg	5	17,000,000	170,000,000	17,000,000	170,000,000	--	--	17,000,000	NO	28	136	28	136	30
SW 8270SIM	Benzo (a) anthracene	56-55-3	ug/kg	5	150	2,100	150	2,100	--	--	150	NO	31	146	31	146	30
SW 8270SIM	Benzo (a) pyrene	50-32-8	ug/kg	5	15	210	15	210	38	130	15	NO	28	128	28	128	30
SW 8270SIM	Benzo (b) fluoranthene	205-99-2	ug/kg	5	150	2,100	150	2,100	--	--	150	NO	30	139	30	139	30
SW 8270SIM	Benzo (g,h,i) perylene	191-24-2	ug/kg	5	--	--	--	--	--	--	--	NO	21	149	21	149	30
SW 8270SIM	Benzo (k) fluoranthene	207-08-9	ug/kg	5	1,500	21,000	1,500	21,000	--	--	1,500	NO	42	129	42	129	30
SW 8270SIM	Chrysene	218-01-9	ug/kg	5	15,000	210,000	15,000	210,000	--	--	15,000	NO	39	134	39	134	30
SW 8270SIM	Dibenzo (a,h) anthracene	53-70-3	ug/kg	5	15	210	15	210	--	--	15	NO	30	138	30	138	30
SW 8270SIM	Fluoranthene	206-44-0	ug/kg	5	2,300,000	22,000,000	2,300,000	22,000,000	--	--	2,300,000	NO	30	142	30	142	30
SW 8270SIM	Fluorene	86-73-7	ug/kg	5	2,300,000	22,000,000	2,300,000	22,000,000	--	--	2,300,000	NO	27	116	27	116	30
SW 8270SIM	Indeno (1,2,3-c,d) pyrene	193-39-5	ug/kg	5	150	2,100	150	2,100	--	--	150	NO	17	164	17	164	30
SW 8270SIM	Naphthalene	91-20-3	ug/kg	5	3,600	18,000	3,900	20,000	--	--	3,600	NO	29	106	29	106	30
SW 8270SIM	Phenanthrene	85-01-8	ug/kg	5	--	--	--	--	--	--	--	NO	32	127	32	127	30
SW 8270SIM	Pyrene	129-00-0	ug/kg	5	1,700,000	17,000,000	1,700,000	17,000,000	--	--	1,700,000	NO	28	130	28	130	30

Notes:

Please keep in mind, Screening Levels are constantly revised by the EPA. The appropriate Screening levels are specific to the project, the location, the agency providing oversight, and the overall Goals of the project.

mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram
µmhos/cm = micromhos per centimeter

All soil results (with the exception of Waste characterization) must be reported as dry weight
SW 7199 soil analysis must be accompanied by a SW 3060A extraction
PCB - LCS, MS, and MSD only require Aroclor-1016 and Aroclor-1260 spikes

[1] For soil, most stringent of:
EPA Regional Screening Levels - 2008 and May 2012
CHHSL = California Human Health Screening Levels, January 2005
DTSC = California Department of Toxic Substance Control, January 2005

Table A-2

Reporting Limits, Accuracy, and Precession Limits for Groundwate

PG&E Program Quality Assurance Project Plan

Method	Constituent	CAS	Units	QAPP RL	EPA Regional Screening Levels May 2012	EPA Regional Screening Levels 2008	Federal Drinking Water Standards MCLs	California Drinking Water Standards MCLs	Most Stringent Screening Level[1]	Does RL Exceed Screening Level?	LCS Accuracy Control Limits (%R) Lower Limit	LCS Accuracy Control Limits (%R) Upper Limit	MS/MSD Accuracy Control Limits (%R) Lower Limit	MS/MSD Accuracy Control Limits (%R) Upper Limit	Precision Water % RPD
EPA 300.0M	Acetate	64-19-7	mg/L	0.1	--	--	--	--	--	NO	75	125	75	125	20
SM 2320 B	Alkalinity	Alkalinity	mg/L	5	--	--	--	--	--	NO	85	115	75	125	20
SM 4500-NH3 B, C, D, E, or G	Ammonia (as N)	7664-41-7	mg/L	0.5	--	--	--	--	--	NO	85	115	75	125	20
SM 2320 B	Bicarbonate	Bicarbonate	mg/L	5	--	--	--	--	--	NO	85	115	75	125	20
SM 5210 B	BOD	BOD	mg/L	--	--	--	--	--	--	NO	--	--	--	--	10
EPA 300.0	Bromide	Bromide	mg/L	0.5	--	--	--	--	--	NO	90	110	80	120	20
EPA 300.0M	Butyrate	107-92-6	mg/L	0.1	--	--	--	--	--	NO	75	125	75	125	20
SM 4500-CO_2	Carbon dioxide	124-38-9	mg/L	5	--	--	--	--	--	NO	--	--	--	--	20
SM 2320 B	Carbonate	Carbonate	mg/L	5	--	--	--	--	--	NO	85	115	75	125	20
EPA 300.0/SM 4500-Cl B, C, E, or D	Chloride	Chloride	mg/L	0.5	--	--	--	--	--	NO	90	110	80	120	20
SM 2120 E	Color	Color	Color unit	1	--	--	--	--	--	NO	90	110	90	110	20
SM 4500-CN	Cyanide	57-12-5	mg/L	0.01							85	115	75	125	20
EPA 300.0/SM 4500-F B, C, D, or E	Fluoride	Fluoride	mg/L	0.5	--	2.2	4	--	2.2	NO	90	110	80	120	20
SM 2340 B or C	Hardness	Hardness	mg/L	2	--	--	--	--	--	NO	75	125	75	125	20
SM 2320 B	Hydroxide alkalinity	Hydroxide	mg/L	5	--	--	--	--	--	NO	85	115	75	125	20
EPA 300.0M	Lactate	50-21-5	mg/L	0.1	--	--	--	--	--	NO	75	125	75	125	20
EPA 300.0	Nitrate (as N)	14797-55-8	mg/L	0.5	25	58	10	--	10	NO	90	110	80	120	20
EPA 353.2/SM 4500-NO_3 E, F or H	Nitrate/nitrite (as N)	NO3NO2N	mg/L	0.5	--	--	--	--	--	NO	85	115	75	125	20
EPA 300.0/SM 4500-NO2 B, F or E	Nitrite (as N)	14797-65-8	mg/L	0.5	--	3.7	1	--	1	NO	90	110	80	120	20
SM 5310 B, C, or D	Organic carbon	DOC/TOC	mg/L	0.3	--	--	--	--	--	NO	85	115	75	125	10
EPA 300.0/SM 4500-P E or F	Ortho phosphate	Ortho Phosphate	mg/L	0.02	--	--	--	--	--	NO	90	110	80	120	20
EPA 314.0	Perchlorate	Perchlorate	µg/L	4	--	26	--	--	26	NO	85	115	85	115	20
SM 4500-H+ B SW 9040	pH	pH	pH units	0.1	--	--	--	--	--	NO	--	--	--	--	20
EPA 300.0M	Propionate	79-09-4	mg/L	0.1	--	--	--	--	--	NO	75	125	75	125	20
EPA 300.0M	Pyruvate	127-17-3	mg/L	0.1	--	--	--	--	--	NO	75	125	75	125	20
SM 4500-SiO_2 E	Reactive silica	7631-86-9	mg/L	1	--	--	--	--	--	NO	75	125	75	125	20
SM 4500-SiO_2 C	Silica	7631-86-9	mg/L	0.04	--	--	--	--	--	NO	75	125	75	125	20
SILICA_CALC	Soluble silica	7631-86-9	mg/L	0.04	--	--	--	--	--	NO	75	125	75	125	20
EPA 120.1/SW 9050	Specific conductance	Conductance	µmhos/cm	2	--	--	--	--	--	NO	85	115	75	125	20
EPA 300.0/SM 4110 B	Sulfate	Sulfate	mg/L	0.5	--	--	--	--	--	NO	90	110	80	120	20
SM 4500-S^{-2} F, E, D, or G	Sulfide	Sulfide	mg/L	0.05	--	--	--	--	--	NO	75	125	75	125	20
SM 2540 C	Total dissolved solids	TDS	mg/L	10	--	--	--	--	--	NO	75	125	--	--	10
SM 4500-N_{org} B or C	Total kjeldahl nitrogen	7727-37-9	mg/L	--	--	--	--	--	--	NO	75	125	75	125	20
EPA 365.1/EPA 365.3 SM 4500-P E or F	Total phosphorous	Total Phosphorous	mg/L	0.02	--	--	--	--	--	NO	75	125	75	125	20
SM 2540 D	Total suspended solids	TSS	mg/L	4	--	--	--	--	--	NO	75	125	75	125	10
EPA 180.1/SM 2130 B	Turbidity	TURB	NTU	0.1	--	--	--	--	--	NO	--	--	--	--	20
SW 6020A/EPA 200.8	Aluminum	7429-90-5	ug/L	50	16,000	37,000	50*	1,000	50	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Antimony	7440-36-0	ug/L	2	6	15	6	--	6	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Arsenic	7440-38-2	ug/L	0.5 (0.1)	0.045	0.045	10	--	0.045	YES	85	115	75	125	20
SW 6020A/EPA 200.8	Barium	7440-39-3	ug/L	2	2,900	7,300	2,000	1,000	1,000	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Beryllium	7440-41-7	ug/L	0.5	16	73	4	--	4	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Boron	7440-42-8	ug/L	50	?	?	?	?	?	?	85	115	75	125	20
SW 6020A/EPA 200.8	Cadmium	7440-43-9	ug/L	1	--	18	5	--	5	NO	85	115	75	125	20
SW 6010B/EPA 200.7	Calcium	7440-70-2	ug/L	100	--	--	--	--	--	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Chromium	7440-47-3	ug/L	1	--	--	100	50	50	NO	85	115	75	125	20
EPA 218.6	Chromium, Hexavalent	18540-29-9	ug/L	0.2	0.031	110	100	--	0.031	YES	90	110	90	110	20
EPA 218.6 LL	Chromium, Hexavalent, LL	18540-29-9	ug/L	0.06	0.031	110	100	--	0.031	YES	90	110	90	110	20
SM 3500-Cr	Chromium, Hexavalent	18540-29-9	ug/L	10	0.031	110	100	--	0.031	YES	85	115	80	120	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Cobalt	7440-48-4	ug/L	5	4.7	11	--	--	4.7	YES	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Copper	7440-50-8	ug/L	1	620	1,500	1,000*	--	620	NO	85	115	75	125	20
SW 6010B or C/EPA 200.7	Iron	7439-89-6	ug/L	20	11,000	26,000	300*	--	300	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Lead	7439-92-1	ug/L	1	--	--	15	--	15	NO	85	115	75	125	20
SW 6010B or C/EPA 200.7	Magnesium	7439-95-4	ug/L	100	--	--	--	--	--	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Manganese	7439-96-5	ug/L	0.5	--	880	50*	--	50	NO	85	115	75	125	20
SW 7070A/EPA 245.1/ EPA 6020A?	Mercury	7439-97-6	ug/L	0.2	0.63	0.63	2	--	0.63	NO	75	125	75	125	20
SW 6020A/EPA 200.8	Molybdenum	7439-98-7	ug/L	2	78	180	--	--	78	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Nickel	7440-02-0	ug/L	2	300	730	100*	100	100	NO	85	115	75	125	20
SW 6010B or C/EPA 200.7	Potassium	7440-09-7	ug/L	100	--	--	--	--	--	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Selenium	7782-49-2	ug/L	10	78	180	50	--	50	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Silver	7440-22-4	ug/L	5	71	180	--	--	71	NO	85	115	75	125	20
SW 6010B or C/EPA 200.7	Sodium	7440-23-5	ug/L	100	--	--	--	--	--	NO	85	115	75	125	20
EPA 200.7/EPA 200.8	Strontium	7440-24-6	ug/L	50	9,300	22,000	--	--	9,300	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Thallium	7440-28-0	ug/L	1	0.16	2.4	2	--	0.16	YES	85	115	75	125	20
SW 6020A/EPA 200.8	Uranium	7440-61-1	ug/L	5	230	--	30	--	30	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Vanadium	7440-62-2	ug/L	5	--	2.6	--	--	2.6	YES	85	115	75	125	20

Table A-2
Reporting Limits, Accuracy, and Precession Limits for Groundwate
PG&E Program Quality Assurance Project Plan

Method	Constituent	CAS	Units	QAPP RL	EPA Regional Screening Levels May 2012	EPA Regional Screening Levels 2008	Federal Drinking Water Standards MCLs	California Drinking Water Standards MCLs	Most Stringent Screening Level[1]	Does RL Exceed Screening Level?	LCS Accuracy Control Limits (%R) Lower Limit	LCS Accuracy Control Limits (%R) Upper Limit	MS/MSD Accuracy Control Limits (%R) Lower Limit	MS/MSD Accuracy Control Limits (%R) Upper Limit	Precision Water % RPD
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Zinc	7440-66-6	ug/L	20	4,700	11,000	5,000*	--	4,700	NO	85	115	75	125	20
SW 8015B or C or D	Motor Oil	TPH-motor oil	mg/L	1	--	--	--	--	--	NO	50	150	50	150	30
SW 8015B or C or D	TPH-Diesel	TPH-diesel	mg/L	0.5	--	--	--	--	--	NO	61	143	61	143	30
SW 8015B or C or D	TPH-Gasoline	TPH-gasoline	mg/L	0.1	--	--	--	--	--	NO	67	136	67	136	30
SW 8081A or B	4,4'-DDD	72-54-8	ug/L	0.1	0.28	0.28	--	--	0.28	NO	50	139	50	139	30
SW 8081A or B	4,4'-DDE	72-55-9	ug/L	0.1	0.2	0.2	--	--	0.2	NO	48	137	48	137	30
SW 8081A or B	4,4'-DDT	50-29-3	ug/L	0.1	0.2	0.2	--	--	0.2	NO	47	138	47	138	30
SW 8081A or B	Aldrin	309-00-2	ug/L	0.1	0.00021	0.004	--	--	0.00021	YES	42	138	42	138	30
SW 8081A or B	alpha-HCH	319-84-6	ug/L	0.1	0.0062	0.011	--	--	0.0062	YES	60	128	60	128	30
SW 8081A or B	alpha-Chlordane	5103-71-9	ug/L	0.1	--	--	2	--	2	NO	63	123	63	123	30
SW 8081A or B	beta-HCH	319-85-7	ug/L	0.1	0.022	0.037	--	--	0.022	YES	66	126	66	126	30
SW 8081A or B	delta-HCH	319-86-8	ug/L	0.1	--	--	--	--	--	NO	46	136	46	136	30
SW 8081A or B	Dieldrin	60-57-1	ug/L	0.1	0.0015	0.0042	--	--	0.0015	YES	62	129	62	129	30
SW 8081A or B	Endosulfan I	959-98-8	ug/L	0.1	--	--	--	--	--	NO	49	120	49	120	30
SW 8081A or B	Endosulfan II	33213-65-9	ug/L	0.1	--	--	--	--	--	NO	42	130	42	130	30
SW 8081A or B	Endosulfan sulfate	1031-07-8	ug/L	0.1	--	--	--	--	--	NO	54	137	54	137	30
SW 8081A or B	Endrin	72-20-8	ug/L	0.1	1.7	11	2	--	1.7	NO	56	134	56	134	30
SW 8081A or B	Endrin aldehyde	7421-93-4	ug/L	0.1	--	--	--	--	--	NO	56	137	56	137	30
SW 8081A or B	gamma-HCH (lindane)	58-89-9	ug/L	0.1	0.036	0.061	0.2	--	0.036	YES	30	146	30	146	30
SW 8081A or B	gamma-Chlordane	5103-74-2	ug/L	0.1	--	--	2	--	2	NO	67	120	67	120	30
SW 8081A or B	Heptachlor	76-44-8	ug/L	0.1	0.0018	0.015	0.4	--	0.0018	YES	51	128	51	128	30
SW 8081A or B	Heptachlor Epoxide	1024-57-3	ug/L	0.1	0.0033	0.0074	0.2	--	0.0033	YES	62	131	62	131	30
SW 8081A or B	Methoxychlor	72-43-5	ug/L	0.5	27	180	40	--	27	NO	56	150	56	150	30
SW 8081A or B	Toxaphene	8001-35-2	ug/L	1	0.013	0.061	3	--	0.013	YES	41	126	41	126	30
SW 8082 or A	Aroclor-1016	12674-11-2	ug/L	0.5	0.96	0.96	0.5	--	0.5	NO	40	144	40	144	30
SW 8082 or A	Aroclor-1221	11104-28-2	ug/L	0.5	0.0043	0.0068	0.5	--	0.0043	YES	41	136	41	136	30
SW 8082 or A	Aroclor-1232	11141-16-5	ug/L	0.5	0.0043	0.0068	0.5	--	0.0043	YES	41	136	41	136	30
SW 8082 or A	Aroclor-1242	53469-21-9	ug/L	0.5	0.034	0.034	0.5	--	0.034	YES	39	150	39	150	30
SW 8082 or A	Aroclor-1248	12672-29-6	ug/L	0.5	0.034	0.034	0.5	--	0.034	YES	41	136	41	136	30
SW 8082 or A	Aroclor-1254	11097-69-1	ug/L	0.5	0.034	0.034	0.5	--	0.034	YES	29	141	29	141	30
SW 8082 or A	Aroclor-1260	11096-82-5	ug/L	0.5	0.034	0.034	0.5	--	0.034	YES	45	145	45	145	30
SW 8151A	2,4-D	94-75-7	ug/L	10	130	370	70	--	70	NO	39	120	39	120	30
SW 8151A	2,4-DB	94-82-6	ug/L	20	91	290	--	--	91	NO	44	120	44	120	30
SW 8151A	2,4,5-T	93-76-5	ug/L	20	120	370	--	--	120	NO	44	122	44	122	30
SW 8151A	2,4,5-TP	93-72-1	ug/L	10	84	290	--	--	84	NO	49	126	49	126	30
SW 8151A	Dalapon	75-99-0	ug/L	30	470	1,100	200	--	200	NO	40	120	40	120	30
SW 8151A	Dicamba	1918-00-9	ug/L	30	440	1,100	--	--	440	NO	60	120	60	120	30
SW 8151A	Dichloroprop	120-36-5	ug/L	20	--	--	--	--	--	NO	68	122	68	122	30
SW 8151A	Dinoseb	88-85-7	ug/L	3	11	37	7	--	7	NO	28	115	28	115	30
SW 8151A	MCPA	94-74-6	ug/L	100	5.7	18	--	--	5.7	YES	62	144	62	144	30
SW 8151A	MCPP	7085-19-0	ug/L	100	--	37	--	--	37	YES	60	133	60	133	30
SW 8260B or C	1,1,1,2-Tetrachloroethane	630-20-6	ug/L	0.5	0.5	0.52	--	--	0.5	NO	81	129	81	129	20
SW 8260B or C	1,1,1-Trichloroethane (TCA)	71-55-6	ug/L	1	7,500	9,100	200	200	200	NO	67	132	67	132	20
SW 8260B or C	1,1,2,2-Tetrachloroethane	79-34-5	ug/L	0.5	0.066	0.067	--	1	0.066	YES	63	128	63	128	20
SW 8260B or C	1,1,2-Trichloroethane	79-00-5	ug/L	1	0.24	0.24	5	5	0.24	YES	75	125	75	125	20
SW 8260B or C	1,1,2-Trichlorotrifluoroethane (Freon 113)	76-13-1	ug/L	1	53,000	59,000	--	1,200	1,200	NO	75	125	75	125	20
SW 8260B or C	1,1-Dichloroethane	75-34-3	ug/L	1	2.4	2.4	--	5	2.4	NO	69	133	69	133	20
SW 8260B or C	1,1-Dichloroethene	75-35-4	ug/L	1	260	340	7	6	6	NO	68	130	68	130	20
SW 8260B or C	1,1-Dichloropropene	563-58-6	ug/L	1	--	--	--	--	--	NO	73	132	73	132	20
SW 8260B or C	1,2,3-Trichlorobenzene	87-61-6	ug/L	1	5.2	--	--	--	5.2	NO	67	137	67	137	20
SW 8260B or C	1,2,3-Trichloropropane	96-18-4	ug/L	1	0.00065	0.0096	--	--	0.00065	YES	73	124	73	124	20
SW 8260B or C	1,2,4-Trichlorobenzene	120-82-1	ug/L	1	0.99	8.2	70	5	0.99	YES	66	134	66	134	20
SW 8260B or C	1,2,4-Trimethylbenzene	95-63-6	ug/L	1	15	15	--	--	15	NO	74	132	74	132	20
SW 8260B or C	1,2-Dibromo-3-Chloropropane	96-12-8	ug/L	2	0.00032	0.00032	0.2	--	0.00032	YES	50	132	50	132	20
SW 8260B or C	1,2-Dibromoethane (EDB)	106-93-4	ug/L	1	0.0065	0.0065	0.05	--	0.0065	YES	80	121	80	121	20
SW 8260B or C	1,2-Dichlorobenzene	95-50-1	ug/L	1	280	370	600	600	280	NO	71	122	71	122	20
SW 8260B or C	1,2-Dichloroethane (EDC)	107-06-2	ug/L	0.5	0.15	0.15	5	0.5	0.15	YES	69	132	69	132	20
SW 8260B or C	1,2-Dichloropropane	78-87-5	ug/L	1	0.38	0.39	5	5	0.38	YES	75	125	75	125	20
SW 8260B or C	1,3,5-Trimethylbenzene	108-67-8	ug/L	1	87	12	--	--	12	NO	74	131	74	131	20
SW 8260B or C	1,3-Dichlorobenzene	541-73-1	ug/L	1	--	--	--	--	--	NO	75	124	75	124	20
SW 8260B or C	1,3-Dichloropropane	142-28-9	ug/L	1	290	730	--	--	290	NO	73	126	73	126	20
SW 8260B or C	1,4-Dichlorobenzene	106-46-7	ug/L	0.5	0.42	0.43	75	5	0.42	YES	74	123	74	123	20
SW 8260B or C	2,2-Dichloropropane	594-20-7	ug/L	1	--	--	--	--	--	NO	69	137	69	137	20
SW 8260B or C	2-Butanone (MEK)	78-93-3	ug/L	10	4,900	7,100	--	--	4,900	NO	49	136	49	136	20
SW 8260B or C	2-Chlorotoluene	95-49-8	ug/L	1	180	730	--	--	180	NO	73	126	73	126	20
SW 8260B or C	4-Chlorotoluene	106-43-4	ug/L	1	190	2,600	--	--	190	NO	74	128	74	128	20

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PG&E Program Quality Assurance Project Plan

Method	Constituent	CAS	Units	QAPP RL	EPA Regional Screening Levels May 2012	EPA Regional Screening Levels 2008	Federal Drinking Water Standards MCLs	California Drinking Water Standards MCLs	Most Stringent Screening Level[1]	Does RL Exceed Screening Level?	LCS Accuracy Control Limits (%R) Lower Limit	LCS Accuracy Control Limits (%R) Upper Limit	MS/MSD Accuracy Control Limits (%R) Lower Limit	MS/MSD Accuracy Control Limits (%R) Upper Limit	Precision Water % RPD
SW 8260B or C	4-Isopropyltoluene	99-87-6	ug/L	1	--	--	--	--	--	NO	73	130	73	130	20
SW 8260B or C	4-Methyl-2-Pentanone	108-10-1	ug/L	10	1,000	2,000	--	--	1,000	NO	58	134	58	134	20
SW 8260B or C	Acetone	67-64-1	ug/L	10	12,000	22,000	--	--	12,000	NO	40	135	40	135	20
SW 8260B or C	Acrolein	107-02-8	ug/L	20	0.041	0.042	--	--	0.041	YES	75	125	75	125	20
SW 8260B or C	Acrylonitrile	107-13-1	ug/L	20	0.045	0.045	--	--	0.045	YES	75	125	75	125	20
SW 8260B or C	Benzene	71-43-2	ug/L	0.4	0.39	0.41	5	1	0.39	YES	81	122	81	122	20
SW 8260B or C	Bromobenzene	108-86-1	ug/L	1	54	20	--	--	20	NO	76	124	76	124	20
SW 8260B or C	Bromochloromethane	74-97-5	ug/L	1	83	--	--	--	83	NO	65	129	65	129	20
SW 8260B or C	Bromodichloromethane	75-27-4	ug/L	0.5	0.12	1.1	100	--	0.12	YES	76	121	76	121	20
SW 8260B or C	Bromoform	75-25-2	ug/L	1	7.9	8.5	100	--	7.9	NO	69	128	69	128	20
SW 8260B or C	Bromomethane	74-83-9	ug/L	3	7	8.7	--	--	7	NO	53	141	53	141	20
SW 8260B or C	Carbon Disulfide	75-15-0	ug/L	1	720	1,000	--	--	720	NO	75	125	75	125	20
SW 8260B or C	Carbon Tetrachloride	56-23-5	ug/L	1	0.39	0.2	5	0.5	0.2	YES	66	138	66	138	20
SW 8260B or C	Chlorobenzene	108-90-7	ug/L	0.5	72	91	100	--	72	NO	81	122	81	122	20
SW 8260B or C	Chloroethane	75-00-3	ug/L	1	21,000	21,000	--	--	21,000	NO	58	133	58	133	20
SW 8260B or C	Chloroform	67-66-3	ug/L	1	0.19	0.19	100	--	0.19	YES	69	128	69	128	20
SW 8260B or C	Chloromethane	74-87-3	ug/L	1	190	1.8	--	--	1.8	NO	56	131	56	131	20
SW 8260B or C	cis-1,2-Dichloroethene	156-59-2	ug/L	1	28	370	70	6	6	NO	72	126	72	126	20
SW 8260B or C	cis-1,3-Dichloropropene	10061-01-5	ug/L	0.5	--	--	--	--	--	NO	69	131	69	131	20
SW 8260B or C	Dibromochloromethane	124-48-1	ug/L	0.5	0.15	0.8	100	--	0.15	YES	66	133	66	133	20
SW 8260B or C	Dibromomethane	74-95-3	ug/L	1	7.9	370	--	--	7.9	NO	76	125	76	125	20
SW 8260B or C	Dichlorodifluoromethane (Freon 12)	75-71-8	ug/L	1	190	390	--	--	190	NO	53	153	53	153	20
SW 8260B or C	Ethylbenzene	100-41-4	ug/L	1	1.3	1.5	700	--	1.3	NO	73	127	73	127	20
SW 8260B or C	Hexachlorobutadiene	87-68-3	ug/L	0.6	0.26	0.86	--	--	0.26	YES	67	131	67	131	20
SW 8260B or C	Isopropylbenzene (Cumene)	98-82-8	ug/L	1	390	680	--	--	390	NO	75	127	75	127	20
SW 8260B or C	Methylene chloride	75-09-2	ug/L	1	9.9	4.8	5	5	4.8	NO	63	137	63	137	20
SW 8260B or C	Naphthalene	91-20-3	ug/L	1	0.14	0.14	--	--	0.14	YES	54	138	54	138	20
SW 8260B or C	n-Butylbenzene	104-51-8	ug/L	1	780	--	--	--	780	NO	69	137	69	137	20
SW 8260B or C	n-Propylbenzene	103-65-1	ug/L	1	530	--	--	--	530	NO	72	129	72	129	20
SW 8260B or C	sec-Butylbenzene	135-98-8	ug/L	1	--	--	--	--	--	NO	72	127	72	127	20
SW 8260B or C	Styrene	100-42-5	ug/L	1	1,100	1,600	100	100	100	NO	65	134	65	134	20
SW 8260B or C	tert-Butyl Methyl Ether (MTBE)	1634-04-4	ug/L	5	12	12	--	13	12	NO	65	123	65	123	20
SW 8260B or C	tert-Butylbenzene	98-06-6	ug/L	1	--	--	--	--	--	NO	70	129	70	129	20
SW 8260B or C	Tetrachloroethene	127-18-4	ug/L	1	9.7	0.11	5	5	0.11	YES	66	128	66	128	20
SW 8260B or C	Toluene	108-88-3	ug/L	1	860	2,300	1,000	150	150	NO	77	122	77	122	20
SW 8260B or C	trans-1,2-Dichloroethene	156-60-5	ug/L	1	86	110	100	10	10	NO	63	137	63	137	20
SW 8260B or C	trans-1,3-Dichloropropene	10061-02-6	ug/L	1	--	--	--	--	--	NO	59	135	59	135	20
SW 8260B or C	Trichloroethene	79-01-6	ug/L	1	0.44	1.7	5	5	0.44	YES	70	127	70	127	20
SW 8260B or C	Trichlorofluoromethane (Freon 11)	75-69-4	ug/L	1	1,100	1,300	--	150	150	NO	57	129	57	129	20
SW 8260B or C	Vinyl Chloride	75-01-4	ug/L	1	0.015	0.016	2	0.5	0.015	YES	50	134	50	134	20
SW 8260B or C	Xylenes, Total	1330-20-7	ug/L	2	190	200	10,000	1,750	190	NO	75	125	75	125	20
SW 8260B or C	m -Xylene	108-38-3	ug/L	2	190	1,400	--	--	190	NO	76	128	76	128	20
SW 8260B or C	o-Xylene	95-47-6	ug/L	1	190	1,400	--	--	190	NO	80	121	80	121	20
SW 8260B or C	p-Xylene	106-42-3	ug/L	1	190	1,500	--	--	190	NO	76	128	76	128	20
SW 8270C or D	1,2,4-Trichlorobenzene	120-82-1	ug/L	10	0.99	8.2	70	--	0.99	YES	37	120	37	120	20
SW 8270C or D	1,2-Dichlorobenzene	95-50-1	ug/L	10	280	370	600	--	280	NO	33	120	33	120	20
SW 8270C or D	1,3-Dichlorobenzene	541-73-1	ug/L	10	--	--	--	--	--	NO	32	120	32	120	20
SW 8270C or D	1,4-Dichlorobenzene	106-46-7	ug/L	10	0.42	0.43	75	--	0.42	YES	32	120	32	120	20
SW 8270C or D	2,4,5-Trichlorophenol	95-95-4	ug/L	50	890	3,700	--	--	890	NO	49	120	49	120	20
SW 8270C or D	2,4,6-Trichlorophenol	88-06-2	ug/L	10	3.5	6.1	--	--	3.5	YES	49	126	49	126	20
SW 8270C or D	2,4-Dichlorophenol	120-83-2	ug/L	10	35	110	--	--	35	NO	48	120	48	120	20
SW 8270C or D	2,4-Dimethylphenol	105-67-9	ug/L	10	270	730	--	--	270	NO	28	120	28	120	20
SW 8270C or D	2,4-Dinitrophenol	51-28-5	ug/L	10	30	73	--	--	30	NO	25	130	25	130	20
SW 8270C or D	2,4-Dinitrotoluene	121-14-2	ug/L	10	0.2	73	--	--	0.2	YES	51	120	51	120	20
SW 8270C or D	2,6-Dinitrotoluene	606-20-2	ug/L	10	15	37	--	--	15	NO	49	120	49	120	20
SW 8270C or D	2-Chloronaphthalene	91-58-7	ug/L	10	550	2,900	--	--	550	NO	49	120	49	120	20
SW 8270C or D	2-Chlorophenol	95-57-8	ug/L	10	71	180	--	--	71	NO	37	120	37	120	20
SW 8270C or D	2-Methylnaphthalene	91-57-6	ug/L	10	27	150	--	--	27	NO	46	120	46	120	20
SW 8270C or D	2-Methylphenol (o-Cresol)	95-48-7	ug/L	10	720	1,800	--	--	720	NO	38	120	38	120	20
SW 8270C or D	2-Nitroaniline	88-74-4	ug/L	50	150	--	--	--	150	NO	48	120	48	120	20
SW 8270C or D	2-Nitrophenol	88-75-5	ug/L	10	--	--	--	--	--	NO	39	123	39	123	20
SW 8270C or D	3,3'-Dichlorobenzidine	91-94-1	ug/L	20	0.11	0.15	--	--	0.11	YES	20	120	20	120	20
SW 8270C or D	3-Nitroaniline	99-09-2	ug/L	50	--	3.2	--	--	3.2	YES	20	126	20	126	20
SW 8270C or D	4,6-Dinitro-2-methylphenol	534-52-1	ug/L	50	1.2	3.7	--	--	1.2	YES	40	130	40	130	20
SW 8270C or D	4-Bromophenyl Phenyl Ether	101-55-3	ug/L	10	--	--	--	--	--	NO	52	120	52	120	20
SW 8270C or D	4-Chloro-3-methylphenol	59-50-7	ug/L	20	1,100	--	--	--	1,100	NO	47	120	47	120	20

Table A-2
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PG&E Program Quality Assurance Project Plan

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SW 8270C or D	4-Chloroaniline	106-47-8	ug/L	20	0.32	1.2	--	--	0.32	YES	20	120	20	120	20
SW 8270C or D	4-Chlorophenyl phenyl ether	7005-72-3	ug/L	10	--	--	--	--	--	NO	50	120	50	120	20
SW 8270C or D	4-Methylphenol (p-Cresol)	106-44-5	ug/L	50	1,400	180	--	--	180	NO	32	120	32	120	20
SW 8270C or D	4-Nitroaniline	100-01-6	ug/L	50	3.3	3.2	--	--	3.2	YES	36	120	36	120	20
SW 8270C or D	4-Nitrophenol	100-02-7	ug/L	50	--	--	--	--	--	NO	20	120	20	120	20
SW 8270C or D	Acenaphthene	83-32-9	ug/L	10	400	2,200	--	--	400	NO	47	120	47	120	20
SW 8270C or D	Acenaphthylene	208-96-8	ug/L	10	--	--	--	--	--	NO	50	120	50	120	20
SW 8270C or D	Anthracene	120-12-7	ug/L	10	1,300	11,000	--	--	1,300	NO	54	120	54	120	20
SW 8270C or D	Benzo (a) anthracene	56-55-3	ug/L	10	0.029	0.029	--	--	0.029	YES	56	100	56	100	20
SW 8270C or D	Benzo (a) pyrene	50-32-8	ug/L	10	0.0029	0.0029	0.2	--	0.0029	YES	53	120	53	120	20
SW 8270C or D	Benzo (b) fluoranthene	205-99-2	ug/L	10	0.029	0.029	--	--	0.029	YES	45	124	45	124	20
SW 8270C or D	Benzo (g,h,i) perylene	191-24-2	ug/L	10	--	--	--	--	--	NO	38	123	38	123	20
SW 8270C or D	Benzo (k) fluoranthene	207-08-9	ug/L	10	0.29	0.29	--	--	0.29	YES	45	124	45	124	20
SW 8270C or D	Benzoic acid	65-85-0	ug/L	100	58,000	150,000	--	--	58,000	NO	20	120	20	120	20
SW 8270C or D	Benzyl alcohol	100-51-6	ug/L	20	1,500	18,000	--	--	1,500	NO	30	120	30	120	20
SW 8270C or D	bis (2-chloroethoxy) methane	111-91-1	ug/L	10	47	110	--	--	47	NO	46	120	46	120	20
SW 8270C or D	bis (2-chloroethyl) ether	111-44-4	ug/L	10	0.012	0.012	--	--	0.012	YES	37	120	37	120	20
SW 8270C or D	bis (2-chloroisopropyl) ether	108-60-1	ug/L	10	0.31	0.32	--	--	0.31	YES	26	131	26	131	20
SW 8270C or D	bis (2-ethylhexyl) phthalate	117-81-7	ug/L	10	0.071	4.8	6	--	0.071	YES	42	126	42	126	20
SW 8270C or D	Butyl benzylphthalate	85-68-7	ug/L	10	14	35	--	--	14	NO	46	120	46	120	20
SW 8270C or D	Chrysene	218-01-9	ug/L	10	2.9	2.9	--	--	2.9	YES	55	120	55	120	20
SW 8270C or D	Dibenzo (a,h) anthracene	53-70-3	ug/L	10	0.0029	0.0029	--	--	0.0029	YES	42	127	42	127	20
SW 8270C or D	Dibenzofuran	132-64-9	ug/L	10	5.8	--	--	--	5.8	YES	54	120	54	120	20
SW 8270C or D	Diethyl phthalate	84-66-2	ug/L	10	11,000	29,000	--	--	11,000	NO	41	120	41	120	20
SW 8270C or D	Dimethyl phthalate	131-11-3	ug/L	10	--	--	--	--	--	NO	25	127	25	127	20
SW 8270C or D	Di-n-butylphthalate	84-74-2	ug/L	10	670	3,700	--	--	670	NO	54	120	54	120	20
SW 8270C or D	Di-n-octylphthalate	117-84-0	ug/L	10	--	--	--	--	--	NO	37	137	37	137	20
SW 8270C or D	Fluoranthene	206-44-0	ug/L	10	630	1,500	--	--	630	NO	54	120	54	120	20
SW 8270C or D	Fluorene	86-73-7	ug/L	10	220	1,500	--	--	220	NO	50	120	50	120	20
SW 8270C or D	Hexachlorobenzene	118-74-1	ug/L	10	0.042	0.042	1	--	0.042	YES	52	120	52	120	20
SW 8270C or D	Hexachlorobutadiene	87-68-3	ug/L	10	0.26	0.86	--	--	0.26	YES	27	120	27	120	20
SW 8270C or D	Hexachloroethane	67-72-1	ug/L	10	0.79	4.8	--	--	0.79	YES	28	120	28	120	20
SW 8270C or D	Indeno (1,2,3-c,d) pyrene	193-39-5	ug/L	10	0.029	0.029	--	--	0.029	YES	43	125	43	125	20
SW 8270C or D	Isophorone	78-59-1	ug/L	10	67	71	--	--	67	NO	50	120	50	120	20
SW 8270C or D	Naphthalene	91-20-3	ug/L	10	0.14	0.14	--	--	0.14	YES	39	120	39	120	20
SW 8270C or D	Nitrobenzene	98-95-3	ug/L	10	0.12	3.4	--	--	0.12	YES	44	120	44	120	20
SW 8270C or D	n-Nitrosodi-n-propylamine	621-64-7	ug/L	10	0.0093	0.0096	--	--	0.0093	YES	34	128	34	128	20
SW 8270C or D	n-Nitrosodiphenylamine	86-30-6	ug/L	10	10	14	--	--	10	NO	48	120	48	120	20
SW 8270C or D	Pentachlorophenol	87-86-5	ug/L	50	0.17	0.56	1	--	0.17	YES	38	120	38	120	20
SW 8270C or D	Phenanthrene	85-01-8	ug/L	10	--	--	--	--	--	NO	51	120	51	120	20
SW 8270C or D	Phenol	108-95-2	ug/L	10	4,500	11,000	--	--	4,500	NO	20	120	20	120	20
SW 8270C or D	Pyrene	129-00-0	ug/L	10	87	1,100	--	--	87	NO	49	128	49	128	20
SW 8270SIM	1-methylnaphthalene	90-12-0	ug/L	0.2	0.97	2.3	--	--	0.97	NO	35	131	35	131	30
SW 8270SIM	2-methylnaphthalene	91-57-6	ug/L	0.2	27	150	--	--	27	NO	36	121	36	121	30
SW 8270SIM	Acenaphthene	83-32-9	ug/L	0.2	400	2,200	--	--	400	NO	39	125	39	125	30
SW 8270SIM	Acenaphthylene	208-96-8	ug/L	0.2	--	--	--	--	--	NO	43	140	43	140	30
SW 8270SIM	Anthracene	120-12-7	ug/L	0.2	1,300	11,000	--	--	1,300	NO	41	132	41	132	30
SW 8270SIM	Benzo (a) anthracene	56-55-3	ug/L	0.2	0.029	0.029	--	--	0.029	YES	58	141	58	141	30
SW 8270SIM	Benzo (a) pyrene	50-32-8	ug/L	0.2	0.0029	0.0029	0.2	--	0.0029	YES	31	142	31	142	30
SW 8270SIM	Benzo (b) fluoranthene	205-99-2	ug/L	0.2	0.029	0.029	--	--	0.029	YES	42	156	42	156	30
SW 8270SIM	Benzo (g,h,i) perylene	191-24-2	ug/L	0.2	--	--	--	--	--	NO	12	171	12	171	30
SW 8270SIM	Benzo (k) fluoranthene	207-08-9	ug/L	0.2	0.29	0.29	--	--	0.29	NO	49	165	49	165	30
SW 8270SIM	Chrysene	218-01-9	ug/L	0.2	2.9	2.9	--	--	2.9	NO	51	155	51	155	30
SW 8270SIM	Dibenzo (a,h) anthracene	53-70-3	ug/L	0.2	0.0029	0.0029	--	--	0.0029	YES	28	153	28	153	30
SW 8270SIM	Fluoranthene	206-44-0	ug/L	0.2	630	1,500	--	--	630	NO	47	158	47	158	30
SW 8270SIM	Fluorene	86-73-7	ug/L	0.2	220	1,500	--	--	220	NO	40	140	40	140	30
SW 8270SIM	Indeno (1,2,3-c,d) pyrene	193-39-5	ug/L	0.2	0.029	0.029	--	--	0.029	YES	20	167	20	167	30
SW 8270SIM	Naphthalene	91-20-3	ug/L	0.2	0.14	0.14	--	--	0.14	YES	39	125	39	125	30
SW 8270SIM	Phenanthrene	85-01-8	ug/L	0.2	--	--	--	--	--	NO	46	144	46	144	30
SW 8270SIM	Pyrene	129-00-0	ug/L	0.2	87	1,100	--	--	87	NO	39	158	39	158	30
CF-IRMS	D18O	D18O	0/00	--	--	--	--	--	--	NO	--	--	--	--	20
CF-IRMS	DD	DD	0/00	--	--	--	--	--	--	NO	--	--	--	--	20
SM 7110 C	Gross alpha	Gross alpha	pCi/L	3	--	--	15	15	15	NO	--	--	--	--	20
EPA 900.0	Gross beta	Gross beta	pCi/L	4	--	--	--	4	4	NO	--	--	--	--	20
EPA 903.1	Radium-226	013982-63-3	pCi/L	1	--	--	5	--	5	NO	--	--	--	--	20
EPA 904.0	Radium-228	015262-20-1	pCi/L	1	--	--	5	--	5	NO	--	--	--	--	20

Table A-2
Reporting Limits, Accuracy, and Precession Limits for Groundwate
PG&E Program Quality Assurance Project Plan

Method	Constituent	CAS	Units	QAPP RL	EPA Regional Screening Levels May 2012	EPA Regional Screening Levels 2008	Federal Drinking Water Standards MCLs	California Drinking Water Standards MCLs	Most Stringent Screening Level[1]	Does RL Exceed Screening Level?	LCS Accuracy Control Limits (%R) Lower Limit	LCS Accuracy Control Limits (%R) Upper Limit	MS/MSD Accuracy Control Limits (%R) Lower Limit	MS/MSD Accuracy Control Limits (%R) Upper Limit	Precision Water % RPD
EPA 905.0	Strontium	7440-26-4	pCi/L	2	--	--	--	8	8	NO	--	--	--	--	20
EPA 906.0	Tritium	10028-17-8	pCi/L	1,000	--	--	--	20,000	20,000	NO	--	--	--	--	20
EPA 908.0	Uranium	7440-61-1	pCi/L	1	--	--	--	20	20	NO	--	--	--	--	20
RSK-175	Carbon Dioxide	124-38-9	ug/L	5	--	--	--	--	--	NO	80	120	80	120	20
RSK-175	Ethane	74-84-0	ug/L	5	--	--	--	--	--	NO	80	120	80	120	20
RSK-175	Ethene	74-85-1	ug/L	5	--	--	--	--	--	NO	80	120	80	120	20
RSK-175	Methane	74-82-8	ug/L	5	--	--	--	--	--	NO	80	120	80	120	20

Notes:

Please keep in mind, Screening Levels are constantly revised by the EPA. The appropriate Screening levels are specific to the project, the location, the agency providing oversight, and the overall Goals of the project.

mg/L = milligrams per liter
ug/L = micrograms per liter
µmhos/cm = micromhos per centimeter
pCi/L = picocuries per liter
PCB - LCS, MS, and MSD only require Aroclor-1016 and Aroclor-1260 spikes

[1] For groundwater, most stringent of:
EPA Regional Screening Levels - 2008 and May 2012
Federal Drinking Water Standards, MCLs
*Secondary Federal Drinking Water Standards, MCLs
California Drinking Water Standards, MCLs

Table A-3

Maximum Concentrations for Title 22

PG&E Program Quality Assurance Project Plan

					CA TTCL/STLC						LCS Accuracy Control Limits (%R)		MS/MSD Accuracy Control Limits (%R)		Precision Soil
Method	Constituent	CAS	Units	TCLP Regulatory Standards	Title 22 TTLC MCL (mg/kg)	If TTLC Concentration is ≥ this value STLC Analysis Must be performed	Title 22 STLC MCL	Most Stringent Screening Level	RL	Does RL Exceed Screening Level?	Lower Limit	Upper Limit	Lower Limit	Upper Limit	% RPD
SW6010B	Antimony	7440-36-0	mg/kg	--	500	150	15	15	5	NO	80	120	75	125	20
SW6010B	Arsenic	7440-38-2	mg/kg	5	500	50	5	5	5	NO	80	120	75	125	20
SW6010B	Barium	7440-39-3	mg/kg	100	10,000	1,000	100	100	10	NO	80	120	75	125	20
SW6010B	Beryllium	7440-41-7	mg/kg	--	75	7.5	0.75	0.75	1	YES	80	120	75	125	20
SW6010B	Cadmium	7440-43-9	mg/kg	1	100	10	1	1	1	NO	80	120	75	125	20
SW6010B	Chromium	7440-47-3	mg/kg	5	2,500	50	5	5	5	NO	80	120	75	125	20
SW3060A	Chromium, Hexavalent	18540-29-9	mg/kg	--	500	50	5	5	0.4	NO	80	120	75	125	20
SW6010B	Cobalt	7440-48-4	mg/kg	--	8,000	800	80	80	10	NO	80	120	75	125	20
SW6010B	Copper	7440-50-8	mg/kg	--	2,500	250	25	25	5	NO	80	120	75	125	20
SW6010B	Lead	7439-92-1	mg/kg	5	1,000	50	5	5	5	NO	80	120	75	125	20
SW7470A	Mercury	7439-97-6	mg/kg	0.2	20	2	0.2	0.2	0.1	NO	75	125	75	125	20
SW6010B	Molybdenum	7439-98-7	mg/kg	--	3,500	3,500	350	350	10	NO	80	120	75	125	20
SW6010B	Nickel	7440-02-0	mg/kg	--	2,000	200	20	20	5	NO	80	120	75	125	20
SW6010B	Selenium	7782-49-2	mg/kg	1	100	10	1	1	5	YES	80	120	75	125	20
SW6010B	Silver	7440-22-4	mg/kg	5	500	50	5	5	5	NO	80	120	75	125	20
SW6010B	Thallium	7440-28-0	mg/kg	--	700	70	7	7	5	NO	80	120	75	125	20
SW6010B	Vanadium	7440-62-2	mg/kg	--	2,400	240	24	24	5	NO	80	120	75	125	20
SW6010B	Zinc	7440-66-6	mg/kg	--	5,000	2,500	250	250	10	NO	80	120	75	125	20
SW8260B	Benzene	71-43-2	mg/L	0.5	--	--	--	0.5	--	YES	--	--	--	--	--
SW8260B	Carbon tetrachloride	56-23-5	mg/L	0.5	--	--	--	0.5	--	YES	--	--	--	--	--
SW8260B	Chlorobenzene	108-90-7	mg/L	100	--	--	--	100	--	YES	--	--	--	--	--
SW8260B	Chloroform	67-66-3	mg/L	6	--	--	--	6	--	YES	--	--	--	--	--
SW8260B	o-Cresol (2-Methylphenol)	95-48-7	mg/L	200	--	--	--	200	--	YES	--	--	--	--	--
SW8260B	m-Cresol	108-39-4	mg/L	200	--	--	--	200	--	YES	--	--	--	--	--
SW8260B	p-Cresol (4-Methylphenol)	106-44-5	mg/L	200	--	--	--	200	--	YES	--	--	--	--	--
SW8260B	Total Cresols		mg/L	200	--	--	--	200	--	YES	--	--	--	--	--
SW8260B	1,4-Dichlorobenzene	106-46-7	mg/L	7.5	--	--	--	7.5	--	YES	--	--	--	--	--
SW8260B	1,2-Dichloroethane (EDC)	107-06-2	mg/L	0.5	--	--	--	0.5	--	YES	--	--	--	--	--
SW8260B	1,1-Dichloroethylene	75-35-4	mg/L	0.7	--	--	--	0.7	--	YES	--	--	--	--	--
SW8260B	Hexachlorobutadiene	87-68-3	mg/L	0.5	--	--	--	0.5	--	YES	--	--	--	--	--
SW8260B	Tetrachloroethylene (PCE)	127-18-4	mg/L	0.7	2,040	--	204	0.7	--	YES	--	--	--	--	--
SW8260B	Vinyl chloride	75-01-4	mg/L	0.2	--	--	--	0.2	--	YES	--	--	--	--	--
SW8260B	Trichloroethylene (TCE)	79-01-6	mg/L	0.5	--	--	--	0.5	--	YES	--	--	--	--	--
SW8260B	2-Butanone (MEK)	78-93-3	mg/L	200	--	--	--	200	--	YES	--	--	--	--	--
SW8270C	2,4-Dinitrotoluene	121-14-2	mg/L	0.13	--	--	--	0.13	--	YES	--	--	--	--	--
SW8270C	Hexachlorobenzene	118-74-1	mg/L	0.13	--	--	--	0.13	--	YES	--	--	--	--	--
SW8270C	Hexachloroethane	67-72-1	mg/L	3	--	--	--	3	--	YES	--	--	--	--	--
SW8270C	Hexachlorobutadiene	87-68-3	mg/L	0.5	--	--	--	0.5	--	YES	--	--	--	--	--
SW8270C	Nitrobenzene	98-95-3	mg/L	2	--	--	--	2	--	YES	--	--	--	--	--
SW8270C	Pentachlorophenol	87-86-5	mg/L	100	17	--	1.7	1.7	--	YES	--	--	--	--	--
SW8270C	2,4,5-Trichlorophenol	95-95-4	mg/L	400	--	--	--	400	--	YES	--	--	--	--	--
SW8270C	2,4,6-Trichlorophenol	88-06-2	mg/L	2	--	--	--	2	--	YES	--	--	--	--	--
SW8270C	Pyridine	110-86-1	mg/L	5	--	--	--	5	--	YES	--	--	--	--	--
SW8270C	3,3-Dichlorobenzidine		mg/L	0.01	--	--	--	0.01	--	YES	--	--	--	--	--
SW8081A	Endrin	72-20-8	mg/L	0.02	0.2	--	0.02	0.02	--	YES	--	--	--	--	--
SW8081A	Heptachlor (and its epoxide)	76-44-8	mg/L	0.008	4.7	--	0.47	0.008	--	YES	--	--	--	--	--
SW8081A	Methoxychlor	72-43-5	mg/L	10	100	--	10	10	--	YES	--	--	--	--	--
SW8081A	Toxaphene	8001-35-2	mg/L	0.5	5	--	0.5	0.5	--	YES	--	--	--	--	--
SW8081A	Chlordane	57-74-9	mg/L	0.03	2.5	--	0.25	0.03	--	YES	--	--	--	--	--
SW8081A	Lindane	58-89-9	mg/L	0.4	4	--	0.4	0.4	--	YES	--	--	--	--	--
SW8081A	Aldrin	309-00-2	mg/L	--	1.4	--	0.14	0.14	--	YES	--	--	--	--	--

Table A-3

Maximum Concentrations for Title 22

PG&E Program Quality Assurance Project Plan

					CA TTCL/STLC						LCS Accuracy Control Limits (%R)		MS/MSD Accuracy Control Limits (%R)		Precision Soil
Method	Constituent	CAS	Units	TCLP Regulatory Standards	Title 22 TTLC MCL (mg/kg)	If TTLC Concentration is ≥ this value STLC Analysis Must be performed	Title 22 STLC MCL	Most Stringent Screening Level	RL	Does RL Exceed Screening Level?	Lower Limit	Upper Limit	Lower Limit	Upper Limit	% RPD
SW8081A	Kepone	143-50-0	mg/L	--	21	--	2.1	2.1	--	YES	--	--	--	--	--
SW8081A	4,4'-DDD	72-54-8	mg/L	--	1	--	0.1	0.1	--	YES	--	--	--	--	--
SW8081A	4,4'-DDE	72-55-9	mg/L	--	1	--	0.1	0.1	--	YES	--	--	--	--	--
SW8081A	4,4'-DDT	50-29-3	mg/L	--	1	--	0.1	0.1	--	YES	--	--	--	--	--
SW8081A	Dieldrin	60-57-1	mg/L	--	8	--	0.8	0.8	--	YES	--	--	--	--	--
SW8081A	Heptachlor	76-44-8	mg/L	--	4.7	--	0.47	0.47	--	YES	--	--	--	--	--
SW8151A	2,4-Dichlorophenoxyacetic acid (2,4-D)	94-75-7	mg/L	10	100	--	10	10	--	YES	--	--	--	--	--
SW8151A	2,4,5-Trichlorophenoxypropionic acid (2,4,5-TP) (Silvex)	93-72-1	mg/L	1	10	--	1	1	--	YES	--	--	--	--	--
SW8082	Polychlorinated biphenyls (PCB)		mg/L	--	50	--	5	5	--	YES	--	--	--	--	--
Dioxins	Dioxin (2,3,7,8-TCDD)	1746-01-6	mg/L	--	0.01	--	0.001	0.001	--	YES	--	--	--	--	--

Notes:

mg/L = milligrams per liter

mg/kg = milligrams per kilogram

TCLP = toxicity characteristic leaching procedure

STLC = soluble threshold limit concentration

TTLC = total threshold limit concentration

QAPP Addendum

Addendum

Addendum to the PG&E Program Quality Assurance Project Plan for the Topock Groundwater Remedy

PG&E Topock Compressor Station Needles, California

Prepared for

Pacific Gas and Electric Company

Revision 2 (November 2015)

CH2MHILL®

155 Grand Avenue
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Oakland, CA 94612

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Addendum to the PG&E Program Quality Assurance Project Plan for the Topock Groundwater Remedy

1.0 Introduction

This Addendum to the *PG&E Program Quality Assurance Project Plan* (QAPP) Revision 2 (CH2M HILL 2012) has been prepared to address any variations from the QAPP or specifications associated with the Topock Groundwater Remedy (the project) that are not included or defined in the QAPP document. The laboratories will be required to adhere to the QAPP and then use the specific information outlined within this Addendum to supersede the QAPP information.

In compliance with the 1996 Corrective Action Consent Agreement (CACA) (California Department of Toxic Substances Control [DTSC] 1996) and the Remedial Design/Remedial Action (RD/RA) Consent Decree (DOI 2013), the sampling and analytical procedures set forth in the QAPP (CH2M HILL 2012), this Addendum, as well as the Sampling and Monitoring Plan (Volume 2 of the Operation and Maintenance Manual) will be followed during remedy operation.

Over the decades-long operation and optimization of the remedy, updates to the aforementioned documents may be necessary for a variety of reasons (e.g., changes driven by field conditions, changes driven by regulations, etc.). As with current practice and required by the QAPP, Standard Operating Procedures (SOPs) will be reviewed on annual basis, at a minimum, and PG&E will inform the agencies of material and substantive changes to the SOPs, as well as the rationale for the changes, prior to implementation.

2.0 Project Organization and Responsibility

2.1 Project Organization

For information on project organization refer to the Operation and Maintenance (O&M) Manual, Main Text, Section L2, and the Construction/Remedial Action Work Plan Section 2.1.

2.2 Certification Requirements

All laboratories participating in analytical services will have a documented Quality System and be certified under the National Environmental Laboratory Accreditation Program (NELAP) or the State of California Environmental Laboratory Accreditation Program (ELAP). Laboratories in California will be required to be certified under the ELAP. Additional accreditation may also be required. The laboratory managers will be responsible for ensuring that all laboratory personnel have been properly trained and are qualified to perform their assigned tasks.

3.0 Sampling Procedures

3.1 Sampling Design

Sampling and monitoring activities are needed for compliance purposes and for effective operation and maintenance of the groundwater remedy. The rationale for the sampling design (sampling locations, frequency, and analytes) and the Data Quality Objectives (DQO) process is documented in the O&M Manual, Volume 2, Sampling and Monitoring Plan.

3.2 Field Sampling Procedures

The groundwater remedy will use the project-specific field database, planned sample tables, chain-of-custody (CoC) forms, and other database-generated paperwork (e.g., purge forms, calibration log books). All sample collection and related activities will follow the SOPs provided in Appendix A of the Sampling and Monitoring Plan. Exhibit 3-1 lists the relevant SOPs for the remedy. Over the decades-long operation of the remedy, SOPs may be updated. The Field Lead and Project Chemist will ensure that the sampling is performed in accordance with the updated SOPs.

EXHIBIT 3-1
List of PG&E Program SOPs Applicable to the Topock Groundwater Remedy
Addendum to the PG&E Program Quality Assurance Project Plan for the Topock Groundwater Remedy

SOP	Title	Version	Date
SOP-A1	Purging and Sampling of Groundwater Monitoring Wells, Well-Volume Method	Rev 06	9/28/2015
SOP-A2	Purging and Sampling of 1-inch-diameter Groundwater Monitoring Wells, Modified Well-Volume Method	Rev 06	9/28/2015
SOP-A3	Purging and Sampling of Active and Inactive Water Supply Wells	Rev 06	9/28/2015
SOP-A4	Depth-Specific Surface Water Sampling	Rev 05	10/12/2015
SOP-A5	Groundwater Sampling from Sonic Drilling Boreholes	Rev 02	10/12/2015
SOP-A6	Sample Field Filtration and Preservation for Metals Analyses	Rev 04	7/31/2012
SOP-A7	Water Level Measurements	Rev 05	9/28/2015
SOP-A8	Field Water Quality Measurements Using a Flow-through Cell	Rev 02	9/28/2015
SOP-A9	Calibration of Field Instruments	Rev 06	10/12/2015
SOP-A10	Decontamination of Water Sampling Equipment	Rev 06	10/12/2015
SOP-A11	Total Depth Measurements	Rev 01	10/12/2015
SOP-A12	Field Water Quality Measurements for Grab Samples	Rev 01	9/28/2015
SOP-A13	Spill Prevention, Containment, and Control Measures for Monitoring Well Development, Purging, and Sampling	Rev 04	10/12/2015
SOP-A14	Pore Water Sampling	Rev 01	10/12/2015
SOP-A16	Access Routes	Rev 03	10/13/2015
SOP-A17	Groundwater and Surface Water Mobile Integrated Sample Tracking	Rev 02	12/5/2008
SOP-A18	Purging and Sampling of Groundwater Wells Minimal Drawdown Method	Rev 02	9/28/2015
SOP-A19	Sampling of Groundwater Monitoring Wells Hydrasleeve No Purge Method	Rev 02	9/28/2015
SOP-A22	Procedures for Calculation of Freshwater Equivalent Heads	Rev 02	10/12/2015
SOP-A23	Sample Handling and Custody	Rev 01	10/12/2015
SOP-L1	Hexavalent Chromium Analysis by Hach Method 1560	Rev 04	10/13/2015
SOP-L2	Ferrous Iron Analysis by Hach Method 8146	Rev 03	10/13/2015
SOP-L3	Total Chromium Analysis by Hach Method 8024	Rev 02	10/13/2015
SOP-L4	Conductivity Analysis by Hach Method 8160	Rev 02	10/13/2015
SOP-L8	Matrix Spike Preparation	Rev 01	6/5/2014
SOP-L9	pH Measurement	Rev 02	10/13/2015
SOP-L10	Hach Model 2100P Turbidimeter Calibration and Analysis Procedures	Rev 02	10/13/2015
SOP-L13	Nitrate Analysis by Hach Method 8171	Rev 01	10/13/2015
SOP-L14	Sulfate Analysis by Hach Method 8051	Rev 01	10/13/2015
SOP-L15	Alkalinity Analysis	Rev 01	10/13/2015
SOP-L16	Total Organic Carbon Analysis by Hach Method 10129	Rev 01	10/13/2015
SOP-L17	Orthophosphate Analysis by Hach Method 8048	Rev 01	10/13/2015

EXHIBIT 3-1
List of PG&E Program SOPs Applicable to the Topock Groundwater Remedy
Addendum to the PG&E Program Quality Assurance Project Plan for the Topock Groundwater Remedy

SOP	Title	Version	Date
SOP-L18	Manganese Analysis by Hach Method 8149	Rev 01	10/13/2015
SOP-L19	Total Dissolved Solids Analysis	Rev 01	10/13/2015
SOP-B16	Field-Portable X-Ray Fluorescence Soil Sampling	Rev 00	9/5/2008
SOP-C1	Solinst Pressure Transducers	Rev 02	10/13/2015
SOP-C2	Pressure Transducer Upload to Topock Database	Rev 01	5/2/2014
Remedy-SOP-01	Process Water Sampling	Rev 00	6/19/2012
Remedy-SOP-02	Safe Fueling and Fuel Handling Policy	Rev 00	7/5/2013

Notes:
The SOPs listed in this exhibit are provided in Appendix A of the Sampling and Monitoring Plan (Volume 2 of the O&M Manual).
Information from SOP-L5 was incorporated into SOP-L10; SOP-L5 was deleted.
Information from SOP-L11 was incorporated into SOP-L9; SOP-L11 was deleted.
Information from SOP-L12 was incorporated into SOP-L1 and SOP-L2; SOP-L12 was deleted.

3.3 Additional or Revised QC Steps for Hexavalent Chromium

The following quality control (QC) steps will be implemented for all samples related to the groundwater remedy:

1. Additional QC Step – All equipment blanks will be blind (versus being identified to the laboratory as “blank”, or “EB” for equipment blanks), with the exception of additional well-specific equipment blanks for the floodplain wells (see Step 2 in Section 3.4).

2. Additional QC Step – Certified filters will be purchased for groundwater and surface water samples. These filters are packaged with manufactures’ testing data and certification. If uncertified filters must be used, each lot (if lot information is available) will be analyzed for hexavalent chromium (Cr[VI]). If no lot number information is available, one filter per day will be analyzed for Cr(VI).

3. Revised QC Step – The following protocol for Cr(VI) has been established using the ammonium sulfate buffer solution for Cr(VI) sample preservation in the field:

    - Within 2 weeks prior to any field event requiring preservation for Cr(VI), fresh buffer solution will be made and the purity checked by the laboratory; the resulting chromatogram will be emailed to the CH2M HILL project chemist for verification.

    - All Cr(VI) samples will be field-filtered and preserved to a pH range of 9.3 to 9.7 with ammonium sulfate buffer solution.

    - The laboratory will confirm preservation at the time of sample receipt.

    - The Topock groundwater remedy will use EPA Methods E218.6 or SM3500-Cr (use of Methods SW7199 and SW7196 are restricted and must be approved by the project chemist) for Cr(VI) analyses. The use of these methods was approved by DTSC in 2008 (DTSC 2008).

3.4 Additional QC Steps for Hexavalent Chromium in Select Floodplain Well Samples

In addition to the QC steps discussed in Section 3.3, the additional QC steps outlined in this section will be followed during sampling of a) monitoring wells located in or near the floodplain (as defined in Exhibit 3-2) that are currently non-detect (or detected at less than 5 parts per billion) for Cr(VI), and b) future wells located in or

near the floodplain as determined by the CH2M HILL project chemist. As water quality changes, the list of wells in Exhibit 3-2 will be reviewed periodically (initially on an annual basis) and updated as applicable.

EXHIBIT 3-2
Floodplain Wells Recommended for Additional Quality Control Steps
Addendum to the PG&E Program Quality Assurance Project Plan for the Topock Groundwater Remedy

MW-21	MW-33-040	MW-43-075	MW-52S
MW-27-020	MW-34-055	MW-43-090	MW-53D
MW-27-060	MW-34-080	MW-44-070	MW-53M
MW-27-085	MW-36-070	MW-49-135	MW-54-85
MW-28-025	MW-39-040	MW-49-275	MW-54-140
MW-28-090	MW-42-055	MW-49-365	MW-54-195
MW-29	MW-42-065	MW-52D	MW-55-45
MW-32-020	MW-43-025	MW-52M	MW-55-120
MW-32-035			

The additional QC steps for the wells listed in Exhibit 3-2 are as follows:

1. Two Cr(VI) sample containers will be filled for each floodplain well listed in Exhibit 3-2, field filtered, and preserved. The duplicate sample will be placed on hold at the laboratory and will not be analyzed unless needed to investigate an anomalous result.
    - Cr(VI) will be analyzed by method E218.6R.
    - The sample labels will have a designation of “1 of 2” and “2 of 2”.
    - The sample identifier (ID) will be recorded and the existence of two sample containers will be indicated on the CoC form.
2. For each of the wells listed in Exhibit 3-2 that have non-dedicated pumps, an extra equipment blank will be collected after decontaminating the pump and prior to lowering the pump down the well. For example, if sampling has just been completed at MW-42-055 and the next well is MW-42-065, the sampling team will need to decontaminate the portable pump and then collect MW-42-065-XXX-EB before placing the pump in MW-42-065.
    - The well-specific equipment blanks (e.g., MW-42-065-XXX-EB) will be placed on hold and will not be analyzed unless needed to investigate an anomalous result.

The additional QC steps were put into place due to the sensitive nature of the sample locations, where low level detections could have large implications if shown to be correct. These additional QC steps are of little use for wells in the uplands where slight differences of a few ppb are of less concern, especially where the sample concentration is less than the background concentration. At the same time, samples with concentrations greater than 10 – 15 ppb can have sufficient variability within the analytical methods to exceed the possible influence from contamination sources or colloidal suspension concentrations.

Extra containers and EBs prescribed in Steps 1 and 2 above are collected to help determine the source for any possible anomalous results found in the wells listed in Exhibit 3-2. All the wells located near the river (specifically those around the active reducing zone) are susceptible to colloidal suspension of chromium which can cause a high variability between the Cr(T) and Cr(VI) results. The special EBs are collected to eliminate the possibility of cross-contamination between the wells (i.e., to verify that carry-over is not occurring).

Note that the MW-55 and MW-21 wells are not necessarily in the floodplain, but are located in areas “near” the river where the “normal” results are either non-detect or low concentrations. In the event results are “detected”

higher than normal or where the Cr(T) and Cr(VI) concentrations differed more than is considered normal, PG&E works to determine the likely causes and provide the analysis in the report where the results are reported.

3.5 Additional QC Steps for Cr(T) and Cr(VI) — River Samples

In addition to the QC steps discussed in Section 3.3, all river samples (shoreline and in-channel) will require the following additional QC steps:

1. For surface water sampling events; three analyte-specific sample containers will be collected from each sample location for both total chromium (Cr[T]) and Cr(VI). The laboratory will analyze the initial sample aliquot; if that result is an anomalous result (any detected concentration in the river will be considered anomalous), corrective action will be implemented and an additional aliquot of the original sample will be reanalyzed along with an aliquot from each of the additional sample volumes for comparison purposes. In addition, the agencies will be notified immediately if anomalous Cr(T) or Cr(VI) results are detected in river samples which require reanalysis.
    - Cr(VI) will be analyzed by method E218.6R. Cr(T) will be analyzed by SW-6020A.
    - The sample labels will have a designation of “1 of 3”, “2 of 3”, and “3 of 3”.
    - The sample ID will be recorded and the existence of three sample containers will be indicated on the CoC form.
2. Blank samples will be collected daily from two sets of randomly selected dedicated equipment (tubing).
3. In addition, one atmospheric (ambient) blank will be collected at the PG&E Topock site per day of river sampling. The atmospheric blank and the dedicated equipment blanks will be placed on hold at the laboratory, and analyzed only in event of river sample detections.
4. The laboratory is required to ensure that the buffer solution and initial calibration method blank concentrations are less than the method detection limit (MDL) prior to proceeding with sample analysis. In all cases in which corrective actions are applied, the CH2M HILL project chemist will be notified to aid in the corrective action process.
5. In the event corrective action is taken due to an anomalous result, the laboratory will document (in detail) the procedure in the analytical report’s case narrative. The narrative must include, at a minimum, the identity of each “anomalous” detection, the result from each analysis, the basis for what likely caused the detection if the detection is found unrelated to the actual sample (e.g., background contamination), and any future corrective action that will be implemented to resolve the identified problem(s).

3.6 Additional Laboratory QC Steps

To ensure precision and accuracy for the project, analytical laboratories will conduct the following additional QC steps for Cr(T) analyses, Cr(VI) analyses, and all other analyses.

All Cr(T) Analysis

1. The laboratory must use the average of three scans/injections to calculate relative standard deviation (RSD) for the analysis of all metals.
2. All reported detections must have a %RSD of less than or equal to 15% for the triplicate inductively coupled plasma/matrix spike injections.
3. All groundwater and soil samples will be digested using an appropriate method.
4. The laboratory may be asked to investigate situations where the Cr(T) and Cr(VI) results differ by more than 20% relative percent difference (RPD) for samples with concentrations > 4 ppb.

All Cr(VI) Analysis

1. The laboratory will analyze a QC sample (low level check standard) after the initial calibration, at the reporting limit (RL) concentration.
2. The laboratory is required to ensure that the buffer solution, initial calibration blank, and method blank concentrations are less than the MDL prior to proceeding with sample analysis. Sample analysis will only proceed after the buffer solution and method blank concentrations are less than the MDL.
3. Initial calibration must be re-established if any of the following occur:
   - The last calibration was established more than 2 weeks prior to the start of a sample's analysis.
   - Two consecutive continuing calibration standards fail.
   - Any of the following operating conditions change:
     - Major maintenance is performed.
     - The system fluid is changed.
     - The instrument requires relocation.
     - The analytical column is replaced.
4. The laboratory will establish a retention time window and monitor the samples for exceedances.
5. If any calibration blank other than the initial calibration blank (see number 3 above) has a detection greater than the RL, and if there are detections in any sample, the laboratory records will document the concentrations and corrective action will be performed. The corrective action will include sample reanalysis and may also include change of reagents, eluate, and/or standards; and/or optimizing instrumentation. In all cases in which corrective actions are applied, the CH2M HILL project chemist will be notified to aid in the corrective action process.
6. If any calibration blank other than the initial calibration blank (see number 3 above) has a detection greater than the MDL but below the RL, and if there are detections in any sample, the laboratory records will document the concentrations and corrective action will be performed. However, the manner of reporting results will remain unchanged (i.e., results less than the RL will be reported as a non-detected result at 0.2 µg/L). Corrective action may include sample reanalysis; change of reagents, eluate and/or standards; and/or optimizing instrumentation. In all cases in which corrective actions are applied, the CH2M HILL project chemist will be notified to aid in the corrective action process.

All Other Analyses

1. The laboratory will supply sample containers that are pre-cleaned and certified to EPA-specified standards for low level chemical analysis for all PG&E programs.
2. In all cases in which corrective actions are applied, the CH2M HILL project chemist will be notified to aid in the corrective action process.

4.0 Method Quality Objectives and Quality Assurance Program

The data quality goal for the groundwater remedy is to achieve defensible data with the highest quality possible, given the variability of parameters for the groundwater remedy. The final output is a data set designed and validated to meet the qualitative and quantitative needs of the project. See Tables 4-1 through 4-3 at the end of this Addendum for project-specific reporting level requirements and EPA/California screening-level information that may differ from the QAPP.

4.1 Analytical Requirements

This Addendum specifies project-specific analytes and analytical methods that differ from the QAPP. All methods, analytes, or QC parameters specified in this Addendum that may differ from the QAPP supersede the criteria in the QAPP.

4.1.1 Reporting Limits

RLs should be a minimum of two times greater than the calculated MDLs. RLs used by the laboratory should not be greater than the RL objectives listed in Tables 4-1 through 4-3. Note that in Table 4-1, the 0.4 mg/kg RL used for this project is currently the lowest RL achievable using SW7199/3060A and is well below the industrial soil screening level. Screening levels are established by use of statistical analysis and are not based on the analytical capabilities of laboratories or methods.

Only analytes detected at concentrations greater than the project-specific RL will be reported. Analytes detected at less than the RL will be flagged "U" and reported as not detected at the RL.

RLs and sample results shall be reported to two significant figures if less than 10 micrograms per liter (µg/L) (parts per billion) and to three significant figures otherwise.

4.1.2 Calibration

In the initial calibration (for all instruments), a standard at a concentration equal to or less than the RL must be included.

Initial calibration must be re-established if any of the following conditions exist:

- The last calibration was established more than 1 year prior to the start of a sample's analysis (gas chromatography, gas chromatography-mass spectrometry, inductively coupled plasma, and inductively coupled plasma-mass spectrometry)
- The last calibration was established more than 2 weeks prior to the start of a sample's analysis (ion chromatography, and other "wet" chemistry analytical instruments)
- Two consecutive continuing calibration standards fail
- The operating conditions change; for example, any of the following:
  - Major maintenance is performed
  - The fluid or gas "carrier" type changes
  - The instrument requires relocation

4.1.3 Matrix Spike for Hexavalent Chromium Analyses

Interference from Topock groundwater is known to reduce the sensitivity of Method EPA 218.6. This can result in an incorrect assessment of the analyte identification or the specific RL if the Matrix Spike and Dilution Protocol is not followed (see Section 5.4.4.1 of the QAPP). All Topock groundwater and surface water samples analyzed by Method EPA 218.6 will follow the Matrix Spike and Dilution Protocol.

4.1.4 Matrix Spike and Dilution Protocol

Matrix interference has been encountered that affects the sensitivity for hexavalent chromium by ion chromatography methods. CH2M HILL shall direct the laboratories to perform an additional quality assurance/ quality control (QA/QC) analyses to aid in assessing any effect on method sensitivity for each project due to the sample matrix. All Topock groundwater and surface water samples analyzed by Method EPA218.6 will follow the Matrix Spike and Dilution Protocol.

The analytes and analytical requirements are presented in Tables 4-1 through 4-3.

4.2 Data Validation

The validation for this QAPP Addendum will follow the Level 3B designation from the QAPP and will be performed by the project chemist and designees.

5.0 Retention of Records

Hardcopy and electronic versions will be archived in project files, on electronic archive tapes, and/or other electronic storage media for the duration of remedy operation plus 10 years, as specified in contractual agreements. All electronic data will be subject to routine back-up until it is archived for long-term retention.

The PG&E Construction Manager, or designee, is responsible for ensuring that training and certification requirements of the QAPP are satisfied. The Construction Headquarters will serve as the primary repository for records during construction.

6.0 References

California Department of Toxic Substances Control (DTSC). 1996. *Corrective Action Consent Agreement (Revised), Pacific Gas and Electric Company's Topock Compressor Station, Needles, California.* EPA ID No. CAT080011729. February 2.

_____. 2008. Letter from Aaron Yue/DTSC to Yvonne Meeks/PG&E. Subject: "Analytical Method Change for Evaluation of Hexavalent Chromium at PG&E Topock Compressor Station, Needles, California (EPA ID No. CAT080011729)." January 18.

CH2M HILL. 2007. *PG&E Topock – River Sampling and Lab Audit Project Audit Report* (Audit No. 3500753340-07-01).

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U.S. Environmental Protection Agency (EPA). 1996. *Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, SW-846, 3rd Edition, Update 1-III*.

_____. 2007. *Final Update Rule – Parts 122-503 of Title 40 of the Code of Federal Regulations (CFR)*.

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U.S. Department of the Interior (DOI). 2013. Remedial Action/Remedial Design Consent Decree (CD) between the United States of America and Pacific Gas & Electric Company. Case 5:13-cv-00074-BRO-OP, Document 23. Entered November 21.

Tables

TABLE 4-1

Reporting Limits, Accuracy, and Precession Limits for Soil

PG&E Program Quality Assurance Project Plan Addendum

Method	Constituent	CAS	Units	QAPP RL[1]	EPA Regional Screening Levels - May 2012		EPA Regional Screening Levels - 2008		DTSC CHHSL		Most Stringent Screening Level[2]	Does RL Exceed Screening Level?	LCS Accuracy Control Limits (%R)		MS/MSD Accuracy Control Limits (%R)		Precision Soil
					Residential	Commercial	Residential	Commercial	Residential	Commercial			Lower Limit	Upper Limit	Lower Limit	Upper Limit	% RPD
SW 9012 or SW 9014	Cyanide	57-12-5	mg/kg	0.25	47	610	1,600	20,000	--	--	0,047	NO	*	*	*	*	30
Walkley-Black	Total organic carbon	TOC	mg/kg	50	--	--	--	--	--	--	--	NO	75	125	75	125	35
SW 9050	Specific conductance	Conductance	µmhos/cm	5	--	--	--	--	--	--	--	NO	75	125	75	125	20
SW 9045	pH	pH	pH units	0.1	--	--	--	--	--	--	--	NO	--	--	--	--	20
SM 2540 B/EPA 160.3	percent moisture	Moist	Percent	--	--	--	--	--	--	--	--	NO	--	--	--	--	20
EPA 300.0	Fluoride	Fluoride	mg/kg	2	--	--	4,700	61,000	--	--	4,700	NO	70	130	70	130	35
EPA 300.0	Chloride	Chloride	mg/kg	2	--	--	--	--	--	--	--	NO	70	130	70	130	35
EPA 300.0	Sulfate	Sulfate	mg/kg	2	--	--	--	--	--	--	--	NO	70	130	70	130	35
EPA 821/R-91-100	Sulfide, acid volatile	18496-25-8	mg/kg	80	--	--	--	--	--	--	--	NO	70	130	70	130	30
SW 7199	Chromium, hexavalent	18540-29-9	mg/kg	0.4	0.29	5.6	230	1,400	17	17	0.29	YES	85	115	85	115	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Aluminum	7429-90-5	mg/kg	10	77,000	990,000	77,000	990,000	--	--	77,000	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Antimony	7440-36-0	mg/kg	2	31	410	31	410	30	380	30	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Arsenic	7440-38-2	mg/kg	0.5	0.39	1.6	0.39	1.6	0.07	0.42	0.07	YES	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Barium	7440-39-3	mg/kg	1	15,000	190,000	15,000	190,000	5,200	63,000	5,200	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Beryllium	7440-41-7	mg/kg	0.5	160	2,000	160	2,000	150	1,700	150	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Cadmium	7440-43-9	mg/kg	0.5	70	800	70	810	1.7	7.5	1.7	NO	85	115	75	125	20
SW 6010B or C/EPA 200.7	Calcium	7440-70-2	mg/kg	100	--	--	--	--	--	--	--	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Chromium	7440-47-3	mg/kg	1	--	--	280	1,400	*	*	280	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Cobalt	7440-48-4	mg/kg	1	23	300	23	300	660	3,200	23	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Copper	7440-50-8	mg/kg	1	3,100	41,000	3,100	41,000	3,000	38,000	3,000	NO	85	115	75	125	20
SW 6010B or C/EPA 200.7	Iron	7439-89-6	mg/kg	10	55,000	720,000	55,000	720,000	--	--	55,000	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Lead	7439-92-1	mg/kg	1	400	800	400	800	150	3,500	150	NO	85	115	75	125	20
SW 6010B or C/EPA 200.7	Magnesium	7439-95-4	mg/kg	100	--	--	--	--	--	--	--	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Manganese	7439-96-5	mg/kg	1	--	--	1,800	23,000	--	--	1,800	NO	85	115	75	125	20
SW 7471A/EPA 245.5	Mercury	7439-97-6	mg/kg	0.1	10	43	6.7	28	18	180	6.7	NO	75	125	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Molybdenum	7439-98-7	mg/kg	1	390	5,100	390	5,100	380	4,800	380	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Nickel	7440-02-0	mg/kg	1	1,500	20,000	1,600	20,000	1,600	16,000	1,500	NO	85	115	75	125	20
SW 6010B or C/EPA 200.7	Potassium	7440-09-1	mg/kg	100	--	--	--	--	--	--	--	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Selenium	7782-49-2	mg/kg	1	390	5,100	390	5,100	380	4,800	380	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Silver	7440-22-4	mg/kg	1	390	5,100	390	5,100	380	4,800	380	NO	85	115	75	125	20
SW 6010B or C/EPA 200.7	Sodium	7440-23-5	mg/kg	100	--	--	--	--	--	--	--	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Thallium	7440-28-0	mg/kg	2	0.78	10	5.1	66	5	63	0.78	YES	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Vanadium	7440-62-2	mg/kg	1	--	--	550	7,200	530	6,700	530	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Zinc	7440-66-6	mg/kg	2	23,000	310,000	23,000	310,000	23,000	100,000	23,000	NO	85	115	75	125	20
SW 8015B or C or D	Motor Oil	TPH-motor oil	mg/kg	10	--	--	--	--	--	--	--	NO	60	120	60	120	50
SW 8015B or C or D	TPH-Diesel	TPH-diesel	mg/kg	10	--	--	--	--	--	--	--	NO	51	153	51	153	50
SW 8015B or C or D	TPH-Gasoline	TPH-gasoline	mg/kg	1	--	--	--	--	--	--	--	NO	57	146	57	146	50
SW 8081A or B	4,4'-DDD	72-54-8	ug/kg	4	2,000	7,200	2,000	7,200	2,300	9,000	2,000	NO	50	139	50	139	50
SW 8081A or B	4,4'-DDE	72-55-9	ug/kg	4	1,400	5,100	1,400	5,100	1,600	6,300	1,400	NO	68	126	68	126	50
SW 8081A or B	4,4'-DDT	50-29-3	ug/kg	4	1,700	7,000	1,700	7,000	1,600	6,300	1,600	NO	46	135	46	135	50
SW 8081A or B	Aldrin	309-00-2	ug/kg	4	29	100	29	100	33	130	29	NO	47	120	47	120	50
SW 8081A or B	alpha-HCH	319-84-6	ug/kg	4	77	270	77	270	--	--	77	NO	62	125	62	125	50
SW 8081A or B	alpha-Chlordane	5103-71-9	ug/kg	4	--	--	--	--	430	1,700	430	NO	63	121	63	121	50
SW 8081A or B	beta-HCH	319-85-7	ug/kg	4	270	960	320	1,300	--	--	270	NO	62	127	62	127	50
SW 8081A or B	delta-HCH	319-86-8	ug/kg	4	--	--	--	--	--	--	--	NO	57	130	57	130	50
SW 8081A or B	Dieldrin	60-57-1	ug/kg	4	30	110	30	110	35	130	30	NO	67	125	67	125	50
SW 8081A or B	Endosulfan I	959-98-8	ug/kg	4	--	--	--	--	--	--	--	NO	41	147	41	147	50
SW 8081A or B	Endosulfan II	33213-65-9	ug/kg	4	--	--	--	--	--	--	--	NO	37	141	37	141	50
SW 8081A or B	Endosulfan sulfate	1031-07-8	ug/kg	4	--	--	--	--	--	--	--	NO	62	135	62	135	50
SW 8081A or B	Endrin	72-20-8	ug/kg	4	18,000	180,000	18,000	180,000	21,000	230,000	18,000	NO	61	133	61	133	50
SW 8081A or B	Endrin aldehyde	7421-93-4	ug/kg	4	--	--	--	--	--	--	--	NO	37	147	37	147	50
SW 8081A or B	gamma-HCH (Lindane)	58-89-9	ug/kg	4	520	2,100	520	21,000	500	2,000	500	NO	59	123	59	123	50
SW 8081A or B	gamma-Chlordane	5103-74-2	ug/kg	4	--	--	--	--	430	1,700	430	NO	48	124	48	124	50
SW 8081A or B	Heptachlor	76-44-8	ug/kg	4	110	380	110	380	130	520	110	NO	51	140	51	140	50
SW 8081A or B	Heptachlor epoxide	1024-57-3	ug/kg	4	53	190	53	190	--	--	53	NO	66	130	66	130	50
SW 8081A or B	Methoxychlor	72-43-5	ug/kg	20	310,000	3,100,000	310,000	3,100,000	340,000	3,800,000	310,000	NO	57	143	57	143	50
SW 8081A or B	Toxaphene	8001-35-2	ug/kg	100	440	1,600	440	1,600	460	1,800	440	NO	31	136	31	136	50
SW 8082 or A	Aroclor-1016	12674-11-2	ug/kg	50	3,900	21,000	3,900	21,200	--	--	3,900	NO	41	138	41	138	50
SW 8082 or A	Aroclor-1221	11104-28-2	ug/kg	50	140	540	170	620	--	--	140	NO	45	136	45	136	50
SW 8082 or A	Aroclor-1232	11141-16-5	ug/kg	50	140	540	170	620	--	--	140	NO	45	136	45	136	50
SW 8082 or A	Aroclor-1242	53469-21-9	ug/kg	50	220	740	220	740	--	--	220	NO	43	150	43	150	50
SW 8082 or A	Aroclor-1248	12672-29-6	ug/kg	50	220	740	220	740	--	--	220	NO	44	136	44	136	50
SW 8082 or A	Aroclor-1254	11097-69-1	ug/kg	50	220	740	220	740	--	--	220	NO	41	141	41	141	50
SW 8082 or A	Aroclor-1260	11096-82-5	ug/kg	50	220	740	220	740	--	--	220	NO	61	131	61	131	50
SW 8082 or A	Total PCB	Total PCB	ug/kg	50	220	740	220	740	89	300	89	NO	--	--	--	--	--
SW 8151A	2,4-D	94-75-7	ug/kg	200	690,000	7,700,000	690	7,700	690	550	550	NO	32	121	32	121	50

TABLE 4-1
Reporting Limits, Accuracy, and Precession Limits for Soil
PG&E Program Quality Assurance Project Plan Addendum

Method	Constituent	CAS	Units	QAPP RL[1]	EPA Regional Screening Levels - May 2012		EPA Regional Screening Levels - 2008		DTSC CHHSL		Most Stringent Screening Level[2]	Does RL Exceed Screening Level?	LCS Accuracy Control Limits (%R)		MS/MSD Accuracy Control Limits (%R)		Precision Soil
					Residential	Commercial	Residential	Commercial	Residential	Commercial			Lower Limit	Upper Limit	Lower Limit	Upper Limit	% RPD
SW 8151A	2,4-DB	94-82-6	ug/kg	500	490,000	4,900,000	490	4,900	--	--	490	YES	42	145	42	145	50
SW 8151A	2,4,5-T	93-76-5	ug/kg	500	610,000	6,200,000	610	6,200	7,700	6,100	610	NO	43	139	43	139	50
SW 8151A	2,4,5-TP	93-72-1	ug/kg	200	490,000	4,900,000	490	4,900	--	--	490	NO	46	128	46	128	50
SW 8151A	Dalapon	75-99-0	ug/kg	100	1,800,000	18,000,000	1,800	18,000	--	--	1,800	NO	22	125	22	125	50
SW 8151A	Dicamba	1918-00-9	ug/kg	500	1,800,000	18,000,000	1,800	18,000	--	--	1,800	NO	56	120	56	120	50
SW 8151A	Dichloroprop	120-36-5	ug/kg	500	--	--	--	--	--	--	--	NO	72	142	72	142	50
SW 8151A	Dinoseb	88-85-7	ug/kg	100	61,000	620,000	61	620	--	--	61	YES	20	131	20	131	50
SW 8151A	MCPA	94-74-6	ug/kg	1,000	31,000	310,000	31	310	--	--	31	YES	65	120	65	120	50
SW 8151A	MCPP	7085-19-0	ug/kg	1,500	--	--	61	620	--	--	61	YES	60	118	60	118	50
SW 8260B or C	1,1,1,2-Tetrachloroethane	630-20-6	ug/kg	5	1,900	9,300	2,000	9,800	--	--	1,900	NO	74	125	74	125	30
SW 8260B or C	1,1,1-Trichloroethane (TCA)	71-55-6	ug/kg	5	8,700,000	38,000,000	9,000,000	39,000,000	--	--	8,700,000	NO	68	130	68	130	30
SW 8260B or C	1,1,2,2-Tetrachloroethane	79-34-5	ug/kg	5	560	2,800	590	2,900	--	--	560	NO	59	140	59	140	30
SW 8260B or C	1,1,2-Trichloroethane	79-00-5	ug/kg	5	1,100	5,300	1,100	5,500	--	--	1,100	NO	62	127	62	127	30
SW 8260B or C	1,1,2-Trichlorotrifluoroethane (Freon 113)	76-13-1	ug/kg	5	43,000,000	180,000,000	43,000,000	180,000,000	--	--	43,000,000	NO	65	135	65	135	30
SW 8260B or C	1,1-Dichloroethane	75-34-3	ug/kg	5	3,300	17,000	3,400	17,000	--	--	3,300	NO	73	125	73	125	30
SW 8260B or C	1,1-Dichloroethylene	75-35-4	ug/kg	5	240,000	1,100,000	250,000	1,100,000	--	--	240,000	NO	65	136	65	136	30
SW 8260B or C	1,1-Dichloropropene	563-58-6	ug/kg	5	--	--	--	--	--	--	--	NO	70	135	70	135	30
SW 8260B or C	1,2,3-Trichlorobenzene	87-61-6	ug/kg	5	49,000	490,000	--	--	--	--	49,000	NO	62	133	62	133	30
SW 8260B or C	1,2,3-Trichloropropane	96-18-4	ug/kg	5	5	95	91	410	--	--	5	NO	63	130	63	130	30
SW 8260B or C	1,2,4-Trichlorobenzene	120-82-1	ug/kg	5	22,000	99,000	87,000	400,000	--	--	22,000	NO	65	131	65	131	30
SW 8260B or C	1,2,4-Trimethylbenzene	95-63-6	ug/kg	5	62,000	260,000	67,000	280,000	--	--	62,000	NO	65	135	65	135	30
SW 8260B or C	1,2-Dibromo-3-chloropropane	96-12-8	ug/kg	5	5.4	69	5.6	73	--	--	5.4	NO	49	135	49	135	30
SW 8260B or C	1,2-Dibromoethane (EDB)	106-93-4	ug/kg	5	34	170	34	170	--	--	34	NO	70	124	70	124	30
SW 8260B or C	1,2-Dichlorobenzene	95-50-1	ug/kg	5	1,900,000	9,800,000	2,000,000	10,000,000	--	--	1,900,000	NO	74	120	74	120	30
SW 8260B or C	1,2-Dichloroethane (EDC)	107-06-2	ug/kg	5	430	2,200	450	2,200	--	--	430	NO	72	137	72	137	30
SW 8260B or C	1,2-Dichloropropane	78-87-5	ug/kg	5	940	4,700	930	4,700	--	--	930	NO	71	120	71	120	30
SW 8260B or C	1,3,5-Trimethylbenzene	108-67-8	ug/kg	5	780,000	10,000,000	47,000	200,000	--	--	47,000	NO	65	133	65	133	30
SW 8260B or C	1,3-Dichlorobenzene	541-73-1	ug/kg	5	--	--	--	--	--	--	--	NO	72	124	72	124	30
SW 8260B or C	1,3-Dichloropropane	142-28-9	ug/kg	5	1,600,000	20,000,000	1,600,000	20,000,000	--	--	1,600,000	NO	76	123	76	123	30
SW 8260B or C	1,4-Dichlorobenzene	106-46-7	ug/kg	5	2,400	12,000	2,600	13,000	--	--	2,400	NO	72	125	72	125	30
SW 8260B or C	2,2-Dichloropropane	594-20-7	ug/kg	5	--	--	--	--	--	--	--	NO	67	134	67	134	30
SW 8260B or C	2-Butanone (MEK)	78-93-3	ug/kg	50	28,000,000	200,000,000	28,000,000	190,000,000	--	--	28,000,000	NO	40	135	40	135	30
SW 8260B or C	2-Chlorotoluene	95-49-8	ug/kg	5	1,600,000	20,000,000	1,600,000	20,000,000	--	--	1,600,000	NO	69	128	69	128	30
SW 8260B or C	4-Chlorotoluene	106-43-4	ug/kg	5	1,600,000	20,000,000	5,500,000	72,000,000	--	--	1,600,000	NO	73	126	73	126	30
SW 8260B or C	4-Isopropyltoluene	99-87-6	ug/kg	6	--	--	--	--	--	--	--	NO	75	133	75	133	30
SW 8260B or C	4-Methyl-2-pentanone	108-10-1	ug/kg	50	5,300,000	53,000,000	5,300,000	52,000,000	--	--	5,300,000	NO	65	135	65	135	30
SW 8260B or C	Acetone	67-64-1	ug/kg	50	61,000,000	630,000,000	61,000,000	610,000,000	--	--	61,000,000	NO	40	141	40	141	30
SW 8260B or C	Acrolein	107-02-8	ug/kg	100	150	650	160	680	--	--	150	NO	65	135	65	135	30
SW 8260B or C	Acrylonitrile	107-13-1	ug/kg	50	240	1,200	240	1,200	--	--	240	NO	65	135	65	135	30
SW 8260B or C	Benzene	71-43-2	ug/kg	5	1,100	5,400	1,100	5,600	--	--	1,100	NO	73	126	73	126	30
SW 8260B or C	Bromobenzene	108-86-1	ug/kg	5	300,000	1,800,000	94,000	410,000	--	--	94,000	NO	66	121	66	121	30
SW 8260B or C	Bromochloromethane	74-97-5	ug/kg	5	160,000	680,000	--	--	--	--	160,000	NO	71	127	71	127	30
SW 8260B or C	Bromodichloromethane	75-27-4	ug/kg	5	270	1,400	10,000	46,000	--	--	0,270	NO	72	128	72	128	30
SW 8260B or C	Bromoform	75-25-2	ug/kg	6	62,000	220,000	61,000	220,000	--	--	61,000	NO	66	137	66	137	30
SW 8260B or C	Bromomethane	74-83-9	ug/kg	5	7,300	32,000	7,900	35,000	--	--	7,300	NO	45	141	45	141	30
SW 8260B or C	Carbon disulfide	75-15-0	ug/kg	5	820,000	3,700,000	670,000	3,000,000	--	--	670,000	NO	65	135	65	135	30
SW 8260B or C	Carbon tetrachloride	56-23-5	ug/kg	5	610	3,000	250	1,300	--	--	250	NO	67	133	67	133	30
SW 8260B or C	Chlorobenzene	108-90-7	ug/kg	5	290,000	1,400,000	310,000	1,500,000	--	--	290,000	NO	75	123	75	123	30
SW 8260B or C	Chloroethane	75-00-3	ug/kg	5	15,000,000	61,000,000	15,000,000	62,000,000	--	--	15,000,000	NO	41	141	41	141	30
SW 8260B or C	Chloroform	67-66-3	ug/kg	2	290	1,500	300	1,500	--	--	290	NO	72	124	72	124	30
SW 8260B or C	Chloromethane	74-87-3	ug/kg	5	120,000	500,000	1,700	8,400	--	--	1,700	NO	51	129	51	129	30
SW 8260B or C	cis-1,2-Dichloroethene	156-59-2	ug/kg	5	160,000	2,000,000	780,000	10,000,000	--	--	160,000	NO	67	125	67	125	30
SW 8260B or C	cis-1,3-Dichloropropene	10061-01-5	ug/kg	5	--	--	--	--	--	--	--	NO	72	126	72	126	30
SW 8260B or C	Dibromochloromethane	124-48-1	ug/kg	5	680	3,300	5,800	21,000	--	--	0,680	NO	66	130	66	130	30
SW 8260B or C	Dibromomethane	74-95-3	ug/kg	5	25,000	110,000	780,000	10,000,000	--	--	25,000	NO	73	128	73	128	30
SW 8260B or C	Dichlorodifluoromethane	75-71-8	ug/kg	5	94,000	400,000	190,000	780,000	--	--	94,000	NO	34	136	34	136	30
SW 8260B or C	Ethylbenzene	100-41-4	ug/kg	5	5,400	27,000	5,700	29,000	--	--	5,400	NO	74	127	74	127	30
SW 8260B or C	Hexachlorobutadiene	87-68-3	ug/kg	5	6,200	22,000	6,200	22,000	--	--	6,200	NO	53	142	53	142	30
SW 8260B or C	Isopropylbenzene (Cumene)	98-82-8	ug/kg	5	2,100,000	11,000,000	2,200,000	11,000,000	--	--	2,100,000	NO	77	129	77	129	30
SW 8260B or C	Methylene Chloride	75-09-2	ug/kg	5	56,000	960,000	1,100	5,400	--	--	1,100	NO	63	137	63	137	30
SW 8260B or C	Naphthalene	91-20-3	ug/kg	5	3,600	18,000	3,900	20,000	--	--	3,600	NO	51	135	51	135	30
SW 8260B or C	n-Butylbenzene	104-51-8	ug/kg	5	3,900,000	51,000,000	--	--	--	--	3,900,000	NO	65	138	65	138	30
SW 8260B or C	n-Propylbenzene	103-65-1	ug/kg	5	3,400,000	21,000,000	--	--	--	--	3,400,000	NO	63	135	63	135	30
SW 8260B or C	sec-Butylbenzene	135-98-8	ug/kg	5	--	--	--	--	--	--	--	NO	63	132	63	132	30
SW 8260B or C	Styrene	100-42-5	ug/kg	5	6,300,000	36,000,000	6,500,000	38,000,000	--	--	6,300,000	NO	74	128	74	128	30
SW 8260B or C	tert-Butyl Methyl Ether (MTBE)	1634-04-4	ug/kg	20	43,000	220,000	39,000	190,000	--	--	39,000	NO	50	135	50	135	30

TABLE 4-1
Reporting Limits, Accuracy, and Precession Limits for Soil
PG&E Program Quality Assurance Project Plan Addendum

Method	Constituent	CAS	Units	QAPP RL[1]	EPA Regional Screening Levels - May 2012		EPA Regional Screening Levels - 2008		DTSC CHHSL		Most Stringent Screening Level[2]	Does RL Exceed Screening Level?	LCS Accuracy Control Limits (%R)		MS/MSD Accuracy Control Limits (%R)		Precision Soil
					Residential	Commercial	Residential	Commercial	Residential	Commercial			Lower Limit	Upper Limit	Lower Limit	Upper Limit	% RPD
SW 8260B or C	tert-Butylbenzene	98-06-6	ug/kg	5	--	--	--	--	--	--	--	NO	65	132	65	132	30
SW 8260B or C	Tetrachloroethene	127-18-4	ug/kg	5	22,000	110,000	570	2,700	--	--	570	NO	67	139	67	139	30
SW 8260B or C	Toluene	108-88-3	ug/kg	5	5,000,000	45,000,000	5,000,000	46,000,000	--	--	5,000,000	NO	71	127	71	127	30
SW 8260B or C	trans-1,2-Dichloroethene	156-60-5	ug/kg	5	150,000	690,000	110,000	500,000	--	--	110,000	NO	66	134	66	134	30
SW 8260B or C	trans-1,3-Dichloropropene	10061-02-6	ug/kg	5	--	--	--	--	--	--	--	NO	65	127	65	127	30
SW 8260B or C	Trichloroethene	79-01-6	ug/kg	5	910	6,400	2,800	14,000	--	--	0,910	NO	77	124	77	124	30
SW 8260B or C	Trichlorofluoromethane (Freon 11)	75-69-4	ug/kg	5	790,000	3,400,000	800,000	3,400,000	--	--	790,000	NO	49	139	49	139	30
SW 8260B or C	Vinyl Chloride	75-01-4	ug/kg	5	60	1,700	60	1,700	--	--	60	NO	58	126	58	126	30
SW 8260B or C	Xylenes, Total	1330-20-7	ug/kg	15	630,000	2,700,000	600,000	2,600,000	--	--	600,000	NO	65	125	65	125	50
SW 8260B or C	m-Xylene	108-38-3	ug/kg	10	590,000	2,500,000	4,500,000	19,000,000	--	--	590,000	NO	79	126	79	126	30
SW 8260B or C	p-Xylene	106-42-3	ug/kg	10	600,000	2,600,000	4,700,000	20,000,000	--	--	600,000	NO	79	126	79	126	30
SW 8260B or C	o-Xylene	95-47-6	ug/kg	5	690,000	3,000,000	5,300,000	23,000,000	--	--	690,000	NO	77	125	77	125	30
SW 8270C or D	1,2,4-Trichlorobenzene	120-82-1	ug/kg	330	22,000	99,000	87,000	400,000	--	--	22,000	NO	44	125	44	125	30
SW 8270C or D	1,2-Dichlorobenzene	95-50-1	ug/kg	330	1,900,000	9,800,000	2,000,000	10,000,000	--	--	1,900,000	NO	45	125	45	125	30
SW 8270C or D	1,3-Dichlorobenzene	541-73-1	ug/kg	330	--	--	--	--	--	--	--	NO	39	125	39	125	30
SW 8270C or D	1,4-Dichlorobenzene	106-46-7	ug/kg	330	2,400	12,000	2,600	13,000	--	--	2,400	NO	35	125	35	125	30
SW 8270C or D	2,4,5-Trichlorophenol	95-95-4	ug/kg	700	6,100,000	62,000,000	6,100,000	62,000,000	--	--	6,100,000	NO	49	125	49	125	30
SW 8270C or D	2,4,6-Trichlorophenol	88-06-2	ug/kg	330	44,000	160,000	44,000	160,000	--	--	44,000	NO	43	125	43	125	30
SW 8270C or D	2,4-Dichlorophenol	120-83-2	ug/kg	330	180,000	1,800,000	180,000	1,800,000	--	--	180,000	NO	45	125	45	125	30
SW 8270C or D	2,4-Dimethylphenol	105-67-9	ug/kg	330	1,200,000	12,000,000	1,200,000	12,000,000	--	--	1,200,000	NO	32	125	32	125	30
SW 8270C or D	2,4-Dinitrophenol	51-28-5	ug/kg	700	120,000	1,200,000	120,000	1,200,000	--	--	120,000	NO	25	132	25	132	30
SW 8270C or D	2,4-Dinitrotoluene	121-14-2	ug/kg	330	1,600	5,500	120,000	1,200,000	--	--	1,600	NO	48	125	48	125	30
SW 8270C or D	2,6-Dinitrotoluene	606-20-2	ug/kg	330	61,000	620,000	61,000	620,000	--	--	61,000	NO	48	125	48	125	30
SW 8270C or D	2-Chloronaphthalene	91-58-7	ug/kg	330	6,300,000	82,000,000	6,300,000	82,000,000	--	--	6,300,000	NO	45	125	45	125	30
SW 8270C or D	2-Chlorophenol	95-57-8	ug/kg	330	390,000	5,100,000	390,000	5,100,000	--	--	390,000	NO	44	125	44	125	30
SW 8270C or D	2-Methylnaphthalene	91-57-6	ug/kg	330	230,000	2,200,000	310,000	4,100,000	--	--	230,000	NO	47	125	47	125	30
SW 8270C or D	2-Methylphenol (o-Cresol)	95-48-7	ug/kg	330	3,100,000	31,000,000	3,100,000	31,000,000	--	--	3,100,000	NO	40	125	40	125	30
SW 8270C or D	2-Nitroaniline	88-74-4	ug/kg	700	610,000	6,000,000	--	--	--	--	610,000	NO	44	125	44	125	30
SW 8270C or D	2-Nitrophenol	88-75-5	ug/kg	700	--	--	--	--	--	--	--	NO	42	125	42	125	30
SW 8270C or D	3,3'-Dichlorobenzidine	91-94-1	ug/kg	1,300	1,100	3,800	1,100	3,800	--	--	1,100	YES	25	128	25	128	30
SW 8270C or D	3-Nitroaniline	99-09-2	ug/kg	700	--	--	18,000	82,000	--	--	18,000	NO	27	125	27	125	30
SW 8270C or D	4,6-Dinitro-2-methylphenol	534-52-1	ug/kg	1600	4,900	49,000	6,100	62,000	--	--	4,900	NO	29	137	29	137	30
SW 8270C or D	4-Bromophenyl phenyl ether	101-55-3	ug/kg	330	--	--	--	--	--	--	--	NO	46	125	46	125	30
SW 8270C or D	4-Chloro-3-methylphenol	59-50-7	ug/kg	600	6,100,000	62,000,000	--	--	--	--	6,100,000	NO	46	125	46	125	30
SW 8270C or D	4-Chloroaniline	106-47-8	ug/kg	700	2,400	8,600	9,000	32,000	--	--	2,400	NO	10	125	10	125	30
SW 8270C or D	4-Chlorophenyl phenyl ether	7005-72-3	ug/kg	330	--	--	--	--	--	--	--	NO	47	125	47	125	30
SW 8270C or D	4-Methylphenol (p-Cresol)	106-44-5	ug/kg	330	6,100,000	62,000,000	310,000	3,100,000	--	--	310,000	NO	41	125	41	125	30
SW 8270C or D	4-Nitroaniline	100-01-6	ug/kg	700	24,000	86,000	23,000	82,000	--	--	23,000	NO	34	125	34	125	30
SW 8270C or D	4-Nitrophenol	100-02-7	ug/kg	700	--	--	--	--	--	--	--	NO	25	138	25	138	30
SW 8270C or D	Acenaphthene	83-32-9	ug/kg	330	3,400,000	33,000,000	3,400,000	33,000,000	--	--	3,400,000	NO	46	125	46	125	30
SW 8270C or D	Acenaphthylene	208-96-8	ug/kg	330	--	--	--	--	--	--	--	NO	44	125	44	125	30
SW 8270C or D	Anthracene	120-12-7	ug/kg	330	17,000,000	170,000,000	17,000,000	170,000,000	--	--	17,000,000	NO	53	125	53	125	30
SW 8270C or D	Benzo (a) anthracene	56-55-3	ug/kg	330	150	2,100	150	2,100	--	--	150	YES	52	125	52	125	30
SW 8270C or D	Benzo (a) pyrene	50-32-8	ug/kg	330	15	210	15	210	38	130	15	YES	50	125	50	125	30
SW 8270C or D	Benzo (b) fluoranthene	205-99-2	ug/kg	330	150	2,100	150	2,100	--	--	150	YES	45	125	45	125	30
SW 8270C or D	Benzo (g,h,i) perylene	191-24-2	ug/kg	330	--	--	--	--	--	--	--	NO	38	126	38	126	30
SW 8270C or D	Benzo (k) fluoranthene	207-08-9	ug/kg	330	1,500	21,000	1,500	21,000	--	--	1,500	NO	45	125	45	125	30
SW 8270C or D	Benzoic acid	65-85-0	ug/kg	5,000	240,000,000	2,500,000,000	240,000,000	2,500,000,000	--	--	240,000,000	NO	25	125	25	125	30
SW 8270C or D	Benzyl alcohol	100-51-6	ug/kg	330	6,100,000	62,000,000	31,000,000	310,000,000	--	--	6,100,000	NO	25	125	25	125	30
SW 8270C or D	bis (2-chloroethoxy) methane	111-91-1	ug/kg	330	180,000	1,800,000	180,000	1,800,000	--	--	180,000	NO	43	125	43	125	30
SW 8270C or D	bis (2-chloroethyl) ether	111-44-4	ug/kg	330	210	1,000	190	900	--	--	190	YES	38	125	38	125	30
SW 8270C or D	bis (2-chloroisopropyl) ether	108-60-1	ug/kg	330	4,600	22,000	3,500	17,000	--	--	3,500	NO	25	125	25	125	30
SW 8270C or D	bis (2-ethylhexyl) phthalate	117-81-7	ug/kg	330	35,000	120,000	35,000	120,000	--	--	35,000	NO	47	127	47	127	30
SW 8270C or D	Butyl benzylphthalate	85-68-7	ug/kg	1000	260,000	910,000	260,000	910,000	--	--	260,000	NO	49	125	49	125	30
SW 8270C or D	Chrysene	218-01-9	ug/kg	330	15,000	210,000	15,000	210,000	--	--	15,000	NO	53	125	53	125	30
SW 8270C or D	Dibenzo (a,h) anthracene	53-70-3	ug/kg	330	15	210	15	210	--	--	15	YES	41	125	41	125	30
SW 8270C or D	Dibenzofuran	132-64-9	ug/kg	330	78,000	1,000,000	--	--	--	--	78,000	NO	51	125	51	125	30
SW 8270C or D	Diethyl phthalate	84-66-2	ug/kg	330	49,000,000	490,000,000	49,000,000	490,000,000	--	--	49,000,000	NO	50	125	50	125	30
SW 8270C or D	Dimethyl phthalate	131-11-3	ug/kg	330	--	--	--	--	--	--	--	NO	49	125	49	125	30
SW 8270C or D	Di-n-butylphthalate	84-74-2	ug/kg	330	6,100,000	62,000,000	6,100,000	62,000,000	--	--	6,100,000	NO	56	125	56	125	30
SW 8270C or D	Di-n-octylphthalate	117-84-0	ug/kg	1000	--	--	--	--	--	--	--	NO	41	132	41	132	30
SW 8270C or D	Fluoranthene	206-44-0	ug/kg	330	2,300,000	22,000,000	2,300,000	22,000,000	--	--	2,300,000	NO	54	125	54	125	30
SW 8270C or D	Fluorene	86-73-7	ug/kg	330	2,300,000	22,000,000	2,300,000	22,000,000	--	--	2,300,000	NO	49	125	49	125	30
SW 8270C or D	Hexachlorobenzene	118-74-1	ug/kg	330	300	1,100	300	1,100	--	--	300	YES	47	125	47	125	30
SW 8270C or D	Hexachlorobutadiene	87-68-3	ug/kg	330	6,200	22,000	6,200	22,000	--	--	6,200	NO	40	125	40	125	30
SW 8270C or D	Hexachloroethane	67-72-1	ug/kg	330	12,000	43,000	35,000	120,000	--	--	12,000	NO	34	125	34	125	30

TABLE 4-1
Reporting Limits, Accuracy, and Precession Limits for Soil
PG&E Program Quality Assurance Project Plan Addendum

Method	Constituent	CAS	Units	QAPP RL[1]	EPA Regional Screening Levels - May 2012		EPA Regional Screening Levels - 2008		DTSC CHHSL		Most Stringent Screening Level[2]	Does RL Exceed Screening Level?	LCS Accuracy Control Limits (%R)		MS/MSD Accuracy Control Limits (%R)		Precision Soil
					Residential	Commercial	Residential	Commercial	Residential	Commercial			Lower Limit	Upper Limit	Lower Limit	Upper Limit	% RPD
SW 8270C or D	Indeno (1,2,3-c,d) pyrene	193-39-5	ug/kg	330	150	2,100	150	2,100	--	--	150	YES	38	125	38	125	30
SW 8270C or D	Isophorone	78-59-1	ug/kg	330	510,000	1,800,000	510,000	1,800,000	--	--	510,000	NO	43	125	43	125	30
SW 8270C or D	Naphthalene	91-20-3	ug/kg	330	3,600	18,000	3,900	20,000	--	--	3,600	NO	40	125	40	125	30
SW 8270C or D	Nitrobenzene	98-95-3	ug/kg	330	4,800	24,000	31,000	280,000	--	--	4,800	NO	41	125	41	125	30
SW 8270C or D	n-Nitrosodi-n-propylamine	621-64-7	ug/kg	330	69	250	69	250	--	--	69	YES	40	125	40	125	30
SW 8270C or D	n-Nitrosodiphenylamine	86-30-6	ug/kg	330	99,000	350,000	99,000	350,000	--	--	99,000	NO	49	125	49	125	30
SW 8270C or D	Pentachlorophenol	87-86-5	ug/kg	700	890	2,700	3,000	9,000	4,400	13,000	0,890	NO	25	125	25	125	30
SW 8270C or D	Phenanthrene	85-01-8	ug/kg	330	--	--	--	--	--	--	--	NO	50	125	50	125	30
SW 8270C or D	Phenol	108-95-2	ug/kg	330	18,000,000	180,000,000	18,000,000	180,000,000	--	--	18,000,000	NO	39	125	39	125	30
SW 8270C or D	Pyrene	129-00-0	ug/kg	330	1,700,000	17,000,000	1,700,000	17,000,000	--	--	1,700,000	NO	46	125	46	125	30
SW 8270SIM	1-methylnaphthalene	90-12-0	ug/kg	5	16,000	53,000	22,000	99,000	--	--	16,000	NO	30	111	30	111	30
SW 8270SIM	2-methylnaphthalene	91-57-6	ug/kg	5	230,000	2,200,000	310,000	4,100,000	--	--	230,000	NO	30	111	30	111	30
SW 8270SIM	Acenaphthene	83-32-9	ug/kg	5	3,400,000	33,000,000	3,400,000	33,000,000	--	--	3,400,000	NO	28	110	28	110	30
SW 8270SIM	Acenaphthylene	208-96-8	ug/kg	5	--	--	--	--	--	--	--	NO	23	126	23	126	30
SW 8270SIM	Anthracene	120-12-7	ug/kg	5	17,000,000	170,000,000	17,000,000	170,000,000	--	--	17,000,000	NO	28	136	28	136	30
SW 8270SIM	Benzo (a) anthracene	56-55-3	ug/kg	5	150	2,100	150	2,100	--	--	150	NO	31	146	31	146	30
SW 8270SIM	Benzo (a) pyrene	50-32-8	ug/kg	5	15	210	15	210	38	130	15	NO	28	128	28	128	30
SW 8270SIM	Benzo (b) fluoranthene	205-99-2	ug/kg	5	150	2,100	150	2,100	--	--	150	NO	30	139	30	139	30
SW 8270SIM	Benzo (g,h,i) perylene	191-24-2	ug/kg	5	--	--	--	--	--	--	--	NO	21	149	21	149	30
SW 8270SIM	Benzo (k) fluoranthene	207-08-9	ug/kg	5	1,500	21,000	1,500	21,000	--	--	1,500	NO	42	129	42	129	30
SW 8270SIM	Chrysene	218-01-9	ug/kg	5	15,000	210,000	15,000	210,000	--	--	15,000	NO	39	134	39	134	30
SW 8270SIM	Dibenzo (a,h) anthracene	53-70-3	ug/kg	5	15	210	15	210	--	--	15	NO	30	138	30	138	30
SW 8270SIM	Fluoranthene	206-44-0	ug/kg	5	2,300,000	22,000,000	2,300,000	22,000,000	--	--	2,300,000	NO	30	142	30	142	30
SW 8270SIM	Fluorene	86-73-7	ug/kg	5	2,300,000	22,000,000	2,300,000	22,000,000	--	--	2,300,000	NO	27	116	27	116	30
SW 8270SIM	Indeno (1,2,3-c,d) pyrene	193-39-5	ug/kg	5	150	2,100	150	2,100	--	--	150	NO	17	164	17	164	30
SW 8270SIM	Naphthalene	91-20-3	ug/kg	5	3,600	18,000	3,900	20,000	--	--	3,600	NO	29	106	29	106	30
SW 8270SIM	Phenanthrene	85-01-8	ug/kg	5	--	--	--	--	--	--	--	NO	32	127	32	127	30
SW 8270SIM	Pyrene	129-00-0	ug/kg	5	1,700,000	17,000,000	1,700,000	17,000,000	--	--	1,700,000	NO	28	130	28	130	30

Notes:

Please keep in mind, Screening Levels are constantly revised by the EPA. The appropriate Screening levels are specific to the project, the location, the agency providing oversight, and the overall Goals of the project.

mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram
µmhos/cm = micromhos per centimeter

All soil results (with the exception of Waste characterization) must be reported as dry weight
SW 7199 soil analysis must be accompanied by a SW 3060A extraction
PCB - LCS, MS, and MSD only require Aroclor-1016 and Aroclor-1260 spikes

[1] Screening levels are established by use of statistical analysis and are not based on the analytical capabilities of labortories or methods. The 0.4 mg/kg RL used for hexavalent chromium for this project is currently the lowest RL achievable using SW7199/3060A and is well below the industrial soil screening level.
[2] For soil, most stringent of:
EPA Regional Screening Levels - 2008 and May 2012
CHHSL = California Human Health Screening Levels, January 2005
DTSC = California Department of Toxic Substance Control, January 2005

TABLE 4-2
Reporting Limits, Accuracy, and Precession Limits for Groundwater
PG&E Program Quality Assurance Project Plan Addendum

Method	Constituent	CAS	Units	QAPP RL	EPA Regional Screening Levels May 2012	EPA Regional Screening Levels 2008	Federal Drinking Water Standards MCLs	California Drinking Water Standards MCLs	Most Stringent Screening Level[1]	Does RL Exceed Screening Level?	Does RL Exceed Federal MCL Level?	Does RL Exceed California MCL Level?	LCS Accuracy Control Limits (%R) Lower Limit	LCS Accuracy Control Limits (%R) Upper Limit	MS/MSD Accuracy Control Limits (%R) Lower Limit	MS/MSD Accuracy Control Limits (%R) Upper Limit	Precision Water % RPD
EPA 300.0M	Acetate	64-19-7	mg/L	0.1	--	--	--	--	--	NO	NO	NO	75	125	75	125	20
SM 2320 B	Alkalinity	Alkalinity	mg/L	5	--	--	--	--	--	NO	NO	NO	85	115	75	125	20
SM 4500-NH3 B, C, D, E, or G	Ammonia (as N)	7664-41-7	mg/L	0.5	--	--	--	--	--	NO	NO	NO	85	115	75	125	20
SM 2320 B	Bicarbonate	Bicarbonate	mg/L	5	--	--	--	--	--	NO	NO	NO	85	115	75	125	20
SM 5210 B	BOD	BOD	mg/L	--	--	--	--	--	--	NO	NO	NO	--	--	--	--	10
EPA 300.0	Bromide	Bromide	mg/L	0.5	--	--	--	--	--	NO	NO	NO	90	110	80	120	20
EPA 300.0M	Butyrate	107-92-6	mg/L	0.1	--	--	--	--	--	NO	NO	NO	75	125	75	125	20
SM 4500-CO_2	Carbon dioxide	124-38-9	mg/L	5	--	--	--	--	--	NO	NO	NO	--	--	--	--	20
SM 2320 B	Carbonate	Carbonate	mg/L	5	--	--	--	--	--	NO	NO	NO	85	115	75	125	20
EPA 300.0/SM 4500-Cl B, C, E, or D	Chloride	Chloride	mg/L	0.5	--	--	--	--	--	NO	NO	NO	90	110	80	120	20
SM 2120 E	Color	Color	Color unit	1	--	--	--	--	--	NO	NO	NO	90	110	90	110	20
SM 4500-CN	Cyanide	57-12-5	mg/L	0.01	0.00014		0.2	0.15	0.00014	YES	NO	NO	85	115	75	125	20
EPA 300.0/SM 4500-F B, C, D, or E	Fluoride	Fluoride	mg/L	0.5	--	2.2	4	--	2.2	NO	NO	NO	90	110	80	120	20
SM 2340 B or C	Hardness	Hardness	mg/L	2	--	--	--	--	--	NO	NO	NO	75	125	75	125	20
SM 2320 B	Hydroxide alkalinity	Hydroxide	mg/L	5	--	--	--	--	--	NO	NO	NO	85	115	75	125	20
EPA 300.0M	Lactate	50-21-5	mg/L	0.1	--	--	--	--	--	NO	NO	NO	75	125	75	125	20
EPA 300.0	Nitrate (as N)	14797-55-8	mg/L	0.5	25	58	10	--	10	NO	NO	NO	90	110	80	120	20
EPA 353.2/SM 4500-NO3 E, F or H	Nitrate/nitrite (as N)	NO3NO2N	mg/L	0.5	--	--	--	--	--	NO	NO	NO	85	115	75	125	20
EPA 300.0/SM 4500-NO2 B, F or E	Nitrite (as N)	14797-65-8	mg/L	0.5	--	3.7	1	--	1	NO	NO	NO	90	110	80	120	20
SM 5310 B, C, or D	Organic carbon	DOC/TOC	mg/L	0.3	--	--	--	--	--	NO	NO	NO	85	115	75	125	10
EPA 300.0/SM 4500-P E or F	Ortho phosphate	Ortho Phosphate	mg/L	0.02	--	--	--	--	--	NO	NO	NO	90	110	80	120	20
EPA 314.0	Perchlorate	Perchlorate	µg/L	4	--	26	--	--	26	NO	NO	NO	85	115	85	115	20
SM 4500-H+ B SW 9040	pH	pH	pH units	0.1	--	--	--	--	--	NO	NO	NO	--	--	--	--	20
EPA 300.0M	Propionate	79-09-4	mg/L	0.1	--	--	--	--	--	NO	NO	NO	75	125	75	125	20
EPA 300.0M	Pyruvate	127-17-3	mg/L	0.1	--	--	--	--	--	NO	NO	NO	75	125	75	125	20
SM 4500-SiO_2 E	Reactive silica	7631-86-9	mg/L	1	--	--	--	--	--	NO	NO	NO	75	125	75	125	20
SM 4500-SiO_2 C	Silica	7631-86-9	mg/L	0.04	--	--	--	--	--	NO	NO	NO	75	125	75	125	20
SILICA_CALC	Soluble silica	7631-86-9	mg/L	0.04	--	--	--	--	--	NO	NO	NO	75	125	75	125	20
EPA 120.1/SW 9050	Specific conductance	Conductance	µmhos/cm	2	--	--	--	--	--	NO	NO	NO	85	115	75	125	20
EPA 300.0/SM 4110 B	Sulfate	Sulfate	mg/L	0.5	--	--	--	--	--	NO	NO	NO	90	110	80	120	20
SM 4500-S^{-2} F, E, D, or G	Sulfide	Sulfide	mg/L	0.05	--	--	--	--	--	NO	NO	NO	75	125	75	125	20
SM 2540 C	Total dissolved solids	TDS	mg/L	10	--	--	--	--	--	NO	NO	NO	75	125	--	--	10
SM 4500-N_{org} B or C	Total kjeldahl nitrogen	7727-37-9	mg/L	--	--	--	--	--	--	NO	NO	NO	90	110	75	125	20
EPA 365.1/EPA 365.3 SM 4500-P E or F	Total phosphorous	Total Phosphorous	mg/L	0.02	--	--	--	--	--	NO	NO	NO	75	125	75	125	20
SM 2540 D	Total suspended solids	TSS	mg/L	4	--	--	--	--	--	NO	NO	NO	75	125	75	125	10
EPA 180.1/SM 2130 B	Turbidity	TURB	NTU	0.1	--	--	--	--	--	NO	NO	NO	--	--	--	--	20
SW 6020A/EPA 200.8	Aluminum	7429-90-5	ug/L	50	16,000	37,000	50*	1,000	50	NO	NO	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Antimony	7440-36-0	ug/L	2	6	15	6	--	6	NO	NO	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Arsenic	7440-38-2	ug/L	0.5 (0.1)	0.045	0.045	10	--	0.045	YES	NO	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Barium	7440-39-3	ug/L	2	2,900	7,300	2,000	1,000	1,000	NO	NO	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Beryllium	7440-41-7	ug/L	0.5	16	73	4	--	4	NO	NO	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Boron	7440-42-8	ug/L	50	?	?	?	?	?	?	NO	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Cadmium	7440-43-9	ug/L	1	--	18	5	--	5	NO	NO	NO	85	115	75	125	20
SW 6010B/EPA 200.7	Calcium	7440-70-2	ug/L	100	--	--	--	--	--	NO	NO	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Chromium	7440-47-3	ug/L	1	--	--	100	50	50	NO	NO	NO	85	115	75	125	20
EPA 218.6	Chromium, Hexavalent	18540-29-9	ug/L	0.2	0.031	110	100	--	0.031	YES	NO	NO	90	110	90	110	20
EPA 218.6 LL	Chromium, Hexavalent, LL	18540-29-9	ug/L	0.06	0.031	110	100	--	0.031	YES	NO	NO	90	110	90	110	20
SM 3500-Cr	Chromium, Hexavalent	18540-29-9	ug/L	10	0.031	110	100	--	0.031	YES	NO	NO	85	115	80	120	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Cobalt	7440-48-4	ug/L	5	4.7	11	--	--	4.7	YES	NO	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Copper	7440-50-8	ug/L	1	620	1,500	1,000*	--	620	NO	NO	NO	85	115	75	125	20
SW 6010B or C/EPA 200.7	Iron	7439-89-6	ug/L	20	11,000	26,000	300*	--	300	NO	NO	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Lead	7439-92-1	ug/L	1	--	--	15	--	15	NO	NO	NO	85	115	75	125	20
SW 6010B or C/EPA 200.7	Magnesium	7439-95-4	ug/L	100	--	--	--	--	--	NO	NO	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Manganese	7439-96-5	ug/L	0.5	--	880	50*	--	50	NO	NO	NO	85	115	75	125	20
SW 7070A/EPA 245.1/ EPA 6020A	Mercury	7439-97-6	ug/L	0.2	0.63	0.63	2	--	0.63	NO	NO	NO	75	125	75	125	20
SW 6020A/EPA 200.8	Molybdenum	7439-98-7	ug/L	2	78	180	--	--	78	NO	NO	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Nickel	7440-02-0	ug/L	2	300	730	100*	100	100	NO	NO	NO	85	115	75	125	20
SW 6010B or C/EPA 200.7	Potassium	7440-09-7	ug/L	100	--	--	--	--	--	NO	NO	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Selenium	7782-49-2	ug/L	5	78	180	50	--	50	NO	NO	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Silver	7440-22-4	ug/L	5	71	180	--	--	71	NO	NO	NO	85	115	75	125	20
SW 6010B or C/EPA 200.7	Sodium	7440-23-5	ug/L	100	--	--	--	--	--	NO	NO	NO	85	115	75	125	20
EPA 200.7/EPA 200.8	Strontium	7440-24-6	ug/L	50	9,300	22,000	--	--	9,300	NO	NO	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Thallium	7440-28-0	ug/L	1	0.16	2.4	2	--	0.16	YES	NO	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Uranium	7440-61-1	ug/L	5	230	--	30	--	30	NO	NO	NO	85	115	75	125	20
SW 6020A/EPA 200.8	Vanadium	7440-62-2	ug/L	5	--	2.6	--	--	2.6	YES	NO	NO	85	115	75	125	20
SW 6010B or C/SW 6020A/EPA 200.7/EPA 200.8	Zinc	7440-66-6	ug/L	20	4,700	11,000	5,000*	--	4,700	NO	NO	NO	85	115	75	125	20
SW 8015B or C or D	Motor Oil	TPH-motor oil	mg/L	1	--	--	--	--	--	NO	NO	NO	50	150	50	150	30
SW 8015B or C or D	TPH-Diesel	TPH-diesel	mg/L	0.5	--	--	--	--	--	NO	NO	NO	61	143	61	143	30
SW 8015B or C or D	TPH-Gasoline	TPH-gasoline	mg/L	0.1	--	--	--	--	--	NO	NO	NO	67	136	67	136	30
SW 8081A or B	4,4'-DDD	72-54-8	ug/L	0.1	0.28	0.28	--	--	0.28	NO	NO	NO	50	139	50	139	30
SW 8081A or B	4,4'-DDE	72-55-9	ug/L	0.1	0.2	0.2	--	--	0.2	NO	NO	NO	48	137	48	137	30
SW 8081A or B	4,4'-DDT	50-29-3	ug/L	0.1	0.2	0.2	--	--	0.2	NO	NO	NO	47	138	47	138	30
SW 8081A or B	Aldrin	309-00-2	ug/L	0.1	0.00021	0.004	--	--	0.00021	YES	NO	NO	42	138	42	138	30
SW 8081A or B	alpha-HCH	319-84-6	ug/L	0.1	0.0062	0.011	--	--	0.0062	YES	NO	NO	60	128	60	128	30
SW 8081A or B	alpha-Chlordane	5103-71-9	ug/L	0.1	--	--	2	--	2	NO	NO	NO	63	123	63	123	30
SW 8081A or B	beta-HCH	319-85-7	ug/L	0.1	0.022	0.037	--	--	0.022	YES	NO	NO	66	126	66	126	30

TABLE 4-2
Reporting Limits, Accuracy, and Precession Limits for Groundwater
PG&E Program Quality Assurance Project Plan Addendum

Method	Constituent	CAS	Units	QAPP RL	EPA Regional Screening Levels May 2012	EPA Regional Screening Levels 2008	Federal Drinking Water Standards MCLs	California Drinking Water Standards MCLs	Most Stringent Screening Level[1]	Does RL Exceed Screening Level?	Does RL Exceed Federal MCL Level?	Does RL Exceed California MCL Level?	LCS Accuracy Control Limits (%R) Lower Limit	LCS Accuracy Control Limits (%R) Upper Limit	MS/MSD Accuracy Control Limits (%R) Lower Limit	MS/MSD Accuracy Control Limits (%R) Upper Limit	Precision Water % RPD
SW 8081A or B	delta-HCH	319-86-8	ug/L	0.1	--	--	--	--	--	NO	NO	NO	46	136	46	136	30
SW 8081A or B	Dieldrin	60-57-1	ug/L	0.1	0.0015	0.0042	--	--	0.0015	YES	NO	NO	62	129	62	129	30
SW 8081A or B	Endosulfan I	959-98-8	ug/L	0.1	--	--	--	--	--	NO	NO	NO	49	120	49	120	30
SW 8081A or B	Endosulfan II	33213-65-9	ug/L	0.1	--	--	--	--	--	NO	NO	NO	42	130	42	130	30
SW 8081A or B	Endosulfan sulfate	1031-07-8	ug/L	0.1	--	--	--	--	--	NO	NO	NO	54	137	54	137	30
SW 8081A or B	Endrin	72-20-8	ug/L	0.1	1.7	11	2	--	1.7	NO	NO	NO	56	134	56	134	30
SW 8081A or B	Endrin aldehyde	7421-93-4	ug/L	0.1	--	--	--	--	--	NO	NO	NO	56	137	56	137	30
SW 8081A or B	gamma-HCH (lindane)	58-89-9	ug/L	0.1	0.036	0.061	0.2	--	0.036	YES	NO	NO	30	146	30	146	30
SW 8081A or B	gamma-Chlordane	5103-74-2	ug/L	0.1	--	--	2	--	2	NO	NO	NO	67	120	67	120	30
SW 8081A or B	Heptachlor	76-44-8	ug/L	0.1	0.0018	0.015	0.4	--	0.0018	YES	NO	NO	51	128	51	128	30
SW 8081A or B	Heptachlor Epoxide	1024-57-3	ug/L	0.1	0.0033	0.0074	0.2	--	0.0033	YES	NO	NO	62	131	62	131	30
SW 8081A or B	Methoxychlor	72-43-5	ug/L	0.5	27	180	40	--	27	NO	NO	NO	56	150	56	150	30
SW 8081A or B	Toxaphene	8001-35-2	ug/L	1	0.013	0.061	3	--	0.013	YES	NO	NO	41	126	41	126	30
SW 8082 or A	Aroclor-1016	12674-11-2	ug/L	0.5	0.96	0.96	0.5	--	0.5	NO	NO	NO	40	144	40	144	30
SW 8082 or A	Aroclor-1221	11104-28-2	ug/L	0.5	0.0043	0.0068	0.5	--	0.0043	YES	NO	NO	41	136	41	136	30
SW 8082 or A	Aroclor-1232	11141-16-5	ug/L	0.5	0.0043	0.0068	0.5	--	0.0043	YES	NO	NO	41	136	41	136	30
SW 8082 or A	Aroclor-1242	53469-21-9	ug/L	0.5	0.034	0.034	0.5	--	0.034	YES	NO	NO	39	150	39	150	30
SW 8082 or A	Aroclor-1248	12672-29-6	ug/L	0.5	0.034	0.034	0.5	--	0.034	YES	NO	NO	41	136	41	136	30
SW 8082 or A	Aroclor-1254	11097-69-1	ug/L	0.5	0.034	0.034	0.5	--	0.034	YES	NO	NO	29	141	29	141	30
SW 8082 or A	Aroclor-1260	11096-82-5	ug/L	0.5	0.034	0.034	0.5	--	0.034	YES	NO	NO	45	145	45	145	30
SW 8151A	2,4-D	94-75-7	ug/L	10	130	370	70	--	70	NO	NO	NO	39	120	39	120	30
SW 8151A	2,4-DB	94-82-6	ug/L	20	91	290	--	--	91	NO	NO	NO	44	120	44	120	30
SW 8151A	2,4,5-T	93-76-5	ug/L	20	120	370	--	--	120	NO	NO	NO	44	122	44	122	30
SW 8151A	2,4,5-TP	93-72-1	ug/L	10	84	290	--	--	84	NO	NO	NO	49	126	49	126	30
SW 8151A	Dalapon	75-99-0	ug/L	30	470	1,100	200	--	200	NO	NO	NO	40	120	40	120	30
SW 8151A	Dicamba	1918-00-9	ug/L	30	440	1,100	--	--	440	NO	NO	NO	60	120	60	120	30
SW 8151A	Dichloroprop	120-36-5	ug/L	20	--	--	--	--	--	NO	NO	NO	68	122	68	122	30
SW 8151A	Dinoseb	88-85-7	ug/L	3	11	37	7	--	7	NO	NO	NO	28	115	28	115	30
SW 8151A	MCPA	94-74-6	ug/L	100	5.7	18	--	--	5.7	YES	NO	NO	62	144	62	144	30
SW 8151A	MCPP	7085-19-0	ug/L	100	--	37	--	--	37	YES	NO	NO	60	133	60	133	30
SW 8260B or C	1,1,1,2-Tetrachloroethane	630-20-6	ug/L	0.5	0.5	0.52	--	--	0.5	NO	NO	NO	81	129	81	129	20
SW 8260B or C	1,1,1-Trichloroethane (TCA)	71-55-6	ug/L	1	7,500	9,100	200	200	200	NO	NO	NO	67	132	67	132	20
SW 8260B or C	1,1,2,2-Tetrachloroethane	79-34-5	ug/L	0.5	0.066	0.067	--	1	0.066	YES	NO	NO	63	128	63	128	20
SW 8260B or C	1,1,2-Trichloroethane	79-00-5	ug/L	1	0.24	0.24	5	5	0.24	YES	NO	NO	75	125	75	125	20
SW 8260B or C	1,1,2-Trichlorotrifluoroethane (Freon 113)	76-13-1	ug/L	1	53,000	59,000	--	1,200	1,200	NO	NO	NO	75	125	75	125	20
SW 8260B or C	1,1-Dichloroethane	75-34-3	ug/L	1	2.4	2.4	--	5	2.4	NO	NO	NO	69	133	69	133	20
SW 8260B or C	1,1-Dichloroethene	75-35-4	ug/L	1	260	340	7	6	6	NO	NO	NO	68	130	68	130	20
SW 8260B or C	1,1-Dichloropropene	563-58-6	ug/L	1	--	--	--	--	--	NO	NO	NO	73	132	73	132	20
SW 8260B or C	1,2,3-Trichlorobenzene	87-61-6	ug/L	1	5.2	--	--	--	5.2	NO	NO	NO	67	137	67	137	20
SW 8260B or C	1,2,3-Trichloropropane	96-18-4	ug/L	1	0.00065	0.0096	--	--	0.00065	YES	NO	NO	73	124	73	124	20
SW 8260B or C	1,2,4-Trichlorobenzene	120-82-1	ug/L	1	0.99	8.2	70	5	0.99	YES	NO	NO	66	134	66	134	20
SW 8260B or C	1,2,4-Trimethylbenzene	95-63-6	ug/L	1	15	15	--	--	15	NO	NO	NO	74	132	74	132	20
SW 8260B or C	1,2-Dibromo-3-Chloropropane	96-12-8	ug/L	2	0.00032	0.00032	0.2	--	0.00032	YES	YES	NO	50	132	50	132	20
SW 8260B or C	1,2-Dibromoethane (EDB)	106-93-4	ug/L	1	0.0065	0.0065	0.05	--	0.0065	YES	YES	NO	80	121	80	121	20
SW 8260B or C	1,2-Dichlorobenzene	95-50-1	ug/L	1	280	370	600	600	280	NO	NO	NO	71	122	71	122	20
SW 8260B or C	1,2-Dichloroethane (EDC)	107-06-2	ug/L	0.5	0.15	0.15	5	0.5	0.15	YES	NO	NO	69	132	69	132	20
SW 8260B or C	1,2-Dichloropropane	78-87-5	ug/L	1	0.38	0.39	5	5	0.38	YES	NO	NO	75	125	75	125	20
SW 8260B or C	1,3,5-Trimethylbenzene	108-67-8	ug/L	1	87	12	--	--	12	NO	NO	NO	74	131	74	131	20
SW 8260B or C	1,3-Dichlorobenzene	541-73-1	ug/L	1	--	--	--	--	--	NO	NO	NO	75	124	75	124	20
SW 8260B or C	1,3-Dichloropropane	142-28-9	ug/L	1	290	730	--	--	290	NO	NO	NO	73	126	73	126	20
SW 8260B or C	1,4-Dichlorobenzene	106-46-7	ug/L	0.5	0.42	0.43	75	5	0.42	YES	NO	NO	74	123	74	123	20
SW 8260B or C	2,2-Dichloropropane	594-20-7	ug/L	1	--	--	--	--	--	NO	NO	NO	69	137	69	137	20
SW 8260B or C	2-Butanone (MEK)	78-93-3	ug/L	10	4,900	7,100	--	--	4,900	NO	NO	NO	49	136	49	136	20
SW 8260B or C	2-Chlorotoluene	95-49-8	ug/L	1	180	730	--	--	180	NO	NO	NO	73	126	73	126	20
SW 8260B or C	4-Chlorotoluene	106-43-4	ug/L	1	190	2,600	--	--	190	NO	NO	NO	74	128	74	128	20
SW 8260B or C	4-Isopropyltoluene	99-87-6	ug/L	1	--	--	--	--	--	NO	NO	NO	73	130	73	130	20
SW 8260B or C	4-Methyl-2-Pentanone	108-10-1	ug/L	10	1,000	2,000	--	--	1,000	NO	NO	NO	58	134	58	134	20
SW 8260B or C	Acetone	67-64-1	ug/L	10	12,000	22,000	--	--	12,000	NO	NO	NO	40	135	40	135	20
SW 8260B or C	Acrolein	107-02-8	ug/L	20	0.041	0.042	--	--	0.041	YES	NO	NO	75	125	75	125	20
SW 8260B or C	Acrylonitrile	107-13-1	ug/L	20	0.045	0.045	--	--	0.045	YES	NO	NO	75	125	75	125	20
SW 8260B or C	Benzene	71-43-2	ug/L	0.4	0.39	0.41	5	1	0.39	YES	NO	NO	81	122	81	122	20
SW 8260B or C	Bromobenzene	108-86-1	ug/L	1	54	20	--	--	20	NO	NO	NO	76	124	76	124	20
SW 8260B or C	Bromochloromethane	74-97-5	ug/L	1	83	--	--	--	83	NO	NO	NO	65	129	65	129	20
SW 8260B or C	Bromodichloromethane	75-27-4	ug/L	0.5	0.12	1.1	100	--	0.12	YES	NO	NO	76	121	76	121	20
SW 8260B or C	Bromoform	75-25-2	ug/L	1	7.9	8.5	100	--	7.9	NO	NO	NO	69	128	69	128	20
SW 8260B or C	Bromomethane	74-83-9	ug/L	3	7	8.7	--	--	7	NO	NO	NO	53	141	53	141	20
SW 8260B or C	Carbon Disulfide	75-15-0	ug/L	1	720	1,000	--	--	720	NO	NO	NO	75	125	75	125	20
SW 8260B or C	Carbon Tetrachloride	56-23-5	ug/L	0.5	0.39	0.2	5	0.5	0.2	YES	NO	NO	66	138	66	138	20
SW 8260B or C	Chlorobenzene	108-90-7	ug/L	0.5	72	91	100	--	72	NO	NO	NO	81	122	81	122	20
SW 8260B or C	Chloroethane	75-00-3	ug/L	1	21,000	21,000	--	--	21,000	NO	NO	NO	58	133	58	133	20
SW 8260B or C	Chloroform	67-66-3	ug/L	1	0.19	0.19	100	--	0.19	YES	NO	NO	69	128	69	128	20
SW 8260B or C	Chloromethane	74-87-3	ug/L	1	190	1.8	--	--	1.8	NO	NO	NO	56	131	56	131	20
SW 8260B or C	cis-1,2-Dichloroethene	156-59-2	ug/L	1	28	370	70	6	6	NO	NO	NO	72	126	72	126	20
SW 8260B or C	cis-1,3-Dichloropropene	10061-01-5	ug/L	0.5	--	--	--	--	--	NO	NO	NO	69	131	69	131	20
SW 8260B or C	Dibromochloromethane	124-48-1	ug/L	0.5	0.15	0.8	100	--	0.15	YES	NO	NO	66	133	66	133	20
SW 8260B or C	Dibromomethane	74-95-3	ug/L	1	7.9	370	--	--	7.9	NO	NO	NO	76	125	76	125	20
SW 8260B or C	Dichlorodifluoromethane (Freon 12)	75-71-8	ug/L	1	190	390	--	--	190	NO	NO	NO	53	153	53	153	20

TABLE 4-2
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PG&E Program Quality Assurance Project Plan Addendum

Method	Constituent	CAS	Units	QAPP RL	EPA Regional Screening Levels May 2012	EPA Regional Screening Levels 2008	Federal Drinking Water Standards MCLs	California Drinking Water Standards MCLs	Most Stringent Screening Level[1]	Does RL Exceed Screening Level?	Does RL Exceed Federal MCL Level?	Does RL Exceed California MCL Level?	LCS Accuracy Control Limits (%R) Lower Limit	LCS Accuracy Control Limits (%R) Upper Limit	MS/MSD Accuracy Control Limits (%R) Lower Limit	MS/MSD Accuracy Control Limits (%R) Upper Limit	Precision Water % RPD
SW 8260B or C	Ethylbenzene	100-41-4	ug/L	1	1.3	1.5	700	--	1.3	NO	NO	NO	73	127	73	127	20
SW 8260B or C	Hexachlorobutadiene	87-68-3	ug/L	0.6	0.26	0.86	--	--	0.26	YES	NO	NO	67	131	67	131	20
SW 8260B or C	Isopropylbenzene (Cumene)	98-82-8	ug/L	1	390	680	--	--	390	NO	NO	NO	75	127	75	127	20
SW 8260B or C	Methylene chloride	75-09-2	ug/L	1	9.9	4.8	5	5	4.8	NO	NO	NO	63	137	63	137	20
SW 8260B or C	Naphthalene	91-20-3	ug/L	1	0.14	0.14	--	--	0.14	YES	NO	NO	54	138	54	138	20
SW 8260B or C	n-Butylbenzene	104-51-8	ug/L	1	780	--	--	--	780	NO	NO	NO	69	137	69	137	20
SW 8260B or C	n-Propylbenzene	103-65-1	ug/L	1	530	--	--	--	530	NO	NO	NO	72	129	72	129	20
SW 8260B or C	sec-Butylbenzene	135-98-8	ug/L	1	--	--	--	--	--	NO	NO	NO	72	127	72	127	20
SW 8260B or C	Styrene	100-42-5	ug/L	1	1,100	1,600	100	100	100	NO	NO	NO	65	134	65	134	20
SW 8260B or C	tert-Butyl Methyl Ether (MTBE)	1634-04-4	ug/L	5	12	12	--	13	12	NO	NO	NO	65	123	65	123	20
SW 8260B or C	tert-Butylbenzene	98-06-6	ug/L	1	--	--	--	--	--	NO	NO	NO	70	129	70	129	20
SW 8260B or C	Tetrachloroethene	127-18-4	ug/L	1	9.7	0.11	5	5	0.11	YES	NO	NO	66	128	66	128	20
SW 8260B or C	Toluene	108-88-3	ug/L	1	860	2,300	1,000	150	150	NO	NO	NO	77	122	77	122	20
SW 8260B or C	trans-1,2-Dichloroethene	156-60-5	ug/L	1	86	110	100	10	10	NO	NO	NO	63	137	63	137	20
SW 8260B or C	trans-1,3-Dichloropropene	10061-02-6	ug/L	1	--	--	--	--	--	NO	NO	NO	59	135	59	135	20
SW 8260B or C	Trichloroethene	79-01-6	ug/L	1	0.44	1.7	5	5	0.44	YES	NO	NO	70	127	70	127	20
SW 8260B or C	Trichlorofluoromethane (Freon 11)	75-69-4	ug/L	1	1,100	1,300	--	150	150	NO	NO	NO	57	129	57	129	20
SW 8260B or C	Vinyl Chloride	75-01-4	ug/L	0.5	0.015	0.016	2	0.5	0.015	YES	NO	NO	50	134	50	134	20
SW 8260B or C	Xylenes, Total	1330-20-7	ug/L	2	190	200	10,000	1,750	190	NO	NO	NO	75	125	75	125	20
SW 8260B or C	m -Xylene	108-38-3	ug/L	2	190	1,400	--	--	190	NO	NO	NO	76	128	76	128	20
SW 8260B or C	o-Xylene	95-47-6	ug/L	1	190	1,400	--	--	190	NO	NO	NO	80	121	80	121	20
SW 8260B or C	p-Xylene	106-42-3	ug/L	1	190	1,500	--	--	190	NO	NO	NO	76	128	76	128	20
SW 8270C or D	1,2,4-Trichlorobenzene	120-82-1	ug/L	10	0.99	8.2	70	--	0.99	YES	NO	NO	37	120	37	120	20
SW 8270C or D	1,2-Dichlorobenzene	95-50-1	ug/L	10	280	370	600	--	280	NO	NO	NO	33	120	33	120	20
SW 8270C or D	1,3-Dichlorobenzene	541-73-1	ug/L	10	--	--	--	--	--	NO	NO	NO	32	120	32	120	20
SW 8270C or D	1,4-Dichlorobenzene	106-46-7	ug/L	10	0.42	0.43	75	--	0.42	YES	NO	NO	32	120	32	120	20
SW 8270C or D	2,4,5-Trichlorophenol	95-95-4	ug/L	50	890	3,700	--	--	890	NO	NO	NO	49	120	49	120	20
SW 8270C or D	2,4,6-Trichlorophenol	88-06-2	ug/L	10	3.5	6.1	--	--	3.5	YES	NO	NO	49	126	49	126	20
SW 8270C or D	2,4-Dichlorophenol	120-83-2	ug/L	10	35	110	--	--	35	NO	NO	NO	48	120	48	120	20
SW 8270C or D	2,4-Dimethylphenol	105-67-9	ug/L	10	270	730	--	--	270	NO	NO	NO	28	120	28	120	20
SW 8270C or D	2,4-Dinitrophenol	51-28-5	ug/L	10	30	73	--	--	30	NO	NO	NO	25	130	25	130	20
SW 8270C or D	2,4-Dinitrotoluene	121-14-2	ug/L	10	0.2	73	--	--	0.2	YES	NO	NO	51	120	51	120	20
SW 8270C or D	2,6-Dinitrotoluene	606-20-2	ug/L	10	15	37	--	--	15	NO	NO	NO	49	120	49	120	20
SW 8270C or D	2-Chloronaphthalene	91-58-7	ug/L	10	550	2,900	--	--	550	NO	NO	NO	49	120	49	120	20
SW 8270C or D	2-Chlorophenol	95-57-8	ug/L	10	71	180	--	--	71	NO	NO	NO	37	120	37	120	20
SW 8270C or D	2-Methylnaphthalene	91-57-6	ug/L	10	27	150	--	--	27	NO	NO	NO	46	120	46	120	20
SW 8270C or D	2-Methylphenol (o-Cresol)	95-48-7	ug/L	10	720	1,800	--	--	720	NO	NO	NO	38	120	38	120	20
SW 8270C or D	2-Nitroaniline	88-74-4	ug/L	50	150	--	--	--	150	NO	NO	NO	48	120	48	120	20
SW 8270C or D	2-Nitrophenol	88-75-5	ug/L	10	--	--	--	--	--	NO	NO	NO	39	123	39	123	20
SW 8270C or D	3,3'-Dichlorobenzidine	91-94-1	ug/L	20	0.11	0.15	--	--	0.11	YES	NO	NO	20	120	20	120	20
SW 8270C or D	3-Nitroaniline	99-09-2	ug/L	50	--	3.2	--	--	3.2	YES	NO	NO	20	126	20	126	20
SW 8270C or D	4,6-Dinitro-2-methylphenol	534-52-1	ug/L	50	1.2	3.7	--	--	1.2	YES	NO	NO	40	130	40	130	20
SW 8270C or D	4-Bromophenyl Phenyl Ether	101-55-3	ug/L	10	--	--	--	--	--	NO	NO	NO	52	120	52	120	20
SW 8270C or D	4-Chloro-3-methylphenol	59-50-7	ug/L	20	1,100	--	--	--	1,100	NO	NO	NO	47	120	47	120	20
SW 8270C or D	4-Chloroaniline	106-47-8	ug/L	20	0.32	1.2	--	--	0.32	YES	NO	NO	20	120	20	120	20
SW 8270C or D	4-Chlorophenyl phenyl ether	7005-72-3	ug/L	10	--	--	--	--	--	NO	NO	NO	50	120	50	120	20
SW 8270C or D	4-Methylphenol (p-Cresol)	106-44-5	ug/L	50	1,400	180	--	--	180	NO	NO	NO	32	120	32	120	20
SW 8270C or D	4-Nitroaniline	100-01-6	ug/L	50	3.3	3.2	--	--	3.2	YES	NO	NO	36	120	36	120	20
SW 8270C or D	4-Nitrophenol	100-02-7	ug/L	50	--	--	--	--	--	NO	NO	NO	20	120	20	120	20
SW 8270C or D	Acenaphthene	83-32-9	ug/L	10	400	2,200	--	--	400	NO	NO	NO	47	120	47	120	20
SW 8270C or D	Acenaphthylene	208-96-8	ug/L	10	--	--	--	--	--	NO	NO	NO	50	120	50	120	20
SW 8270C or D	Anthracene	120-12-7	ug/L	10	1,300	11,000	--	--	1,300	NO	NO	NO	54	120	54	120	20
SW 8270C or D	Benzo (a) anthracene	56-55-3	ug/L	10	0.029	0.029	--	--	0.029	YES	NO	NO	56	100	56	100	20
SW 8270C or D	Benzo (a) pyrene	50-32-8	ug/L	10	0.0029	0.0029	0.2	--	0.0029	YES	YES	NO	53	120	53	120	20
SW 8270C or D	Benzo (b) fluoranthene	205-99-2	ug/L	10	0.029	0.029	--	--	0.029	YES	NO	NO	45	124	45	124	20
SW 8270C or D	Benzo (g,h,i) perylene	191-24-2	ug/L	10	--	--	--	--	--	NO	NO	NO	38	123	38	123	20
SW 8270C or D	Benzo (k) fluoranthene	207-08-9	ug/L	10	0.29	0.29	--	--	0.29	YES	NO	NO	45	124	45	124	20
SW 8270C or D	Benzoic acid	65-85-0	ug/L	100	58,000	150,000	--	--	58,000	NO	NO	NO	20	120	20	120	20
SW 8270C or D	Benzyl alcohol	100-51-6	ug/L	20	1,500	18,000	--	--	1,500	NO	NO	NO	30	120	30	120	20
SW 8270C or D	bis (2-chloroethoxy) methane	111-91-1	ug/L	10	47	110	--	--	47	NO	NO	NO	46	120	46	120	20
SW 8270C or D	bis (2-chloroethyl) ether	111-44-4	ug/L	10	0.012	0.012	--	--	0.012	YES	NO	NO	37	120	37	120	20
SW 8270C or D	bis (2-chloroisopropyl) ether	108-60-1	ug/L	10	0.31	0.32	--	--	0.31	YES	NO	NO	26	131	26	131	20
SW 8270C or D	bis (2-ethylhexyl) phthalate	117-81-7	ug/L	10	0.071	4.8	6	--	0.071	YES	YES	NO	42	126	42	126	20
SW 8270C or D	Butyl benzylphthalate	85-68-7	ug/L	10	14	35	--	--	14	NO	NO	NO	46	120	46	120	20
SW 8270C or D	Chrysene	218-01-9	ug/L	10	2.9	2.9	--	--	2.9	YES	NO	NO	55	120	55	120	20
SW 8270C or D	Dibenzo (a,h) anthracene	53-70-3	ug/L	10	0.0029	0.0029	--	--	0.0029	YES	NO	NO	42	127	42	127	20
SW 8270C or D	Dibenzofuran	132-64-9	ug/L	10	5.8	--	--	--	5.8	YES	NO	NO	54	120	54	120	20
SW 8270C or D	Diethyl phthalate	84-66-2	ug/L	10	11,000	29,000	--	--	11,000	NO	NO	NO	41	120	41	120	20
SW 8270C or D	Dimethyl phthalate	131-11-3	ug/L	10	--	--	--	--	--	NO	NO	NO	25	127	25	127	20
SW 8270C or D	Di-n-butylphthalate	84-74-2	ug/L	10	670	3,700	--	--	670	NO	NO	NO	54	120	54	120	20
SW 8270C or D	Di-n-octylphthalate	117-84-0	ug/L	10	--	--	--	--	--	NO	NO	NO	37	137	37	137	20
SW 8270C or D	Fluoranthene	206-44-0	ug/L	10	630	1,500	--	--	630	NO	NO	NO	54	120	54	120	20
SW 8270C or D	Fluorene	86-73-7	ug/L	10	220	1,500	--	--	220	NO	NO	NO	50	120	50	120	20
SW 8270C or D	Hexachlorobenzene	118-74-1	ug/L	10	0.042	0.042	1	--	0.042	YES	YES	NO	52	120	52	120	20
SW 8270C or D	Hexachlorobutadiene	87-68-3	ug/L	10	0.26	0.86	--	--	0.26	YES	NO	NO	27	120	27	120	20
SW 8270C or D	Hexachloroethane	67-72-1	ug/L	10	0.79	4.8	--	--	0.79	YES	NO	NO	28	120	28	120	20
SW 8270C or D	Indeno (1,2,3-c,d) pyrene	193-39-5	ug/L	10	0.029	0.029	--	--	0.029	YES	NO	NO	43	125	43	125	20

TABLE 4-2
Reporting Limits, Accuracy, and Precession Limits for Groundwater
PG&E Program Quality Assurance Project Plan Addendum

Method	Constituent	CAS	Units	QAPP RL	EPA Regional Screening Levels May 2012	EPA Regional Screening Levels 2008	Federal Drinking Water Standards MCLs	California Drinking Water Standards MCLs	Most Stringent Screening Level[1]	Does RL Exceed Screening Level?	Does RL Exceed Federal MCL Level?	Does RL Exceed California MCL Level?	LCS Accuracy Control Limits (%R) Lower Limit	LCS Accuracy Control Limits (%R) Upper Limit	MS/MSD Accuracy Control Limits (%R) Lower Limit	MS/MSD Accuracy Control Limits (%R) Upper Limit	Precision Water % RPD
SW 8270C or D	Isophorone	78-59-1	ug/L	10	67	71	--	--	67	NO	NO	NO	50	120	50	120	20
SW 8270C or D	Naphthalene	91-20-3	ug/L	10	0.14	0.14	--	--	0.14	YES	NO	NO	39	120	39	120	20
SW 8270C or D	Nitrobenzene	98-95-3	ug/L	10	0.12	3.4	--	--	0.12	YES	NO	NO	44	120	44	120	20
SW 8270C or D	n-Nitrosodi-n-propylamine	621-64-7	ug/L	10	0.0093	0.0096	--	--	0.0093	YES	NO	NO	34	128	34	128	20
SW 8270C or D	n-Nitrosodiphenylamine	86-30-6	ug/L	10	10	14	--	--	10	NO	NO	NO	48	120	48	120	20
SW 8270C or D	Pentachlorophenol	87-86-5	ug/L	50	0.17	0.56	1	--	0.17	YES	YES	NO	38	120	38	120	20
SW 8270C or D	Phenanthrene	85-01-8	ug/L	10	--	--	--	--	--	NO	NO	NO	51	120	51	120	20
SW 8270C or D	Phenol	108-95-2	ug/L	10	4,500	11,000	--	--	4,500	NO	NO	NO	20	120	20	120	20
SW 8270C or D	Pyrene	129-00-0	ug/L	10	87	1,100	--	--	87	NO	NO	NO	49	128	49	128	20
SW 8270SIM	1-methylnaphthalene	90-12-0	ug/L	0.2	0.97	2.3	--	--	0.97	NO	NO	NO	35	131	35	131	30
SW 8270SIM	2-methylnaphthalene	91-57-6	ug/L	0.2	27	150	--	--	27	NO	NO	NO	36	121	36	121	30
SW 8270SIM	Acenaphthene	83-32-9	ug/L	0.2	400	2,200	--	--	400	NO	NO	NO	39	125	39	125	30
SW 8270SIM	Acenaphthylene	208-96-8	ug/L	0.2	--	--	--	--	--	NO	NO	NO	43	140	43	140	30
SW 8270SIM	Anthracene	120-12-7	ug/L	0.2	1,300	11,000	--	--	1,300	NO	NO	NO	41	132	41	132	30
SW 8270SIM	Benzo (a) anthracene	56-55-3	ug/L	0.2	0.029	0.029	--	--	0.029	YES	NO	NO	58	141	58	141	30
SW 8270SIM	Benzo (a) pyrene	50-32-8	ug/L	0.2	0.0029	0.0029	0.2	--	0.0029	YES	NO	NO	31	142	31	142	30
SW 8270SIM	Benzo (b) fluoranthene	205-99-2	ug/L	0.2	0.029	0.029	--	--	0.029	YES	NO	NO	42	156	42	156	30
SW 8270SIM	Benzo (g,h,i) perylene	191-24-2	ug/L	0.2	--	--	--	--	--	NO	NO	NO	12	171	12	171	30
SW 8270SIM	Benzo (k) fluoranthene	207-08-9	ug/L	0.2	0.29	0.29	--	--	0.29	NO	NO	NO	49	165	49	165	30
SW 8270SIM	Chrysene	218-01-9	ug/L	0.2	2.9	2.9	--	--	2.9	NO	NO	NO	51	155	51	155	30
SW 8270SIM	Dibenzo (a,h) anthracene	53-70-3	ug/L	0.2	0.0029	0.0029	--	--	0.0029	YES	NO	NO	28	153	28	153	30
SW 8270SIM	Fluoranthene	206-44-0	ug/L	0.2	630	1,500	--	--	630	NO	NO	NO	47	158	47	158	30
SW 8270SIM	Fluorene	86-73-7	ug/L	0.2	220	1,500	--	--	220	NO	NO	NO	40	140	40	140	30
SW 8270SIM	Indeno (1,2,3-c,d) pyrene	193-39-5	ug/L	0.2	0.029	0.029	--	--	0.029	YES	NO	NO	20	167	20	167	30
SW 8270SIM	Naphthalene	91-20-3	ug/L	0.2	0.14	0.14	--	--	0.14	YES	NO	NO	39	125	39	125	30
SW 8270SIM	Phenanthrene	85-01-8	ug/L	0.2	--	--	--	--	--	NO	NO	NO	46	144	46	144	30
SW 8270SIM	Pyrene	129-00-0	ug/L	0.2	87	1,100	--	--	87	NO	NO	NO	39	158	39	158	30
CF-IRMS	D18O	D18O	0/00	--	--	--	--	--	--	NO	NO	NO	--	--	--	--	20
CF-IRMS	DD	DD	0/00	--	--	--	--	--	--	NO	NO	NO	--	--	--	--	20
SM 7110 C	Gross alpha	Gross alpha	pCi/L	3	--	--	15	15	15	NO	NO	NO	--	--	--	--	20
EPA 900.0	Gross beta	Gross beta	pCi/L	4	--	--	--	4	4	NO	NO	NO	--	--	--	--	20
EPA 903.1	Radium-226	013982-63-3	pCi/L	1	--	--	5	--	5	NO	NO	NO	--	--	--	--	20
EPA 904.0	Radium-228	015262-20-1	pCi/L	1	--	--	5	--	5	NO	NO	NO	--	--	--	--	20
EPA 905.0	Strontium	7440-26-4	pCi/L	2	--	--	--	8	8	NO	NO	NO	--	--	--	--	20
EPA 906.0	Tritium	10028-17-8	pCi/L	1,000	--	--	--	20,000	20,000	NO	NO	NO	--	--	--	--	20
EPA 908.0	Uranium	7440-61-1	pCi/L	1	--	--	--	20	20	NO	NO	NO	--	--	--	--	20
RSK-175	Carbon Dioxide	124-38-9	ug/L	5	--	--	--	--	--	NO	NO	NO	80	120	80	120	20
RSK-175	Ethane	74-84-0	ug/L	5	--	--	--	--	--	NO	NO	NO	80	120	80	120	20
RSK-175	Ethene	74-85-1	ug/L	5	--	--	--	--	--	NO	NO	NO	80	120	80	120	20
RSK-175	Methane	74-82-8	ug/L	5	--	--	--	--	--	NO	NO	NO	80	120	80	120	20

Notes:

Please keep in mind, Screening Levels are constantly revised by the EPA. The appropriate Screening levels are specific to the project, the location, the agency providing oversight, and the overall Goals of the project.

mg/L = milligrams per liter
ug/L = micrograms per liter
µmhos/cm = micromhos per centimeter
pCi/L = picocuries per liter
PCB - LCS, MS, and MSD only require Aroclor-1016 and Aroclor-1260 spike

[1] Screening levels are established by use of statistical analysis and are not based on the analytical capabilities of labortories or methods. For groundwater, most stringent of:
EPA Regional Screening Levels - 2008 and May 201
Federal Drinking Water Standards, MCLs
*Secondary Federal Drinking Water Standards, MCLs
California Drinking Water Standards, MCLs

TABLE 4-3

Maximum Concentrations for Title 22

PG&E Program Quality Assurance Project Plan Addendum

					CA TTCL/STLC						LCS Accuracy Control Limits (%R)		MS/MSD Accuracy Control Limits (%R)		Precision Soil
Method	Constituent	CAS	Units	TCLP Regulatory Standards	Title 22 TTLC MCL (mg/kg)	If TTLC Concentration is ≥ this value STLC Analysis Must be performed	Title 22 STLC MCL	Most Stringent Screening Level	RL	Does RL Exceed Screening Level?	Lower Limit	Upper Limit	Lower Limit	Upper Limit	% RPD
SW6010B	Antimony	7440-36-0	mg/L	--	500	150	15	15	0.04	NO	85	115	75	125	20
SW6010B	Arsenic	7440-38-2	mg/L	5	500	50	5	5	0.01	NO	85	115	75	125	20
SW6010B	Barium	7440-39-3	mg/L	100	10,000	1,000	100	100	0.04	NO	85	115	75	125	20
SW6010B	Beryllium	7440-41-7	mg/L	--	75	7.5	0.75	0.75	0.01	NO	85	115	75	125	20
SW6010B	Cadmium	7440-43-9	mg/L	1	100	10	1	1	0.02	NO	85	115	75	125	20
SW6010B	Chromium	7440-47-3	mg/L	5	2,500	50	5	5	0.02	NO	85	115	75	125	20
SW3060A	Chromium, Hexavalent	18540-29-9	mg/L	--	500	50	5	5	0.004	NO	90	110	90	110	20
SW6010B	Cobalt	7440-48-4	mg/L	--	8,000	800	80	80	0.1	NO	85	115	75	125	20
SW6010B	Copper	7440-50-8	mg/L	--	2,500	250	25	25	0.02	NO	85	115	75	125	20
SW6010B	Lead	7439-92-1	mg/L	5	1,000	50	5	5	0.02	NO	85	115	75	125	20
SW7470A	Mercury	7439-97-6	mg/L	0.2	20	2	0.2	0.2	0.004	NO	75	125	75	125	20
SW6010B	Molybdenum	7439-98-7	mg/L	--	3,500	3,500	350	350	0.04	NO	85	115	75	125	20
SW6010B	Nickel	7440-02-0	mg/L	--	2,000	200	20	20	0.04	NO	85	115	75	125	20
SW6010B	Selenium	7782-49-2	mg/L	1	100	10	1	1	0.2	NO	85	115	75	125	20
SW6010B	Silver	7440-22-4	mg/L	5	500	50	5	5	0.1	NO	85	115	75	125	20
SW6010B	Thallium	7440-28-0	mg/L	--	700	70	7	7	0.02	NO	85	115	75	125	20
SW6010B	Vanadium	7440-62-2	mg/L	--	2,400	240	24	24	0.1	NO	85	115	75	125	20
SW6010B	Zinc	7440-66-6	mg/L	--	5,000	2,500	250	250	0.4	NO	85	115	75	125	20
SW8081A	4,4'-DDD	72-54-8	mg/L	--	1	--	0.1	0.1	0.002	NO	50	139	50	139	30
SW8081A	4,4'-DDE	72-55-9	mg/L	--	1	--	0.1	0.1	0.002	NO	48	137	48	137	30
SW8081A	4,4'-DDT	50-29-3	mg/L	--	1	--	0.1	0.1	0.002	NO	47	138	47	138	30
SW8081A	Aldrin	309-00-2	mg/L	--	1.4	--	0.14	0.14	0.002	NO	42	138	42	138	30
SW8081A	Chlordane	57-74-9	mg/L	0.03	2.5	--	0.25	0.03	0.002	NO	63	123	63	123	30
SW8081A	Dieldrin	60-57-1	mg/L	--	8	--	0.8	0.8	0.002	NO	62	129	62	129	30
SW8081A	Endrin	72-20-8	mg/L	0.02	0.2	--	0.02	0.02	0.002	NO	56	134	56	134	30
SW8081A	Heptachlor	76-44-8	mg/L	--	4.7	--	0.47	0.47	0.002	NO	51	128	51	128	30
SW8081A	Heptachlor (and its epoxide)	76-44-8	mg/L	0.008	4.7	--	0.47	0.008	0.002	NO	62	131	62	131	30
SW8081A	Kepone	143-50-0	mg/L	--	21	--	2.1	2.1	1	NO					30
SW8081A	Lindane	58-89-9	mg/L	0.4	4	--	0.4	0.4	0.002	NO	30	146	30	146	30
SW8081A	Methoxychlor	72-43-5	mg/L	10	100	--	10	10	0.01	NO	56	150	56	150	30
SW8081A	Toxaphene	8001-35-2	mg/L	0.5	5	--	0.5	0.5	0.02	NO	41	126	41	126	30
SW8082	Polychlorinated biphenyls (PCB)		mg/L	--	50	--	5	5	1	NO	29	141	29	141	30
SW8151A	2,4,5-Trichlorophenoxypropionic acid (2,4,5-TP) (Silvex)	Vanadium	mg/L	1	10	--	1	1	0.2	NO	49	126	49	126	30
SW8151A	2,4-Dichlorophenoxyacetic acid (2,4-D)	94-75-7	mg/L	10	100	--	10	10	0.2	NO	39	120	39	120	30
SW8260B	1,1-Dichloroethylene	75-35-4	mg/L	0.7	--	--	--	0.7	0.02	NO	68	130	68	130	20
SW8260B	1,2-Dichloroethane (EDC)	107-06-2	mg/L	0.5	--	--	--	0.5	0.01	NO	69	132	69	132	20
SW8260B	1,4-Dichlorobenzene	106-46-7	mg/L	7.5	--	--	--	7.5	0.01	NO	74	123	74	123	20
SW8260B	2-Butanone (MEK)	78-93-3	mg/L	200	--	--	--	200	0.2	NO	49	136	49	136	20
SW8260B	Benzene	71-43-2	mg/L	0.5	--	--	--	0.5	0.008	NO	81	122	81	122	20
SW8260B	Carbon tetrachloride	56-23-5	mg/L	0.5	--	--	--	0.5	0.01	NO	66	138	66	138	20
SW8260B	Chlorobenzene	108-90-7	mg/L	100	--	--	--	100	0.01	NO	81	122	81	122	20
SW8260B	Chloroform	67-66-3	mg/L	6	--	--	--	6	0.02	NO	69	128	69	128	20
SW8260B	Hexachlorobutadiene	87-68-3	mg/L	0.5	--	--	--	0.5	0.012	NO	67	131	67	131	20
SW8260B	m-Cresol	108-39-4	mg/L	200	--	--	--	200	1	NO	29	141	29	141	20
SW8260B	o-Cresol (2-Methylphenol)	95-48-7	mg/L	200	--	--	--	200	1	NO	38	120	38	120	20
SW8260B	p-Cresol (4-Methylphenol)	106-44-5	mg/L	200	--	--	--	200	1	NO	32	120	32	120	20
SW8260B	Tetrachloroethylene (PCE)	127-18-4	mg/L	0.7	2,040	--	204	0.7	0.02	NO	66	128	66	128	20
SW8260B	Total Cresols		mg/L	200	--	--	--	200	10	NO					20
SW8260B	Trichloroethylene (TCE)	79-01-6	mg/L	0.5	--	--	--	0.5	0.02	NO	70	127	70	127	20
SW8260B	Vinyl chloride	75-01-4	mg/L	0.2	--	--	--	0.2	0.01	NO	50	134	50	134	20
SW8270C	2,4,5-Trichlorophenol	95-95-4	mg/L	400	--	--	--	400	1	NO	49	120	49	120	20

TABLE 4-3
Maximum Concentrations for Title 22
PG&E Program Quality Assurance Project Plan Addendum

					CA TTCL/STLC						LCS Accuracy Control Limits (%R)		MS/MSD Accuracy Control Limits (%R)		Precision Soil
Method	Constituent	CAS	Units	TCLP Regulatory Standards	Title 22 TTLC MCL (mg/kg)	If TTLC Concentration is ≥ this value STLC Analysis Must be performed	Title 22 STLC MCL	Most Stringent Screening Level	RL	Does RL Exceed Screening Level?	Lower Limit	Upper Limit	Lower Limit	Upper Limit	% RPD
SW8270C	2,4,6-Trichlorophenol	88-06-2	mg/L	2	--	--	--	2	0.2	NO	49	126	49	126	20
SW8270C	2,4-Dinitrotoluene	121-14-2	mg/L	0.13	--	--	--	0.13	0.1	NO	51	120	51	120	20
SW8270C	Hexachlorobenzene	118-74-1	mg/L	0.13	--	--	--	0.13	0.1	NO	52	120	52	120	20
SW8270C	Hexachlorobutadiene	87-68-3	mg/L	0.5	--	--	--	0.5	0.2	NO	27	120	27	120	20
SW8270C	Hexachloroethane	67-72-1	mg/L	3	--	--	--	3	0.2	NO	28	120	28	120	20
SW8270C	Nitrobenzene	98-95-3	mg/L	2	--	--	--	2	0.2	NO	44	120	44	120	20
SW8270C	Pentachlorophenol	87-86-5	mg/L	100	17	--	1.7	1.7	1	NO	38	120	38	120	20
SW8270C	Pyridine	110-86-1	mg/L	5	--	--	--	5	5	NO	27	120	27	120	20
Dioxins	Dioxin (2,3,7,8-TCDD)	1746-01-6	mg/L	--	0.01	--	0.001	0.001	0.001	NO					20

Notes:

mg/L = milligrams per liter
mg/kg = milligrams per kilogram

TCLP = toxicity characteristic leaching procedure
STLC = soluble threshold limit concentration
TTLC = total threshold limit concentration

Appendix D
Construction Health and Safety Plan

Construction Health and Safety Plan

Remedial Action Work Plan
Topock Compressor Station
Needles, California

Prepared for

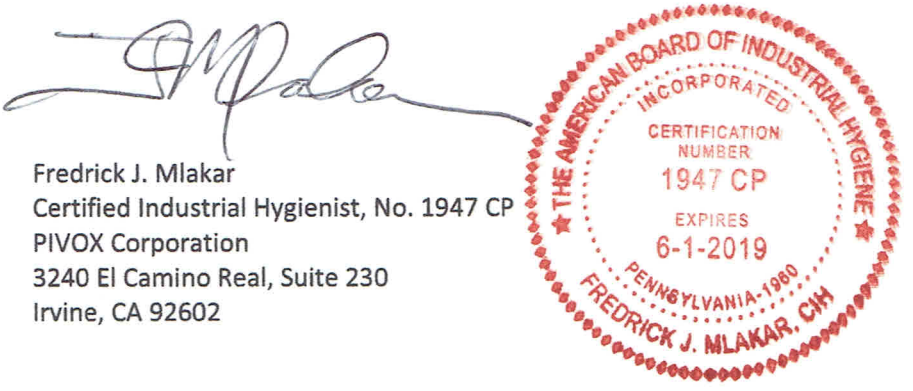
Pacific Gas and Electric Company

November 2015

Pivox Corporation

Certification Statement

I have reviewed and approved this Construction Health and Safety Plan.



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SECTION 1

Introduction

The purpose of the Construction Health and Safety Plan (CHSP) is to provide a basic framework for the safe construction of the Pacific Gas and Electric (PG&E) Topock Compressor Station (TCS) Groundwater Remediation Project (Remedy) located and in the vicinity of PG&E's TCS facility in Needles, California (Site). This CHSP meets the standards set by the United States Occupational Safety and Health Administration (OSHA) (29 CFR 1910 and 1926), and California Occupational Safety and Health Administration (Cal/OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) regulations found at Title 8 of the California Code of Regulations Section 5192 (8 CCR 5192).

This CHSP is packaged with the PG&E Topock Final Design Construction/Remedial Action Work Plan (C/RAWP). Additional detail on the strategy for constructing the Remedy will be found in the C/RAWP. Remedy technical design information used to develop this CHSP is detailed in the PG&E Topock Final Groundwater Remedy Final (100%) Basis of Design (Remedy BOD Report).

1.1 CHSP Scope

This CHSP will not be used on its own to direct the health and safety program during Remedy construction; the information and procedures contained herein are to provide high-level project information and serve as the basis for the development of site-specific project health and safety plans (PHSP) by PG&E or their Remedy contractors prior to construction of the Remedy. The Remedy involves a vast array of construction tasks, from well drilling, to installation of high-voltage electrical equipment, to tunneling under active roadways, each with their specific hazards and H&S requirements. Detailed H&S information and requirements for these varied tasks will be provided by the respective PHSP.

This CHSP will be used, in addition to other site orientation information (e.g., cultural resource orientation, protected species orientation) to develop a visitor safety orientation to be reviewed by site visitors upon their initial visit to the Site.

This CHSP will also cover work associated with decommissioning of the IM3 treatment plant. While IM3 decommissioning will be performed after acceptance and startup of the final groundwater remedy, for the purposes of this CHSP, references to final groundwater remedy work includes IM3 decommissioning, and all information included in this CHSP applies.

1.2 Site-Specific Project Health and Safety Plans

Contractors and their subcontractors will be required to prepare and submit a PHSP for approval by PG&E or their designee prior to mobilizing to the site. Contractor PHSP will contain detailed Health and Safety (H&S) procedures, hazard communications, and requirements specific to their work. Contractor and their personnel (including subcontractors) will be required to sign in acknowledgment, understanding and agreement to comply with their PHSP.

PG&E personnel, visitors, and other non-contractor personnel will also be required to review and sign-in to the relevant PHSP when visiting an active work zone governed by a PHSP.

1.3 Stop Work Authority

PG&E recognizes that to achieve the safest possible work environment, all personnel working onsite must be empowered to assume responsibility for their own safety and the safety of others. All personnel will have

the authority to stop work that they feel is unsafe at any time and bring the issue to the attention of their organization, PG&E, or others without repercussion.

1.4 Promoting Safety Culture

A safety culture is built on the compilation of all of our safe behaviors and attitudes. Behavior Based Safety (BBS) Program will be flow-down requirement at the project to facilitate a safety culture. Not really a "program" per se, it is a set of principles to be used in all other programs and procedures. Its purpose is to influence personal attitudes by focusing on observable behaviors, reinforcing exemplary behaviors, and correcting unsafe behaviors which are typically the root causes of accidents.

Leadership will implement behavior observations to identify safe/at-risk behaviors. Until an individual is fully incorporated into safety culture, mentoring arrangements may be implemented for recent hires. Participation, Ownership, Personal Responsibility are key elements to BBS.

SECTION 2

Project Overview

Groundwater activities at the Topock site are being performed in conformance with the requirements of the Resource Conservation and Recovery Act (RCRA) Corrective Action pursuant to a Corrective Action Consent Agreement (CACA) entered into by PG&E and the California Department of Toxic Substances Control (DTSC) in 1996. In addition, PG&E and the United States executed a Remedial Design/Remedial Action Consent Decree (CD), on behalf of the U.S. Department of the Interior (DOI), under the Comprehensive Environmental Response, Compensation, and liability Act (CERCLA) in 2012, which was approved by the U.S. District Court for the Central District of California in November 2013. Section 13a of the CD, and the CD's Scope of Work Sections 2.2.7 and 3 stipulate preparation of this CHSP.

2.1 Site Background and Project Description

The Compressor Station is located adjacent to the Colorado River in eastern San Bernardino County, California, approximately 12 miles southeast of Needles, California, south of Interstate 40 (1-40), at the north end of the Chemehuevi Mountains. The surrounding project site includes land owned and/or managed by a number of government and private entities including PG&E, the U.S. Bureau of Reclamation (BOR) (managed by the U.S. Bureau of Land Management [BLM]), the U.S. Fish and Wildlife Service (USFWS) (managing the Havasu National Wildlife Refuge [HNWR]), San Bernardino County, BNSF Railroad, Fort Mojave Indian Tribe (FMIT), and the Southern California Metropolitan Water District.

The existing chromium contamination in groundwater is largely attributable to historical wastewater discharge from Compressor Station operations to Bat Cave Wash, designated as Solid Waste Management Unit (SWMU 1/Area of Concern (AOC) 1, and within the East Ravine, designated as AOC 10. Please refer to the Remedy BOD Report for a detailed overview of the remedial concept, objectives, design basis, and design details.

2.2 GW Remedy Construction Project Component Tasks

Key to any activity at the project is working safely, and protecting the environment. Protecting the environment will be understood to encompass preventing release of contaminants into the air, soil and water, as well as preserving the cultural dignity of this site. Remedy construction will be broken into discrete tasks. It is expected that a number of companies will be contracted to implement work required to build one or more of the component tasks described below. Key safety and health concepts for the various tasks listed below are briefly noted under each task.

Key safety and health considerations for the various tasks are also briefly noted below, as a summary of the hazard identification process. Tasks may occur in the typical HAZWOPER zones (Areas of Concern (AOC)) where low levels of chemical contamination may be in the surface soils, or in other work areas of the site where contact with groundwater may occur. Most tasks may be performed without personnel coming in contact with contaminated soils or groundwater and will be evaluated by the HSO for application of HAZWOPER requirements.

Note: asbestos abatement is not considered as a planned feature of the project and is discussed here on a contingency basis.

2.2.1 Mobilization and Site Preparation

- Biological and environmental hazards (e.g., heat stress)

- Loading and unloading of facility equipment, heavy equipment, construction materials.
- Exposure to overhead and buried utilities.
- Heavy equipment operation, including minor earthwork to prepare site staging areas.
- Electrical hookup and distribution

2.2.2 Well Installation

- Biological and environmental hazards (e.g., heat stress)
- Pinch points, between fixed and moving equipment
- Work on uneven ground
- Loud machinery operation
- Slip, trips, falls
- Elevated work and suspended loads
- Struck by parts or equipment
- Work in low-visibility conditions around equipment

2.2.3 Pipeline Installation

- Biological and environmental hazards (e.g., heat stress)
- Airborne dust
- Pinch points, between fixed and moving equipment
- Slip, trips, falls
- Elevated work and suspended loads
- Work in low-visibility conditions around equipment
- Struck by parts or equipment
- Pressurized system hazards; flying debris, whipping hoses, injection hazard
- Excavation/trench hazards; collapse, traffic hazard, hazardous atmosphere
- Work in or near active roadways; struck by traffic
- Electrical hazards
- Work in and around active underground utilities
- Overhead utilities
- Work within the active Compressor Station; multi-employer worksite

2.2.4 Material Import

- Biological and environmental hazards (e.g., heat stress)
- Manual loading and unloading of materials; muscle strain
- Heavy equipment operation; strike personnel or equipment
- Work in or near active roadways; struck by traffic
- Work in low-visibility conditions around equipment

2.2.5 Electrical and Controls Systems Installation

- Biological and environmental hazards (e.g., heat stress)
- Electrical contact; shocks and burns
- Slip, trips, falls
- Elevated work and suspended loads
- Overhead utilities
- Work within the active Compressor Station; multi-employer worksite
- Ergonomics; muscle strain and repetitive motion

2.2.6 Earthwork, Grading, Retaining Wall Construction

- Biological and environmental hazards (e.g., heat stress)
- Airborne dust
- Heavy equipment operation; strike personnel or equipment
- Falls; on ground or on equipment ladders
- Elevated work and suspended loads
- Work in low-visibility conditions around equipment
- Struck by parts or equipment
- Hydraulics pressurized system hazards; whipping hoses, injection hazard
- Excavation/trench hazards; collapse, traffic hazard, hazardous atmosphere
- Work in or near active roadways; struck by traffic
- Work around active underground utilities
- Overhead utilities
- Work within the active Compressor Station; multi-employer worksite

2.2.7 Process Facility Construction and Buildout

- Biological and environmental hazards (e.g., heat stress)
- Airborne dust
- Heavy equipment operation; strike personnel or equipment
- Materials movement hazards; struck by
- Slip, trips, falls
- Elevated work; fall hazard
- Work in low-visibility conditions around equipment
- Pressurized system hazards(pneumatic systems and concrete pumper equipment); whipping hoses,
- Work in or around active natural gas transmission operations
- Work in or near active roadways; struck by traffic
- Work around active underground utilities

- Overhead utilities

2.2.8 Pipeline Bridge/Overhead Crossings

- Biological and environmental hazards (e.g., heat stress)
- Electrical contact; shocks and burns
- Slip, trips, falls
- Elevated work
- Suspended loads
- Overhead utilities
- Unprotected exposure to elements
- Rescue and emergency preparations
- Ergonomics; muscle strain and repetitive motion

SECTION 3

Project Organization and Responsibilities

The following section describes general roles and responsibilities for PG&E and contractor project and H&S leadership. Valuing personal safety, working in a safe manner, and understanding and following established H&S practices and requirements is the responsibility for every person involved with construction of the remedy, whether they represent PG&E, a contractor, a project stakeholder, or a visitor. It is up to the entire project team, starting with project leadership, to establish a culture of safety during implementation of this project.

It is also the responsibility of the project leadership to ensure that all project personnel understand they have stop work authority when confronted with potentially unsafe actions or conditions.

3.1 PG&E H&S Organization

The PG&E organization provided below is preliminary, and will be finalized as the construction project team is established. The roles below may change, or one person may serve more than one role as the Remedy construction project evolves.

3.1.1 PG&E Remediation Program H&S Manager

The PG&E Remediation Program Health & Safety Manager is responsible for managing PG&E's health and safety program for the Environmental Remediation Department. The Program H&S Manager will not have day-to-day involvement with the Project; however, he/she will be responsible for setting Company standards for H&S operations and culture.

The Program Health and Safety Manager may become involved in resolving issues or H&S questions that cannot be resolved within the project team, responding to H&S incidents, or providing high-level H&S inspections during implementation.

3.1.2 Topock Project Manager

The Topock Project Manager (PM) is responsible for the overall direction of the project, relations with external stakeholders, and regulatory compliance issues. The PM is responsible for communication, including status reporting, risk management, escalation of issues that cannot be resolved within the team, and will serve as review and approval authority where the construction project potentially affects long term regulatory compliance of the remedy or acceptance by external stakeholder. In general the PM will serve as the primary point of contact between the Topock GW remedy construction project and other facets of the Topock project.

The Topock PM is responsible for staying apprised of H&S performance during implementation of the project, and maintaining compliance with PG&E's H&S program requirements. The PM may perform site inspections and audits, may assist with incident investigations, and will serve as a liaison with the PG&E Remediation Program H&S Manager.

3.1.3 Site Operations Manager

The Site Operations Manager is the primary point of contact for field activities related to the construction project. The Site Operations Manager holds daily meetings, coordinates site operations, and provides review for contractor submittals in coordination with the Construction Manager. The Site Operations Manager has front-line responsibility for implementing PG&E's H&S program during the full life cycle of Remedy implementation, and works with the Topock Construction Manager to manage PG&E H&S during Remedy construction.

The Site Operations Manager reviews all H&S documentation and performance data and leads PG&E-driven H&S inspections and audits.

3.1.4 PG&E Construction Manager

The PG&E Construction Manager (CM) will be the primary point of contact for the Owner regarding all construction activities. The PG&E CM is responsible for overall management of the Remedy construction project, including the health and safety program. The PG&E CM reports to the Topock Project Manager, and works with the project CM, Site Operations Manager, and PG&E Site H&S Supervisor to confirm that the H&S program is implemented in accordance with this CHSP, PG&E H&S standards, and in accordance with project and regulatory requirements.

3.1.5 Construction Manager

The project Construction Manager (CM) is responsible for management of construction activities, including implementation of the health and safety program. The CM will also serve as the point of contact with the project's independent quality control/quality assurance (QA/QC) organization, and with project contracting/controls personnel for contract change management.

The CM, along with the PG&E Site H&S Supervisor, oversees the implementation of all contractor H&S programs while on-site. Upon consultation with the PG&E Site H&S Supervisor, the CM is responsible for confirming and enforcing contractual H&S obligations, including using contractual enforcement mechanisms if a contractor is found to be non-compliant to contracted project H&S performance requirements.

The CM will lead the regular high-level H&S project meetings described in Section 3.3. The CM may also lead H&S inspections and assist in incident investigations. The CM will report H&S performance information on a regular basis to both the Topock PM and Site Operations Manager.

3.1.6 Construction Health and Safety Manager

The Construction Health and Safety Manager (HSM) will be the main point of contact for contractors' health and safety teams. This person may not be a PG&E employee, however, they will serve on the site management team leading the H&S effort. The HSM has direct responsibility for day-to-day implementation of all H&S practices across the Remedy project. The HSM is the primary POC to all contractor H&S personnel, and leads a parallel line of authority with contractor H&S managers, such that H&S performance maintains independence from production-oriented operational performance.

The HSM reviews contractor H&S submittals (including contractor PHSPs) prior to mobilization, performs ongoing reviews of work being performed against H&S requirements documented in this CHSP and the appropriate contractor PHSP, ensures all personnel have received site-specific H&S training, develops and leads site-specific H&S training/orientation sessions, and leads incident investigations, including preparing incident investigation documentation. The PG&E HSM also leads the morning H&S Principals Meetings described in Section 3.3.2.

3.2 Contractor H&S Organization

The contractor organizational structure provided below is preliminary, and will be finalized for each contractor team during the project bid and contracting process. All Contractors or their sub-contractors may be required to undergo a to-be-determined PG&E H&S review and certification process prior to being qualified to bid or be contracted to work on the GW Remedy project. Contractor H&S team size and scale will vary based on the scope of work a given contractor is tasked with, the inherent hazards associated with that scope, and the requirements described in the contractor's approved PHSP.

All personnel assigned HSO responsibilities shall be expected to meet standards of professional level training, relevant experience, and professional certification. The standard for these expectations will be commensurate to the scope of the project, its duration, number of personnel, and potential for aspects of

the task to present significant safety hazards. Certified Industrial Hygienist, Certified Safety Professional, Occupational Health and Safety Technologist, Construction Health and Safety Technician are each examples of acceptable certifications.

3.2.1 Contractor PM

The Contractor's PM is responsible for oversight and management of all aspects of their contracted project scope of work, including health and safety, quality assurance, personnel, contract management, schedule management, and change management.

The PM provides safety leadership by establishing the safety standard throughout the project by example and by holding all personnel assigned to this project accountable for their safety responsibilities. The Contractor PM conducts periodic site inspections and participates in incident investigations.

3.2.2 Contractor Corporate Health and Safety Manager

The Contractor Corporate Health and Safety Manager is the senior health and safety professional assigned to the project for the purpose of providing technical assistance to the Contractor PM and on-site health and safety personnel. The Corporate Health and Safety Manager is responsible for the following:

- Developing and implementing contractor PHSP in compliance with this CHSP, contract requirements, and applicable PG&E and government standards
- Reviews lower-tier contractor H&S submittals
- Assists Site Health and Safety Officers in developing and reviewing project health and safety procedures, hazard analysis and other supporting documents;
- Reviews analytic data, and other safety managerial professional services
- Conducts periodic inspections and audits of the project site, including subcontractors.

3.2.3 Contractor Site Health & Safety Officer (HSO)

The Contractor's HSO will be the employee(s) designated as the H&S competent persons for their organization's contracted scope of work. Each HSO will be responsible for:

- Implements the provisions of their approved PHSP
- Conducts and documents daily site safety inspections
- Maintains health and safety records on site
- Assists the project manager with incident investigations related to health and safety
- Conducts monitoring tasks on site
- As needed, accompanies employees to clinics or other health care providers to ensure proper care and evaluation of injured or ill employees.

3.2.4 Contractor Site Supervisors

The site supervisors will be responsible for directing the work and schedule at their site, coordinating delivery of equipment and materials, and managing any subcontractors performing work at their site.

Site supervisors have direct responsibility for ensuring that their teams are implementing their H&S program as they work, including completing H&S tailgate meetings, implementing the Job Hazard Analysis process, and planning work such that it can be completed in a responsible and safe manner.

3.2.5 Subcontractors

Subcontractors will work under the direction of their respective site supervisor(s) and will be subject to all health and safety requirements set forth in their respective contractor PHSP. Subcontractors will also be responsible for producing and maintaining their own health and safety plan with plans and procedures specific to their work.

Subcontractor's compliance with this CHSP will be on a flow down basis with the expectation that additional training and PPE appropriate for the craft has been provided. Subcontractors with more than a few employees who will be expected to be onsite for an extended period of time will be expected to provide a site-specific health and safety plans, and job safety analyses. BBS program elements will similarly be implemented.

3.3 Meetings

3.3.1 Plan of the Day

Daily operational meetings will be held each morning to discuss upcoming work, anticipated hazards, external stakeholder monitoring or site visits, and related logistical information. The goal of the Plan of the Day meeting is to ensure that all parties are coordinated in the day's work. An H&S discussion and daily topic will be an agenda item for this meeting; however, this meeting will be focused on logistics and operations rather than H&S discussions.

3.3.2 Morning H&S Principals Meeting

PG&E and contractor health and safety principals will meet each morning to discuss overall health and safety concerns for the day, any ongoing H&S issues, and general H&S performance. Topics covered will include anticipated hazards, safe work policies to address the anticipated hazards, and any health and safety concerns from the previous day's work or lessons learned. This meeting will also discuss upcoming H&S inspections, and will serve as the follow-up milestone after completion of H&S inspections.

3.3.3 Tailgate Meetings

A daily tailgate meeting will be held at each work site each morning prior to commencement of construction activities. The purpose of this meeting will be to communicate objectives for the day's work and any anticipated hazards to the crew members at each Site. Safe work procedures for minimizing these hazards will be discussed and crew members will be invited to contribute their health and safety concerns. Job Hazard Analysis documentation will be reviewed and completed during Tailgate Meetings.

3.3.4 Weekly Project Meetings

Weekly project meetings will be held between principals and the project management staff. These meetings will provide a structure for clear communication between all parts of the project team. Topics will include progress of work, project schedule, health and safety concerns for the coming week, and review of lessons learned.

3.3.5 Inspections

Inspections shall be performed on a regular and spot basis by PG&E H&S leadership, and contractors will be responsible for internal inspections and audits as required by their approved PHSP. Pre-use inspections of equipment, tools, and work areas will be conducted to ensure safe work conditions and that safety related equipment and emergency response materials are in working condition. All site managerial personnel will be expected to participate in individual and team safety walk downs.

Records audits will be conducted to ensure that training and medical qualifications of Contractor and subcontractor personnel are in order. Reports of inspections and audit shall be made to the PM who will assign responsibility and correction date for any contractual or regulatory compliance issues.

This CHSP does not prescribe a formal H&S audit program. Regular H&S audits are an important tool in ensuring that PG&E and contractors are in compliance with project H&S requirements. The PG&E H&S audit program will be developed when the PG&E construction project organization has been finalized, and specific audit requirements will be developed and included in bid and contract documentation as the construction project procurement process gets underway.

SECTION 4

General Rules and Conditions

4.1 General Site Access

Upon initial entry to the site (usually at the site visitor center located at the project construction headquarters), all project personnel, visitors and vendors shall check in and receive an orientation. As appropriate to anticipated tasks and duration on site, they will receive a visitor safety orientation and/or review this CHSP, and sign the certification page acknowledging that they have read, understand, and agree to comply with the provisions. In addition, project personnel and visitors will also be required to review and certify the appropriate contractor PHSP(s) and other relevant safety information prior to entering the support or exclusion zone for a specific active work zone.

All activities outside the site visitor area, except in vehicles while driving between site locations, will require a minimum of OSHA Level D PPE. Specific work zones may require additional PPE and training, as described in Sections 5 through 7.

In general, due to safety considerations at the construction site, visitors will be prohibited from entering designated construction work areas, including, but not limited to exclusion zones, and contamination reduction zones, unless otherwise authorized by PG&E or the onsite Contractor site supervisor or HSO. If a visitor requests entry into an active work zone, the construction team will evaluate the situation and make appropriate adjustments (such as ceasing an activity during the observation) to allow safe entry by the visitor. Visitors will be required to don the necessary PPE prior to entry.

4.2 Topock Compressor Station Access

The Topock Compressor Station requires specific training prior to unaccompanied personnel access within the Station boundary. Remedy construction will be coordinated with the Station supervisors to minimize potential impact on Station operations, and construction personnel access to the Station will be limited to personnel essential to complete planned Remedy construction at the Station. All personnel must complete specific PG&E Compressor Station safety training in order to work within the Station without an escort.

Personnel who have not received this training must be escorted at all times while within the Compressor Station. All personnel must sign in and out at the front office when visiting the Compressor Station.

All visitors who will be entering a work zone will be required, to attend the daily safety meeting for those activities or receive a safety briefing from the Safety Officer prior to entering the work zone.

4.3 General Site Conduct Rules

Personnel employed by or representing PG&E, contractors, or external stakeholders will be responsible for complying with their respective organization's code of conduct. Unacceptable employee conduct and/or violation of a project rule or requirement will be managed as a contractual issue the appropriate organization, and may result in individual denial of access to the work area or project facilities. Examples of unacceptable employee conduct and/or rule violation are as follows:

- Abusing equipment, vehicles, or other property.
- Operating equipment or vehicles without authorization and proper qualification.
- Failure to operate equipment or vehicles in the manner specified by the manufacturer (including proper maintenance and repairs).

- Willful negligence that results in violations of health and safety or project rules or requirements.
- Behaving in a culturally inappropriate or disrespectful manner.
- Behaving in a verbally or physical threatening manner, fighting
- Engaging in horseplay of any kind.
- Sexual harassment, including making inappropriate comments or displaying inappropriate behavior toward an individual's sexual or gender orientation.
- Improperly using, or failure to use, toilet facilities.
- Violating the Site security rules.
- Littering, not using trash receptacles, or otherwise creating unsanitary conditions.
- Smoking, using tobacco, or eating in prohibited areas.
- Possessing, when not authorized, project, or other person's property or services, or theft of the same.
- Altering, damaging, or mutilating public, project, or another person's property.
- Reporting or badging for other employees or other identification misrepresentation.
- Refusing to submit to drug and alcohol screening or testing or other similar inspections.
- Possessing or using alcoholic beverages, controlled substances, or weapons on any project.
- Sleeping on the project.
- Not reporting an accident or health and safety incident, no matter how minor.

4.4 Sanitary Facilities

PG&E will maintain sanitary facilities at the construction headquarters. Topock Compressor Station sanitary facilities cannot be assumed as usable by Remedy construction personnel, whether employed by PG&E or others.

Contractors are required to coordinate site work with the project's general site support organization such that adequate sanitary facilities in the appropriate number and in accordance with OSHA standards are available at all work sites. Because some operations may be remote from the principal site of operations, provisions must be made ensure they are reasonably accessible.

SECTION 5

Work Zone Training Requirements

Information provided below constitutes the general minimum site-wide requirements for all personnel that require unaccompanied access to project work zones. Specific work zones will require additional training relative to the work being performed, e.g., personnel entering a work zone were high voltage electrical hazards are present will require the appropriate electrical safety training prior to entering that work zone. This CHSP cannot responsibly attempt to list out all required training for all work involved during Remedy construction. The PHSP for each scope of work will provide the detailed training requirements involved for that work, and is to be used in conjunction with this CHSP to identify training requirements for project personnel.

This section assumes all personnel have already completed site orientation and Compressor Station safety training (if needed) described in Sections 4.1 and 4.2. Work zones themselves are described in detail in Section 6.

5.1 Initial Training

At a minimum, all personnel entering exclusion zones are to be trained in accordance with the Cal/OSHA HAZWOPER regulation (8 CCR 5192) Workers must have a current 8-hour HAZWOPER refresher training. Supervisors must have completed the additional 8 hours of hazardous waste supervisors' training. Documents verifying adequate training will be maintained by the contractor HSO and submitted to the PG&E HSM prior to mobilization.

Prior to entering the exclusion zone, all personnel assigned to work zone are required to read the relevant PHSP and verify by signature that they have read and understand the potential hazards and required protection. The HSO shall maintain a current Health and Safety Plan signature sheet.

Each work zone must have at least one person with first aid/CPR certification and blood borne pathogen training (29 CFR 1910.1030) present during all activity. All personnel entering any the exclusion zone must also have the following minimum site-specific and Cal/OSHA compliant training:

- Heat Stress (Attachment 2)
- Biological Hazards (Attachment 3)
- Hearing Conservation
- Hazard Communication including chemical specific training for contaminants of concern (reference Program)

Additional training (e.g., lockout/tagout, elevated work, confined space entry, arc flash safety) will be required based on the specific scope of work at each exclusion zone, to be described in the relevant PHSP. Note that asbestos abatement is not considered as a planned feature of the project and is discussed here on a contingency basis. Contractor personnel involved with debris removal where asbestos containing materials (ACM) may be present will be trained as described in 8 CCR 1529, and work under the direction of a Certified Asbestos Consultant (CAC).

All personnel assigned work within the restricted work areas are required to attend Safety briefings on a daily basis. Topics of discussion will include chemical, physical, and safety hazards for the activities to be conducted and may be presented by any member of the crew.

Senior crew members are be expected to mentor new hires or personnel learning a new skill.

Lessons Learned and more extensive specialized training (e.g., lockout/tagout procedure to a specific piece of equipment) will be conducted on as needed and as available basis.

5.2 Visitor/Observer Training

Visitors to the site who wish to observe on-site activities from within the exclusion zone are required to have a minimum of 24 hours HAZWOPER initial training. All visitors must be expected to read and comply with all signs and postings.

All personnel will be expected to be in Level D apparel except if in a vehicle, or on the Project Trailers facility.

SECTION 6

Work Zones

The site safety zone layout and procedures should match the prescribed levels of personal protection. The contractor HSO will establish, control, and monitor these areas accordingly. For the purpose of identifying the perimeters of functional safety zones on the site, barriers such as fencing, barricades, traffic cones or warning tape will be used. Work zones may be modified by the HSO based on meteorological data.

Pre-mobilization planning (performed prior to Remedy construction as required by the Project EIR mitigation measures) will include a site review to determine where contaminated soil may be encountered, and to establish procedures for handling encountered soil. This site review, in addition with existing site soil investigation results will be used to delineate work areas as within or outside an AOC, as described in Sections 6.1 and 6.2.

Work zone definitions will also be routinely evaluated during the course of Remedy construction, and a work zones may be reclassified based on site conditions encountered during implementation.

6.1 Work Outside of AOC and No Groundwater Contact

6.1.1 Work Zone

Appropriate personal protection must be worn in this zone (minimum Level D). Because there is no need for a decontamination line, the barricade or barrier to entry will be entirely dependent on the type of hazards in the work zone, and the proximity of personnel not directly performing the task. A “work zone” is not a free access area, or the same as a support zone. If personnel (employee or visitor) appear to be exposed to a work-zone hazard, the activity must stop until a corrective remedy is made.

6.1.2 Observation Zone

Observation zones may be established to manage a safe distance for observers.

6.2 Work within AOC and Where Groundwater Exposure Occurs

Work described in this section and termed as “within AOC” includes any of the locations defined as Solid Waste Management Units or AOCs by the project soil investigation program, areas where contaminated soil was encountered during the pre-mobilization site review, or areas where exposure to impacted groundwater is possible.

6.2.1 Exclusion Zone (EZ)

Appropriate personal protection must be worn in this zone. This zone is normally separated from the non-exclusion zone by a hotline or barrier to prevent personnel from entering the exclusion zone without proper PPE. If there is the possibility of anyone entering the work area from outside, a barrier must be in place.

To minimize risks associated with exposure to groundwater or AOC soil, access to exclusion zones will be limited to personnel that are absolutely necessary to perform the work within the exclusion zone. Visitors entering an exclusion zones, must wear the level of PPE required by the PHSP and approved by the HSO for work there. If respiratory protection is required, training in respiratory protection per 8 CCR 5144 will be required, as well as documentation of fit testing. The HSO will substantiate that visitors or observers entering the exclusion zone have received proper training.

Contamination Reduction Zone (CRZ)

This zone is a transition area between the Exclusion and the Support areas. The contamination reduction areas will be set up to prevent the spread of contaminants from the Exclusion Area. Decontamination will be performed in this area. Decontamination procedures will depend on the type of protective clothing and the nature and magnitude of contamination.

6.2.2 Support Zone (SZ)

The support zone is considered to be free of contaminants and PPE is not required but should be available for emergency use, if necessary. All equipment and materials are stored within this zone. Donning of PPE is done in the support zone before entering the exclusion zone.

6.3 Decontamination

In order to reduce the physical transfer of contaminants or suspected contaminants from the exclusion zone by personnel and/or equipment, decontamination procedures will be instituted. Heavy equipment, waste bins and other reusable materials will be decontaminated prior to leaving the site. The contractor will provide a detailed description of the decontamination process as part of their premobilization submittals. Personal protective equipment worn into the EZ will be decontaminated in accordance with the manufacturer's instructions upon leaving those areas, or placed in bins for disposal.

Direct skin contact with contaminated or suspected contaminated materials shall be avoided. Individuals whose skin comes into contact with contaminated or suspected contaminated materials must immediately remove the contaminated material and wash the skin with soap and water, and if necessary, seek medical attention.

Adequate hand washing facilities will be available in the support zone.

6.4 Multi-employer Zones

More than one contractor may be working in or otherwise passing through another contractor’s work area. To prevent an inadvertent exposure to a hazardous condition, all contractors will be expected to comply with OSHA Directive CPL 2-0.124 for multi-employer worksites. H&S at a multi-employer work area will be managed based on the specific contractual relationships at the specific work area. At a minimum, all H&S requirements provided in this CHSP, Contractor PHSPs, and project specifications will flow down to all personnel on the site, regardless of the specific contractual details.

Each Contractor’s PHSP shall acknowledge methods to comply with this requirement.

SECTION 7

Hazard Control

7.1 Summary and Ranking of Anticipated Hazards

A preliminary evaluation of the common hazards expected during Remedy construction is provided in Table 1. Project hazard risks can be assessed by assigning a relative value (1-4) to match the severity, frequency and probability of each type of expected hazards. The numerical product of these parameters are then multiplied by an integer (1-4) scaled to the number of personnel that may be exposed to such a hazard. The resulting product is intended provide a rough ranking of hazards to ensure focused efforts, and appropriate dedication of resources for controls.

Table 1: Risk Evaluation Matrix

Type of Hazard	Severity score	Frequency score	Probability score	Number of employees	RISK Potential	Description of potential hazards
Physical	1	4	2	4	**32**	Slips/trips/falls and walking and working surfaces
	3	2	2	2	**24**	Falls from heights > 6 ft.
	4	2	1	3	**24**	Heavy equipment - struck by
	4	2	1	2	**16**	Vehicle traffic - project site and related travel
	2	4	1	2	**16**	Excavations - personnel exposure
	2	2	2	2	**16**	Manual lifting - muscle strain
	3	2	2	1	**12**	Drilling activities - pinch points, struck by
	2	2	1	2	**8**	Structural and Equipment Fires - Fueling, materials storage
	4	1	2	1	**8**	Utility strikes
	2	2	1	1	**4**	Pressurized systems; hydraulics, pumps, conveyance piping
	3	1	1	1	**3**	Cranes, boomed equipment, hoisting
Biological and Environ-mental	3	3	3	4	**108**	Heat stresses;,
	1	4	2	4	**32**	Noise from equipment
	2	1	2	2	**8**	snakes
	2	1	1	3	**6**	severe weather
	3	1	1	2	**6**	electrical strikes
	2	1	1	2	**4**	cold

7.2 Job Safety Analysis

Job Safety Analysis (JSA), is also known as Activity Hazard Analysis (AHA)) or Job Hazard Analysis (JHA).

The planning and hazard assessment process continues into the individual job task through the use of JSAs. While some activities will be covered by the hazard analysis sections in this CHSP, as the task planning process and lessons-learned evolve during the course of this project, new JSAs shall be developed to address these changes as necessary.

JSAs describe each step of the activity, the types of exposures, accidents or incidents that can be anticipated, and the control measures that must be implemented before and during the activity. Employee input regarding their knowledge of the activity, hazards and controls will be solicited, and even in the field a JSA may be "dirtied up" by adding newly recognized job steps, hazards and controls. The JSA must be reviewed by every member of the activity, whenever a change is made to it, and as deemed necessary by safety or project management.

7.3 Chemical Hazard Assessment

7.3.1 Chemical Hazards

The chemical of concern for this project is primarily hexavalent chromium (Cr (VI)) in groundwater. Outside of established Areas of Concern (AOC), as shown on Attachment 4), there is no known soil contamination to which site workers and visitors may become exposed to.

Within the site AOCs, lead, dioxins and a number of other materials have been identified in soil. Contractors with work within a specific AOC will be provided with existing soil characterization data during the submittal process, and will develop project specific worker protection and monitoring requirements in the applicable PHSP. The health hazards and Permissible Exposure Limits (PEL) for AOC soil contaminants are shown in Table 2 and provided in this CHSP as an initial guidance to assist contractors in preparing PHSP where required. Where there is no Cal/OSHA PEL for a chemical, the Reference Exposure Level (REL) published by the California Office of Environmental Health Hazard Assessment (CA OEHHA) will be used to calculate the action level.

As an example, soil data provided below is from the PG&E Topock AOC 4 Health and Safety Plan (Table 1, Arcadis, 2010). The action levels for total dust were based on the concentrations of the specific contaminants found in the soil and are expressed as 8-hour time weighted average concentrations. The Industrial Hygienist took the Cal/OSHA permissible exposure level (PEL) and divided that by the highest concentration level in soil, and thus calculated the level of total dust required to exceed the PEL. Table 2 provides a preliminary evaluation of dust exposure hazards associated with chemicals found in AOC-4 soil, prior to the cleanup that occurred in 2010. These data were used by the industrial hygienist to set guidelines related to minimizing exposure by minimizing the generation of visible dust.

Table 2: AOC Dust Exposure Hazard Evaluation

Chemical Constituent in Site AOC Soil and Exposure Standard	AOC Soil Constituent PEL/REL and Highest Concentration Found in Site Soil		Minimum Total Dust Required to reach PEL/REL for AOC Soil Constituent
Example Calculation	$\frac{\text{PEL (mg/m}^3\text{) X } 10^6 \text{ mg/kg}}{\text{Concentration in Soil (mg/kg)}}$	=	Minimum site dust concentration (mg/m^3)
Chromium (VI) (PEL)	$\frac{0.005 \text{ mg/m}^3 \text{ x } 10^6 \text{ mg/kg}}{1{,}560 \text{ mg/kg}}$	=	3.2 mg/m³
PCB (PEL)	$\frac{0.5 \text{ mg/m}^3 \text{ x } 10^6 \text{ mg/kg}}{1.9 \text{ mg/kg}}$	=	263,000 mg/m³
Lead (PEL)	$\frac{0.05 \text{ mg/m}^3 \text{ x } 10^6 \text{ mg/kg}}{11{,}000 \text{ mg/kg}}$	=	4.5 mg/m³
Pentachlorophenol (PEL)	$\frac{0.5 \text{ mg/m}^3 \text{ x } 10^6 \text{ mg/kg}}{8.9 \text{ mg/kg}}$	=	56,000 mg/m³
Dioxins (REL)	$\frac{40 \text{ pg/m}^3 \text{ x } 10^6 \text{ mg/kg}}{6085 \text{ ng/m}^3}$	=	6.6 mg/m^3
PAHs (REL)	$\frac{0.001 \text{ mg/m}^3 \text{ x } 10^6 \text{ mg/kg}}{12 \text{ mg/kg}}$	=	83.3 mg/m³

These same principles will be used to determine appropriate standards for respiratory protection when working within AOCs during the Remedy construction. In most cases, effective dust control will be the primary protection mechanism. However, in some cases, it may also be necessary for affected, site workers to don Level C PPE during earth-disturbing work within an AOC. If so, personnel air monitoring of workers will be conducted. Area air monitoring may also be conducted, as appropriate.

If air monitoring is initiated, it should be noted that not all contaminants would need to be monitored each day. This assessment will be made by the HSO. After a negative exposure assessment is made based on monitoring information, the HSO may elect to reduce or eliminate monitoring for a specific contaminant.

7.3.2 Chemical Hazard Control

Chemical hazard control at the site will be primarily managed by some or all of the following:

- Active dust control. Visible dust emissions shall be anticipated and controlled by the following
    - Required reporting of dust generating activities to PG&E HSM and Site Operations Manager
    - Dust suppression with water
    - Pre-water roads and work areas
    - Reduce vehicle speed
    - Reduce drop height of excavated soils
- Monitor wind conditions to minimize contaminant dispersion
    - Monitoring with real-time particulate monitoring equipment
    - Implement dust control measures to minimize airborne dust
    - Implement Level C respiratory protection when dust monitoring data indicate protection is required
    - Establish a work shutdown wind velocity threshold, and stop work when that threshold has been met
- Hygienic practices including prohibitions against eating/tobacco use in exclusion zone, and mandatory decontamination practices
- Reporting all suspect personnel exposures or contamination spread beyond set boundaries.

7.3.3 Physical Hazards

Hazards typically encountered at construction sites will be present, namely, slippery ground, uneven terrain, and operation of heavy equipment. Fire hazards may also exist around fueling operations or electrical systems. Operating heavy equipment is a severe contact hazard to ground personnel, vehicles and other equipment and facilities

All workers shall be trained and certified (when applicable) to operate the equipment they are using. Equipment will be inspected prior to use and removed from service if found to be not in conformance with any specifications or regulations. Specifics related to the control of these hazards shall be covered in the site specific JHA's and contractor PHSP for activities with exposure to these physical hazards.

7.3.4 Special Hazards

The wide scope of the Topock Remedy construction project can be expected to result in a number of special hazards that will be unique to the various construction methods, locations, and site-specific constraints. This CHSP cannot attempt to list every unique hazard associated with the wide variety of construction work that will occur during Remedy construction. Instead, this CHSP will list general descriptions of unique site hazards that can be expected to be encountered during Remedy construction. The PHSP for specific contracted work will be required to describe special hazards unique to the scoped work, and the goal of the JSA process is for construction team members to carefully consider their work, the hazards associated with their work, and the means to avoid and/or mitigate those hazards. The following discussion is not meant to serve as a complete discussion of hazards from which to plan work.

7.3.4.1 Work In/Near Steep Topography

The nature of the operations in and near ravines makes it necessary to consider the safety issues associated with personnel and equipment around them. Slope stability is a matter of concern during the excavation. The contractor will utilize previously prepared geotechnical reports (if available) in its technical approach to the excavation of the ravine, and include the technical approach in their PHSP. The technical approach will be approved by the contractor's geotechnical expert and the HSO prior to the start of excavation of the ravine.

The PG&E Slope Safety Standard is to be followed, and is included with this CHSP as Attachment 5.

7.3.4.2 Work in Remote Locations

Many locations in the Remedy construction area are physically remote or relatively inaccessible to other Remedy construction sites (e.g., well HNWR-1, well IRL-4). When working at remote locations, emergency contact service may be compromised. Personnel are to avoid working alone, ensure phone or radio service is adequate before beginning operations, and the PHSP and JSA for this type of work will describe a personnel tracking/contact protocol.

Cellular phone service is known to be poor in specific work locations. All personnel are required to test cellular phone service at a work location prior to beginning work, and implement an alternative communication procedure if cellular phone service is found to be unreliable. Alternative communications procedures will be detailed in the PHSP and JHA for the work, and may include use of 2-way radios, utilization of a 3-person buddy system, or use of satellite phones.

7.3.4.3 Elevated Work

Pipeline installation work includes pipeline installation on aerial bridges that span ravines/washes, and installation pipeline on the existing Kinder Morgan pipeline bridge that spans the Colorado River. The PHSP and/or JSA for this work will need to address suspended/elevated work, fall protection, safe equipment staging and operation, and emergency rescue.

7.3.4.4 Exposure to the Elements

As described throughout this PHSP, exposure to the elements (sun, wind etc.) are severe when not mitigated. Heat-related illness and sunburn are constant hazards throughout the year. The elements may change from day to day or even during a shift. Short-duration heavy rainfall with little warning is typical of the climate in the Topock area. Personnel working in washes and other natural drainage features may be caught in flash floods caused by sudden rainfall. The PHSP and /or JSA for this work will need to address seasonal weather patterns, access/egress to work sites, weather monitoring, evacuation triggers, and work zone evacuation procedures.

7.3.4.5 High Voltage Electrical Power

Remedy construction includes construction of high voltage (12kV) power distribution. Specialized skills are required from personnel directly working near power voltage power. The PHSO and/or JSA for this work will need to address minimum training requirements, specialized PPE, lock-out/tag-out, and work zone access control when working in and around high-voltage electrical equipment.

7.3.4.6 Underground Utilities

Pipeline construction will require extensive crossing of existing underground utilities. Many of these utilities are large high-pressure natural gas transmission lines. Gas transmission pipeline crossings are described and designed in the project plans, however, pipeline installation and other contractors that will have to cross these lines will have to describe associated safety and observation requirements in their PHSP and/or JSA.

Pipeline installation work, specifically at the Topock Compressor Station, can expect to encounter unknown underground utilities. While every attempt will be made to locate and identify underground utilities,

contractor specifications and PHSP for this work will need to include excavation observation, advance potholing/visual confirmation of utilities, and low-impact excavation techniques.

In all cases, work near underground utilities will be conducted in coordination with the utility owners(s) and in conformance with USA requirements.

7.3.4.7 Overhead Utilities

Remedy construction will involve work near overhead utilities, including work near suspended high pressure gas transmission pipelines. PHSP and/or JSAs for this work will need to address procedures for personnel and equipment that need to pass beneath overhead gas and electrical power lines, prescribe pre-operation walkdowns, safe clearances for equipment, and overhead power line clearances.

In all cases, work near overhead utilities will be conducted in coordination with the utility owners(s).

7.3.4.8 Work In and Around Vehicular Traffic

Much of the work will take place on or adjacent to public roads. PHSP and JSAs for this work will need to address compliance with traffic control requirements, work zone delineation/visibility, traffic barriers, and access/egress to work zones from public roads.

7.4 Hazard Prevention, Control and Mitigation

7.4.1 Physical Hazards Control

Specifics related to the control of physical hazards shall be covered in the site specific JHA's or any contractor provided PHSP for activities with exposure to these physical hazards. If the prescribed controls are not in place, leaving an employee or visitor exposed to a hazardous condition, the activity must immediately stop.
At a minimum, each contractor's PHSP must address all the concerns and guidelines in this section (7.4).

7.4.1.1 Practice Good Housekeeping

- Keep your work area clean and orderly.
- Do not litter, and maintain and utilize trash containers within easy access to work areas. Trash containers must be able to be tightly sealed for protection in windy conditions or against animal access. Trash containers may not be left full at a work area when not active or outside of work hours.
- Properly store food in appropriate containers away from the work zone. Food may not be left at the work area when not active or outside of work hours.
- Keep work, storage, and access areas clean of tools, equipment, and debris.
- All means of egress shall be kept unblocked, kept clear of debris and slip or trip hazards, kept well lighted, and kept unlocked at times.
- Immediately remove spilled liquids from the floor.
- Clean up or otherwise remove slip/trip/fall hazards immediately.
- Keep aisles and walkways clear of electrical cords.
- Do not overload electrical outlets.
- Electric cords shall not be exposed to potential damage from vehicles.
- Mark or barricade slip/trip/fall hazards that cannot be removed.
- Any time work is performed overhead, barricades shall be erected.

- Barricades shall consist of caution (yellow) or danger (red) barricade colors and appropriately worded tape or signs.
- All barricades shall be removed when not in use.

7.4.1.2 Follow Standard Procedures

The following standard safety behaviors are valuable for work across the site and are expected to be habitually followed as part of a Contractor's organization values:

- Do not eat, drink, chew tobacco or gum, smoke, or engage in any other activity that may increase the possibility of hand-to mouth contact in the EZ or the CRZ. (Exceptions may be permitted by the HSO for other reasons, such as to allow fluid intake during heat stress conditions.
- Employees under a physician's care and/or taking prescribed narcotics must notify the designated site safety supervisor.
- Lift material in a safe manner and avoid strains. Bend your knees, keep your back straight, and push upwards with your legs when lifting. Get help (mechanical help or more people) when lifting heavy or awkward materials.
- Wear the personal protective equipment (PPE) specified in the site HASP.
- Use safety devices provided for your protection (e.g., handrails, guards, pressure relief valves, and seat belts). Do not remove these devices while the equipment is being operated.
- Never approach within 25 feet of the operating area of a piece of equipment without first making eye contact with the operator, signaling your intention, and receiving an acknowledgement from the operator. If you wish to approach the equipment (e.g., to speak with the operator) the operator must first lower all buckets, blades, etc. and idle the engine before you approach.
- When ground personnel support heavy equipment, pay particular attention to pinch points (e.g., the counterweight swing radius and the tracks of an excavator). Keep out from under suspended loads.
- Make sure fall protection or fall arrest systems are in place when working at elevations greater than 6 feet above the surrounding work area.
- Follow the work-rest regimens and other practices required by the heat stress program.
- Where appropriate, lockout procedures shall be used.

7.4.2 Permit Required Procedures

A permit system will be established for:

- Hot work, defined as welding, cutting, grinding, activities that generate heat, sparks, and ignition sources
- Confined space entry, defined as work within a confined space as defined by law).
- Work near pressurized natural gas equipment

The Contractor PHSP for work that may require work described above will require permit documentation, protocols for completing these permits, work zone preparation, personnel and work zone monitoring during permitted work, additional PPE requirements, and additional worker and observer training requirements. Following are general guidelines for workers related to permit-required work.

- Do not enter a permit-required Confined Space without a permit, and follow all requirements of permits as issued.

- Don't rely on postings to warn you of confined space hazards. When in doubt ask for a permit and testing. Manholes, underground vaults, chambers, certain confining trenches, excavations, tanks, silos or other similar spaces may have a confined space hazard.
- Check with your Supervisor prior to starting any Hot Work operation (welding or cutting operations) and, if you are working in an area that requires a Hot Work Permit, follow the permit as issued.
- The combination of hot work and confined spaces is particularly dangerous even if you don't plan to enter the space. No burning, welding, or other source of ignition shall be applied to, or near any enclosed tank or vessel, even if there are some openings, until it has first been determined that no possibility of explosion exists and authority for the work is obtained from the foreman or superintendent.
- Follow lockout/tagout procedures when working on equipment involving moving parts or hazardous energy sources. Install and remove locks and tags only in accordance with procedure and only when authorized.
- Complete explosive atmosphere testing when working near pressurized gas equipment even if work does not include hot work.

7.4.3 Soil Disturbing Activities

Workers must follow these general guidelines prior to conducting soil disturbing activities. Do not dig or drive objects into the ground without first:

- ensuring that necessary permits have been obtained;
- A competent person has been assigned and has inspected the site;
- Utilities have been located prior to beginning excavation activities;
- Checking that excavations slopes are checked daily for stability. The PG&E Excavation Safety Standard is to be followed, and is included with this CHSP as Attachment 6.
- Do not enter an excavation greater than 4 feet deep unless this work is covered by the appropriate PHSP, JSAs have been reviewed and signed, entrance/egress has been installed, observation is present, the excavation has been shored/sloped properly, and the HSO has authorized access. Maintain safe means access and egress from all excavations.

7.4.3.1 Operations at sites in AOCs and/or Areas with Suspected Soil Contamination

- PPE appropriate to the exposure of contaminated dusts, and/or fluids shall be assigned and worn in addition to PPE assigned for protection from physical hazards
- Worker and air monitoring program is in place, as required
- Dust control measures shall be available at all times during operations
- Delineated zones shall be established, maintained and implemented for purposes of decontamination and prevention of cross-contamination
- Soils that are excavated shall be directly loaded into specified, labeled containers

7.4.4 Safe Use of Tools

Tools, especially hand tools, are used frequently with minimal supervision. It can be all too easy to use tools improperly and create serious safety hazards.

- Use all tools in the manner intended and/or prescribed. The operating instructions for all tools and equipment ARE MANDATORY.

- Modification of use or design must be in accordance with the written instructions or permission of the manufacturer.
- Inspect safety devices before every use, especially guards on cutting devices.
- Do not remove or circumvent guards or other safety devices on tools.
- Inspect other tools and equipment before use and do not use defective equipment. Identify/tag defective equipment per organization protocols such that they cannot be inadvertently brought back into service.
- A competent person must inspect scaffolds and man lifts before each day's use.
- Ladders must be in good service, placed at the proper angle, secured, and extents to the proper length (for access to heights the ladder must be 3 feet above the landing).
- Inspect power tools, looking especially for damaged insulation or missing ground plugs on electrical cords.
- Use ground fault circuit interrupters (GFCI) for cord and plug equipment used outdoors, in damp locations, or when equipment is not plugged directly into permanent wiring.
- Use only extension cords rated for hard service or junior hard service (e.g., SO, JSO, SOW, JSOW).
- Keep electrical cords out of walkways and accumulations of water unless protected and rated for such service.
- Portable generators shall be properly grounded, and shall be allowed to cool prior to refueling.
- All fuel shall be stored in appropriate containers and in appropriate locations.

7.4.5 Safe Construction Equipment Operation

- All heavy equipment operation must be accompanied by a spotter, who is responsible for communicating operating clearances, equipment navigation aid, and hazards to the equipment operator. The operator is required to heed the direction of their spotter and may not operate their machine without their spotter present and visible.
- All equipment is to be operated in accordance with manufacture's written instructions and/or manuals.
- Equipment shall not be modified or operated out of specified limits without written permission from the manufacturer and the health and safety manager for the project.
- Do not operate equipment unless you are properly trained and authorized to do so in a manner consistent with the owner/operators manual.
- DO NOT use a piece of equipment, which has been tagged out of service! Do not remove red tags without authorization from the person placing the tag or the person responsible for the repairs.
- Inspect equipment before using it.
- Heavy equipment inspections shall be documented. Note all discrepancies and tag out equipment that may be dangerous to operate.
- Machinery shall not be serviced, repaired, or adjusted while in operation, nor shall oiling of moving parts be attempted, except on equipment that is designed or fitted with safeguards to protect the person performing the work.
- Use vehicle or equipment seat belts any time the vehicle or equipment is in motion.

- Excavating equipment shall not be operated near tops of cuts, banks, or cliffs if employees are working below.
- Do not maneuver equipment into the working area of other equipment without first making eye contact with the operator working in the area and signaling your intentions to maneuver into that area.
- Always acknowledge that you understand that other equipment or ground personnel may enter your working area.
- Do not allow people on foot to approach without lowering hydraulically lifted or suspended components (e.g., buckets, blades, bellies) and reducing engine speed to idle.
- Tractors, bulldozers, scrapers, and carryalls shall not operate where there is a possibility of overturning in dangerous areas such as the edges of deep fills, cut banks, and steep slopes.
- Do not allow supporting ground personnel to work within pinch points of the equipment (e.g., the swing radius of a counterweight and the tracks on an excavator) or under suspended loads.

7.4.6 Environmental Hazards Controls

7.4.6.1 Heat Stress Prevention

Refer to Attachment 2 for a detailed discussion of heat stress, including recommendations on preventing heat stress injuries, identifying heat stress injuries, and responding to heat stress emergencies.

Wearing PPE puts site personnel at considerable risk of heat stress. Heat stress is caused by a number of interacting factors including environmental conditions, clothing, workload and the individual characteristics of the worker. Heat stress monitoring will commence when personnel are wearing PPE that has the potential to add to heat stress (including Tyvek coveralls) or whenever the ambient temperature exceeds 80 degrees F. If a worker's pulse rate exceeds 110 beats per minute following a break, then additional break time will be employed. An adequate amount of shade and drinking water will be available to all workers on site.

7.4.6.2 Noise

The equipment to be used on this site may produce high noise levels. Personnel working near this equipment will wear hearing protection during operation. On-site personnel may have other limited exposures to occupational noise exceeding the action level of 8-hour TWA of 85 dBA. For those cases, hearing protection will be worn whenever regular conversation becomes difficult at a distance of three feet in any work area, which is indicative of noise levels exceeding 85 dBA. The HSO will conduct noise monitoring as necessary and will require wearing earplugs for noise levels that even approach the permissible exposure limit. The control of occupational noise exposures shall comply with Cal/OSHA requirements. Contractor workers will be included in their respective company’s hearing conservation program.

7.4.6.3 Biological Hazards

Biological hazards such as rattlesnakes and spiders may exist on the site. Each contractor will address these concerns and means to prevent exposure in their respective HASPs. Supplemental information on Biological Hazards is included in Attachment 4.

7.4.7 Spill Containment

7.4.7.1 Fuel Handling

During construction activities, there is a potential for spills of fuel during fueling operations for construction equipment. The policy for safe fueling and fuel handling are similar to those that are provided in Remedy Standard Operating Procedure (SOP) -01. Remedy-SOP-01 can be found in Appendix A, Sampling and

Monitoring Plan, Operation and Maintenance Manual Volume 2 (CH2M Hill, 2014). In the event of a spill, the PG&E Site Operations Manager/Sr. Environmental Inspector must be notified immediately.

7.4.7.2 Well Installation

During well installation, there is a potential for spills of liquids used for well drilling and well development. The procedures for spill prevention, containment, and control to be used during well installation are similar to those that must be used for monitoring well development, purging, and sampling. Those procedures are provided in SOP-A13. SOP-A13 can be found in Appendix A, Sampling and Monitoring Plan, Operation and Maintenance Manual Volume 2 (CH2M Hill, 2014). In the event of a spill, the PG&E Site Operations Manager/Sr. Environmental Inspector must be notified immediately.

7.4.7.3 Hazardous Waste

Should any hazardous waste (including contaminated soil) be spilled, the procedures for spill reporting and response outlined in the Sections 4.7 and 4.8 of the Soil Management Plan, Operation and Maintenance Manual Volume 4 (CH2M Hill, 2014), will be followed.

7.5 Personal Protective Equipment

Based on an evaluation of the hazards of the site, personal protective equipment (PPE) will be required for all personnel and visitors entering the controlled portion of the site. It is anticipated that PPE requirements will be limited to Level D or Level C protection. It is not anticipated that either Level B or Level A PPE will be required. However, if field conditions or site monitoring indicate that a higher level (greater protection) of PPE is required, such work will be temporary halted, and the program will be further evaluated and modified as deemed appropriate. PPE for each level of protection is described in general below. Note that specific tasks, including (but not limited to) work at the Compressor Station, elevated/suspended work, or high-voltage electrical work will require additional PPE.

7.5.1 Site Baseline Level D

All site personnel and visitors will be required to wear the following minimum PPE within all work zones as described in Section 6:

- Safety glasses.
- Boots with toe protection.
- Hard-hat.
- Gloves, must be available if a worker is expected to perform any degree manual work.
- Hearing Protection must be available on a worker's/visitor's person, and donned when in high-noise work zones
- Safety Vest
- A long sleeved sleeved shirt is required for work at the Compressor Station

7.5.2 Modified Level D

- Safety glasses.
- Boots with toe protection.
- Disposable coveralls (as specified by the HSO)
- Disposable booties or rubber boots
- Hard-hat.
- Chemical protective gloves, if warranted by work activity

- Hearing Protection must be available on a worker's/visitor's person, and donned when in high-noise work zones
- Safety Vest
- Face shield and/or goggles (as specified by the HSO)

7.5.3 Level C

- Half or full face air purifying respirator, daily or more frequent cartridge change-out
- Safety glasses.
- Boots with toe protection.
- Disposable coveralls (as specified by the HSO)
- Disposable booties or rubber boots
- Hard-hat.
- Chemical protective gloves
- Hearing Protection
- Safety Vest

Prior to ground-disturbing work in an AOC, an industrial hygienist will evaluate the need for respiratory protection of workers in the work zone. If the analytical data available indicates that it is appropriate, Level C PPE will be the initial level of protection in the exclusion zone. Level D PPE will be the minimum level of PPE required during soil disturbance outside of an AOC, however, the IH, HSO, or HSM may upgrade PPE requirements based on site observations or new data. This applies to all PG&E, contractor, visitor and observers in the exclusion zone or contaminant reduction work zones. Any upgrades or downgrades to these requirements must be approved by the HSO. The contractor HSO will review the PPE requirements at the start of each shift. Air monitoring data will be utilized to support the assessment, as appropriate.

SECTION 8

Exposure Monitoring and Protection

Exposure monitoring may be required and implemented when:

- Handling groundwater with elevated concentrations of hexavalent chromium.
- Handling drill cuttings that were exposed to groundwater with elevated concentrations of hexavalent chromium.
- Work near pressurized gas infrastructure
- Soil disturbing activities within AOCs, unless otherwise directed by the HSO
- Entry into a confined space

8.1 Chemical Monitoring

Preliminary work zone and worker breathing zone monitoring guidelines which may be applicable are provided in Table 3. Contractor PHSP will provide additional direction on chemical monitoring at specific work sites, and Contractor PHSP requirements will take precedence over the guidelines provided in Table 3.

Table 3: Air Monitoring Guidelines and Action Levels

Chemical Hazard	Instrument	Method[1]	Action level	ACTION
Oxygen (O2)	Combustible Gas /O2 meter	Direct read area sample prior to confined space entry.	<19.5%, or >23.5%	• Ventilate until readings can be brought to 21% +/- 1% or do not enter. • Ventilate until readings can be brought to 21% +/- 1% or do not enter.
Combustible Gas /Vapors (CG)	Combustible Gas /O2 meter	Direct reading area sample prior to entering confined space	>10% LEL	Clean, secure source of vapors, ventilate until readings can be brought to +/- 1% LEL or do not enter.
		• Prior to hot work near flammables • Suspect gas leak	Any detection above background drift or fluctuation	Clean, secure source of vapors, ventilate until readings indicate source has been controlled.
Chromium	Personal sampling pumps, MCE filter cassette in breathing zone of worker	NIOSH 7300 when suspected	>50% < 10x PEL or TLV	Apply engineering controls Upgrade PPE as necessary.
			>50X PEL or TLV	Apply engineering controls Upgrade PPE as necessary.
			>1000 PPM or > IDLH	Stop work, determine source of hazard and apply engineering control
Respirable PNOC (Particulates Not Otherwise Classified)	Personal sampling pumps, pre-weighted PVC filter cassette in breathing zone of worker	NIOSH 0600 when suspect or monthly	>50% < 10x PEL or TLV	Apply engineering controls Upgrade PPE as necessary.
			>50X PEL or TLV	Apply engineering controls Upgrade PPE as necessary.
			>1000 PPM or > IDLH	Stop work, determine source of hazard and apply an engineering control
Silica	Per cassette,	NIOSH 7500	>50% < 10x	Apply engineering controls

(respirable fraction)	and cyclone or respirable dust separator.	when suspect or monthly	PEL or TLV	Upgrade PPE as necessary.
			>50X PEL or TLV	Apply engineering controls Upgrade PPE as necessary.
			>1000 PPM or > IDLH	Stop work, determine source of hazard and apply an engineering control

Comments or special instructions:

1. Monitoring methodology determines the analytical method used by the laboratory
2. Breathing zone is the location of the sampling media; it would be attached to the worker's shoulder at approximately the same height of the workers nose and mouth.

8.2 Particulate Monitoring

The most important method for particulate monitoring is using each individual to recognize airborne particulate conditions or "dust" in the air and to take a corrective action to minimize its generation and control its dispersion. Employees will be empowered to call for the water truck to respond to areas where any visible dust is evident.

Real-time dust monitors with data logging capabilities will be used to monitor work areas and perimeters when visible dust is present, when specified by the HSO. Noise Monitoring

Noise monitoring shall be conducted in accordance Section 7.4.6.2.

SECTION 9

Medical Surveillance

9.1 Requirements for Work Zone Entry

All personnel, including subcontractors and visitors, entering the exclusion or contamination reduction zones as defined in Section 6.2, must have completed appropriate medical monitoring requirements required under 8 CCR 5912(f):

- Prior to hazardous waste activities at the Site;
- Annually;
- Upon termination;
- Following exposure or injury; and
- Additionally as needed on a site-specific basis.

The minimum specific examination content and frequency based on probable Site conditions, potential occupational exposures, and required protective equipment, based on consultation with the Occupational Physician.

The HSO will maintain copies of the physician's written authorization statements that all employees conducting hazardous waste Site operations are fit for hazardous waste Site duty and able to wear a respirator. Any restrictions shall be clearly stated. No one shall be permitted to conduct hazardous waste Site operations until a copy of the medical certification is received by the HSO.

Personnel wearing respiratory protection will require a certification from the Occupational Physician that the person is medically qualified to wear respiratory protection.

SECTION 10

Emergency Planning

A map to the hospital will be posted on site, and is provided in this CHSP as Attachment 1. Each contractor will have at least one person currently trained and certified in first aid/CPR present at all work zones. The following general procedures will be followed in the case of a medical emergency at the site.

10.1 Incident Notification & Reporting

An effective safety culture encourages an environment where all project personnel feel they can raise safety-related issues without peer pressure or fear of reprisal. This includes notification, reporting, evaluation, and continuous correction of any safety incidents or unsafe conditions encountered during implementation of the project. This requires open and honest communication on safety, a non-punitive reporting process, and implementing appropriate personnel disciplinary actions only in response to the reported incident itself, and not in response of the act of reporting the incident.

10.1.1 PHSP Incident Reporting Process Requirements

All personnel are required to immediately report any incident (including, but not limited to "near hits," actual safety incidents, utility strikes, or motor vehicle incidents) in which they are involved or witness, to their supervisor. All PHSPs will be required to include an incident notification/reporting section that describes each Contractor's notification process, including the required notification timeline, Contractor internal chain of communications and contact information, and the Contractor personnel who is responsible for reporting incidents to the HSM, CM, PG&E CM, and Site Operations Manager. The incident notification process to be detailed in every PHSP will include (but is not limited to) reporting of the following information:

- Name and contact information of the reporting personnel
- Name(s) of all personnel involved in the incident
- Names(s) of all personnel witnessing the incident
- A description of the incident
- The extent of known injuries or damage
- Medical response, if any, including the level of medical response provided
- A preliminary root cause/corrective action assessment

PG&E Contractor incident reporting requirements are included as Attachment 7. The incident notification process included in each PHSP will be required to be in compliance with these reporting requirements.

10.1.2 Incident Root Cause Analysis

All H&S incidents, as described above, will undergo a root cause analysis (RCA) to determine and solve the root causes of the incident, in addition to addressing the incident itself. The RCA process for the GW Remedy construction project is detailed in the project Construction Quality Assurance Project Plan.

10.2 Personnel Injury

10.2.1 First Aid

The HSO, or supervisor on-site shall ensure necessary first aid or medical attention is obtained. First aid shall be provided by qualified first aid providers or site Fire Department EMTs. If personnel need medical evaluation, ensure that a safety officer or supervisor is assigned to escort the employee. Do not allow injured personnel to drive themselves unless a doctor determines they are fit to do so. If a doctor prescribes

medication determine if that medication limits ability to drive. Do not allow employees to drive themselves if the medication impacts on driving safety. Any indications of dizziness, confusion, lack of responsiveness difficulty breathing, or swallowing shall be treated as a medical emergency and emergency response providers contacted.

10.2.2 Heat Stress

Heat stress prevention and emergency response is presented in Attachment 2.

10.2.3 Chemical Inhalation

If warning symptoms such as dizziness, headache, nausea, shortness of breath, burning in the mouth, or other symptoms indicative of the exposure are experienced, the victim will leave or be removed from the controlled area of the site immediately. If the victim is no longer breathing, rescuers will first remove the victim from the contaminated area wearing respiratory protection. Rescue breathing or cardiopulmonary resuscitation (as applicable) will be undertaken immediately, and medical attention will be obtained as soon as possible.

10.2.4 Chemical Ingestion

Medical attention will be sought immediately.

10.2.5 Chemical Eye Contact

If eye contact is made with any of the materials at the site, the eye will be flooded with water for at least 15 minutes. An emergency eyewash will be available in each work zone, either at the CRZ (at AOC work areas) or at the support zone at non-AOC sites. Medical attention will be obtained as soon as possible.

10.2.6 Chemical Skin Contact

Skin exposure will be treated by washing with soap and water. Any contaminated clothing will be removed. First aid will then be applied and medical attention obtained as required.

10.3 Anomalies and Unanticipated Conditions

If contaminated soils, not previously characterized, are suspected of being present (as recognizable by discoloration, odors, or monitoring equipment), then activities shall stop until it is reported to project management and the HSO. Activities may not resume in this area until soil samples are analyzed, regulatory notifications are made and a review of the work plan and PHSP are completed to ensure health protection and environmental compliance.

10.4 Environmental Emergencies

10.4.1 Lightning

Outdoor operations will be suspended when lightning is within a 15 second count of the site (i.e., the time difference between seeing a lightning strike and hearing the sound). High profile equipment operations shall be suspended when lightning is within 30 seconds of the site. High profile operations include crane operations, drilling operations, or electrical wiring tasks. Equipment operators shall stop their equipment and park it safely before heading for shelter. No personnel will be left on the ground in an exposed location.

Preferred shelter is a permanent building. Personnel may also take shelter in trailers or low profile rubber tired equipment (e.g., pickups). Avoid driving pickups or any other equipment except to help evacuate personnel. Work will resume after a 30 minute period without lightning.

10.5 Emergency Response Equipment Required On Site

Contractors will be expected to provide and, maintain the emergency response equipment at their field office, work zones, or vehicles as shown on Table 4:

Table 4: Baseline Emergency Response Equipment Requirements

Emergency Supplies and Equipment	
First Aid Kit	All work zones and field offices
Fire Extinguisher (Type ABC)	All work zones, heavy equipment, and field offices
Mobile Phone	On person
Satellite Phone in limited mobile access locations	On person where required
Traffic Cones	All work zones and field offices
Radios for traffic control or remote access locations	On person where required
Water or other Rehydration Fluid	All work zones, heavy equipment, and field offices
Eyewash	All work zones and field offices
Hand wash and Towels	All work zones and field offices
Sunscreen	All work zones, heavy equipment, and field offices
Insect Repellent	All work zones and field offices
Chemical Spill Kit	All work zones and field offices
Snake Rod (to be used by authorized staff only)	Field office

10.6 Emergency Contacts and Telephone Numbers

10.6.1 Hospital Route

Maps for the Route to Hospital are included as Attachment 1.

10.6.2 Telephone numbers

Note: At this time tentative identification of titles and contact information has been made, but is subject to change. As an interim measure, the color code will identify this section as being subject to future completion.

Emergency telephone numbers will be posted on site.

10.6.2.1 PG&E Contact Info

- Topock Project Manager – Yvonne Meeks (contact info added when finalized)
- Topock Site Operations Manager – Curt Russell (contact info added when finalized)
- Topock Construction Manager – Danielle Starring (contact info added when finalized)
- Topock Project Safety Officer – Jennefer Garcia (contact info added when finalized)
- Topock Compressor Station Operator (760) 326-5535

10.6.2.2 Contractor Contact Info

Note: Contractor H&S personnel organization, roster, and contact info will be detailed in each contractor PHSP.

- Contractor PM - To be determined
- Contractor Site Safety Officer - To be determined

10.6.2.3 General Emergency Contact Info

- General/All emergencies -- dial 911
- Ambulance -- dial 911
- Police Department -- dial 911
- Fire Department -- dial 911
- Hospital: Colorado River Medical Center (See Attachment 1)

  760-326-4531
  1401 Bailey Ave
  Needles, California 92363

SECTION 11

Health and Safety Plan Certification

All project personnel including subcontractors working at the Site are required to sign acknowledging receipt of training, and agreement to comply with project work and safety rules.

ATTACHMENT 1
HOSPITAL ROUTE MAP
CONSTRUCTION HEALTH AND SAFETY PLAN
TOPOCK GROUNDWATER REMEDY

Hospital

Colorado River Medical Center,
1401 Bailey Avenue, Needles , CA
Phone: (760) 326-4531

Directions

- Exit the work area or facility, travel north on National Trails Highway
- Turn West (left if coming from the Topock Compressor Station or IM3 Plant) onto Park Moabi Road
- Enter Highway 40 West at the Park Moabi onramp
- Drive northwest approximately 10 miles on Highway 40 west to Needles.
- Take the "J" Street exit & turn left onto "J Street.
- Go several blocks & turn left onto Bailey Ave.

The Hospital is on the left after the park.

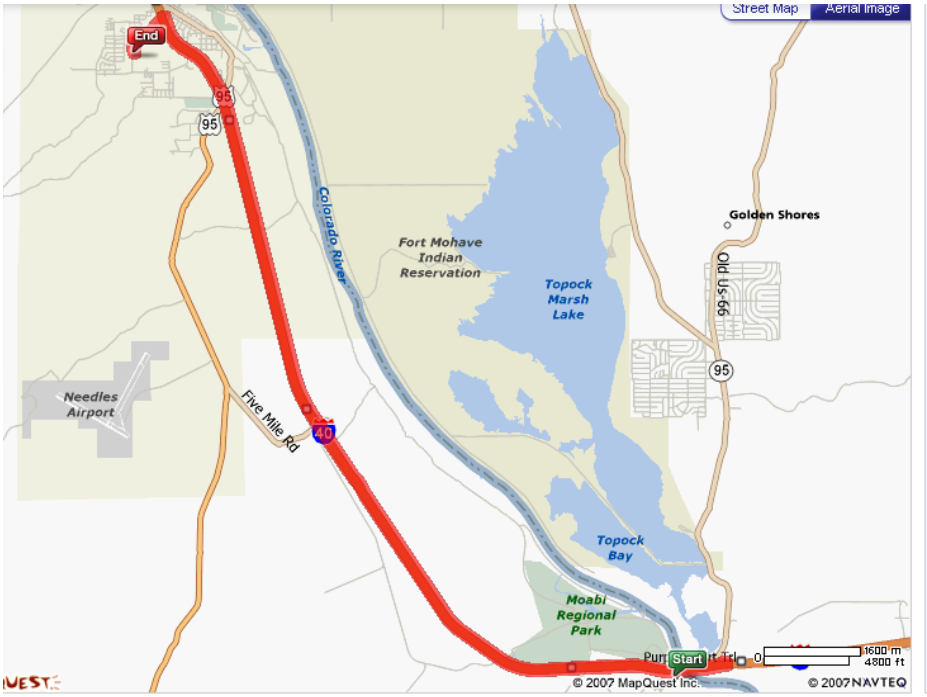

Figure 1: Route Overview from TCS



Figure 2: Closeup of Destination

ATTACHMENT 2

HEAT STRESS PREVENTION AND EMERGENCIES
CONSTRUCTION HEALTH AND SAFETY PLAN
TOPOCK GROUNDWATER REMEDY

Attachment 2

Heat Stress Prevention and Emergencies
Construction Health and Safety Plan Topock Groundwater Remedy

The site-specific Project Health and Safety Plans (PHSP) to be prepared by PG&E or their construction subcontractors shall include a Health Illness Prevention Plan that complies with Title 8, California Code of Regulations, Section 3395, Heat Stress Prevention.

Heat Stress: Signs, Symptoms, and Adverse Health Effects.

The incidence and severity of heat stress will vary widely among people, even under identical heat stress conditions. Disabilities often arise from the combined effects of environmental heat loading and metabolic heat production.

Prolonged increases in deep body temperature during the first trimester of pregnancy may endanger the fetus and are associated with temporary infertility for people of both genders.

Profuse and extended sweating produces dehydration and loss of body electrolytes and may lead to heat exhaustion or muscle cramps. A prime objective of heat stress management must always be preventing heat stroke, which is life threatening and is the most serious of the heat-induced disabilities.

The **heat stroke** victim is often manic, disoriented, confused, delirious, or unconscious. The victim's

skin is hot and dry, sweating has ceased, and the body temperature is 40°C (104°F) or higher. Immediate emergency care and hospitalization are essential if signs of heat stroke develop.

Guidelines for Heat Exposure Limits

Always monitor signs and symptoms of heat stressed workers. When WBGT-TLV criteria are exceeded or water vapor impermeable clothing is worn, discontinue any environmentally-induced or activity-induced heat stress for a person when:

- ✓ Sustained heart rate is greater than 160 beats per minute (bpm) for those under 35 years of age; 140 for 35 years and older; or
- ✓ Deep body temperature is greater than 38°C (100.4°F); or
- ✓ There is disorientation or confusion for more than several minutes; or
- ✓ There are complaints of sudden and severe fatigue, nausea, dizziness, light-headedness, or fainting; or
- ✓ There are periods of inexplicable irritability, malaise, or flu-like symptoms; or
- ✓ Sweating stops and the skin becomes hot and dry.

--Good physical fitness and adequate hydration are the first lines of defense against heat strain--

Guidelines for Optimizing Safety and Health For People Working in Hot Conditions

- ✓ Encourage drinking small volumes (approximately 1 cup) of cool or tepid water about every 20 minutes.
- ✓ Provide work settings with good ventilation and shielding from radiant heat sources.
- ✓ Provide accurate verbal and written instructions, frequent training programs, and other information about heat stress and strain.
- ✓ Assure co-worker observation to detect signs and symptoms of heat stress.
- ✓ Pay extra attention to those who take medications that compromise normal cardiovascular, blood pressure, body temperature regulation, renal, or sweat gland functions.
- ✓ Pay extra attention to those who abuse or who are recovering from the abuse of alcohol or other intoxicants.

--NEVER ignore anyone's signs or symptoms of heat stress--

Heat Stress: Response

Recognition of a heat stress condition in its early stages may respond within 10-minutes by simply stopping activities, removing impermeable clothing, resting in shade with rehydration liquids. Position individual in front of a fan. Apply wet towels to skin. Continue observation and pulse monitoring.

If anyone adversely affected does not seem to respond to the treatment, notify a supervisor. Any changes in behavior, dizziness, cessation of sweating, inability to comfortably drink fluids indicate a heat stress condition that is potentially a medical emergency.

Profuse and extended sweating produces dehydration and loss of body electrolytes and may lead to heat exhaustion or muscle cramps. A prime objective of heat stress management must always be preventing heat stroke, which is life threatening and is the most serious of the heat-induced disabilities.

The heat stroke victim is often manic, disoriented, confused, delirious, or unconscious. The victim's skin is hot and dry, sweating has ceased, and the body temperature is 40°C (104°F) or higher. Immediate emergency care and hospitalization are essential if signs of heat stroke develop

ATTACHMENT 3

BIOLOGICAL HAZARD INFORMATION SUPPLEMENT

CONSTRUCTION HEALTH AND SAFETY PLAN

TOPOCK GROUNDWATER REMEDY

Biological Hazards and Controls

Spiders

Spiders are frequently encountered in or near well monuments, inside sheds, or anywhere protected from the elements. Be very careful when working around these areas where spiders may be established. Take proper precautions-wear gloves and pay attention to where you are working.

If a person is bitten by a spider, clean the site well with soap and water. Apply a cool compress over the bite location and keep the affected limb below heart level, if possible. Aspirin or Tylenol may be used to relieve minor symptoms. **DO NOT** cut the wound or apply a tourniquet. If the wound is painful, seek medical attention immediately, or call the Poison Control Center at 1-800-222-1222.

Try to identify the type of spider: note color, size, patterns, and markings. The main spiders of concern in the Mojave area are the Black Widow and Brown Recluse.

Black Widow (*Lactrodectus mactans*)

The black widow spider is easily identified by its shiny black body and red, hour-glass marking on the underside of its abdomen. The venom of the black widow spider is 15 times as toxic as the venom of the Prairie Rattlesnake. But only a minute amount of the toxin is injected with a single bite by the spider, so they are rarely fatal.

The bite itself is often not painful and may go unnoticed, but the poison injected by the Black Widow bite can cause abdominal pain similar to appendicitis as well as pain to muscles or the soles of the feet. Other symptoms include alternating salivation and dry-mouth, paralysis of the diaphragm, profuse sweating and swollen eyelids.

Persons younger than 16 and older than 60, especially those with a heart condition, may require a hospital stay. (Heart and lung failure may result in death.) A physician can give specific antivenin or calcium gluconate to relieve pain. Healthy people recover rapidly in two to five days.

Desert Recluse (*Loxosceles deserta*)

The abdomen of the brown recluse spider is uniformly colored, although the coloration can range from light tan to dark brown, and is covered with numerous fine hairs that provide a velvety appearance. The long, thin, brown legs also are covered with fine hairs, but not spines. Brown recluse spiders are also commonly referred to as "fiddleback" spiders or "violin" spiders because of the violin-shaped marking on the top surface of the cephalothorax (fused head and thorax). However, this feature can be very faint depending on the species of recluse spider, particularly those in the southwestern U.S., or how recently the spider has molted.

Adult brown recluse spiders have a leg span about the size of a quarter. Their body is about 3/8 inches long and about 3/16 inches wide. Males are slightly smaller in body length than females, but males have proportionally longer legs. Both sexes are venomous. The brown recluse spider is not aggressive, and it normally bites only when crushed, handled or disturbed. Some people have been bitten in bed after inadvertently rolling over onto the spider. Others have been bitten after accidentally touching the spider when cleaning storage areas. Some bites occur when people put on seldom used clothing or shoes inhabited by a brown recluse.

The physical reaction to a brown recluse spider bite depends on the amount of venom injected and an individual's sensitivity to it. Some people are unaffected by a bite, whereas others experience immediate or delayed effects as the venom kills the tissue (necrosis) at the site of the bite. Many brown recluse bites cause just a little red mark that heals without event.

Initially, the bite may feel like a pinprick or go unnoticed. Some may not be aware of the bite for 2 to 8 hours. Others feel a stinging sensation followed by intense pain. Infrequently, some victims experience general systemic reactions that may include restlessness, generalized itching, fever, chills, nausea, vomiting, or shock. A small white blister usually initially rises at the bite site surrounded by a swollen area. The affected area enlarges and becomes red, and the tissue is hard to the touch for some time. The lesion from a brown recluse spider bite is a dry, blue-gray or blue-white,

irregular sinking patch with ragged edges and surrounding redness--termed the "red, white, and blue sign." The lesion usually is 1½ inches by 2¾ inches or smaller.

Tarantula (g. *Aphonopelma*)

The tarantula, the largest Mojave desert spider (body, 2 to 3 inches; 4 inch legs), is not poisonous to humans but its bite can be painful. They inhabit burrows, but freely roam. They are reluctant to bite humans and their venom is usually no worse than a bee sting. Tarantulas also release bristles from their abdomen for self-defense. The bristles, while not venomous, can be highly irritating to the skin and mucus membranes. If a person receives tarantula bristles, wash the effective area thoroughly with soap and water. Use an eyewash and seek medical attention if receiving bristles to the eye.

Snakes

Mojave-area snakes typically are found in underbrush, rock ledges, shady spots on hot days, and sunny rock shelves on cool mornings. If you encounter a snake, stay calm and look around; there may be other snakes. If it is apparent the snake is a rattlesnake, or if an identification cannot be made, turn around and walk away on the same path you used to approach the area.

Notify a project biologist whenever a snake has been encountered, regardless of whether the snake could be identified. Do not attempt to pick up or otherwise move a snake that may be in a work area or on an access/travel path. Instead, stop work to allow the snake to leave on its own, and/or notify a project biologist.

If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately and contact the Poison Control Center at 1-800-222-1222. **DO NOT** apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings.

Mojave Rattlesnake (*Crotalus scutulatus*)

The Mojave rattlesnake (Figure 1), also known as the Mojave Green Rattlesnake, is the most dangerous of rattlesnakes in the area. Its venom, about 16 times more powerful than that of the Sidewinder rattlesnake (see below), attacks both the nervous system and the bloodstream. These snakes are not known to be aggressive, but are known to stand their ground rather than to flee from perceived danger.

It looks similar to a diamondback rattlesnake, having diamond shapes along its back. Its color will vary from green-gray to yellowish tones. Adults range from 2-4 feet in length. The creosote bush (see Figure 2), found in the 2,000 to 4,000 foot elevation is the primary, but not the only, habitat of this snake.

They can be identified by their triangular-shaped head and diamond-shaped markings along their body, and of course, rattles. They are brown in color in the lower elevations and darken to a green in the higher regions near the mountains. It seems to prefer desert flats over hilly or canyon habitat. This species is active from April until September. It forages actively in the open and under bushes.

Figure 1 – Mojave Rattlesnake



Figure 2 – Typical Creosote Brush Habitat of the Mohave Rattlesnake



Sidewinder rattlesnake (*Crotalus cerastes*)

The sidewinder rattlesnake is most abundant in desert washes and flats with shrub cover and wind-blown sand, and especially at the bases of bushes partially buried in sand. This snake is active from mid-spring to early fall, but activity may be restricted during the hottest part of the summer. It is an active forager, but it also waits under bushes for prey, partially buried. It may occasionally use mammal burrows or surface cover objects.

Other venomous snakes

Two other snakes, the Speckled Rattlesnake and the Timber Rattle-snake may also be encountered, and excepting color variations and size, are very distinguishable as belonging to the rattlesnake family.

Field Identification – Rattlesnakes

By comparing Figure 1 with Figure 3, it can be seen the most distinguishing features in identifying rattlesnakes are the triangle-shaped head, and a less-pronounced tapering of the tail with whole or remnant rattles. Do not rely on the "buzz" of the rattles for identification, they are sometimes lost, or not deployed!

Figure 3 – A non-venomous gopher snake.



Mammals and Associated Hazards

The only predatory mammal in the area is the mountain lion, although mountain lions are rare in the Topock area. While generally wary of human activities, and seldom prone to attack, they will engage in stalking behavior, particularly for unaccompanied individuals. Attacks are most likely when they have the clear advantage of surprise, or rapid overpowering of their target.

Other mammals such as skunks, rats, bats, coatimundis, coyotes, foxes, raccoons, are present and are often not afraid of humans, particularly if poor food-waste practices draw their attention. Approaching "friendly" animals, juveniles,

or injured animals is particularly dangerous. These animals are sometimes found in open holes and trenches, and are particularly active at night, or cooler times of the day.

Being bitten can potentially result in rabies, and/or infections. Observations of the animal's behavior, and the carcass if safely available, will be important in the physician's evaluation regarding whether to implement prophylactic rabies treatment.

Hanta Virus or Four Corners disease, is a debilitating disease that may be fatal. It is associated with airborne exposure to fecal residue of rodents. Inactive areas where rodent activities are in evidence (pellet-like feces, shredded nesting materials) should be treated as Hanta virus suspect and precautions taken to prevent air-borne dissemination of dust bearing the virus. Use of wet methods for clearing the area will provide dust control to keep surfaces from shedding dust. Do not use dry sweeping, or pressurized air. Best practice is to use a mixture of soap, water and bleach applied by appropriate sized sprayer. "HEPA" filter respiratory protection is recommended during cleaning.

Bees, Stinging Insects, and Scorpions

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Personnel are to watch for and avoid nests, and keep exposed skin to a minimum. Personnel known to be allergic should also carry sting kit, and inform the SSO and immediate coworkers, who may be called to assist in the event of a sting and allergic response. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.

Mosquitoes breed in open still water and will be uncommon unless rain events or unusual factors contribute to their propagation. They carry a number of infectious diseases in their saliva. If identified or suspected, DEET and similar class of mosquito repellents are effective in minimizing bites to exposed skin. Mosquito borne diseases recognized in California include:

- Chikungunya
- Dengue
- Malaria
- Mosquito-Borne Encephalitis/Encephalomyelitis
- Rift Valley Fever
- West Nile virus

The Striped Bark Scorpion is found in areas with a lot of cracks where it will hide. It is an active forager that does not burrow. It is distinctly associated with dead vegetation. During periods of hot weather, scorpions may move into living areas to escape the high temperatures. Scorpion behavior is non-aggressive, unless physically threatened.

Figure 4 - Striped Bark Scorpion



Scorpions have two pincers, 8 legs and an elongated body with a tail composed of segments. The last tail segment contains the stinger (also termed a telson) that transmits a toxin to the recipient of a sting. Scorpions may sting more than once; the stinger, located at the end of the tail segment is usually not lost or left in the person's tissue after a sting.

The sting is very a painful, but has a minor medical significance for healthy humans. Besides being painful a person who has been stung by a scorpion may feel a tingling, burning or numbing sensation at the sting site.

The reaction at the sting site may appear mild. However, infrequently, a person experiencing a serious reaction may develop severe symptoms throughout the body. Severe symptoms include widespread numbness, difficulty swallowing, a thick tongue, blurred vision, roving eye movements, seizures, salivation, and difficulty breathing. These symptoms constitute a medical emergency. Death may occur. Antivenom therapy is available.

1. Wash the sting with soap and water and remove all jewelry because swelling of tissue may impede the circulation if it not allowed to expand (for example, a sting on a finger that has a ring surrounding it).
2. Apply cool compresses, usually 10 minutes on and ten minutes off of the site of the sting.
3. Acetaminophen (Tylenol) 1-2 tablets every 4 hours may be given to relieve pain (usually not to exceed 3g per 24 hours). Avoid aspirin and ibuprofen (Advil, Motrin) because they may contribute to other problems.
4. Antibiotics are not helpful unless the sting area become secondarily infected.
5. Do not cut into the wound or apply suction.

Many scorpion stings can be prevented by taking precautions such as shaking out clothing and shoes to dislodge any scorpions, wearing clothing that covers the body (for example, wearing gloves and tucking in pant legs into boots may limit exposure). Many pesticides that are commercially used outside on homes may make some scorpions sluggish and easier to kill before they can sting. In addition, pesticides may markedly reduce the food source of scorpions.

If a scorpion is seen or felt on the skin, it is better to brush it off quickly instead of slapping at it because the scorpion will likely sting if the slap does not kill it.

Scorpions glow (fluoresce) under UV light (black light), so if a person is doing tasks in areas where scorpions might reside (dark areas like a closet or underneath a porch), people can use a black light to find them before they sting. This technique can be used at night when scorpions are more active and may be found on the floors or walls.

Bloodborne Pathogens

Exposure to bloodborne pathogens may occur when rendering first aid or CPR, or when coming into contact with landfill waste or waste streams containing potentially infectious material. Exposure controls and PPE are required per recommendation of Medical Professional. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

All site H&S equipment must include a bloodborne pathogen kit, to be used when rendering first aid, and H&S personnel expected to serve as first responders are to be trained in the use of the bloodborne pathogen kit.

ATTACHMENT 4
MAP OF AOCS
CONSTRUCTION HEALTH AND SAFETY PLAN
TOPOCK GROUNDWATER REMEDY

Soil Investigation Area		Overlaps with Groundwater Remedy Infrastructure? List type of infrastructure
Located Outside the Topock Compressor Station Fence Line		
AOC 1	Area Around Former Percolation Bed	Yes - wells
AOC 4	Debris Ravine	Yes - tanks
AOC 10	East Ravine	Yes - pipes, wells
AOC 11	Topographic Low Areas	Yes - pipes, wells
AOC 12	Fill Area	Yes - pipes, wells, building
AOC 28	Pipeline Drip Legs	Yes - pipes
AOC 30	MW 20 Bench	Yes - pipes, wells, building
Located Inside the Topock Compressor Station Fence Line		
AOC 7	Hazardous Materials Storage Area	Yes - tanks
AOC 13	Unpaved Areas Within the Compressor Station	Yes - pipes, wells, building
AOC 17	Onsite Septic System	Yes - pipes
AOC 22	Unidentified Three-sided Structure	Yes - pipes
AOC 33	Potential Former Burn Area Near AOC 17	Yes - pipes
Perimeter Area		Yes - pipes, wells

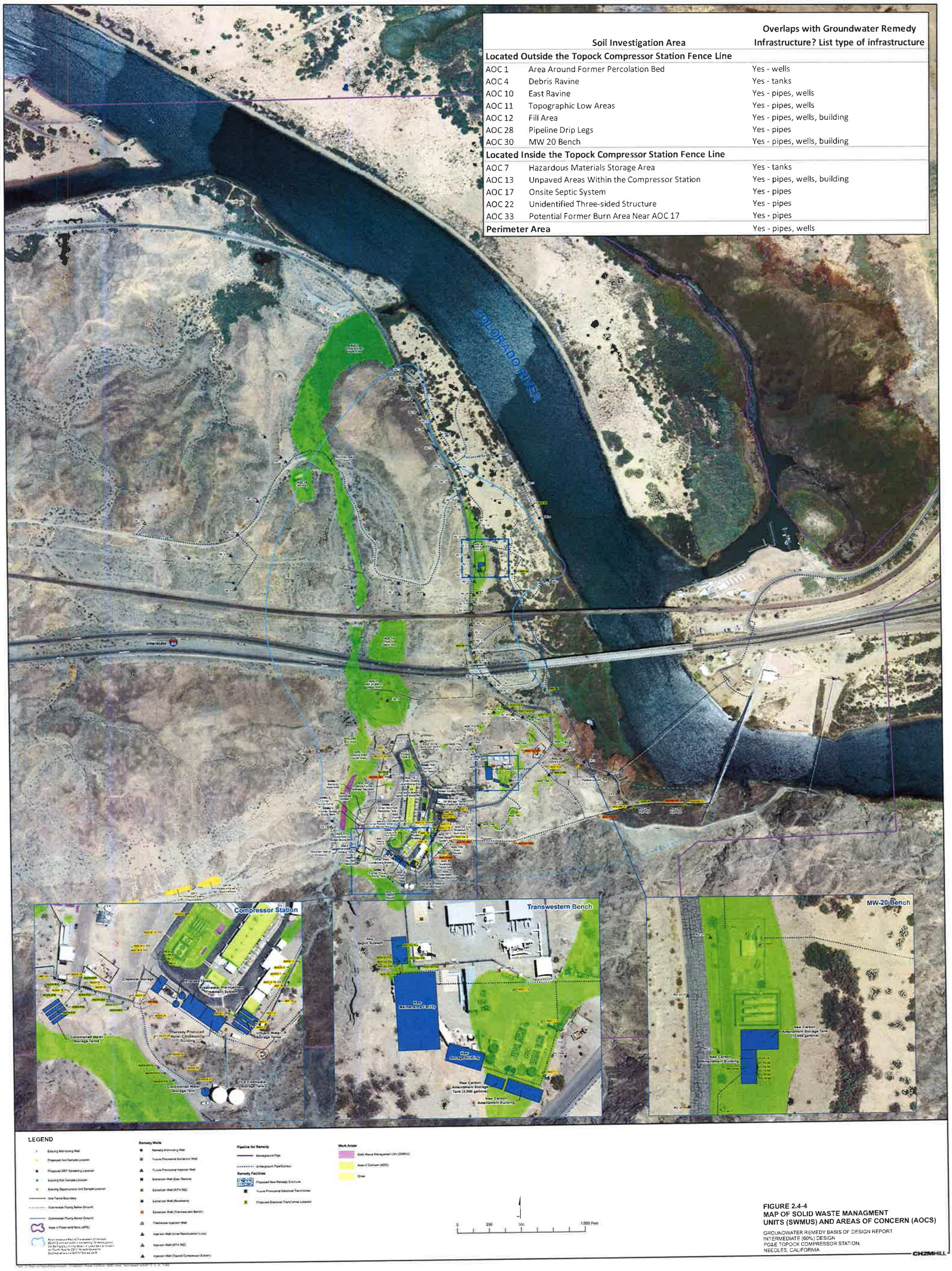

FIGURE 2.4-4
MAP OF SOLID WASTE MANAGMENT UNITS (SWMUS) AND AREAS OF CONCERN (AOCS)

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Attachment 4
Map of AOCs
Topock Groundwater Remedy Construction H&S Plan

Source: Topock Groundwater Remedy 60% Basis of Design Report, 2013

ATTACHMENT 5
SLOPE SAFETY UTILITY PROCEDURE 2027P-01
CONSTRUCTION HEALTH AND SAFETY PLAN
TOPOCK GROUNDWATER REMEDY

Slope Safety

Summary

This utility procedure identifies hazards associated with working on sloped or angled terrain and describes appropriate work methods to mitigate potential slip and fall hazards.

Level of Use: Information Use

Target Audience

All electric maintenance and construction (EM&C), general construction, electric transmission (ET), and restoration employees.

Safety

- Slope safety is defined as using conventional American National Standards Institute (ANSI)- and Pacific Gas and Electric Company (PG&E)-approved fall protection equipment on sloped surfaces greater than 40°.
- Where a free fall over 2 feet (ft) exists, always use fall arrest equipment. Knot tying is not permitted where loads need support.
- Workers may only use approved fall protection equipment. Many Conformity European (CE) equipment types are not PG&E-approved (for example, non-ANSI-approved rope grabs).
- It is PG&E policy that employees not be exposed to fall hazards. When practical, design or retrofit work areas and processes to eliminate fall hazards before starting work.
- All workers on the job must understand their roles and how those roles relate to the overall work plan, as well as the hazards and hazard controls associated with the job.
- Where feasible, employ approved fall protection systems. Where using a fall protection system is not feasible, implement approved work procedures to protect employees from falls.
- When using a life line, each person must be anchored to a separate, unquestionably strong anchor and life line.
- Only one person may be attached to a life line at a time.
- If the first person ascending or descending a slope reaches stable footing on a slope less than 40°, that person may detach from the life line. The next person may then attach to the same life line to ascend or descend the slope.

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Slope Safety

Before You Start

- Consider all methods of accessing a site to determine if the worksite is accessible without ascending or descending the slope (helicopter long-line-certified employees, alternate route, line-throwing gun, etc.)
- Evaluate and discuss the hazards associated with a sloped or angled jobsite.
- Complete PG&E Course, “Safety at Heights – Authorized Person” (at a minimum).
    - **Authorized person**: A person designated by PG&E who, by reason or training or experience, can work safely at heights and knows how to select and use fall protection equipment properly.
    - **Competent person**: “One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.” (California Code of Regulations, Title 8, Subchapter 4, Article 2)
    - **Qualified person**: “A person designated by the employer who by reason of training, experience or instruction has demonstrated the ability to safely perform all assigned duties and, when required, is properly licensed in accordance with federal, state, or local laws and regulations.” (California Code of Regulations, Title 8, Subchapter 4, Article 2)

Table of Contents – Procedures

Subsection	Title	Page
1	First Aid Emergency Procedures	3
2	Evaluating the Hazards	3
3	Accessing a Slope	6
4	Tools and Equipment – Harnesses	11
5	Ropes and Life Lines	12

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Slope Safety

Procedures

1 First Aid Emergency Procedures

- Before ascending or descending slopes at the jobsite, establish a site emergency/first aid response plan; document this plan using the jobsite tailboard form and magnetic placard. Ensure the information is complete, communicated, and understood by the entire crew.
- When working alone, perform and document a single-worker tailboard. Always discuss the following information with the person in charge (PIC) – for example, the supervisor:
  - Exact location (global positioning system [GPS] and/or physical location).
  - Time the employee reports back to the PIC after ascending or descending a slope.
  - A follow-up plan in the event the employee is unable to report back at the designated time.

2 Evaluating the Hazards

- When practical, ensure that work areas and processes are designed or retrofitted to eliminate fall hazards.
- Consider all methods of accessing the worksite before working on slopes. Determine if the work can be performed without ascending or descending the slope (helicopter long-line-certified employees, alternate route, line-throwing gun, etc.).

CAUTION

There is no state or federal requirement for working on sloped surfaces less than 40°. However, sloped surfaces less than 40° may pose a hazard. Always consider using fall protection under these circumstances.

2.1 When working on slope surfaces steeper than 40°, adhere to the following guidelines:

- Using fall protection equipment is required, per the Safety Engineering and Health Services (SEHS) *Safety at Heights User Guide*.
- Using a fall arrest system is required when working on a slope ending in a cliff.
- A minimum of two people are required and a fall arrest system must be used when working on a slope where a drop-off greater than 2 ft exists.

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Slope Safety

2.2 IF a hazard cannot be abated through design and any of the following conditions exist:

- The potential vertical fall distance is 2 ft or greater.
- There are sloped roof surfaces steeper than 7:12.
- There are sloped surfaces steeper than 40°.

THEN employ approved fall protection systems, where feasible.

2.3 IF using a fall protection system is not feasible,

THEN implement approved *Safety at Heights User Guide* procedures to protect employees from falls. If necessary, contact a Safety at Heights qualified person (QP) before starting work.

2.4 Before starting work, evaluate and discuss the hazards associated with sloped or angled worksites.

2.5 Always assess the environment. The following is a partial list of work environment and footing conditions to consider:

- What are the general soil conditions (for example, dry and loose or wet and slippery)?
- What are the terrain conditions (for example, general stability, loose rocks, leaves, debris, bush, uneven or moss covered surfaces, steep drop off)?
- What type of vegetation is at the worksite and how might it impact jobsite safety?
- What is the potential for falling/sliding objects (for example, rocks and tools)?
- What are the weather conditions and how might they impact the workers' ability to perform the job safely?
- Is visibility and lighting sufficient to perform the job safely?
- Is the crew properly staffed or are additional resources needed?
- Are approved tools and equipment available at the jobsite to access the slope safely?
- What personal protective equipment (PPE) is needed to perform the job safely? (Be sure to include foot wear for ankle support and traction.)
- Are the workers' hands free of materials and tools while ascending or descending slopes?

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Slope Safety

2.6 Identifying a Slope Hazard

Use a slope indicator to determine the angle of the slope or worksite where employees will be working or must access. (Backcountry slope meter: Code BCASS-10)

- A bubble level or inclinometer may be used to indicate slope angle.
- A protractor may be used (Figure 1), as described in the following Section 2.7, "Identifying Slope Angle Using a Protractor."

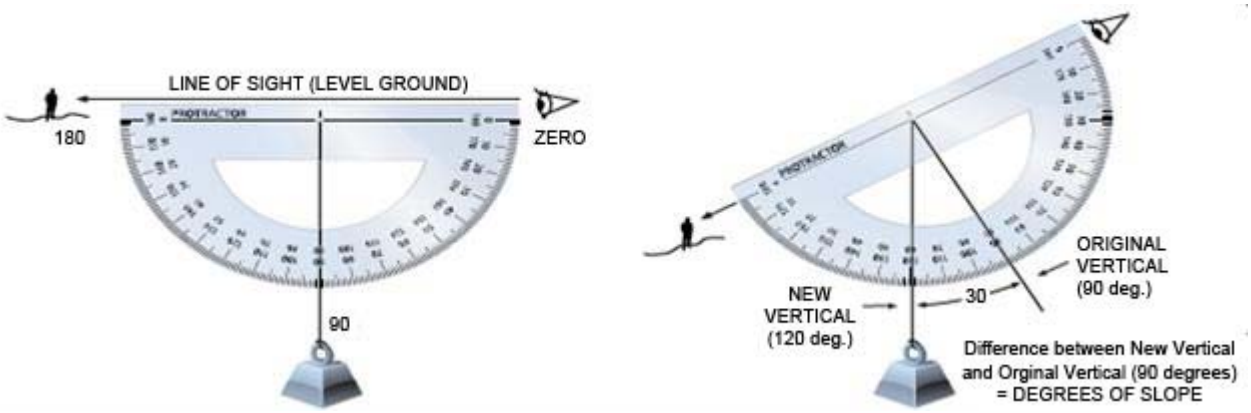

Figure 1. Identifying Slope Angle Using a Protractor

2.7 Identifying Slope Angle Using a Protractor

1. Attach the string to the protractor at the midpoint between the zero and 180° marks (the vertex of the angle).
2. Hang a small weight on the end of the string to make a plumb-bob. The string should hang over the 90° mark when the protractor's flat edge is parallel to level ground.
3. To measure the slope angle from the top of the slope, put your eye by the zero degree mark, and look along the flat edge of the protractor toward the bottom of the hill. If you are at the bottom of the hill, put your eye at the 180° mark and look up toward the top.
4. Check the new angle where the string falls when the plumb-bob is hanging straight down.
5. To ascertain the slope measurement in degrees, subtract 90° from the new vertical angle. In Figure 1 the new angle is 120°, so the slope angle is 30° (120-90=30).
6. To be as accurate as possible, look along the protractors edge to a point the same height above the ground as eye level. (It helps to imagine someone the same height standing at the other end of the slope.)

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Slope Safety

3 Accessing a Slope

3.1 Consider the following partial list of precautions when accessing a slope:

- Access the worksite from above whenever possible. Employees must always be attached to a fall protection system, provided there is a suitable anchor.
- Maintain a sharp visual and mental focus (keep eyes on path) when ascending or descending a slope.
- Wear heavy, Vibram-type boots with good ankle support.
- Use a side step method, if necessary, to maintain stable footing.
- Use a hiking stick or pole for balance.
- Proceed with caution, maintaining a firm footing with each step (take smaller steps).
- Create a step at the worksite for level footing, if needed.

3.2 When using a life line, each person must be anchored to a separate, unquestionably strong anchor. Make sure the anchor is connected at the following points:

- To the frame or other anchor points of a vehicle weighing more than 5,000 pounds (lb.) for fall arrest. Make sure the vehicle ignition is off, the key is removed, and the man-on-line (MOL) tag (notifying others that the vehicle is being used as an anchor) is attached to the steering wheel.
- To a large, firmly planted tree greater than 8 inches in diameter.

3.3 IF there are no suitable anchor points (such as a tree, pole, tower, or truck),

THEN re-evaluate the worksite access. Terrain variables do not allow for a portable engineering solution.

3.4 Accessing a Slope from Above

1. Assess the entire jobsite and slope for potential hazards from the top of the slope.
2. Identify appropriate anchor(s).
3. Ensure that the entire crew participates in a tailboard. Tailboard topics must include the documented emergency plan and all identified, discussed, and mitigated hazards. The entire crew must understand all aspects of the job and emergency plan.
4. Attach a ⅝-inch green life line to the anchor (using a permanently attached steel sling with a minimum ⅝-inch shackle or a 5,000 lb. carabiner).

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3.4 (continued)



Figure 2. ⅝-Inch Green Life Line

5. IF the steel sling is too short,

   THEN choke an improvised anchor strap (Figure 3) around the anchor, and attach the steel sling eye to the D-ring on the improvised anchor strap with a minimum ⅝-inch shackle or 5,000 lb. carabiner.



Figure 3. Improvised Anchor Strap
(See Table 2 on Page 13 for ordering information.)

6. Put on and adjust an approved full body harness (Figure 4, Page 11).

7. Attach the shock pack end of shock absorbing lanyard (Figure 6, Page 12) to the dorsal (back) D-ring on the harness, and attach the other end to the compatible Buckingham rope grab using approved 5,000 lb. carabiners supplied with shock absorbing lanyard.

8. Attach the approved and compatible Buckingham rope grab (Figure 6) to the life line with the arrow pointing toward the anchor.

9. Begin walking down the slope while holding the rope and moving the rope grab down the rope.

10. When at the worksite, if the slope is over 40°, pull down on the ring of rope grab to lock the rope grab on the life line.

11. Keep equipment on while working on the ground at this location unless the slope can be minimized to less than 40° by digging, relocating to a flatter area, etc.

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Slope Safety

3.4 (continued)

CAUTION

Only one person may be attached to any life line at a time.

NOTE

When using a life line, each person must be anchored to a separate, unquestionably strong anchor and life line.

12. IF the first person remains on the first life line,

    THEN the next person repeats Steps 4-10 (starting on Page 6).

13. IF the first person reaches stable ground with less than 40° of slope and disconnects from the life line,

    THEN the next person repeats Steps 6-10 (on Page 7) for each person accessing the slope.

14. Reverse these steps (Section 3.4, "Accessing a Slope from Above," Steps 1-13 starting on Page 6) to ascend the slope after the work is completed.

3.5 Accessing Slope from Below

1. First Person Up

   The first person up performs the following Steps a-j to access a slope from below:

   a. Assess the entire jobsite from the bottom of the slope for potential hazards.

   b. Ensure that the entire crew participates in the tailboard. Tailboard topics must include the documented emergency plan and all identified, discussed, and mitigated hazards. The entire crew must understand all aspects of the job and emergency plan.

   c. Put on and adjust the approved full body harness (Figure 4, Page 11).

   d. Coil the life line up and carry it over your shoulder, or uncoil and attach the life line steel sling to the harness, dragging the life line rope up the hill by the steel sling.

   e. Carry an additional short life line to secure the first person up to a separate anchor, in the event the first person up cannot reach stable ground with less than a 40° slope and additional people will be ascending the hillside.

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Slope Safety

3.5 (continued)

CAUTION

Use extreme caution while ascending a hillside. Consider moving up the hill in a switchback pattern, and side step up and along the path to ensure there is a solid foundation for each step. (Consider using a hiking stick/pole for balance.)

f. Use extreme caution while ascending the hillside.

g. When the worksite is reached, identify the appropriate anchor(s).

h. IF the first person up cannot reach stable ground with less than a 40° slope,

THEN the first person up attaches a short ⅝-inch green life line (Figure 2, Page 7) to the appropriate anchor using a permanently attached steel sling with a minimum ⅝-inch shackle or 5,000 lb. carabiner.

i. IF the steel sling is too short,

THEN choke an improvised anchor strap (Figure 3, Page 7) around the anchor, and attach the steel sling eye to the D-ring on the improvised anchor strap with a minimum ⅝-inch shackle or 5,000 lb. carabiner.

(1) Attach the shock pack end of shock absorbing lanyard (Figure 6, Page 12) to the dorsal (back) D-ring on the harness.

(2) Attach the approved and compatible Buckingham rope grab to the other end of the shock absorbing lanyard using approved 5,000 lb. carabiners supplied with shock absorbing lanyard.

(3) Attach the approved and compatible Buckingham rope grab (Figure 6) to the life line with the arrow pointing toward the anchor.

NOTE

When using a life line, each person must be anchored to a separate, unquestionably strong anchor and life line.

CAUTION

Only one person may be attached to any life line at a time

j. Attach the other ⅝-inch green life line to another appropriate anchor (see Step h above).

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Slope Safety

3.5 (continued)

2. Next Person Up

The next person up ascends the hillside using the vacant life line (Steps a-g below).

a. Put on and adjust an approved full body harness (Figure 4, Page 11).

b. Attach the shock pack end of shock absorbing lanyard (Figure 6, Page 12) to the dorsal D-ring on the harness, and attach the other end to the Buckingham rope grab.

c. Attach the approved and compatible Buckingham rope grab (Figure 6) to the life line with the arrow pointing toward the anchor.

d. IF the next person up will remain on the life line at the worksite,

THEN that person will take another life line up, and attach the life line to another appropriate anchor for the next person.

e. The next person up begins walking up the slope, while holding the rope and moving the rope grab up the rope.

f. When at the worksite, if the slope is over 40°, pull on the rope grab to lock it on the life line.

g. Keep equipment on while working on the ground at this site unless the slope can be minimized by digging, relocating to a flatter area, etc.

h. Reverse Steps a-g above to descend the slope after the work is completed.

3. Last Person Down

The last person to walk down the slope must disconnect the remaining life lines from the anchors so they can be pulled down the hill.

CAUTION

Use extreme caution while descending a hillside. Consider moving down the hill in a switchback pattern, and side step down and along the path to ensure there is a solid foundation for each step. (Consider using a hiking stick/pole for balance.)

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4 Tools and Equipment – Harnesses

For information regarding other tools and equipment, see the SEHS *Safety Equipment Guide*.

4.1 Full Body Harness

A full body harness is designed with straps that fasten around a person to contain their torso and distribute fall arrest forces over at least their upper thighs, pelvis, chest, and shoulders (with a means for attaching the harness to other components or subsystems).

Workers may use front, side, or back D-rings with a full body harness. While working on steeper slopes, workers must employ a fall arrest system and use a back D-ring as the attachment point.

4.2 Fall Arrest Harness

A fall arrest harness has a single forged D-ring affixed to the shoulder straps and positioned between the shoulder blades. It allows workers to climb and work without interference from the rope. The dorsal attachment ensures that an individual hangs in an upright position after a fall and that the forces of a fall are distributed correctly. The upright position is especially helpful if the fallen worker is unconscious or injured. This design enables workers to be safe and reasonably comfortable while suspended for prolonged periods of time.

4.3 PG&E-Approved Harnesses

When working on slopes, use any of the following harnesses:

- Buckingham Harness.
- DBI Exofit – XP Full Body 4 D-Ring Harness (Figure 4).
- Yates Tower Harness.



Figure 4. DBI Exofit – XP Full Body 4 D-Ring Harness

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5 Ropes and Life Lines

5.1 Rope is defined as any cordage (synthetic or natural) with an external diameter greater than 3/16 inch (4 millimeters [mm]). The length may be twist balanced, as in a “laid” rope, or braided.

5.2 Vertical Life Line (Figure 5 and Table 1 below)

A component, element, or constituent of a life line subsystem consists of a vertically suspended flexible line with a connector at the upper end for fastening the line to an overhead anchor or anchor connector, along which a fall arrester travels.

Figure 5 and Figure 6 are illustrations of the PG&E-approved rope/vertical life line with compatible shock pack and rope grab.

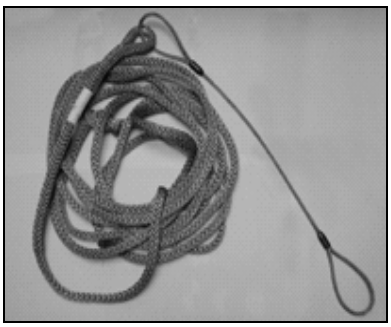

Figure 5. ⅝-Inch Green Life Line



Figure 6. Rope Grab and Buckingham Lanyard for Use with ⅝-Inch Green Life Line

Table 1. Single Braided 12-Strand Rope for Fall Arrest Systems – Requirements and Ordering Codes

Rope Size (inches)	Minimum Breaking Strength (lbs)	Approximate Net Weight per 100 ft (lbs)	Diameter (inches)	M&S Ordering Codes
⅝	15,000	13.1 ±/- .5	0.657 ±/- .015	
Standard Fall Arrest System Ropes				
Specify length of rope				20-9276
Tower Structure Fall Arrest System Ropes				
25 ft length				20-9277
40 ft length				20-9278
Specify length of rope				20-9279
Rope Grab Devices				
MIO ⅝-inch rope grab (non-free following)				20-9280
3 ft Buckingham Energy Absorbing Lanyard, Pt. No. 611113				20-9282
*RTC Rope Grab and Energy Absorbing Lanyard (free following), Mod. No. 23000P3E				20-9281

*Do not use the RTC Rope Grab and Energy Absorbing Lanyard with a Buckingham Bucket Harness.

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5.2 (continued)

Table 2. Improvised Anchor Strap – Ordering Information (See Figure 3 on Page 7 for illustration.)

Supplier Part #	Description	Manufacturer Part #
DBI1002200	Tie-off adapter, 3 ft long – welding and arc-flash rated (made with Kevlar)	1002200
DBI1002202	Tie-off adapter, 6 ft long – welding and arc-flash rated (made with Kevlar)	1002202
DBI1002207	Tie-off adapter, 12 ft long (for CRE only), welding and arc-flash rated (made with Kevlar)	1002207
DBI1002206	Tie-off adapter, 20 ft long (for CRE only), welding and arc-flash rated (made with Kevlar)	1002206
Tie-off adapters wrap around a structural member to provide an anchorage point for fall restraint/arrest systems. Pass a tie-off adapter through a type D-ring, 1-¾ inch polyester load strap, with a 3-inch wide wear pad and green webbing down the middle of the strap.		

5.3 Horizontal Life Line

The horizontal life line consists of an anchor, anchor connector, life line, and a variety of subsystems. The entire system (from anchor to body support) must be designed, engineered, and approved by a QP and must have a safety factor of at least two.

QP(s) designing or engineering horizontal life line systems **must** conduct appropriate research, maintain adequate safety margins, and receive additional training on designing man-rated systems. Employees may not install or use a horizontal life line for fall arrest unless a QP has properly designed or engineered such life line. Horizontal life line systems are relatively flexible in type, situation, size, and the span they can accommodate.

END of Instructions

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Slope Safety

Definitions

Fall arrest system: Prevents an employee from free falling to the ground. Always wear a full body harness as part of a fall arrest system.

Fall arrester (rope grab): A device which travels along a lifeline and automatically engages a line and lock to prevent an employee from falling.

Fall restraint system: A fall protection method that prevents employees from approaching an edge. With a properly constructed fall restraint system, employees are not in danger of a free fall should they trip or become unconscious. In situations where exposure to a fall hazard cannot be prevented, always use a fall arrest system.

Jobsite: A 360° area within which a worksite is contained.

Worksite: The immediate site where a task is conducted within a jobsite.

Implementation Responsibilities

All electric maintenance and construction (EM&C), general construction, electric transmission (ET), and restoration area superintendents must ensure that the supervisors in their areas conduct tailboards on this procedure.

Governing Document

NA

Compliance Requirement/ Regulatory Commitment

American National Standards Institute (ANSI)

California Code of Regulations, Title 8, “Industrial Relations”

California Occupational Safety and Health Administration (Cal/OSHA)

Reference Documents

PG&E Courses:

- Safety at Heights – Authorized Person
- Safety at Heights – Competent Person
- Safety at Heights – Qualified Person

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Slope Safety

Reference Documents, *Continued*

Safety Engineering and Health Services (SEHS) Manuals:

- *Safety at Heights Reference Manual*
- *Safety at Heights User Guide M62-1073*
- *Safety Equipment Guide*

SEHS Safety Tailboard, "Safety in the Field – Slope Safety Awareness"

Utility Standard Practice (USP) 22, "Safety and Health Program"

Appendices

NA

Attachments

NA

Document Recision

NA

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Revision Notes

Where?	What Changed?
NA	This is a new document.

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ATTACHMENT 6
EXCAVATION SAFETY UTILITY STANDARD
TD-4621S

CONSTRUCTION HEALTH AND SAFETY PLAN
TOPOCK GROUNDWATER REMEDY

Excavation Safety

SUMMARY

This standard establishes design requirements for working safely in excavations. This standard mandates use of the Pacific Gas and Electric Company (Company or PG&E) *Excavation Safety Manual*.

TARGET AUDIENCE

Personnel who work in or near excavations or perform standby.

SAFETY

Compliance with the Company's *Excavation Safety Manual* ensures safe working conditions.

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2 Adherence to the *Excavation Safety Manual* 2

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Excavation Safety

REQUIREMENTS

1 General

1.1 This standard establishes use of the *Excavation Safety Manual* and any appendices or attachments.

1.2 The *Excavation Safety Manual* provides key information to personnel planning, creating, and/or working near excavations including, but not limited to, the following:

- Pre-construction jobsite preparation or inspection.
- Description of soil types and their characteristics.
- Controlling hazards at the jobsite.
- Monitoring excavation conditions for changes.
- Installation and removal procedures for various types of shoring.
- Designs for sloping and benching excavations.
- Emergency contact numbers and procedures for responding to a cave-in of an excavation.
- Frequently asked questions (FAQs).

1.3 The Company must maintain competent person training records.

2 Adherence to the *Excavation Safety Manual*

2.1 Personnel must adhere to the requirements in the *Excavation Safety Manual* when working in excavations including, but not limited to, the following items:

- Presence of a competent person onsite at all times.
- Analysis of soil classification.
- Identification of jobsite or environmental hazards affecting the stability of the excavation.
- Installation of cave-in protective system (shoring, sloping, benching, shielding, or other approved method).
- Inspection of the excavation and cave-in protective system at the beginning of each shift, and anytime conditions change.
- Securing the jobsite.

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Excavation Safety

END of Requirements

DEFINITIONS

Competent person: one who is through training and experience, qualified of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to personnel, and who has the authority to take prompt corrective measures to eliminate such conditions.

Excavation: Any man-made cut, cavity, trench, or depression in an earth surface formed by earth removal.

IMPLEMENTATION RESPONSIBILITIES

The area directors, superintendents, and supervisors ensure that personnel are trained and comply with the requirements of this standard. In addition, they are responsible for providing sufficient resources to achieve the requirements of this standard and ensuring that the Excavation Safety Manual is available at every jobsite where excavation activities are being performed to comply with the California Division of Occupational Safety and Health (DOSH), better known as Cal/OSHA, regulations.

Personnel assigned tasks related to entering excavations must carry out their designated tasks. For their own safety and that of the general public, personnel must perform only the tasks for which they are trained, knowledgeable, and qualified. When necessary, personnel must notify their supervisor(s) of any additional training, equipment, or resources needed to perform assigned tasks.

GOVERNING DOCUMENT

- NA

COMPLIANCE REQUIREMENT / REGULATORY COMMITMENT

- Occupational Safety and Health Administration (OSHA) 29 CFR 1926 subpart P, Excavations
- 1926.800; Underground Construction
- 1926.956, Underground Lines
- California Code of Regulations (CCR) Title 8, Section 1540, 1541, and 1542 governing Excavation Safety

REFERENCE DOCUMENTS

Developmental References:

- INGAA Document Cs-s-12, “Trenching and Excavation Safety”

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Excavation Safety

- OSHA Technical Manual (OTM) Section, “Excavations: Hazard Recognition in Trenching and Shoring”

Supplemental References:

- NA

APPENDICES

- NA

ATTACHMENTS

- Attachment 1, “Excavation Safety Guide”
- TD-4621M-F01, “Excavation Safety Checklist”

DOCUMENT RECISION

- This document cancels Utility Standard S4415, “Excavation Safety,” issued 01/2003.

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REVISION NOTES

Where?	What Changed?
NA	This is a new document.

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ATTACHMENT 7

PG&E ENVIRONMENTAL REMEDIATION
CONTRACTOR REPORTING GUIDANCE

CONSTRUCTION HEALTH AND SAFETY PLAN
TOPOCK GROUNDWATER REMEDY

Pacific Gas and Electric Company®

Preparation Date: 01-28-2014
Rev: 2

Environmental Remediation Contractor Reporting Guidance

Summary

This is guidance for contractor reporting of safety and compliance incidents to PG&E Environmental Remediation (ER) personnel. This guidance provides definitions and an example incident reporting form for contactor use. Contractors are encouraged to report all incidents to PG&E for broader project application of lessons learned.

NOTE: Reporting incidents to PG&E personnel DOES NOT supersede required external agency reporting. The ER contractor is responsible for appropriately reporting all incidents to local, state and federal agencies as required by law.

Environmental Incident Definitions

COMPLIANCE: A written notification of non-compliance (NOV) by a regulatory agency issued for failure to comply with environmental laws, regulations, permits, certifications licenses or registrations. This includes judicial sanctions to address non-compliance. The three levels of action to be measured in this metric include:

- **Level 1:** Having an actual or potential impact on the environment and/or having a negative impact to the company's financial position, reputation, or regulatory status (the Environmental VP determines whether an enforcement action is a Level 1).
- **Level 2:** Having no impact to the environment—typically administrative or a "parking ticket" citation.
- **Near Hit:** A situation or a condition in which PG&E is in non-compliance and no enforcement action is administered; a situation or a condition, if not corrected, that could result in non-compliance. These situations include self-reported and non-self-reported incidents.

HAZMAT RELEASE: Any release of a material/substance to the land, water, or air that was not permitted or intentional. This would include odor incidents. The three levels of action to be measured in this metric include:

- **Minor Release:** A release of a hazardous material/substance that does not extend beyond the boundaries of the project site, does not require an emergency agency response (agency notification may be required depending on jurisdiction), does not result in immediate or observable injury, and is cleaned up or mitigated within 8 hours of release termination.
- **Moderate Release:** A release of hazardous material/substance that extends beyond the boundary of the facility, but does not require an emergency agency response (agency notification may be required depending on jurisdiction), does not result in immediate or observable injury, and is cleaned up or mitigated within 8 hours of release termination. For purposes of air releases, this includes situations where site operations are fully or partially shut down for less than 24 hours.
- **Major Release:** A release of hazardous material/substance that may or may not extend beyond the boundary of the property, but results in injury or significant exposure, or requires outside emergency response assistance, or cannot be terminated or clean up within 8 hours of release discovery, or results in shutdown of all site operations for more than 24 hours.

Safety Incident Definitions

NEAR HIT: Any safety incident that was identified before it could have resulted in a damage to person or property, or release.

NOISE/VIBRATION INCIDENT: Any incident that results in the public or agency responding to noise or vibration issues related to work on a PG&E Project. The three levels of action to be measured in these metrics include:

- **Complaint:** Any visit or contact by an agency or the public to notify the contractor or PG&E that a noise or vibration issue has been identified.
- **Shutdown:** Any noise or vibration incident that would result in a shutdown of all site operations for more than 24 hours.
- **Damage:** Any noise or vibration incident that results in operational disturbance or nuisance to the public or damage to structures from work on a PG&E Project. This would include any monetary fines or payments for loss of business.

SAFETY INCIDENT: Any incident that results in an injury or property damage. The five levels of action to be measured in this metric include:

- **Property Damage:** An incident that results in any incidental property damage (not including utility strike related incidents) incurred due to work on a PG&E Project.
- **Minor Safety Incident:** A safety incident that occurs on a PG&E Project; however, does not result in first aid or medical treatment. This would include incidents such as minor electrical shocks, pinched hands/fingers, slip/trip/fall without injury, etc.
- **First Aid/Medical Treatment Injury:** An incident that results in a first aid injury related to work on a PG&E Project. This would include any onsite first aid care or a visit to an urgent care facility.
- **OSHA Recordable:** An incident that results in an OSHA recordable related to work on a PG&E Project.
- **Fatality:** An incident that results in any fatality related to work on a PG&E Project.

UTILITY STRIKE: Damage or contact to an above- or underground utility that may or may not result in damage to the utility. The four levels of action to be measured in this metric include:

- **Category 1 Strike:** Utility strike not involving electricity, gas, or hazardous materials that result in no injury or death; results in customer outage of no more than 24-hours; or causes property/equipment damage less than $50K.
- **Category 2 Strike:** Utility strike involving electricity, gas, or hazardous materials that result in no injury or death; results in customer outage less than 24-hours; causes property/equipment damage less than $50K; or results in no fire, release or explosion requiring outside emergency response.
- **Category 3 Strike:** Utility strikes of any kind that result in property/equipment damage exceeding $50K, or customer outage greater than 24-hours, but does not result in injury or death; hazardous materials release requiring agency notification; or release, fire or explosion requiring outside emergency response.
- **Category 4 Strike:** Utility strike of any kind that results in injury or death; hazardous materials release requiring agency notification; or release, fire or explosion requiring outside emergency response.

MOTOR VEHICLE INCIDENT: Any incident involving a vehicle that results in a potential accident or unintentional damage to person(s) or property. The two levels of enforcement action to be measured in this metric include:

- **Minor Vehicle Incident:** A vehicle incident occurring either on-site or on public roadways that results in no injuries, no USDOT or CHP violations or fines over $1,000 and no property or equipment damage over $50K (standard traffic violations are not included in this metric).

Environmental Remediation Contractor Reporting Guidance

- **Major Vehicle Incident:** A vehicle incident occurring either on-site or on public roadways that results in injuries, death, hazardous materials release requiring agency notification or response, fire or explosion requiring outside emergency response, USDOT or CHP NOV or fine over $1,000, property damage or equipment damage over $50K (standard traffic violations are not included in this metric).

Best Practice Definition

A safety or compliance method or technique that has consistently shown results superior to those achieved with other means. Note: Best practices communicated to PG&E will be shared across Remediation project teams.

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Environmental Remediation Contractor Reporting Guidance

Initial Notification Procedure

Upon an incident occurring, the contractor should gather the recommended information for reporting to PG&E. The information is recommend to be transmitted via email; however, can be transmitted via telephone, then follow-up with an email summary. The initial information should at a minimum include the following:

- Project Name
- Project/Incident Location
- Date and time of the incident
- Contractors/Parties Involved
- Initial Incident Category
- Incident Description
- Initial response or corrective actions

EH&S Principal
Heather Crawford
HMS9@pge.com
925.337.0172 (Mobile)

For major incidents such as suspected Level 1 Sanction, Major Release, Noise/Vibration Damage, Category 3 or 4 Utility Strike, Major Vehicle Incident, or any safety incident resulting in offsite emergency care, initial notification to the PG&E Project Manager should be submitted within *2 hours*, preferably sooner. If you do not receive positive confirmation of receipt of the notification from the PG&E Project Manager within 1 hour of reporting the incident, notify the EH&S Principal. For all other incidents, the initial notification to the PG&E Project Manager should be submitted within *24 hours*.

Incident Root Cause Analysis

For most incidents, it is recommended that the Contractor prepare a Root Cause Analysis (RCA) to evaluate the casual and contributing factors of the incident. The findings from the RCA can be shared among Environmental Remediation to provide incident learning and shared experiences. RCA can be summarized in an email or prepared in a contractor specific RCA form. The 9 Root Cause categories include the following:

- RC 1 - Lack of skill or knowledge
- RC 2 - Lack of procedure or work standard
- RC 3 - Not following procedure or directions
- RC 4 - Inadequate communication of procedures
- RC 5 - Inadequate tools or equipment
- RC 6 - Improper tool or equipment used
- RC 7 - Short cuts were taken
- RC 8 - Engineering or design deficiency
- RC 9 - Uncontrollable (external factor, **USE RARELY**)

For major incidents such as suspected Level 1 Sanction, Major Release, Noise/Vibration Damage, Category 3 or 4 Utility Strike, Major Vehicle Incident, or any safety incident resulting in offsite emergency care, RCA are to be submitted to the PG&E Project Manager and EH&S Principal within *5 business days* For all other incidents, the RCA are to be submitted to the PG&E Project Manager and EH&S Principal within *10 business days*.

A RCA is not required for near-hits; however, PG&E Project Manager and EH&S Principal can request a RCA, based on near-hit severity and conditions.

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Example Incident Report

The attached page presents an example incident report. The example includes all the information recommended for the initial notification to the PG&E Project Manager and EH&S Principal. This example incident report can be used by the contractor for reporting purposes, or the contractor can prepare their own notification.

The follow-up RCA may be prepared in a contractor specific RCA form.

Monthly Incident Report

On a monthly basis, submit a summary of the following to the EH&S Principal:

- Near hits
- Environmental and safety incidents
- Agency inspections (include any ADQM, CUPA, LOP, etc. inspection)

Provide a brief summary and date of the near hits, incidents, and inspections. For any near hits or incidents, include the time to implement any correction actions in days.

Environmental Remediation Contractor Reporting Guidance

Error! Reference source not found. **Incident Report**

Incident Details
Project Name: Click here to enter text.
Incident Location: Click here to enter text.
Date of Incident: Click here to enter a date.
Date Incident Identified: Click here to enter a date.
Incident Description: Click here to enter text.
Incident Type: Choose an item.
Incident Cause
Root Cause: Choose an item.
Description: Click here to enter text.
Responsible Party: Choose an item.
Prime Contractor: Click here to enter text.
Subcontractor: Click here to enter text.
Third Party: Click here to enter text.
Corrective Actions
Immediate Actions Taken: Click here to enter text.
Corrective Actions Taken to Prevent Recurrence: Click here to enter text.
Completion Date: Click here to enter a date.
Report Details
Report Completed By: Click here to enter text.
Report Date: Click here to enter a date.

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Error! Reference source not found. **Incident Report**

Incident Details
Project Name:
Incident Location:
Date of Incident:
Date Incident Identified:
Incident Description:
Incident Type:
Incident Cause
Root Cause:
Description:
Responsible Party:
Prime Contractor:
Subcontractor:
Third Party:
Corrective Actions
Immediate Actions Taken:
Corrective Actions Taken to Prevent Recurrence:
Completion Date:
Report Details
Report Completed By:
Report Date:

Appendix E
Cost Estimate
(On CD-ROM Only)

APPENDIX E

Cost Estimate

This section will not be completed in time for the publication of the Final Construction/Remedial Action Work Plan on November 18, 2015. It will be completed on December 4, 2015 and at that time will be sent to all recipients of the C/RAWP hardcopies for insertion into their binders. Other readers will be able to download a PDF of Section 8 from the project SharePoint site or the DTSC project website at http://dtsc-topock.com/ (located in Documents\Cleanup Implementation\Groundwater\Remedy Design\Remedial Design Documents\Final Design).

Appendix J
Paleontological Resources Management Plan: MMRP CUL-3
(On CD-ROM Only)

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PALEONTOLOGY - ARCHAEOLOGY - HISTORY

PG&E Pacific Gas and Electric Company®

Paleontological Resources Management Plan: MMRP CUL-3

Topock Groundwater Remediation Project
San Bernardino County, California, and
Mohave County, Arizona

October 2015

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PALEONTOLOGY - ARCHAEOLOGY - HISTORY



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Title Principal Investigator

Signature 2 Name
Title

Signature 3 Name
Title

Paleontological Resources Management Plan

Topock Groundwater Remediation Project
San Bernardino County, California, and
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PALEONTOLOGY - ARCHAEOLOGY - HISTORY

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Acronyms and Abbreviations

AOC	Area of Concern
BLM	Bureau of Land Management
CACA	Corrective Action Consent Agreement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Compressor Station	Topock Compressor Station
DOI	Department of the Interior
DTSC	Department of Toxic Substances Control
EIR	Environmental Impact Report
LACM	Natural History Museum of Los Angeles County, Vertebrate Paleontology Section
LACMIP	Natural History Museum of Los Angeles County, Invertebrate Paleontology Section
MMRP	Mitigation Monitoring and Reporting Program
my	million years
mya	million years ago
PG	Professional Geologist
PFYC	Potential Fossil Yield Classification
PG&E	Pacific Gas and Electric Company
RCRA	Resource Conservation and Recovery Act
SBCM	San Bernardino County Museum
SWMU	Solid Waste Management Unit

UCMP	University of California Museum of Paleontology
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UTM	Universal Transverse Mercator

1. Executive Summary

This Paleontological Resources Management Plan is being prepared as required by the Mitigation Monitoring and Reporting Program (MMRP) document for the Topock Remediation Project at the Pacific Gas & Electric (PG&E) Topock Compressor Station. The following protocol describes the paleontological evaluation and survey results and provides protocols for PG&E and their subcontractors during construction. PG&E is implementing the selected groundwater remedy for chromium in groundwater at the Topock Compressor Station, which is located within eastern San Bernardino County, California, and western Mohave County, Arizona.

There is both public and private land ownership in the project area. Substantial portions are owned by the BLM or managed by the BLM on behalf of the Bureau of Reclamation. A portion of the project area also includes the Havasu National Wildlife Refuge, which is administered by the USFWS. No BLM paleontology permit and fieldwork authorization will be required for any paleontological fieldwork in these areas due to the CERCLA exemption.

The project study area consists of three subcomponents: (1) the Groundwater Remedy Area (793.7 acres); (2) the Park Moabi Facilities Area (3.4 acres); and (3) Freshwater Supply Area (52 acres) in Arizona. The project has numerous components more fully described in the Final Design Submittal for the Final Groundwater Remedy. The maximum depth of grading (not drilling) in Groundwater Remedy Area will be approximately nine feet. The maximum depth of grading for the Park Moabi Facilities will be fourteen feet and the maximum depth of grading for the Freshwater Supply Area will be seven feet.

Substrate in the project study area is mapped as Holocene alluvium of sand, river, lake, and floodplain deposits; Pleistocene Chemehuevi Formation and Pleistocene older alluvium; Pliocene Bouse Formation; Miocene fanglomerate; Cretaceous or Jurassic Whale Mountains quartz monzonites; and Precambrian igneous and metamorphic rocks. Paleontological records searches were conducted by the Natural History Museum of Los Angeles County, the San Bernardino County Museum, and by Cogstone in online databases and paleontological and geological professional journals. Within the project area near locations proposed for new wells, the San Bernardino County Museum reported collecting unidentified mollusk shell fragments in the Chemehuevi Formation. Pleistocene and Pliocene localities near the groundwater project in Topock/Golden Shores and upriver at Needles have produced fossils.

Geological setting and fossil localities were considered in determining paleontological sensitivity according to the Potential Fossil Yield Criteria (PFYC). No deposits within the facility boundaries have consistently produced abundant fossils and thus, none is ranked 4 (High) or 5 (Very High). In addition, a large percentage of the project area is known to have disturbed surface sediments. Both the Chemehuevi Formation and the Bouse Formation are known to produce vertebrate fossils or scientifically significant nonvertebrate fossils but only as unpredictable scatters or isolates resulting in a ranking of 3a (Moderate

and unevenly distributed). The Pleistocene alluvial fan deposits are also ranked as 3a because they are similar to the Chemehuevi Formation but have not been formally described. Types of fossils that may be recovered include Ice Age megafauna such as extinct mammoth, horse, and camel; microvertebrate fossils; invertebrate fossils such as mollusk shells; and trace fossils including root casts and animal burrows. Holocene youngest alluvium, Holocene young alluvium, Holocene dune and river sands, and the Miocene fanglomerate are ranked 2 (Low). The Holocene sediments are too young to contain fossils, and the Miocene fanglomerate is too coarse-grained to contain fossils. Igneous and metamorphic rocks are ranked 1 (Very Low) due to their heat and pressure of formation. This includes the Cretaceous/Jurassic Whale Mountains quartz monzonites, the Early Proterozoic gneiss, and the Precambrian igneous and metamorphic rocks.

A paleontological reconnaissance survey was conducted on July 25, 2012. Only areas ranked PFYC 3a were considered for survey and previously disturbed areas were not included. No fossils were observed during the reconnaissance survey, however, sediments with the potential to contain fossils were observed within the proposed impact area. Of the sediments observed, the fine grained deposits of the Chemehuevi Formation sands/Pleistocene older alluvium and the sediments of the Bouse Formation have the highest potential for fossil resources.

The potential to impact any fossils varies with depth of impacts, previous disturbance and presence of non-fossiliferous sediments. Shallow grading and shallow trenching are unlikely to impact any fossils in areas mapped as Holocene alluvium as the surface sediments are too young to contain fossils. Drilling may impact older sediments that might contain fossils. Generally the potential to recover fossils that meet significance criteria will be unlikely since the specimens will not be associated with necessary contextual information such as formation of origin, depth and exact location.

Since the trenching for the Groundwater Remedy Area is designed to have a maximum depth of 9 feet, it is anticipated that most trenching will be within recent alluvium. A small portion of this area has sediments of the Bouse Formation which are sensitive for paleontological resources. Deeper excavations for the Groundwater Remedy Area are limited to exploratory boreholes and extraction and injection wells to depths of up to 400 feet with diameters of approximately 42 inches.

Two of the three Park Moabi Facilities Area parcels have undisturbed sediments of the Bouse Formation which are sensitive for paleontological resources. Grading will have a maximum depth of 14 feet.

Chemehuevi Formation sands/Pleistocene older alluvium are present only along the northernmost boundary for the Freshwater Supply Area and are sensitive for paleontological resources. Maximum depth of grading is seven feet.

Prior fossil recoveries in the vicinity and field survey indicate that only the Chemehuevi Formation sands/Pleistocene older alluvium and the Bouse Formation appear to have potential to produce fossils. Only the small portion of the Groundwater Remedy Area and two of the Park Moabi parcels have undisturbed sediments of the Bouse Formation. Only the northernmost boundary of the Freshwater Supply Area has undisturbed sediments of the Chemehuevi Formation sands/Pleistocene older alluvium. Therefore, paleontological monitoring is required during construction only for these small areas only. All borings, regardless of depth, have a low potential to produce fossils meeting significance criteria.

It is recommended that paleontological awareness training be completed by all personnel so they will understand the procedures to follow in the event of a find. PG&E recommends that a paleontologist should be on call to respond in the unlikely event that fossils are encountered during construction so that they may be evaluated to determine whether they meet significance criteria and to provide monitoring in the limited areas delineated above.

2. Introduction

The protocols presented in this document have been developed in accordance with the Mitigation Monitoring and Reporting Program (MMRP) for the Topock Remediation Project. MMRP CUL-3 requires that a paleontological investigation, including a detailed survey, be completed for the area. The following protocol describes the paleontological evaluation and survey results and provides protocols for Pacific Gas & Electric (PG&E) and their subcontractors during construction.

The project will provide for compliance with the MMRP by PG&E and all subcontractors during the construction, operations and maintenance, and decommissioning phases, specifically with mitigation measures CUL-3 (Department of Toxic Substances Control [DTSC] 2011):

> ***A paleontological investigation, including a detailed survey of the project area by a qualified paleontologist, shall be conducted to refine the potential impacts on unique paleontological resources within the final design area and determine whether preconstruction recovery of sensitive resources and/or construction monitoring would be warranted. If construction monitoring is determined to be warranted, ground-altering activity would be monitored by a qualified paleontologist to assess, document, and recover unique fossils. Monitoring shall include the inspection of exposed surfaces and microscopic examination of matrix in potential fossil bearing formations. In the event microfossils are discovered, the monitor shall collect matrix for processing. In the event paleontological resources are encountered during earthmoving activities, recovered specimens shall be prepared by the paleontologist to a point of identification and permanent preservation. PG&E shall retain a Qualified Paleontologist to***

observe ground-disturbing activities where determined necessary based on the results of the paleontological investigation and shall be required to request the participation of tribal monitors during those activities, including steps necessary during operations and decommissioning activities to ensure that historically significant resources are avoided to the maximum extent feasible, as determined by DTSC, during actual construction.

Paleontological resources of scientific value shall be identified and curated into an established, accredited, professional museum repository in the region with permanent retrievable paleontological storage. This measure does not apply to the activities included as part of the East Ravine Revised Addendum, Groundwater Investigation.

See Final Environmental Impact Report (EIR) at 4.4-72. The paleontological investigation under Mitigation Measure CUL-3 is to be implemented before construction activities begin. If deemed necessary, monitoring of ground-disturbing activities in areas that could contain unique paleontological resources would be conducted during construction. Under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the selected groundwater remedy and other site activities must also comply with the substantive requirements of all Applicable or Relevant and Appropriate Requirements (ARARs).

3. Background

This Paleontological Resources Management Plan is being prepared as required by the MMRP document for the Topock Remediation Project at the PG&E Topock Compressor Station, which is located within eastern San Bernardino County, California, and western Mohave County, Arizona (Figure 1).

The Colorado River runs through the eastern portion of the facility property and also forms a portion of its northern border. The project area is situated within Sections 5, 6, 8, and 9 of Township 7 North and Range 24 East of the Topock and Whale Mountain United States Geological Survey (USGS) 7.5-minute quadrangles, San Bernardino Base and Meridian. .



Figure 1. Project Vicinity

3.1 Project Description

PG&E is implementing the selected groundwater remedy for chromium in groundwater at the Topock Compressor Station (the Compressor Station) in San Bernardino County, California. The existing chromium contamination in groundwater near the Compressor Station is largely attributable to the historical wastewater discharge from Compressor Station operations to Bat Cave Wash, designated as Solid Waste Management Unit (SWMU) 1/Area of Concern (AOC) 1, and within the East Ravine, designated as AOC 10 (CH2M Hill, 2012).

Remedial activities at the Topock site are being performed in conformance with the requirements of the Resource Conservation and Recovery Act (RCRA) Corrective Action pursuant to a Corrective Action Consent Agreement (CACA) entered into by PG&E and the California Department of Toxic Substances Control (DTSC) in 1996, as well as the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) pursuant to the Administrative Consent Agreement entered into between PG&E and the federal agencies (U.S. Department of the Interior [DOI], Bureaus of Land Management [BLM] and Reclamation [Reclamation] and the United States Fish and Wildlife Service [USFWS]) in 2005. A Record of Decision was issued by the United States Department of Interior under CERCLA in Jan. 2011 and DTSC's remedy decision letter to PG&E dated January 31, 2011 approved the groundwater remedy consistent with applicable state and federal law.

There is both public and private land ownership in the project area. Substantial portions are owned by the BLM or managed by the BLM on behalf of the Bureau of Reclamation. A portion of the project area also includes the Havasu National Wildlife Refuge, which is administered by the USFWS. No BLM paleontology permit and fieldwork authorization will be required for any paleontological fieldwork in these areas due to the CERCLA exemption.

3.2 Project Study Area

The project study area consists of three subcomponents (Figure 2): (1) the Groundwater Remedy Area (793.7 acres); (2) the Park Moabi Facilities Area (3.4 acres); and (3) Freshwater Supply Area (52 acres) in Arizona. The project has numerous components more fully described in the Final Design Submittal for the Final Groundwater Remedy (CH2MHill 2015). The maximum depth of grading (not drilling) in Groundwater Remedy Area will be approximately nine feet. The maximum depth of grading for the Park Moabi Facilities will be fourteen feet and the maximum depth of grading for the Freshwater Supply Area will be seven feet.

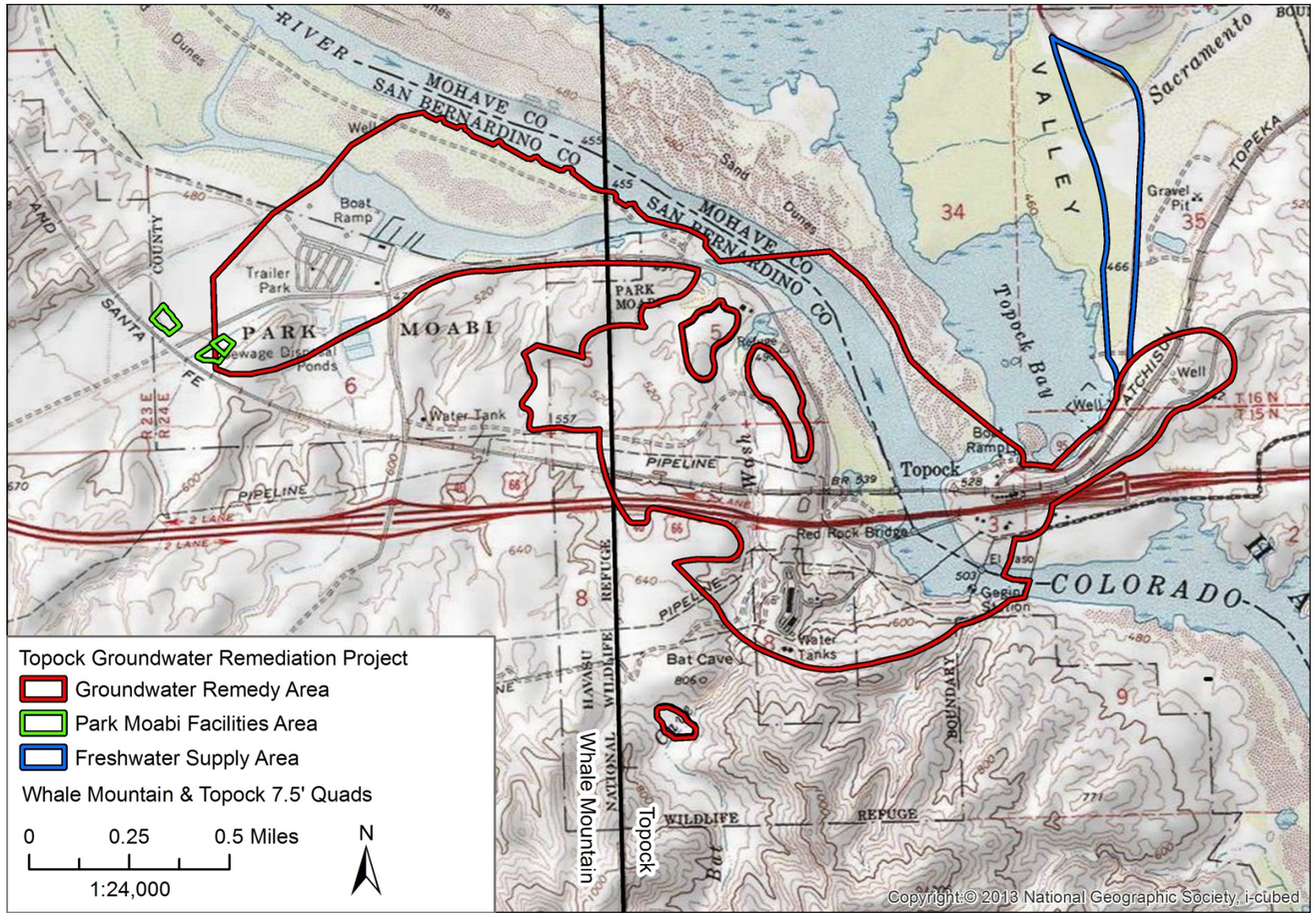


Figure 2. Topock Project Study Area Map

3.3 Project Personnel

Cogstone Resource Management Inc. prepared this report. At the time of the survey, Cogstone held California Statewide BLM Paleontology permit CA-10-00-004P. The subsequent permit, CA-13-05P, is active until May 12, 2016. The permits name Sherri Gust as Principal Investigator and Kim Scott as Field Director.

Sherri Gust served as the Principal Investigator for the project, wrote the management plan, and edited the report. Gust is an associate of the Vertebrate Paleontology and Rancho La Brea sections of the Natural History Museum of Los Angeles County. She has an M.S. in Anatomy (Evolutionary Morphology) from the University of Southern California and a B.S. in Anthropology from the University of California, Davis, She has more than 34 years of experience in paleontology. Her speciality is Plio-Pleistocene vertebrate fossils.

Kim Scott conducted the research and literature review and field survey. She wrote the background and survey results. Scott has a B.S. in Geology with an emphasis in Paleontology from the University of California, Los Angeles, as well as an M.S. in Biology from California State University San Bernardino and over 18 years of experience in California paleontology and geology. Todd Wirths reviewed the bore logs. Wirths is a Professional Geologist (PG) 7588 and has a M.S. in Geology from San Diego State University. He has more than 15 years of experience as a geologist and over two as a paleontologist. Courtney Richards prepared some revisions to this report. She has a M.S. in Biological Sciences with an emphasis in Paleontology from Marshall University. She has three years of paleontological experience.

Molly Valasik prepared the maps for the report. Valasik has an M.A. in Anthropology from Kent State University in Ohio and experience in Southern California archaeology with cross training in paleontology.

4. Regulatory Environment

The selected remedy is being conducted under the authority of CERCLA Section 104 and is therefore exempt from obtaining federal, state, or local permits or complying with other administrative requirements, pursuant to CERCLA Section 121(e). However, PG&E will comply with the substantive requirements of all applicable laws.

4.1 Federal Potential Fossil Yield Classification System

The federal Potential Fossil Yield Classification (PFYC) system was developed by the U.S. Forest Service and refined by the BLM (2007). Occurrences of paleontological resources are closely tied to the geologic units (i.e., formations, members, or beds) that contain them. The probability for finding paleontological resources can be broadly predicted from the geologic units present at or near the surface. Therefore, geologic mapping can be used to assess the potential for the occurrence of paleontological resources.

Using the PFYC system, geologic units are classified based on the relative abundance of vertebrate fossils or scientifically significant invertebrate or plant fossils and their sensitivity to adverse impacts, with a higher class number indicating a higher potential. This classification is applied to the geologic formation, member, or other distinguishable unit, preferably at the most detailed mappable level. It is not intended to be applied to specific paleontological localities or small areas within units. Although significant localities may occasionally occur in a geologic unit, a few widely scattered important fossils or localities do not necessarily indicate a higher class; instead, the relative abundance of significant localities is intended to be the major determinant for the class assignment.

The PFYC system is meant to provide baseline guidance for predicting, assessing, and mitigating paleontological resources. The classification should be considered at an intermediate point in the analysis, and should be used to assist in determining the need for further mitigation assessment or actions.

The descriptions for the classes listed below are written to serve as guidelines rather than as strict definitions. Knowledge of the geology and conditions for preservation, and hence, the paleontological potential for individual units should be considered when determining the appropriate class assignment. Assignments are best made by collaboration between land managers and knowledgeable researchers.

Class 1 Very Low. Geologic units that are not likely to contain recognizable fossil remains.

- Units that are igneous or metamorphic, excluding reworked volcanic ash units.
- Units that are Precambrian in age or older.

(1) Management concern for paleontological resources in Class 1 units is usually negligible or not applicable. (2) Assessment or mitigation is usually unnecessary except in very rare or isolated circumstances.

The probability for impacting any fossils is negligible. Assessment or mitigation of paleontological resources is usually unnecessary. The occurrence of significant fossils is nonexistent or extremely rare.

Class 2 Low. Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils.

- Vertebrate or significant invertebrate or plant fossils not present or very rare.
- Units that are generally younger than 10,000 years before present.
- Recent aeolian deposits.
- Sediments that exhibit significant physical and chemical changes (i.e., diagenetic alteration).

(1) Management concern for paleontological resources is generally low. (2) Assessment or mitigation is usually unnecessary except in rare or isolated circumstances.

The probability for impacting vertebrate fossils or scientifically significant invertebrate or plant fossils is low. Assessment or mitigation of paleontological resources is not likely to be necessary. Localities containing important resources may exist, but would be rare and would not influence the classification. These important localities would be managed on a case-by-case basis.

Class 3 Moderate or Unknown. Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence; or sedimentary units of unknown fossil potential.

- Often marine in origin with sporadic known occurrences of vertebrate fossils.
- Vertebrate fossils and scientifically significant invertebrate or plant fossils known to occur intermittently; predictability known to be low.
- Poorly studied and/or poorly documented. Potential yield cannot be assigned without ground reconnaissance.

Class 3a Moderate Potential. Units are known to contain vertebrate fossils or scientifically significant nonvertebrate fossils, but these occurrences are widely scattered. Common invertebrate or plant fossils

may be found in the area, and opportunities may exist for hobby collecting. The potential for a project to be sited on or to impact a significant fossil locality is low, but is somewhat higher for common fossils.

Class 3b Unknown Potential. Units exhibit geologic features and preservational conditions that suggest significant fossils could be present, but little information about the paleontological resources of the unit or the area is known. This may indicate the unit or area is poorly studied, and field surveys may uncover significant finds. The units in this Class may eventually be placed in another Class when sufficient survey and research is performed. The unknown potential of the units in this Class should be carefully considered when developing any mitigation or management actions.

(1) Management concern for paleontological resources is moderate; or cannot be determined from existing data. (2) Surface-disturbing activities may require field assessment to determine appropriate course of action.

This classification includes a broad range of paleontological potential. It includes geologic units of unknown potential, as well as units of moderate or infrequent occurrence of significant fossils. Management considerations cover a broad range of options as well, and could include pre-disturbance surveys, monitoring, or avoidance. Surface-disturbing activities will require sufficient assessment to determine whether significant paleontological resources occur in the area of a proposed action, and whether the action could affect the paleontological resources. These units may contain areas that would be appropriate to designate as hobby collection areas due to the higher occurrence of common fossils and a lower concern about affecting significant paleontological resources.

Class 4 High. Geologic units containing a high occurrence of significant fossils. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented, but may vary in occurrence and predictability. Surface-disturbing activities may adversely affect paleontological resources in many cases.

Class 4a. Unit is exposed with little or no soil or vegetative cover. Outcrop areas are extensive with exposed bedrock areas often larger than 2 acres. Paleontological resources may be susceptible to adverse impacts from surface-disturbing actions. Illegal collecting activities may impact some areas.

Class 4b. These are areas underlain by geologic units with high potential but have lowered risk of human-caused adverse impacts and/or lowered risk of natural degradation due to moderating circumstances. The bedrock unit has high potential, but a protective layer of soil, thin alluvial material, or other conditions may lessen or prevent potential impacts to the bedrock resulting from the activity.

- Extensive soil or vegetative cover; bedrock exposures are limited or not expected to be impacted.

- Areas of exposed outcrop are smaller than 2 contiguous acres.

- Outcrops form cliffs of sufficient height and slope so that impacts are minimized by topographic conditions.

- Other characteristics are present that lower the vulnerability of both known and unidentified paleontological resources.

(1) Management concern for paleontological resources in Class 4 is moderate to high, depending on the proposed action. (2) A field survey by a qualified paleontologist is often needed to assess local conditions. (3) Management prescriptions for resource preservation and conservation through controlled access or special management designation should be considered. (4) Class 4 and Class 5 units may be combined as Class 5 for broad applications, such as planning efforts or preliminary assessments, when geologic mapping at an appropriate scale is not available. Resource assessment, mitigation, and other management considerations are similar at this level of analysis, and impacts and alternatives can be addressed at a level appropriate to the application.

The probability for impacting significant paleontological resources is moderate to high, and is dependent on the proposed action. Mitigation considerations must include assessment of the disturbance, such as removal or penetration of protective surface alluvium or soils, potential for future accelerated erosion, or increased ease of access resulting in greater looting potential. If impacts to significant fossils can be anticipated, on-the-ground surveys before authorizing surface-disturbing actions will usually be necessary. On-site monitoring or spot-checking may be necessary during construction.

Class 5 Very High. Highly fossiliferous geologic units that consistently and predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils, and that are at risk of human-caused adverse impacts or natural degradation.

Class 5a. Unit is exposed with little or no soil or vegetative cover. Outcrop areas are extensive with exposed bedrock areas often larger than 2 contiguous acres. Paleontological resources are highly susceptible to adverse impacts from surface-disturbing actions. Unit is frequently the focus of illegal collecting activities.

Class 5b. These are areas underlain by geologic units with very high potential but have lowered risk of human-caused adverse impacts and/or lowered risk of natural degradation due to moderating circumstances. The bedrock unit has very high potential, but a protective layer of soil, thin alluvial material, or other conditions may lessen or prevent potential impacts to the bedrock resulting from the activity.

- Extensive soil or vegetative cover; bedrock exposures limited or not expected to be impacted.

- Areas of exposed outcrop smaller than 2 contiguous acres.
- Outcrops form cliffs of sufficient height and slope so that impacts are minimized by topographic conditions.
- Other characteristics that lower the vulnerability of both known and unidentified paleontological resources.

(1) Management concern for paleontological resources in Class 5 areas is high to very high. (2) A field survey by a qualified paleontologist is usually necessary prior to surface-disturbing activities or land tenure adjustments. Mitigation will often be necessary before and/or during these actions. (3) Official designation of areas of avoidance, special interest, and concern may be appropriate.

The probability for impacting significant fossils is high. Vertebrate fossils or scientifically significant invertebrate fossils are known or can reasonably be expected to occur in the impacted area. On-the-ground surveys will usually be necessary before authorizing any surface-disturbing activities. Onsite monitoring may be necessary during construction (BLM 2007).

5. Background

5.1 Regional Setting

The physiographical, geological, and ecological zones represented in the project area are best described as the mountains and alluvial valleys of the eastern Mojave Desert Geomorphic Province. Local extension has created subparallel, fault-bounded mountains with steeply climbing western slopes and shallowly dipping eastern slopes throughout the eastern Mojave Desert. These north-south trending ranges are interrupted by valleys with internal drainage systems, resulting in the formation of lakes during Ice Ages and playas during interglacials (Wagner 2002). The Colorado River formed along the California-Arizona corridor from a series of naturally dammed lakes that filled and failed sequentially starting approximately 6 million years ago (Spencer and Pearthree 2001, 2005).

5.2 Stratigraphy

Substrate beneath the PG&E Topock Compressor Station is mapped as Holocene alluvium of sand, river, lake, and floodplain deposits; Pleistocene Chemehuevi Formation and Pleistocene older alluvium; Pliocene Bouse Formation; Miocene fanglomerate; Cretaceous or Jurassic Whale Mountains quartz monzonites; and Precambrian igneous and metamorphic rocks (Table 1, Figure 3; Bishop 1963; Howard et al. 1997; John 1987; Stone and Howard 1979; Wilson et al. 1959).

5.2.1 Holocene Deposits

Holocene alluvial deposits (Qal, Qs, Qya) include silts, sands, and conglomerates exist in the form of drainage fill, alluvial fans, and dunes (Figure 3; Bishop 1963; Howard et al. 1997; John 1987; Stone and Howard 1979; Wilson et al. 1959). The character of river deposits (Qal) differs depending on stream flow energy and distance from the source. In the Colorado River area, river deposits consist of poorly to moderately sorted sands and gravels having angular to subangular clasts composed of igneous and metamorphic rock (Howard et al. 1997).

The younger alluvial fan deposits (Qya) cap older deposits. Sediments consist of poorly to moderately sorted, undissected sands and gravels composed of angular to subangular, igneous and metamorphic clasts (Howard et al. 1997). Windblown dune sands (Qs) are typically well-sorted, fine to medium-grained sand.

Table 1. Geological Deposits in Chronological Order

Era	Period	Time (million years ago [mya])	Epoch	Project Geologic Deposit
Cenozoic	Quaternary	< 0.01	Holocene	Holocene alluvium and sands (Qal, Qya, Qs)
		2.60	Pleistocene	Chemehuevi Formation (Qrg, Qrs, Qc)
	Tertiary	5.30	Pliocene	Bouse Formation (Tb)
		23.00	Miocene	Miocene fanglomerate (Tf)
		33.90	Oligocene	
		55.80	Eocene	
		65.50	Paleocene	
Mesozoic	Cretaceous	145.50		Cretaceous or Jurassic Whale Mountains quartz monzonites (KJqm, KJqd)
	Jurassic	199.60		
	Triassic	251.00		
Paleozoic	Permian	299.00		
	Carboniferous	359.20		
	Devonian	416.00		
	Silurian	443.70		
	Ordovician	488.30		
	Cambrian	542.00		
Precambrian		2500.00		Early Proterozoic gneiss (p€g), Precambrian igneous and metamorphic rocks (p€c)

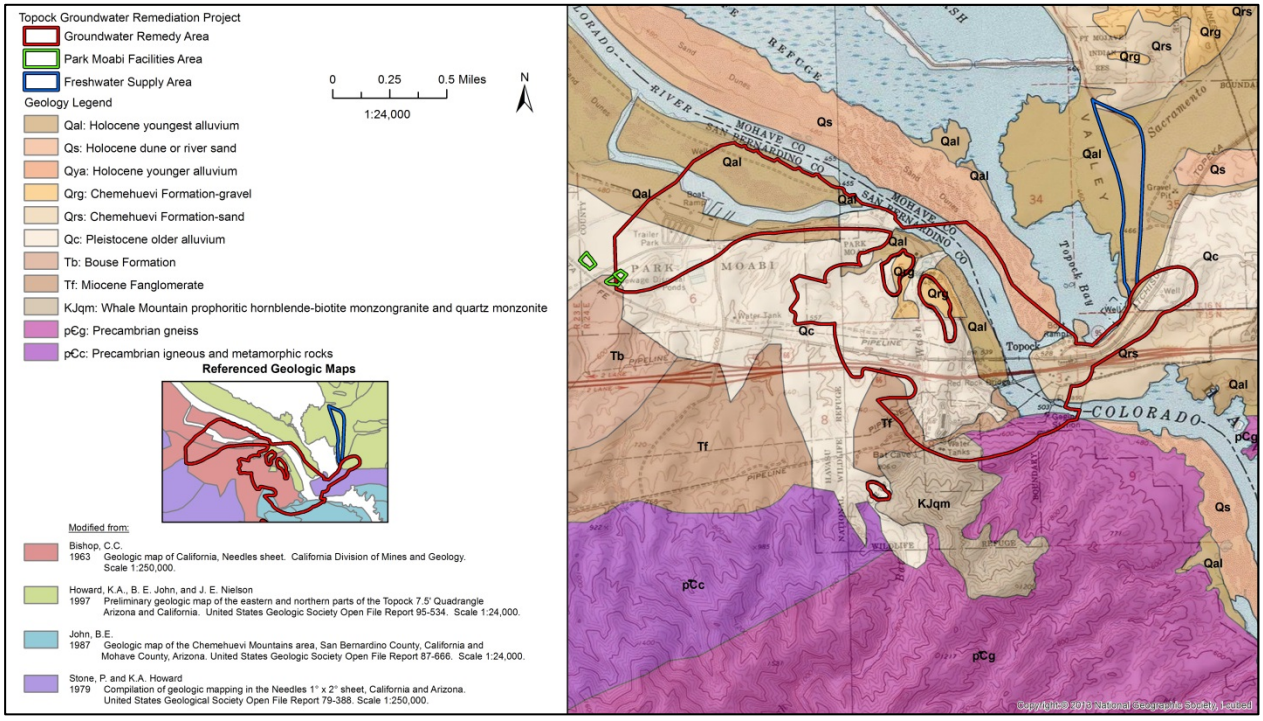


Figure 3. Geology of the Remediation Project Area

5.2.2 Pleistocene to Pliocene Deposits

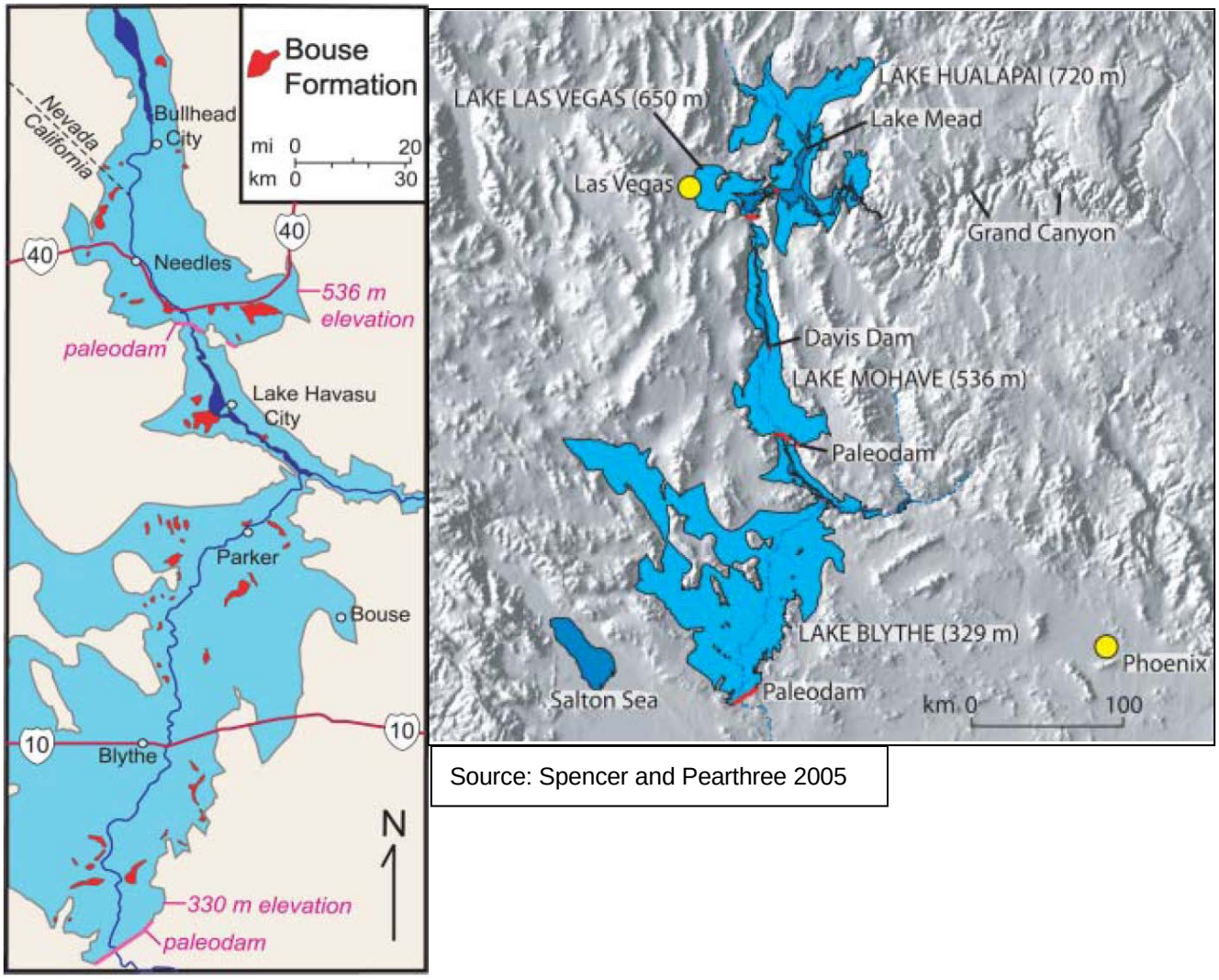
The Pleistocene Chemehuevi Formation (Qrg, Qrs, Qc) and the earliest Pliocene to latest Miocene Bouse Formation (Tb) (Howard et al. 1997; John 1987; and Stone and Howard 1979) occur on the project. At Topock, Golden Shores, and in Needles, the Chemehuevi Formation and Bouse Formation have produced mammoth (*Mammuthus meridionalis, Mammuthus* sp.; Agenbroad et al. 1992; Howard et al. 1997), mollusks, animal burrows, and plant remains (Scott 2010).

Ancestral Colorado River deposits include the Pleistocene (11,000 years to 2.6 million years [my]) Chemehuevi Formation, described by some geologists as alluvial fan deposits, and the Pliocene (5 to 2.6 my) Bouse Formation. Sediments of the Chemehuevi Formation consist of about 800 feet of sands and gravels from the ancestral Colorado River that forms terraces along the river valleys. These are capped by a 4-million-year-old volcanic ash (Spencer and Pearthree 2005). Chemehuevi Formation gravels (Qrg) are interbedded with Chemehuevi Formation sands (Qrs). The Chemehuevi Formation gravels consist of well sorted sands and gravels composed of well-rounded clasts of limestone, quartzite, and chert, much of which is derived as erosional debris from the Colorado Plateau. Locally derived clasts of gneiss and volcanic

rocks are also present and include boulders up to 3 feet in diameter (Howard et al. 1997). The Chemehuevi Formation sands (Qrs) consist of pink to tan, weakly to moderately indurated clays, silts, and sands interbedded with well-sorted, well-rounded pebble conglomerates. Near Topock, Arizona, this unit contains charcoal and root casts (Howard et al. 1997).

The Pleistocene older alluvial fan deposits (Qc) are up to tens of meters thick, and consists of poorly sorted sands to boulder conglomerates, and is dissected by younger stream channels. The Pleistocene fan deposits can be distinguished from similar Holocene deposits by the Pleistocene fans' deep dissection, varnishing, terracing, thickness, and presence of clasts of basalt from the Black Mountains and gneiss from the Hualapai Mountains (Howard et al. 1997).

The Bouse Formation (Tb) of Pliocene (2.6 to 5.3 my) to Miocene (5.3 to 23.3 my) age occurs at the base of the Colorado River deposits. This 10- to 250-foot-thick, green to tan to pinkish, limey claystone to siltstone contains green nodules and yellowish-brown to white concretions (Howard et al. 1997; Spencer and Pearthree 2005). The unit was deposited as a result of a series of overspilling lakes that drained into the Salton Trough about 5.3 million years ago (Figure 4; Spencer and Pearthree 2005). The Bouse Formation overlies volcanic ash dated at 5.5 my, placing the age of the formation to be approximately 5.3 to 5.5 million years old, making it earliest Pliocene or latest Miocene in age (Spencer and Pearthree 2005).



Source: Spencer and Pearthree 2005

Figure 4. Map of Paleolakes and Paleodams Associated with Bouse Formation.

5.2.3 Miocene Fanglomerate

Miocene (5.3 to 23.0 my) nonmarine deposits within the project area consist of a gneiss-rich fanglomerate (Tf). These are dark-red to brown, poorly sorted alluvial fan deposits having subangular to subrounded clasts of Proterozoic gneiss, granite, and amphibolite from the Chemehuevi Mountains (John 1987; Stone and Howard 1979).

5.2.4 Cretaceous or Jurassic Whale Mountain Quartz Monzonites

Two Cretaceous (65.5 to 145.5 my) or Jurassic (145.5 to 299.6 my) granitoid bodies (quartz monzonites) of the Whale Mountain sequence occur within the project area (KJqm and KJqd). KJqm, a porphyritic hornblende-biotite monzogranite and quartz monzonite, is tan to pale-pink, medium- to coarse-grained with feldspar crystals of up to 1.25 inches long. KJqd, a hornblende biotite quartz diorite and quartz monzonite, consists of dark-grey to brown intrusive bodies up to 0.6 mile wide by 2.5 miles long (John 1987).

5.2.5 Precambrian Igneous and Metamorphic Rocks

Two Precambrian (542 my to 4.6 by) units are present in the project area – Early Proterozoic (1.6 to 2.5 by) gneiss (pЄg) and Precambrian igneous and metamorphic rocks (pЄc) (Bishop 1963; John 1987). The highly metamorphosed rocks (pЄg) include augen gneiss, granitic to dioritic gneiss, and several named gneisses (Bishop 1963; John 1987). The Precambrian igneous and metamorphic rocks (pЄc) include granite to diorite igneous rocks mixed with gneisses (Bishop 1963). Although Bishop (1963) mapped all these rocks as Precambrian, Bishop states that the gneisses may be younger.

6. Record Search Results

A paleontological records search was conducted in 2010 by the Natural History Museum of Los Angeles County, Vertebrate Paleontology Section (LACM; McLeod 2010) and the San Bernardino County Museum (SBCM) (Scott 2010). Additional searches were conducted in online databases of the Natural History Museum of Los Angeles County, Invertebrate Paleontology Section (LACMIP 2011), in the University of California Museum of Paleontology database (UCMP 2011), and in pertinent paleontological literature (Hay 1927; Jefferson 1991a, 1991b).

No localities were reported by LACM or UCMP. Within the project area near locations proposed for new wells, SBCM reports collecting unidentified mollusk shell fragments (Figure 5) on the surface at 600 to 640 feet of elevation in the Chemehuevi Formation (SBCM 1.39.3; Scott 2010). Root casts and animal burrows were also reported by SBCM (SBCM 1.39.1; Scott 2010); however, none were collected or photographed. No additional fossils have been reported from Topock since the SBCM survey. Pleistocene and Pliocene localities near the groundwater project in Topock/Golden Shores and upriver at Needles have produced fossils (Table 2).

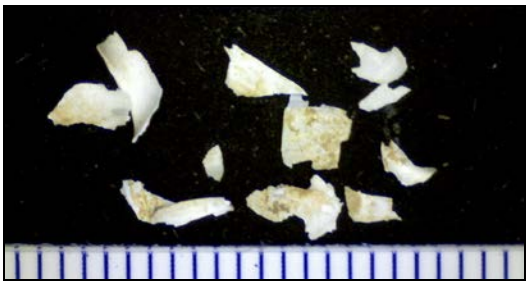


Figure 5. Mollusk Shell Fragments (photo courtesy of Eric Scott, SBCM)

Table 2. Pleistocene and Pliocene fossil localities near project area (no locality numbers assigned)

Common name, element	Taxon	Location; Institution	Reference	Figure
Mammoth, nearly complete skeleton	*Mammuthus meridionalis* or *imperator*	Golden Shores, AZ, elev. 645'; Northern Arizona University	Agenbroad et al. 1992	6
Mammoth, humerus, distal end	*Mammuthus* sp.	Needles, CA; Needles Museum	Agenbroad et al. 1992	7
Horse, molar, upper	*Equus* sp.	Needles, CA; Needles Museum	this report	8, 9
Bison, molar, lower, third	*Bison* sp.	Needles, CA; Needles Museum	this report	8, 9
Camel, vertebrae, partial	*Camelops* sp.	Needles, CA; Needles Museum	this report	10

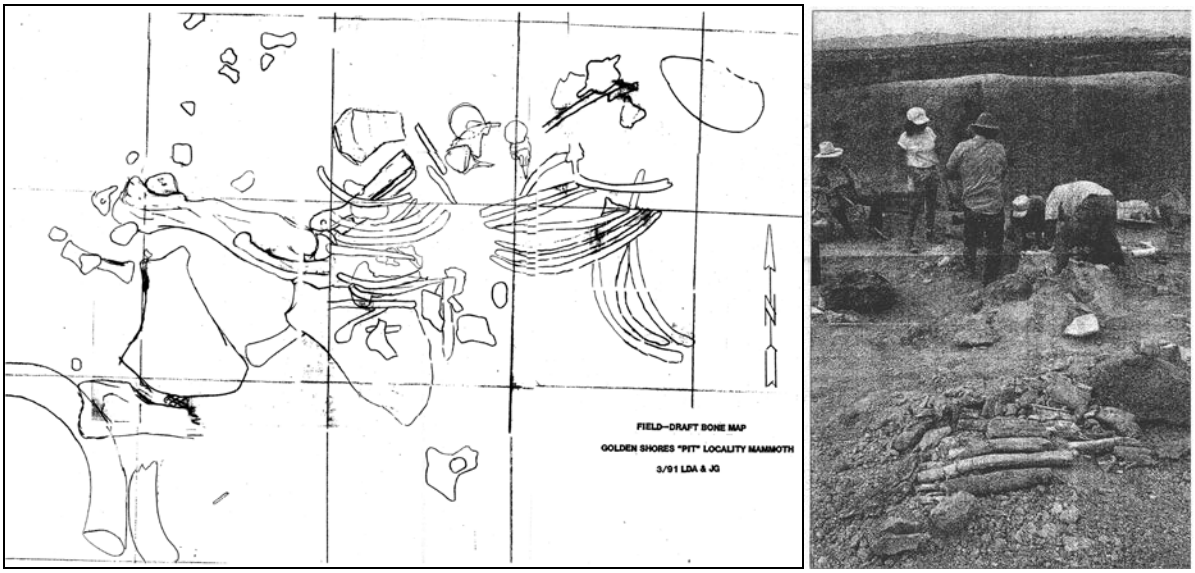


Figure 6. Field map and recovery of Golden Shores mammoth skeleton



Figure 7. Mammoth, humerus, distal end (elbow articulation)



Figure 8. Horse, upper molar tooth, and Bison, lower third molar, occlusal view



Figure 9. Horse, upper molar tooth, and Bison, lower third molar, lateral view



Figure 10. Camel, vertebrae

Kim Scott of Cogstone relocated the SBCM localities during the field survey, visited the Needles Museum to view the fossils held there, and visited the site of the Golden Shores mammoth with George Shannon of BLM. Additional information learned modifies the previous locality information, as discussed below.

A locality discovered by SBCM in 1991 was relocated during the survey. SBCM collected the specimens during their survey but provided Cogstone with exact coordinates to allow the locality to be re-located for evaluation. The SBCM 1.39.3 locality produced a specimen was a fragment of mollusk that was mapped in a channel to the north of a pipeline.

The Golden Shores mammoth, reported by Agenbroad et al. (1992) as being in the Bouse or Chemehuevi Formation, was actually in Chemehuevi/Pleistocene older alluvium sands as verified by a visit to the locality. Specimens from the Needles Museum that were reported by Agenbroad as being in the Chemehuevi Formation were actually found at the Golden Shore gravel quarry and no exact location information is known (Needles Museum Vice-President Corrine Moore, personal communication 2012). All of the specimens were donated by local citizens who found them. In addition to mammoth, fossils of camel, bison and horse are also known. These specimens were identified by Sherri Gust from photographs taken by Kim Scott during her visit.

Paleontological Sensitivity Analysis

Geological setting and fossil localities were considered in determining paleontological sensitivity according to PFYC criteria (Table 3, Figure 11). No deposits within the project study area as mapped in this report have consistently produced abundant fossils and thus, none is ranked 4 (High) or 5 (Very High). In addition, a large percentage of the project area is known to have disturbed surface sediments (Figure 12). Disturbed areas in this context means those areas outside of documented archaeological site boundaries that have experienced ground disturbance in the last 50 years.

Both the Chemehuevi Formation (Qrg, Qrs) and the Bouse Formation (Tb) are known to produce vertebrate fossils or scientifically significant nonvertebrate fossils but only as unpredictable scatters or isolates resulting in a ranking of 3a (Moderate and unevenly distributed). The Pleistocene alluvial fan deposits (Qc), as mentioned above, is also ranked as 3a because they are essentially similar to the Chemehuevi Formation but have not been formally described. Types of fossils that may be recovered include Ice Age megafauna such as extinct mammoth, horse, and camel; microvertebrate fossils; invertebrate fossils such as mollusk shells; and trace fossils including root casts and animal burrows (Scott 2010). Small portions of the Groundwater Remedy Area have undisturbed Chemehuevi Formation or Pleistocene alluvial fan deposits and two of the three Park Moabi Facilities parcels have undisturbed Bouse Formation (refer to Figure 11 and Figure 12).

Holocene youngest alluvium (Qal), Holocene young alluvium (Qya), Holocene dune and river sands (Qs), and the Miocene fanglomerate (Tf) are ranked 2 (Low). The Holocene sediments are too young to contain fossils, and the Miocene fanglomerate is too coarse-grained to contain fossils.

Igneous and metamorphic rocks are ranked 1 (Very Low) due to their heat and pressure of formation. This includes the Cretaceous/Jurassic Whale Mountains quartz monzonites (KJqm, KJqd), the Early Proterozoic gneiss (pЄg), and the Precambrian igneous and metamorphic rocks (pЄc).

Table 3. Potential Fossil Yield of Topock Geological Deposits

Geologic Deposit	PFYC Ranking			
	3a (Moderate with uneven distribution)	3b (Unknown with undemonstrated yield)	2 (Low)	1 (Very Low)
Holocene alluvium and sands (Qal, Qya, Qs)			x	
Chemehuevi Fm. (Qrg, Qrs, Qc)	x			
Bouse Fm. (Tb)	x			

Geologic Deposit	PFYC Ranking			
	3a (Moderate with uneven distribution)	3b (Unknown with undemonstrated yield)	2 (Low)	1 (Very Low)
Miocene fanglomerate (Tf)			x	
Cretaceous or Jurassic Whale Mountains quartz monzonites (KJqm, KJqd)				x
Early Proterozoic gneiss (p€g)				x
Precambrian igneous and metamorphic rocks (p€c)				x

Topock Project

- Groundwater Remedy Area
- Park Moabi Facilities Area
- Freshwater Supply Area
- US Bureau of Land Management

PFYC

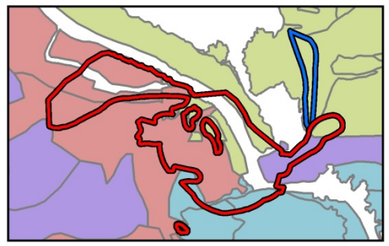
- 1 Very Low to none
- 2 Low Potential
- 3b Undemonstrated, assumed Moderate
- 3a Moderate, uneven distribution
- 4 High Potential
- 5 Very High Potential

0 0.25 0.5 Miles

1:24,000

N

Referenced Geologic Maps



Modified from:

Bishop, C.C.
1963 Geologic map of California, Needles sheet. California Division of Mines and Geology. Scale 1:250,000.

Howard, K.A., B. E. John, and J. E. Nielson
1997 Preliminary geologic map of the eastern and northern parts of the Topock 7.5' Quadrangle Arizona and California. United States Geologic Society Open File Report 95-534. Scale 1:24,000.

John, B.E.
1987 Geologic map of the Chemehuevi Mountains area, San Bernardino County, California and Mohave County, Arizona. United States Geologic Society Open File Report 87-666. Scale 1:24,000.

Stone, P. and K.A. Howard
1979 Compilation of geologic mapping in the Needles 1° x 2° sheet, California and Arizona. United States Geological Society Open File Report 79-388. Scale 1:250,000.

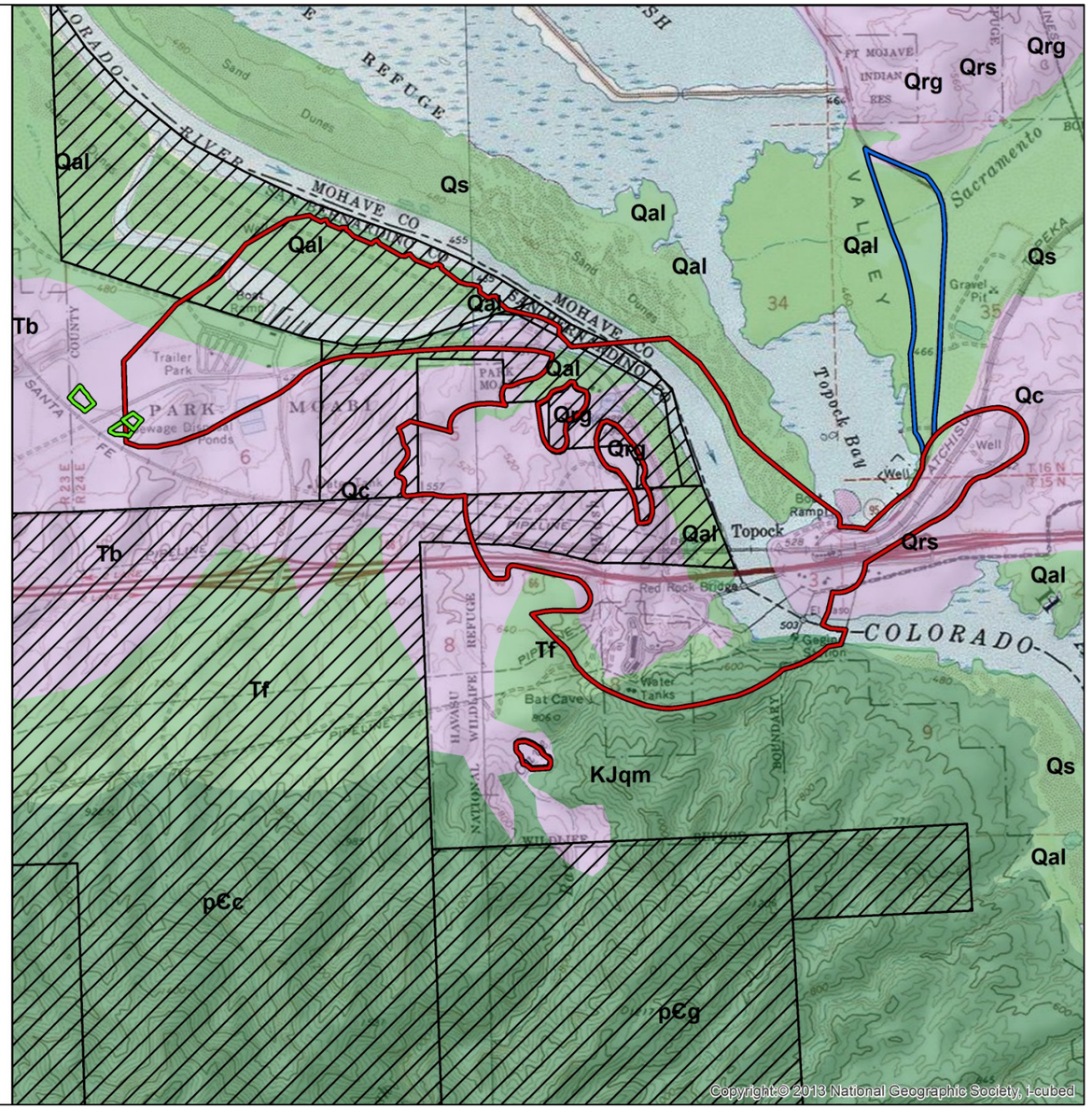


Figure 11. Remediation Project Paleontological Sensitivity Map

Topock Groundwater Remediation Project

- Park Moabi Facilities Area
- Groundwater Remedy Area
- Freshwater Supply Area

PFYC

- 1 Very Low to none
- 2 Low Potential
- 3b Undemonstrated, assumed Moderate
- 3a Moderate, uneven distribution
- 4 High Potential
- 5 Very High Potential

Level of Disturbance of Areas with Moderate or Higher Fossil Potential

- Undisturbed
- Active Wash Channel
- Mechanical Soil Surface Damage

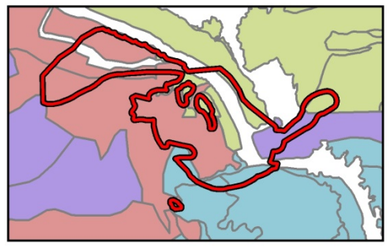
Information on extent and nature of disturbance provided by CH2M Hill

0 0.25 0.5 Miles

1:24,000

N

Referenced Geologic Maps



Modified from:

Bishop, C.C.
1963 Geologic map of California, Needles sheet. California Division of Mines and Geology. Scale 1:250,000.

Howard, K.A., B. E. John, and J. E. Nielson
1997 Preliminary geologic map of the eastern and northern parts of the Topock 7.5' Quadrangle Arizona and California. United States Geologic Society Open File Report 95-534. Scale 1:24,000.

John, B.E.
1987 Geologic map of the Chemehuevi Mountains area, San Bernardino County, California and Mohave County, Arizona. United States Geologic Society Open File Report 87-666. Scale 1:24,000.

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1979 Compilation of geologic mapping in the Needles 1° x 2° sheet, California and Arizona. United States Geological Society Open File Report 79-388. Scale 1:250,000.

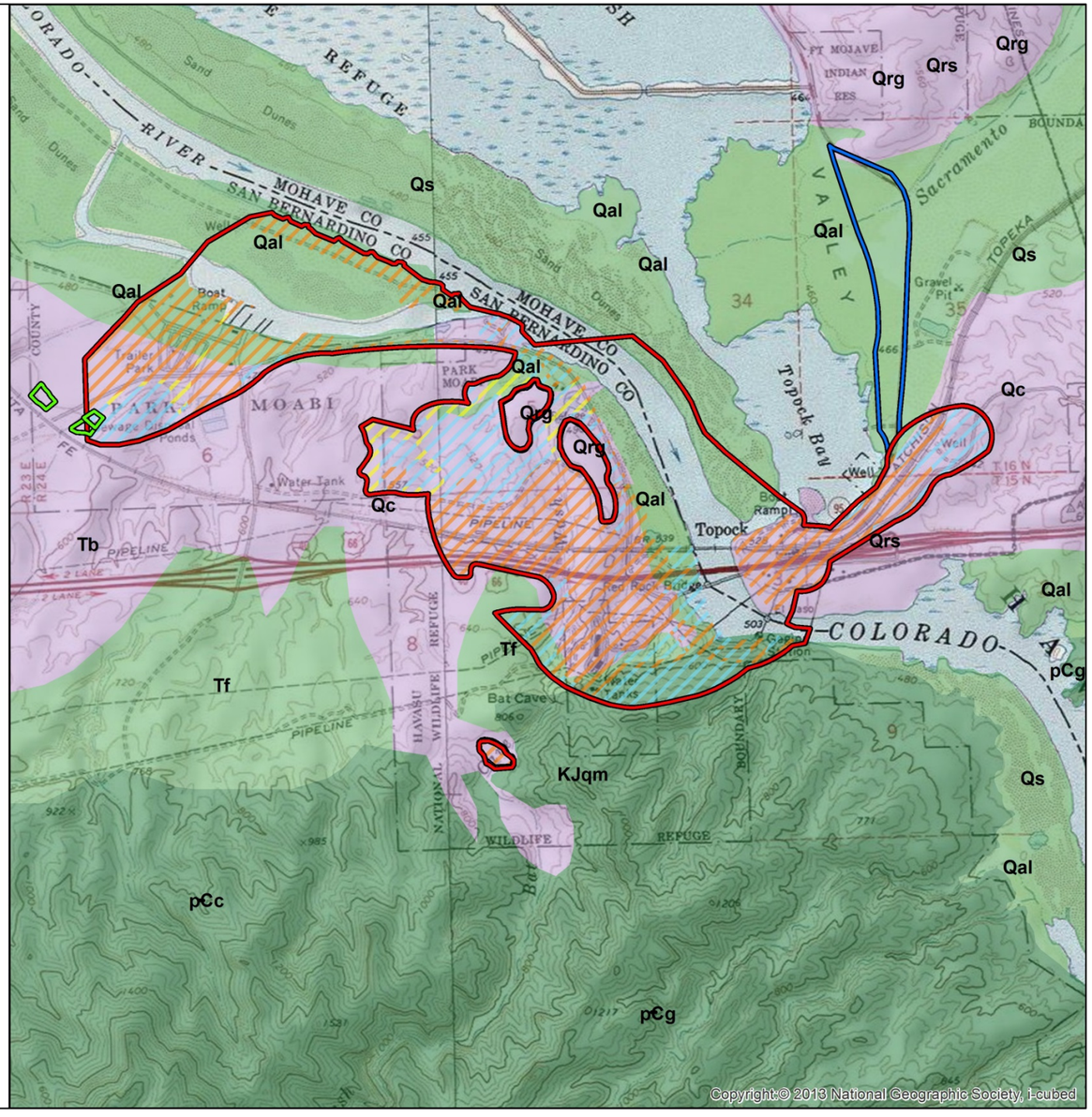

Figure 12. Project Surface Disturbance Map

7. Field Indicators

7.1 Borings Logs

Site specific geologic information from available borehole data was reviewed from the existing well network on site. The groundwater project remedy map was overlain onto the borehole location map and the project was divided into quadrants (Figure 13). Utilizing only those borehole locations near groundwater remediation impact areas, limited information resulted due to generic interpretations by the soil scientists who prepared the boring logs. For example, in the southwest quadrant a contact was reported between the recent and older alluvium at 10.5-12 feet and between Quaternary alluvium and Miocene sediments at 85 feet. In the southeast quadrant the Miocene contact is reported at 11 feet in one borehole and between 80-103 feet in others. No contacts are reported for the northwest quadrant until Miocene bedrock is encountered at 200 feet. In the northeast quadrant the contact between the recent and Quaternary alluvium is reported at 23-45 feet and the Miocene contact at 65-13 feet.

The dynamic fluvial environment of the project area probably accounts for these variations but recent geo-archaeological study should define the stratigraphy in a manner more useful for paleontology. Currently, it appears that recent alluvium is widely present in all quadrants at depths of 10-25 feet. Metzger et al. (1973) estimated the depth of Holocene deposition in the Colorado River channel to be between 130 and 260 feet in the Parker area. Resistivity studies undertaken by CH2M Hill (2012) indicate that the thickness of fluvial sediments in wells near the Topock site indicate up to 150 feet of Holocene sediment above the older Tertiary alluvium, which is consistent with Metzger's observations near Parker (Metzger et al. 1973).

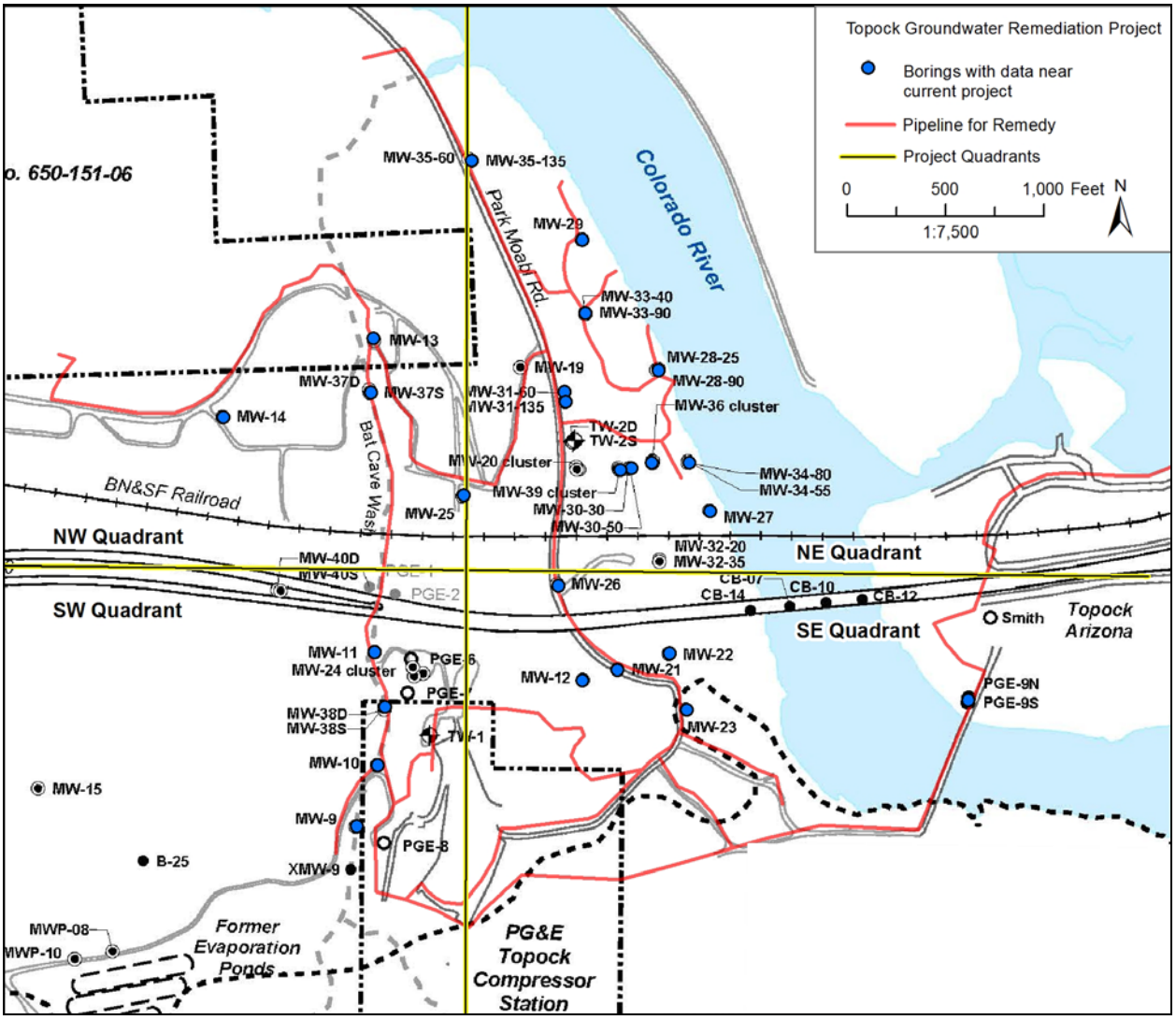

Figure 13. Prior Borings with Logs Available near Project

7.2 Survey

A paleontological reconnaissance survey of the project study area was conducted on July 25, 2012 by Kim Scott of Cogstone. Only areas ranked PFYC 3a were considered for survey and previously disturbed areas were not included (Figure 14). The Park Moabi Facilities and Freshwater Supply Areas were added subsequently and are evaluated based entirely on the geology. A windshield survey was used to review the sediments to assess their overall potential. The paleontologist exited the vehicle and implemented pedestrian survey of areas likely to produce fossils. A two meter rod with decimeter intervals of alternating colors was used in many photos for scale.

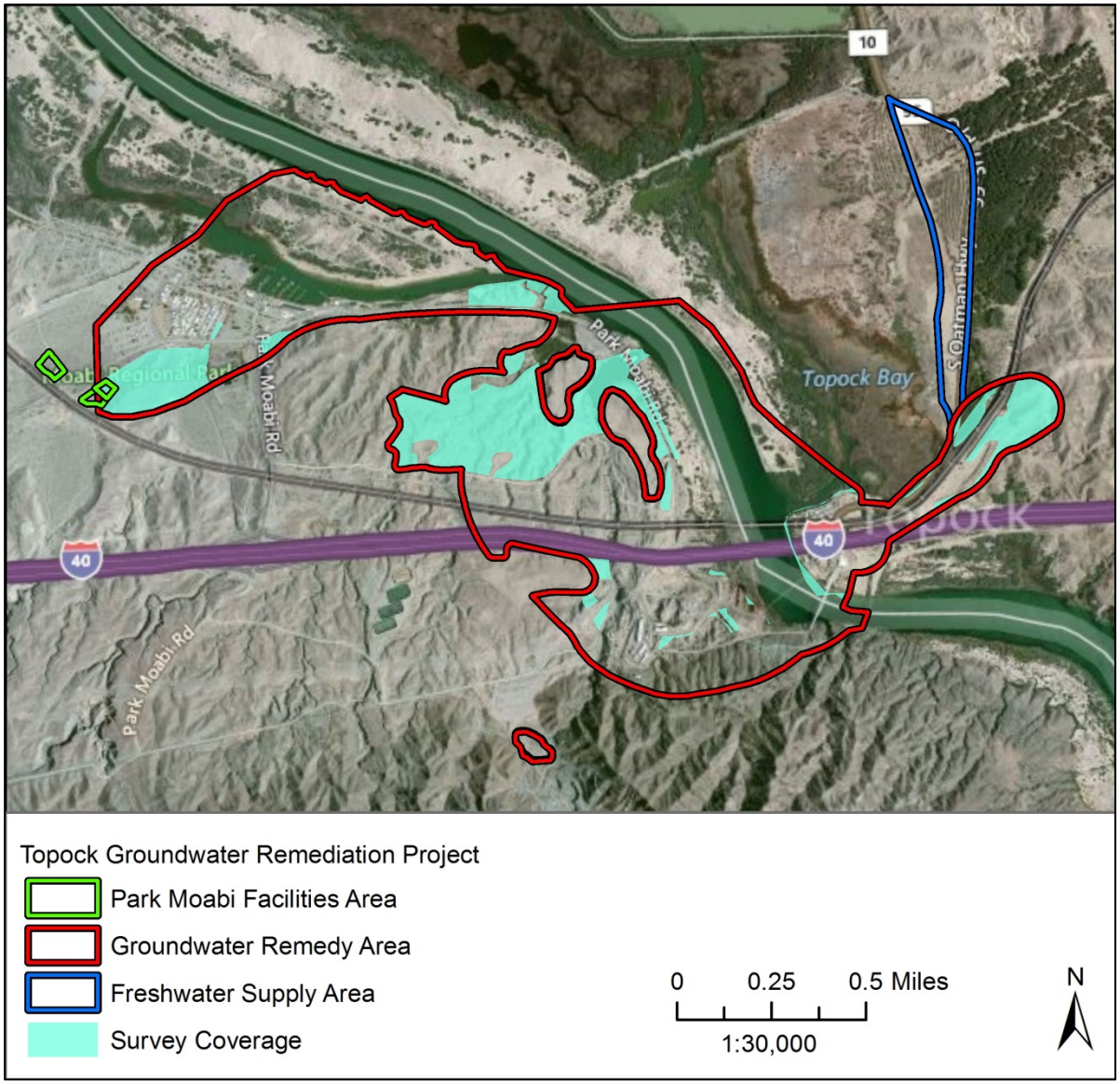

Figure 14. Survey Coverage Map

On the western shore of the Colorado River, the Chemehuevi/Pleistocene older alluvium existed as light pink silts to sands with occasional pebble to cobble channel conglomerates. This was covered by angular to

subangular clast supported, pebble to cobble conglomerate of sheet floods and channels from a proximal alluvial fan (Figure 15).



Figure 15. Quaternary Silts and Sands Covered by Cobbles of the Alluvial Fan Deposits

On the eastern shore of the Colorado River, the finer sediments of the Chemehuevi/Pleistocene older alluvium are buff colored and are covered by a more distal alluvial fan of matrix supported, rounded pebbles to cobbles (Figure 16).



Figure 16. Pleistocene Older Alluvium under Cobbles, East Side, Colorado River

The Pleistocene Chemehuevi Formation gravels consist of imbricated, clast supported cobble to boulder conglomerate (Figure 17). No fine-grained sediments were observed in the small portion of these deposits within the project area along Route 66.



Figure 17. Imbricated Cobbles and Boulders of the Chemehuevi Formation Gravels

Only a small section of the Pliocene Bouse Formation is mapped at the surface of the project study area . It is located along Park Moabi Road in the westernmost portion of the project study area (refer to Figure 3). Sediments consisted of greenish silts and sands (Figure 18). The representative photograph of the Bouse Formation (Figure 18) was taken from a road cut along Park Moabi Road just south of the project study area (refer to Figure 14).



Figure 18. Greenish Silts and Sands of the Bouse Formation

Miocene Fanglomerate sediments were mapped in Bat Cave Wash and along the Colorado River. Those along the wash are indurated pebble to cobble conglomerates oxidized to a light pinkish grey (Figure 19a) or more fully oxidized to red along the river (Figure 19b).



Figure 19a. Miocene Fanglomerate along Bat Cave Wash



Figure 19b. Miocene Fanglomerate along the Colorado River

A couple of shallow caves including “Bat Cave” are present in Bat Cave Wash in the Cretaceous or Jurassic Whale Mountains quartz monzonite complex at the south end of the project area. Bat Cave only extended about 15 feet into the canyon wall (Figure 20). Most of the floor had been covered in breccia from a recent

flood in the area. A second "cave" north of Bat Cave in the wash was filled with wood rat midden deposits of unknown age. As no impacts are planned in this area, these wood rat middens were not further investigated. Should impacts be planned in the future, these deposits should be fully investigated.



Figure 20. Bat Cave

No fossils were observed during the reconnaissance survey. While previous SBCM localities were relocated, the specimens had been previously removed. Sediments with the potential to contain fossils were observed within the proposed impact area. Of the sediments observed, the fine grained deposits of the Chemehuevi Formation sands/Pleistocene older alluvium and the sediments of the Bouse Formation have the highest potential for fossil resources.

8. DEFINITION OF SIGNIFICANCE FOR PALEONTOLOGICAL RESOURCES

Only qualified, trained paleontologists with specific expertise in the type of fossils being evaluated can determine the scientific significance of paleontological resources. Fossils are considered to be significant if one or more of the following criteria apply:

1. The fossils provide information on the evolutionary relationships and developmental trends among organisms, living or extinct;

2. The fossils provide data useful in determining the age(s) of the rock unit or sedimentary stratum, including data important in determining the depositional history of the region and the timing of geologic events therein;

3. The fossils provide data regarding the development of biological communities or interaction between paleobotanical and paleozoological biotas;

4. The fossils demonstrate unusual or spectacular circumstances in the history of life; or

5. The fossils are in short supply and/or in danger of being depleted or destroyed by the elements, vandalism, or commercial exploitation, and are not found in other geographic locations.

As so defined, significant paleontological resources are determined to be fossils or assemblages of fossils that are unique, unusual, rare, uncommon, or diagnostically important. Significant fossils can include remains of large to very small aquatic and terrestrial vertebrates or remains of plants and animals previously not represented in certain portions of the stratigraphy. Assemblages of fossils that might aid stratigraphic correlation, particularly those offering data for the interpretation of tectonic events, geomorphologic evolution, and paleoclimatology are also critically important (Scott and Springer 2003, Scott et al. 2004).

PRELIMINARY SIGNIFICANCE EVALUATION

The potential to impact any fossils varies with depth of impacts, previous disturbance and presence of non-fossiliferous sediments. Shallow grading and shallow trenching are unlikely to impact any fossils in areas mapped as Holocene alluvium as the surface sediments are too young to contain fossils. Drilling may impact older sediments that might contain fossils. Generally the potential to recover fossils that meet significance criteria will be unlikely since the specimens will not be associated with necessary contextual information such as formation of origin, depth and exact location.

Unidentifiable fossils will generally not meet significance criteria and should not be collected unless the amount and preservation is sufficient for dating purposes (criteria 5 above). For identifiable fossils, significance will need to be assessed subsequent to recovery but generally single fossils are isolated finds that will not meet significance criteria unless they represent previously unknown species in the area or they provide a useful radiocarbon date that assists with local sedimentary sequencing (criteria 2 and 5 above).

This is because single fossils, such as a left bison tibia, do not have sufficient data potential to evaluate evolutionary relationships, development of biological communities, interaction between paleobotanical and paleozoological biotas, or unusual or spectacular circumstances in the history of life (criteria 1, 3 and 4 above). Associations of whole or partial skeletons of different animals are likely to meet multiple significance criteria.

The above discussion does not include cultural context or significance. Fossils are known in direct association with Holocene human deposits and thus project archaeologists should be aware that fossils may occur in archaeological sites.

9. Impact Analysis

Since the trenching for the Groundwater Remedy Area is designed to have a maximum depth of 9 feet, it is anticipated that most trenching would be within recent alluvium. A small portion of this area has sediments of the Bouse Formation which are sensitive for paleontological resources. Deeper excavations for the Groundwater Remedy Area are limited to exploratory boreholes and extraction and injection wells to depths of up to 400 feet with diameters of approximately 42 inches.

Two of the three Park Moabi Facilities Area parcels have undisturbed sediments of the Bouse Formation which are sensitive for paleontological resources. Grading will have a maximum depth of 14 feet.

Chemehuevi Formation sands/Pleistocene older alluvium are present only along the northernmost boundary for the Freshwater Supply Area and are sensitive for paleontological resources. Maximum depth of grading is seven feet.

10. Management Recommendations

10.1 Grading and Trenching Recommendations

Prior fossil recoveries in the vicinity and field survey indicate that only the Chemehuevi Formation sands/Pleistocene older alluvium and the Bouse Formation appear to have potential to produce fossils. Only the small portion of the Groundwater Remedy Area and two of the Park Moabi parcels have undisturbed sediments of the Bouse Formation (refer to Figure 12). Only the northernmost boundary of the Freshwater Supply Area has undisturbed sediments of the Chemehuevi Formation sands/Pleistocene older alluvium.

Therefore, paleontological monitoring is required during construction only for these small areas only (refer to Figure 11 and Figure 12). For all other work it is recommended that paleontological awareness training (Section 10.4) be completed by all personnel so they will understand the procedures to follow in the event of a find. PG&E recommends that a paleontologist should be on call to respond in the unlikely event that fossils are encountered during construction so that they may be evaluated to determine whether they meet significance criteria and to provide the limited full time monitoring for undisturbed sediments of sensitive formations.

10.2 Drilling Management Recommendations

All borings, regardless of depth or diameter, have a low potential to produce fossils meeting significance criteria since any fossils that rotate out on the auger during drilling activities will not have information on formation, depth or context. The only instance in which such fossils will meet significance criteria is if the fossil is a new species in the region. It is recommended that paleontological resources awareness training (Section 10.4) be completed by all personnel so they will understand the procedures to follow in the event of a find. PG&E recommends that a paleontologist be on call to respond in the unlikely event that fossils are encountered during drilling so that they may be evaluated to determine whether they meet significance criteria.

11. Paleontological Procedures

11.1 Introduction

The following paleontological monitoring procedures and personnel are established to ensure timely and accurate communication and implementation to minimize adverse effects on significant paleontological resources that may be discovered during earth-disturbing activities.

11.2 Personnel

The Principal Paleontologist will have a graduate degree with a specialization in Vertebrate Paleontology and more than ten years of experience as a principal investigator. The Principal Paleontologist is responsible for ensuring that all paleontological personnel are qualified and experienced and maintaining professional standards of work and conduct and meeting the substantive requirements of all ARARs. Qualified paleontological crew members will have a minimum of a bachelor's degree with paleontological training and experience. All paleontological personnel will receive safety training and environmental awareness training including cultural resources awareness before performing any fieldwork on the project.

11.3 Communication

Paleontological surveyors and monitors will act to protect potentially significant paleontological resources (including direct notification to construction personnel onsite) and then notify the PG&E site manager and the paleontological field supervisor of any find. The surveyor or monitor will estimate the time required to recover the fossil as part of that notification. If work will be diverted for more than two hours, the PG&E site supervisor will be notified and will, in turn, notify the appropriate agencies. The agencies shall consult to determine final decisions regarding formal work stoppage orders and disputes between parties. Temporary halt work conditions will be in effect until the PG&E site supervisor has made a decision regarding treatment.

The Principal Paleontologist will notify the BLM contact when significant finds are discovered on BLM lands and the USFWS contact if significant finds are discovered on USFWS lands.

Site Manager: Curt Russell (760) 326-5582

11.4 Paleontological Resources Awareness Training

All project personnel involved in ground-disturbing activities will receive paleontological resources awareness training as part of the general worker environmental awareness program before beginning work. This is critical when paleontological monitors will not be present full-time. Attendance rosters will be submitted to verify training and hard hat stickers will be issued to demonstrate completion of the training. The training will be developed by the Principal Paleontologist and presented by the Principal Paleontologist or Field Director.

11.5 Surveys

A survey has been completed for the present project. If additional work is planned in the future, survey should be conducted for any areas ranked PFYC 3a or above. Generally, a paleontological survey is conducted by checking the unvegetated ground surface and both natural and man-made cuts but does not involve transects or comprehensive coverage. The project boundaries, project geology, and locations of any known fossil localities will be loaded to Trimble® GeoXH units to ensure that surveyors have all information necessary to accurately record field information. Detailed information on where sediments conducive to the preservation of fossils occur, any stratigraphy revealed in cuts, contacts between formations, and other important information will be recorded. If fossils are discovered, BLM locality forms (or other appropriate forms depending upon land ownership) will be completed and photographs will be taken.

11.6 Monitoring and On-Call Response

In the unanticipated event that sensitive sediments are impacted during grading and trenching activities, a paleontological monitor will observe and inspect all earthmoving in native sediments to potentially contain fossils (refer to Figure 11). This may include locations where depth of impacts will remove sediments of low paleontological sensitivity to reveal sediments of moderate paleontological sensitivity and in response to finds reported by construction personnel. This excludes drilling activities as any recovered fossils will lack information on formation, depth or context (Section 9.2). Monitoring will include inspection of exposed cut surfaces and microscopic examination of exposed sediments for microfossils.

The paleontological monitor is responsible for maintaining close communication with the on-site earthmoving personnel in order to maintain a safe working environment and to be fully apprised of the upcoming areas of impact and any schedule changes. The paleontological monitor is empowered to temporarily redirect

earthmoving to permit recovery of potentially significant fossils. It is important that all earthmoving contractor personnel recognize the authority of the paleontological monitor to redirect them. The paleontological monitor will attempt to minimize schedule impacts. The monitor will stay with the fossil and utilize a cell phone to contact the site supervisor and paleontological field supervisor. If phone communication is problematic, the paleontological monitor will demarcate a buffer zone around the specimen using a method that avoids damage of the find and speak personally with the site supervisor.

The paleontological monitor will complete daily documentation of monitoring presence, activities, location, observations of sediment type and distribution, observations of fossils, collection, and other information. A completed BLM Locality Form (or other appropriate forms depending upon land ownership) is required for all fossils recovered on federal lands. The paleontological monitor is responsible for photographing activities, sediments, and paleontological resources, and for filling out a Photograph Record Sheet for each digital roll. All documentation is submitted to the Principal Paleontologist weekly and will be submitted to the repository along with any significant fossils upon completion of the project with an electronic copy to PG&E.

11.7 Fossil Discovery and Recovery

Fossils observed will be treated differently depending on type and circumstance. Generally, discovery of identifiable invertebrate (shells, crustaceans, etc.) fossils requires that a scientifically significant sample be collected for identification and analysis and that the locality be documented (see below). Similar procedures are followed for microvertebrates such as rodents. Current professional standards call for testing 200 pounds of sample (five full 5-gallon buckets) from each locality followed by processing of up to 6,000 pounds of matrix if significant fossils are recovered by testing. Documentation of localities is required.

Larger fossils observed must be evaluated to determine their condition. Generally, the paleontological monitor will be able to quickly determine if the fossils are sufficiently well preserved to meet significance criteria (refer to section 8). If necessary, the paleontological monitor will cordon off the immediate area around the fossil to permit a safe work zone to recover the fossil and will notify the site manager. The monitor will also immediately notify the field supervisor if assistance is needed and sufficient personnel to perform the work will be fielded. Documentation of localities is required.

Discovery of a bone bed or other type of fossil sites containing multiple large fossils will likely require a formal Stop Work order but is considered unlikely. The paleontological monitor will cordon off the area until evaluation occurs. The project Principal Paleontologist will consult with the site supervisor regarding the amount of time necessary. This type of discovery requires a detailed field map, a sedimentary structure analysis, one or more stratigraphic columns, and data for taphonomic analysis.

Depending on the formations being impacted, additional samples collected may include specimens for dating analyses or materials for microfossil, botanical, or pollen analyses. All fossils and specimens are accompanied by a field tag with project and locality information, including a unique number.

11.8 Locality Documentation

Each fossil locality requires a standard set of data be taken. This includes one or more Universal Transverse Mercator (UTM) readings using a global positioning system unit, an accurate elevation measurement if possible, the depth below surface, a lithology, and true north reading. Additional information collected may include one or more stratigraphic columns, sedimentary structure analysis, taphonomic analysis, and photographs of the fossil *in situ*.

11.9 Fossil Preparation

Many fossils require only cleaning and stabilization through the use of hardeners. Others require lab excavation of plaster jackets with gradual cleaning and hardening. Sometimes larger fossils require a "cradle," usually a form-fitted plaster lined with acid-free cloth to provide support and prevent breakage during transport or storage. Depending on the hardness of the surrounding sediment, fossils may require more tedious preparation using mechanical devices such as zip scribes. Funding for fossil preparation will be the responsibility of PG&E.

Processing of matrix samples for microvertebrates varies depending on the nature of the sediments and may be washed using water, may require chemical agents to break apart the rock, or may require floatation using heavy liquids.

11.10 Fossil Identification

All fossils will be identified by experts. All identifications will be as specific as possible and include element, portion, side, sex, age, taphonomy, and notes. Cataloging, including identification information, is entered into a computer database. Each specimen in maintained with a tag specifying the provenience and identification information. Necessary funding for fossil identification and cataloguing of scientific value will be the responsibility of PG&E.

11.11 Fossil Analyses

Analyses conducted depend to a great extent on the number of fossils recovered and their condition. Guild analysis (relative number of carnivores, herbivores, and omnivores of various body weights in an ecosystem), demographic analysis (age and sex structure of populations), habitat analysis (e.g., certain types of animals indicate grasslands as opposed to deserts), paleoecology (use of botanical and/or pollen

analysis to reconstruct the paleoenvironment), and comparative analysis (comparison to other fossil faunal assemblages of the same time period regionally) are the most typical. Geological context analyses include stratigraphy of the fossil deposits, dating (to narrow the time range of the fossils), taphonomy (history of alteration of the fossils by scavengers, water transport, etc.), and other ancillary studies. Necessary funding for fossil analyses of scientific value will be the responsibility of PG&E.

11.12 Repository

The SBCM will be the primary repository for fossils recovered on this project (Figure 21). This museum is a federally accredited repository for fossils. Necessary funds for curation of paleontological resources of scientific value will be the responsibility of PG&E. The project Principal Paleontologist is authorized to submit fossils with accompanying deeds of gift for curation on behalf of PG&E.

29 September 2011

Sherri Gust
Cogstone
Paleontology Archaeology History
1518 W Taft Ave
Orange, CA 92865-4157

Dear Ms. Gust:

The San Bernardino County Museum (SBCM) is a professional, permanent repository for paleontologic resources collected from private and Federal lands, and is accredited by the American Association of Museums. Additionally, the SBCM upholds professional museum standards and has been recognized by the Federal Government as DM411compliant as set forth by the Department of the Interior's Departmental Manual. Our institution will accept and professionally curate paleontologic collections and accompanying samples, records, data, maps, photographs, field notes, and other documents derived from paleontologic work conducted by Cogstone, under the direction of Ms. Sherri Gust as the Principal Investigator. This repository letter is written specifically for the PG & E Topock Compressor Station, near Needles, San Bernardino County, California.

The SBCM further agrees to assume permanent curatorial responsibility for such materials collected during the course of this project. Curation costs and storage fees will be borne by the project proponent and will require a curation contract between Cogstone and the SBCM at that time.

Sincerely,

Kathleen Springer, Senior Curator
Division of Geological Sciences
San Bernardino County Museum

Figure 21. Repository Letter

11.13 Reporting

The daily field documentation will be the basis for preparing the Weekly Summary of Activities for submittal to PG&E. If fossils are recovered, additional documentation regarding laboratory work will also be incorporated. These records and the field notes will be used to prepare a monthly letter report. The monthly reports will summarize the monitoring activities of the previous period, discoveries made, progress of laboratory work, incidents, and actions taken. PG&E will subsequently distribute copies of the monthly report to lead agencies and other stakeholders including the Tribes.

Upon the conclusion of earthmoving activities, a final report will be prepared. The final report will include the inclusive dates of monitoring, personnel utilized including qualifications, a summary of the monitoring effort and coverage using text and maps, documentation of paleontological localities discovered, paleontological resources identified, interpretation of fossils, non-compliance issues and their resolution, evaluation of the adequacy of this Paleontological Resources Management Plan, and suggestions for improving paleontological resource monitoring procedures. The final report will include all specialists' reports as appendices.

PG&E will submit the draft final report for review by the lead agencies and other stakeholders. A comment matrix and revised report will be resubmitted for compliance review. Subsequently, copies of the final report will be distributed by PG&E to the BLM Needles field office, the Havasu National Wildlife Refuge, the repository and other stakeholders including the Tribes.

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Appendix K
Summary of Compliance with EIR Mitigation Measures, CIMP, Identified ARARs, Applicable PA Stipulations, and Applicable Cultural and Historic Property Management Plan Provisions
(On CD-ROM Only)

Summary of Compliance with EIR Mitigation Measures, CIMP
(On CD-ROM only)

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)				Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design	
Aesthetics	**AES-1**	**Impacts on Views from Topock Maze Locus B, a Scenic Vista (Key View 5) - The proposed project shall be designed and implemented to adhere to the design criteria presented below.**						
Aesthetics	AES-1a	a) Existing mature plant specimens shall be protected in place during construction, operation, and decommissioning phases consistent with CUL1a-5. The identification of plant specimens that are determined to be mature and retained shall occur as part of the design phase and mapped/identified by a qualified plant ecologist or biologist and integrated into the final design and project implementation.	Mature Plants Survey Report including map of mature plant species Aesthetics and Visual Resources Protection and Revegetation Plan	Identification and mapping of mature plant species was completed in August 2011. The survey methodology is summarized in a technical memorandum entitled "*Topock Groundwater Remediation Project, Mature Plants Survey Methodology*" (CH2M HILL 2011b) and is included in Appendix A3 of the Basis of Design Report. The mature plant map is under preparation and will be used to guide the remedy design and the planning for construction.	The Mature Plants Survey Report (CH2M HILL 2012b) was completed on January 17, 2012, and is included in Appendix A4 of the 60% BOD Report. The report contains surveys results and associated maps, which have been used to guide the design. An overview of the report and the survey results were discussed with interested Tribes on January 26, 2012. Figure 2.4-8 in the 60% BOD Report document presents the mature plant survey information for Key Views 5 and 11. PG&E biologist Melanie Day and CH2M HILL biologist Marjorie Eisert participated in a field review of planned remedial facilities with the design team on April 23-24, 2012. A field review was also conducted on June 20 by PG&E biologist Virginia Strohl. The purpose of these field reviews along with in office reviews was to ensure the footprints of planned facilities including potential access routes are designed to avoid disturbance of sensitive habitats to the extent feasible.	An addendum to the Mature Plants Survey Report (CH2M HILL 2014j) was completed on May 22, 2014, and is included in Appendix A4 of the 90% BOD Report. The addendum contains surveys results and associated maps for the freshwater well sites (HNWR-1 and Site B) in Arizona as well as potential sites identified for soil storage and/or construction staging west of Moabi Regional Park. Figure 2.4-8 in the 90% BOD Report presents the mature plant survey information for Key Views 5 and 11.The Aesthetics and Visual Resources Protection and Revegetation Plan (CH2M HILL 2014l) is included in an appendix of the Construction/Remedial Action Work Plan. CH2M HILL biologist Steve Long and E2 biologist Russell Huddleston participated in a field review of planned remedial facilities with the design team on April 7-10, 2014.An additional field review of planned remedial facilities was conducted by CH2M HILL biologist Melissa Fowler and E2 biologist Russell Huddleston on August 6-8, 2014. PG&E biologist Virginia Strohl also led the office reviews of planned facilities and footprints. The purpose of the field reviews along with in office reviews was to ensure the footprints of planned facilities including access routes and construction footprints are designed to avoid disturbance of mature plant specimens and sensitive habitats to the extent feasible.		The survey methodology tech memo was completed on October 31, 2011, and provided to Interested Tribes on November 8, 2011. The Mature Plants Survey Report (CH2M HILL 2012e) was completed on January 17, 2012. An addendum to the Mature Plants Survey Report was completed on May 22, 2014. The Aesthetics and Visual Resources Protection and Revegetation Plan was submitted with the Construction/Remedial Action Work Plan (Appendix N) on September 8, 2014 with the 90% design submittal and again on November 18, 2015 with the final design submittal.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)				Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design	
Aesthetics	AES-1b	b) Revegetation of disturbed areas within the riparian vegetation along the Colorado River shall occur concurrently with construction operations. Plans and specifications for revegetation shall be developed by a qualified plant ecologist or biologist before any riparian vegetation is disturbed and shall be implemented consistent with CUL-1a-5. The revegetation plan shall include specification of maintenance and monitoring requirements, which shall be implemented for a period of 5 years after project construction or after the vegetation has successfully established, as determined by a qualified plant ecologist or biologist.	Aesthetics and Visual Resources Protection and Revegetation Plan	A revegetation plan for the riparian vegetation along the river will be prepared and submitted with the final design.	A revegetation plan for the riparian vegetation along the river will be prepared and submitted with the final design.	The Aesthetics and Visual Resources Protection and Revegetation Plan is included in Appendix N of the Construction/Remedial Action Work Plan. The plan was prepared by plant ecologist Russell Huddleston of E2 Consulting under the direction of Linda Cyra-Korsgaard, a CH2M HILL landscape architect licensed in California. The plan will be implemented consistent with mitigation measure CUL-1a-5. A technical memorandum titled *Preliminary Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California* (CH2M HILL 2015e) identifies potential revegetation areas where mitigation vegetation could be planted to offset potential impacts to riparian vegetation along the Colorado River that may occur during construction of the remedy. The memo was completed on January 27, 2015 and included in Appendix V of the Supplemental 90% for review and comment.	The *Preliminary Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California* was revised to incorporate review comments, and was submitted with the Construction/Remedial Action Work Plan concurrently with the final design.	The Aesthetics and Visual Resources Protection and Revegetation Plan was submitted with the Construction/Remedial Action Work Plan (Appendix N) on September 8, 2014 with the 90% design submittal and again on November 18, 2015 with the final design submittal. The revised *Preliminary Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California* (CH2M HILL 2015e) was submitted with the Construction/ Remedial Action Work Plan, concurrently with the final design submittal.
Aesthetics	AES-1c	c) Plant material shall be consistent with surrounding native vegetation.	Aesthetics and Visual Resources Protection and Revegetation Plan	This requirement will be incorporated into the revegetation plan, and therefore, will be satisfied by implementation of AES-1b/2c.	This requirement will be incorporated into the revegetation plan, and therefore will be satisfied by implementation of AES-1b/2c.	This requirement was incorporated into the revegetation plan, and therefore satisfied by implementation of AES-1b/2c.	This requirement was incorporated into the revegetation plan, and will be satisfied by implementation of AES-1b/2c.	See AES-1b/2c.
Aesthetics	AES-1d	d) The color of the wells, pipelines, reagent storage tanks, control structures, and utilities shall consist of muted, earth-tone colors that are consistent with the surrounding natural color palette. Matte finishes shall be used to prevent reflectivity along the view corridor. Integral color concrete should be used in place of standard gray concrete.	Design submittals	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of this Basis of Design Report for the preliminary design. In addition, the detailed specification for colors will also be included the intermediate (60%) design.	The requirement of this mitigation measure was incorporated into the design criteria as presented in Appendix C of the 60% BOD Report. The detailed specification for colors are included in Appendix E of the 60% BOD Report.	The requirement of this mitigation measure was incorporated into the design criteria as presented in Appendix C of the 90% BOD Report. The detailed specification for colors are included in Appendix E of the 90% BOD Report.	The requirement of this mitigation measure was incorporated into the design criteria as presented in Appendix C (Section C.8) of this Final BOD Report. The detailed specifications for colors are included in Volume 1 Specifications, Painting and Coating, Part 3, Section 3.01.D, in Appendix E of this Final BOD Report.	The Final BOD Report was submitted on November 18, 2015.
Aesthetics	AES-1e	e) The final revegetation plans and specifications shall be reviewed and approved by an architect, landscape architect, or allied design professional licensed in the State of California to ensure that the design objectives and criteria are being met. Planting associated with biological mitigation may contribute to, but may not fully satisfy, visual mitigation.	Aesthetics and Visual Resources Protection and Revegetation Plan	This requirement will be incorporated into the revegetation plan, and therefore, will be satisfied by implementation of AES-1b/2c.	This requirement will be incorporated into the revegetation plan, and therefore will be satisfied by implementation of AES-1b/2c.	This requirement was incorporated into the final revegetation plan, and therefore will be satisfied by implementation of AES-1b/2c.	This requirement was incorporated into the revegetation plan and will be satisfied by implementation of AES-1b/2c.	See AES-1b/2c.

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Aesthetics	**AES-2**	**Impacts on Views from Colorado River, a Scenic Resources Corridor (Key View 11) - The proposed project shall be designed and implemented to adhere to the design criteria presented below:**						
Aesthetics	AES-2a	a) A minimum setback requirement of 20 feet from the water (ordinary high water mark or OHWM) shall be enforced, except with regard to any required river intake facilities, to prevent substantial vegetation removal along the river bank.	Design submittals	The OHWM along the bank of the Colorado River, from the mouth of Bat Cave Wash to the BNSF railroad bridge, was mapped in March 2011. The OHWM methodology is summarized in a technical memorandum entitled "*Topock Groundwater Remediation Project, Ordinary High Water Mark Mapping Methodology*" (CH2M HILL 2011d) and is included in Appendix A3 of this Basis of Design Report. A 20-feet setback from the OHWM was used to guide the placement of the River Bank Extraction Wells and associated infrastructure in the floodplain. A map showing the OHWM and the 20-feet setback is included in Figure 2-17 of the 30% BOD Report.	Figure 2.4-6 in the 60% BOD Report illustrates that the locations of the River Bank Extraction Wells and associated piping met the 20-foot setback requirement.	Figure 2.4-6 in the 90% BOD Report illustrates that the locations of the River Bank Extraction Wells and associated access road/piping corridor met the 20-foot setback requirement.	Figure 2.4-6 in this Final BOD Report illustrates that the locations of the River Bank Extraction Wells and associated access road/piping corridor will meet the 20-foot setback requirement.	The mapping methodology technical memorandum and a map with the 20-foot setback from the OHWM were submitted on November 18, 2011, and are included in Appendix A of this report.
Aesthetics	AES-2b	b) Existing mature plant specimens shall be protected in place during construction, operation, and decommissioning phases. The identification of plant specimens that are determined to be mature and retained shall occur as part of the design phase and mapped/identified by a qualified plant ecologist or biologist and integrated into the final design and project implementation consistent with CUL1a-5.	Mature Plants Survey Report including map of mature plant species Aesthetics and Visual Resources Protection and Revegetation Plan	Identification and mapping of mature plant species was completed in August 2011. The survey methodology is summarized in a technical memorandum entitled "*Topock Groundwater Remediation Project, Mature Plants Survey Methodology*" (CH2M HILL 2011b) and is included in Appendix A3 of this Basis of Design Report. The mature plant map is under preparation and will be used to guide the remedy design and the planning for construction.	The Mature Plants Survey Report (CH2M HILL 2012b) was completed on January 17, 2012, and is included in Appendix A4 of the 60% BOD Report. The report contains surveys results and associated maps, which have been used to guide the design. An overview of the report and the survey results were discussed with interested Tribes on January 26, 2012. Figure 2.4-8 in the 60% BOD Report presents the mature plant survey information for Key Views 5 and 11. PG&E biologist Melanie Day and CH2M HILL biologist Marjorie Eisert participated in a field review of planned remedial facilities with the design team on April 23-24, 2012. A field review was also conducted on June 20 by PG&E biologist Virginia Strohl. The purpose of these field reviews along with in office reviews was to ensure the footprints of planned facilities including potential access routes are designed to avoid disturbance of sensitive habitats to the extent feasible.	An addendum to the Mature Plants Survey Report (CH2M HILL 2014j) was completed on May 19, 2014 and is included in Appendix A4 of the 90% BOD Report. The addendum contains surveys results and associated maps for the freshwater well sites (HNWR-1 and Site B) in Arizona as well as potential sites identified for soil storage and/or construction staging west of Moabi Regional Park. Figure 2.4-8 in the 90% BOD Report presents the mature plant survey information for Key Views 5 and 11. The Aesthetics and Visual Resources Protection and Revegetation Plan (CH2M HILL 2014l) is included as an appendix to the Construction/Remedial Action Work Plan (CH2M HILL 2014m). CH2M HILL biologist Steve Long and E2 biologist Russell Huddleston participated in a field review of planned remedial facilities with the design team on April 7-10, 2014. An additional field review of planned remedial facilities was conducted by CH2M HILL biologist Melissa Fowler and E2 biologist Russell Huddleston on August 6-8, 2014. PG&E biologist	On January 30, 2015, PG&E conducted biological surveys to identify plant specimens that are mature and to be retained in the area proposed for remedy use at Moabi Regional Park. On June 24-25, 2015, in conformance with direction from DTSC, PG&E conducted biological surveys to identify plant specimens that are mature and to be retained in an additional 35-acre area considered on the west side of Moabi Regional Park. The survey results were summarized in a technical memorandum titled *Assessment of Biological Resources for a 35-acre Area on the West Side of Moabi Regional Park* (CH2M HILL 2015d), which is included in Appendix A10 of this report. This memorandum provides updates to the January 2015 memorandum as well as information on the natural resources observed within the larger 35-acre area. In addition, a technical memorandum titled *Assessment of Biological Resources for the Proposed Sewer and Firewater Lines for the Construction Headquarters, Final Groundwater Remedy, Topock Compressor Station,*	The survey methodology tech memo was completed on October 31, 2011, and provided to Interested Tribes on November 8, 2011. The Mature Plants Survey Report was completed on January 17, 2012. An addendum to the Mature Plants Survey Report was completed on May 22, 2014. The Aesthetics and Visual Resources Protection and Revegetation Plan was submitted with the Construction/Remedial Action Work Plan (Appendix N) on September 8, 2014 with the 90% design submittal and again on November 18, 2015 with the final design submittal. The *Assessment of Biological Resources for the Proposed Soil Management Area* was completed on January 19, 2015, and submitted with the Supplemental 90% on February 5, 2015. The *Assessment of Biological Resources for the Proposed Sewer and Firewater Lines for the*

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						Virginia Strohl also led the office reviews of planned facilities and footprints. The purpose of the field review along with in-office reviews was to ensure the footprints of planned facilities, including access routes and construction footprints, are designed to avoid disturbance of mature plant specimens and sensitive habitats to the extent feasible. In support of the Supplemental 90% design, PG&E conducted biological surveys (including for mature plants) of the 6.74-acre Construction Headquarters and soil management area at Moabi Regional Park on November 19, 2014 to identify existing mature plant specimens to be protected in place, consistent with mitigation measures AES-2b and CUL-1a-5. The survey results was summarized in a technical memorandum titled *Assessment of Biological Resources for the Proposed Soil Management Areas* (CH2M HILL 2015b), which was submitted in Appendix A10 of the Supplemental 90%.	*California* (CH2M HILL 2015c) was prepared to provide a general assessment of biological resources (including mature plants) that could be affected by the proposed sewer and fire water lines that may be installed in the future and are associated with the construction headquarters facilities that would be located to the west of Moabi Regional Park, south of the National Trails Highway. The memo was completed on August 5, 2015 and submitted for review during the 90% RTC process and is included in Appendix A10 of this report.	*Construction Headquarters, Final Groundwater Remedy, Topock Compressor Station, California* was completed on August 5, 2015 and submitted for review during the 90% RTC process. The *Assessment of Biological Resources for a 35-acre Area on the West Side of Moabi Regional Park: Final Groundwater Remedy, Topock Compressor Station, California* was completed on September 8, 2015. The above documents are also submitted again with the final design on November 18, 2015.
Aesthetics	AES-2c	c) Revegetation of disturbed areas within the riparian vegetation along the Colorado River shall occur concurrently with construction operations. Plans and specifications for revegetation shall be developed by a qualified plant ecologist or biologist before any riparian vegetation is disturbed. The revegetation plan shall include specification of maintenance and monitoring requirements, which shall be implemented for a period of 5 years after project construction or after the vegetation has successfully established, as determined by a qualified plant ecologist or biologist.	Aesthetics and Visual Resources Protection and Revegetation Plan	A revegetation plan for the riparian vegetation along the river will be prepared and submitted with the final design.	A revegetation plan for the riparian vegetation along the river will be prepared and submitted with the final design.	A Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (CH2M HILL 2014o) is included in an appendix of the Construction/Remedial Action Work Plan (CH2M HILL 2014m). A technical memorandum titled *Preliminary Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California* (CH2M HILL 2015e) identifies potential revegetation areas where mitigation vegetation could be planted to offset potential visual impacts that may occur from potential disturbance of riparian vegetation along the Colorado River during construction of the remedy. The memo was completed on January 27, 2015 and included in Appendix V of the Supplemental 90% for review and comment.	The Preliminary Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California was revised to incorporate review comments.	The Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats was submitted with the Construction/Remedial Action Work Plan on September 8, 2014. Both the revised *Preliminary Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station* (CH2M HILL 2015e) and the Habitat Restoration Plan were submitted with the Construction/ Remedial Action Work Plan, concurrently with the final design submittal.

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Aesthetics	AES-2d	d) Plant material shall be consistent with surrounding native vegetation.	Aesthetics and Visual Resources Protection and Revegetation Plan	This requirement will be incorporated into the revegetation plan, and therefore, will be satisfied by implementation of AES-1b/2c.	This requirement will be incorporated into the revegetation plan, and therefore will be satisfied by implementation of AES-1b/2c.	This requirement was incorporated into the Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (CH2M HILL 2014o) included as an appendix to the Construction/Remedial Action Work Plan, and therefore was satisfied by implementation of AES-1b/2c.	This requirement was incorporated into the Aesthetics and Visual Resources Protection and Revegetation Plan (CH2M HILL 2014l) drafted to satisfy AES-1/2 and included as Appendix N to the Construction/Remedial Action Work Plan, and which will be followed when AES-1/2 are implemented.	The Aesthetics and Visual Resources Protection and Revegetation Plan was submitted with the Construction/Remedial Action Work Plan (Appendix N) on September 8, 2014 with the 90% design submittal and again on November 18, 2015 with the final design submittal.
Aesthetics	AES-2e	e) The color of the wells, pipelines, and utilities shall consist of muted, earth-tone colors that are consistent with the surrounding natural color palette. Matte finishes shall be used to prevent reflectivity along the view corridor. Integral color concrete should be used in place of standard gray concrete.	Design submittals	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of the Basis of Design Report for the preliminary design. In addition, the detailed specification for colors will also be included the intermediate (60%) design.	The requirement of this mitigation measure was incorporated into the design criteria as presented in Appendix C of the BOD Report for the 60% design. The detailed specifications for colors are included in Appendix E of the 60% BOD Report.	The requirement of this mitigation measure was incorporated into the design criteria as presented in Appendix C of the 90% BOD Report. The detailed specifications for colors are included in Appendix E of the 90% BOD Report.	The requirement of this mitigation measure was incorporated into the design criteria as presented in Appendix C (Section C.8) of this Final BOD Report. The detailed specifications for colors are included in Volume 1 Specifications, Painting and Coating, Part 3, Section 3.01.D, in Appendix E of this Final BOD Report.	The Final BOD Report was submitted on November 18, 2015.
Aesthetics	AES-2f	f) The final revegetation plans and specifications shall be reviewed and approved by an architect, landscape architect, or allied design professional licensed in the State of California to ensure that the design objectives and criteria are being met. Planting associated with biological mitigation may contribute to, but may not fully satisfy, visual mitigation.	Aesthetics and Visual Resources Protection and Revegetation Plan	This requirement will be incorporated into the revegetation plan, and therefore will be satisfied by implementation of AES-1b/2c.	This requirement will be incorporated into the revegetation plan, and therefore will be satisfied by implementation of AES-1b/2c.	This requirement was incorporated into the Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats revegetation plan (CH2M HILL 2014o) included as an appendix to the Construction/ Remedial Action Work Plan, and therefore was satisfied by implementation of AES-1b/2c.	The Aesthetics and Visual Resources Protection and Revegetation Plan is included in Appendix N of the Construction/Remedial Action Work Plan. The plan was prepared by plant ecologist Russell Huddleston of E2 Consulting under the direction of Linda Cyra-Korsgaard, a CH2M HILL landscape architect licensed in California.	The Aesthetics and Visual Resources Protection and Revegetation Plan was submitted with the Construction/Remedial Action Work Plan (Appendix N) on September 8, 2014 with the 90% design submittal and again on November 18, 2015 with the final design submittal.
Aesthetics	AES-3	**Impacts on Visual Quality and Character along the Colorado River (Key View 11)** -- Mitigation Measure AES-1 shall be implemented. Implementation of Mitigation Measures AES-1 would reduce the overall change to the visual character of the view corridor along the Colorado River. Although the proposed project would still be visible, incorporating a facilities design that is aesthetically sensitive and preserving the vegetation would blend the proposed project into their visual setting within the floodplain and would reduce the overall contrast of the proposed project.	Design submittals	This requirement is addressed by the actions taken to address AES-1.	This requirement is addressed by the actions taken to address AES-1.	This requirement is addressed by the actions taken to address AES-1.	This requirement is addressed by the actions taken to address AES-1.	See AES-1.

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Air Quality	**AIR-1**	**Short-Term Construction-Related Emissions of Criteria Air Pollutants and Precursors - PG&E shall implement the fugitive dust control measures below for any construction and/or demolition activities:**						
Air Quality	AIR-1a	a) Use periodic watering for short-term stabilization of disturbed surface area to minimize visible fugitive dust emissions during dust episodes. Use of a water truck to maintain moist disturbed surfaces and actively spread water during visible dusting episodes shall be considered sufficient;	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be incorporated into the forthcoming Corrective Measure Construction/ Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; and Closure Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be incorporated into the forthcoming Corrective Measure Construction/Remedial Action Work Plan (which will be submitted as part of the 90% design) and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (which will be submitted as part of the Cultural Impact Mitigation Program [CIMP; PG&E 2014] and concurrently with the 90% design). The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	This requirement was incorporated into the BMP Plan of the Construction/Remedial Action Work Plan (Section 4) and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (presented as an appendix in the CIMP and the Construction/Remedial Action Work Plan). Both plans were submitted as part of the 90% design documents. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	This requirement was incorporated into the BMP Plan of the Construction/Remedial Action Work Plan (Section 4) and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (presented as an appendix in the CIMP and the Construction/Remedial Action Work Plan). Both plans were submitted as part of the final design documents. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	The Construction/Remedial Action Work Plan was submitted on November 18, 2015. The revised IM-3 Decommissioning Plan was included in the C/RAWP as Appendix F and as part of the CIMP in Appendix H.
Air Quality	AIR-1b	b) Cover loaded haul vehicles while operating on publicly maintained paved surfaces;	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be incorporated into the forthcoming Corrective Measure Construction/ Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; and Closure Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be incorporated into the forthcoming Corrective Measure Construction/Remedial Action Work Plan which will be submitted as part of the 90% design, and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration which will be submitted as part of the CIMP and concurrently with the 90% design. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	This requirement was incorporated into the BMP Plan of the Construction/Remedial Action Work Plan (Section 4) and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (presented as an appendix in the CIMP and the Construction/Remedial Action Work Plan). Both plans were submitted as part of the 90% design documents. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	This requirement was incorporated into the BMP Plan of the Construction/Remedial Action Work Plan (Section 4) and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (presented as an appendix in the CIMP and the Construction/Remedial Action Work Plan). Both plans were submitted as part of the final design documents. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	The Construction/Remedial Action Work Plan was submitted on November 18, 2015. The Revised IM-3 Decommissioning Plan was included in the C/RAWP as Appendix F and as part of the CIMP in Appendix H.
Air Quality	AIR-1c	c) Stabilize (using soil binders or establish vegetative cover) graded site surfaces upon completion of grading when subsequent development is delayed or expected to be delayed more than 30 days, except when such delay is caused by precipitation that dampens the disturbed surface sufficiently to eliminate visible fugitive dust emissions;	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be incorporated into the forthcoming Corrective Measure Construction/ Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; and Closure Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be incorporated into the forthcoming Corrective Measure Construction/Remedial Action Work Plan which will be submitted as part of the 90% design, and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration which will be submitted as part of the CIMP and concurrently with the 90% design. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	This requirement was incorporated into the BMP Plan of the Construction/Remedial Action Work Plan (Section 4) and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (presented as an appendix in the CIMP and the Construction/Remedial Action Work Plan). Both plans were submitted as part of the 90% design documents. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	This requirement was incorporated into the BMP Plan of the Construction/Remedial Action Work Plan (Section 4) and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (presented as an appendix in the CIMP and the Construction/Remedial Action Work Plan). Both plans were submitted as part of the final design documents. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	The Construction/Remedial Action Work Plan was submitted on November 18, 2015. The revised IM-3 Decommissioning Plan was included in the C/RAWP as Appendix F and as part of the CIMP in Appendix H.

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Air Quality	AIR-1d	d) Cleanup project-related track out or spills on publicly maintained paved surfaces within twenty-four hours; and	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be incorporated into the forthcoming Corrective Measure Construction/ Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; and Closure Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be incorporated into the forthcoming Corrective Measure Construction/Remedial Action Work Plan which will be submitted as part of the 90% design, and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration which will be submitted as part of the CIMP and concurrently with the 90% design. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	This requirement was incorporated into the BMP Plan of the Construction/Remedial Action Work Plan (Section 4) and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (presented as an appendix in the CIMP and the Construction/Remedial Action Work Plan). Both plans were submitted as part of the 90% design documents. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	This requirement was incorporated into the BMP Plan of the Construction/Remedial Action Work Plan (Section 4) and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (presented as an appendix in the CIMP and the Construction/Remedial Action Work Plan). Both plans were submitted as part of the final design documents. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	The Construction/Remedial Action Work Plan was submitted on November 18, 2015. The revised IM-3 Decommissioning Plan was included in the C/RAWP as Appendix F and as part of the CIMP in Appendix H.
Air Quality	AIR-1e	e) Curtail nonessential earth-moving activity under high wind conditions (greater than 25 miles per hour) or develop a plan to control dust during high wind conditions. For purposes of this rule, a reduction in earth-moving activity when visible dusting occurs from moist and dry surfaces due to wind erosion shall be considered sufficient to maintain compliance.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be incorporated into the forthcoming Corrective Measure Construction/ Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; and Closure Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be incorporated into the forthcoming Corrective Measure Construction/Remedial Action Work Plan which will be submitted as part of the 90% design, and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration which will be submitted as part of the CIMP and concurrently with the 90% design. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	This requirement was incorporated into the BMP Plan of the Construction/Remedial Action Work Plan (Section 4) and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (presented as an appendix in the CIMP and the Construction/Remedial Action Work Plan). Both plans were submitted as part of the 90% design documents. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	This requirement was incorporated into the BMP Plan of the Construction/Remedial Action Work Plan (Section 4) and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (presented as an appendix in the CIMP and the Construction/Remedial Action Work Plan). Both plans were submitted as part of the final design documents. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	The Construction/Remedial Action Work Plan was submitted on November 18, 2015. The revised IM-3 Decommissioning Plan was included in the C/RAWP as Appendix F and as part of the CIMP in Appendix H.
Biological Resources	BIO-1	**Potential Fill of Wetlands and Other Waters of the United States and Disturbance or Removal of Riparian Habitat** -Areas of sensitive habitat in the project area have been identified during project surveys. These areas include floodplain and riparian areas, wetlands, and waters of the United States. Habitats designated by CDFW as sensitive, including desert washes and desert riparian, are also included. To the extent feasible, elements of the project shall be designed to avoid direct effects on these sensitive areas. During the design process and before ground disturbing activities within such areas (not including East Ravine), a qualified biologist shall coordinate with PG&E to ensure that the footprints of construction zones, drill pads, staging areas, and access routes are designed to avoid disturbance of sensitive habitats to the extent feasible. DTSC shall be responsible for enforcing compliance with design and all preconstruction measures.	Design submittals	During the preparation of the Construction/ Remedial Action Work Plan as part of the design process, a qualified biologist will coordinate to ensure that the footprints of construction zones, drill pads, staging areas, and access routes are designed to avoid disturbance of sensitive habitats (floodplain and riparian areas, wetlands, waters of the US, desert washes, and desert riparian) to the extent feasible. The draft and final work plans are planned for submittal in 2012.	During the preparation of the Construction/Remedial Action Work Plan as part of the design process, a qualified biologist will coordinate to ensure that the footprints of construction zones, drill pads, staging areas, and access routes are designed to avoid disturbance of sensitive habitats (floodplain and riparian areas, wetlands, waters of the US, desert washes, and desert riparian) to the extent feasible. The draft Construction/Remedial Action Work Plan is planned for submittal in late 2013, concurrently with the 90% design.	CH2M HILL biologist Steve Long and E2 biologist Russell Huddleston participated in a field review of planned remedial facilities with the design team on April 7-10, 2014. An additional field review of planned remedial facilities was conducted by CH2M HILL biologist Melissa Fowler and E2 biologist Russell Huddleston on August 6-8, 2014. CH2M HILL biologists Steve Long and Russell Huddleston also conducted field reviews of the planned facilities at Moabi Regional Park on November 19, 2014. PG&E biologist Virginia Strohl also led the office reviews of planned facilities and footprints. The purpose of the field review along with in-office reviews was to ensure	PG&E biologist Virginia Strohl led the office reviews of planned facilities and footprints in September 2015. The purpose of the review was to ensure that the footprints of planned facilities, including footprints of construction zones, staging areas, and access routes had been designed to avoid direct effects on sensitive habitats to the extent feasible. The Construction/Remedial Action Work Plan was submitted concurrently with the final design documents.	September 22, 2015.

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						the footprints of planned facilities, including access routes and construction footprints, are designed to avoid disturbance of sensitive habitats to the extent feasible. The Construction/Remedial Action Work Plan was submitted on September 8, 2014 as part of the 90% design document.		
Biological Resources	BIO-1	If during the design process it is shown that complete avoidance of habitats under USACE jurisdiction is not feasible, the Section 404 permitting process shall be completed, or the substantive equivalent per CERCLA Section 121(e)(1). In either event, the acreage of affected jurisdictional habitat shall be replaced and/or rehabilitated to ensure "no-net-loss." Before any ground-disturbing project activities begin in areas that contain potentially jurisdictional wetlands, the wetland delineation findings shall be documented in a detailed report and submitted to USACE for verification as part of the formal Section 404 wetland delineation process and to DTSC. For all jurisdictional areas that cannot be avoided as described above, authorization for fill of wetlands and alteration of waters of the United States shall be secured from USACE through the Section 404 permitting process before project implementation. Habitat restoration, rehabilitation, and/or replacement shall be at a location and by feasible methods agreeable to USACE and consistent with applicable county and agency policies and codes. Minimization and compensation measures adopted through any applicable permitting processes shall be implemented. Alternately, if USACE declines to assert jurisdiction because it determines that CERCLA Section 121(e)(1) applies, the substantive equivalent of the Section 404 permitting process shall be complied with by ensuring that the acreage of jurisdictional wetland affected is be replaced on a "no-net-loss" basis in accordance with the substantive provisions of USACE regulations. Habitat restoration, rehabilitation, and/or replacement shall be at a location and by feasible methods consistent with USACE methods, and consistent with the purpose and intent of applicable county and agency policies and codes. Minimization and compensation measures adopted through any applicable permitting processes shall be implemented. In any event, a report shall be submitted to DTSC to document compliance with these mandates.	Jurisdictional Delineation of Waters and Wetlands Report	During the preliminary (30%) design, it has been determined that complete avoidance of habitats under USACE jurisdiction (e.g., Bat Cave Wash) is not feasible. PG&E will work with the USACE to determine and complete the Section 404 permitting process or the substantive equivalent per CERCLA Section 121(e)(1). It is anticipated that a wetland delineation will be conducted in the Spring of 2012.	Figure 2.4-5 in the 60% BOD Report shows the overlaps between planned remedy infrastructure and the USACE jurisdictional waters/wetlands. As shown in Figure 2.4-5, complete avoidance of washes is not feasible due to the need to install remediation and monitoring wells in washes (e.g., a wash in the Upland, Bat Cave Wash). On February 12, 2013, PG&E consulted with Mr. Gerardo Salas of USACE Los Angeles District in Los Angeles regarding the application of the CERCLA 121(e)(1) permit exemption to the Topock remediation project. PG&E will continue to coordinate with USACE on this matter, including on the substantive requirements of CWA Section 404.	On February 13-17, 2012, a wetland delineation was conducted to determine and map the extent of wetlands and other waters of the U.S. located within the EIR project area. Additional wetland delineation was conducted on July 16-17 and December 12-13, 2012, in study areas identified in the alternative freshwater evaluation. A report titled "*Wetlands and Waters of the United States Final Delineation Report for the Topock Compressor Station Groundwater Remediation Project, San Bernardino County, California*" (CH2M HILL 2014c) was prepared to summarize results of the above delineation efforts and submitted to DTSC and DOI on April 18, 2014. The report is also included in Appendix A3 of the 90% BOD Report. In support of the Supplemental 90% design, PG&E conducted surveys for jurisdictional waters and wetlands in the 6.74-acre Construction Heaquarters and soil management area at Moabi Regional Park on November 19, 2014. The survey results were summarized in a technical memorandum titled *Assessment of Biological Resources for the Proposed Soil Management Areas* (CH2M HILL 2015b), which was submitted with the Supplemental 90%. On July 10, 2013, the USACE confirmed that CERCLA 121(e)(1) permit exemption applies to the Topock remediation project, and therefore, PG&E is not required to comply with the administrative and procedural elements of Section 404 of the Clean Water Act; however,	On January 30, 2015, PG&E conducted biological surveys (including habitats under USACE jurisdiction) of the area proposed for remedy use at Moabi Regional Park. On June 24-25, 2015, in conformance with direction from DTSC, PG&E conducted surveys (for jurisdictional waters and wetlands) of an additional 35-acre area on the west side of Moabi Regional Park. The survey results were summarized in a technical memorandum titled *Assessment of Biological Resources for a 35-acre Area on the West Side of Moabi Regional Park* (CH2M HILL 2015d). This memorandum provides updates to the January 2015 memorandum as well as information on the natural resources observed within the larger 35-acre area, and is also included in Appendix A10 of this report. In addition, a technical memorandum titled *Assessment of Biological Resources for the Proposed Sewer and Firewater Lines for the Construction Headquarters, Final Groundwater Remedy, Topock Compressor Station, California* (CH2M HILL 2015c) was prepared to provide a general assessment of biological resources (including jurisdictional waters and wetlands) that could be affected by the proposed sewer and fire water lines that may be installed in the future and are associated with the construction headquarters facilities that would be located to the west of Moabi Regional Park, south of the National Trails Highway. The memo was completed on August 5, 2015 and submitted for review during the 90%	On July 10, 2013, USACE issued a letter (USACE 2013a) that confirmed that a Section 404 permit is not required for the Topock remediation project because the site is exempted under CERCLA 121(e)(1). Additionally, USACE confirmed that it will not verify a jurisdictional delineation for this action because a permit is not required (G. Salas USACE, email communication to V. Nez PG&E, July 12, 2013). The wetland delineation report (CH2M HILL 2014c) was completed on April 18, 2014. The *Assessment of Biological Resources for the Proposed Soil Management Areas* (CH2M HILL 2015b) was completed on January 19, 2015. The *Assessment of Biological Resources for a 35-acre Area on the West Side of Moabi Regional Park: Final Groundwater Remedy, Topock Compressor Station, California* (CH2M HILL 2015d) was completed on September 8, 2015. The *Assessment of Biological Resources for the Proposed Sewer and Firewater Lines for the Construction Headquarters, Final Groundwater Remedy, Topock Compressor Station, California* was completed on August 5, 2015. The above documents are included in Appendix A of this report. The *Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats* (CH2M HILL

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						PG&E is obligated to comply with the substantive elements that would normally be required by a permit. The USACE also stated that it therefore will not verify the wetlands and waters delineation. Therefore, PG&E is not seeking verification from the USACE. Rather, PG&E assumes that the jurisdictional waters and wetlands delineated and identified as such in the aforementioned report are all the jurisdictional waters under Section 404 of the CWA. The locations of jurisdictional waters have been incorporated into the design. At the 90%/Supplemental 90% design stage, the final remedy avoids almost all permanent impacts within USACE jurisdictional areas with the following exceptions. There is one planned well, IRL-4, that will occur within a jurisdictional water of the U.S. There is also a freshwater pipeline that will be installed within an existing unpaved access road within the 100-year floodplain of the Colorado River. In addition, piping and conduits will be installed in two locations in Bat Cave Wash – one location in the Upland Area and one location near the TCS. However, complete avoidance of other jurisdictional non-wetland waters is not feasible. It has been determined that in order to meet the goals of protection of human health and the environment, to meet the RAOs for the remedy, to monitor remedy performance, to gather data for demonstration of compliance, as well as in response to resolution of design comments with the Tribes, infrastructure (remediation, monitoring wells, and associated piping/conduits) must be installed in certain washes. There are no practicable alternatives to locating certain infrastructure within waters of the United States. Figure 2.4-5 in the 90% BOD Report shows the unavoidable overlaps between planned remedy	RTC process and is included in Appendix A10 of this report. The locations of USACE jurisdictional habitats were considered during the design. At the final design stage, the final remedy avoids almost all permanent impacts within USACE jurisdictional habitats with the following exceptions (see Figure 2.4-5 of this BOD Report): 1) Inner Recirculation Loop Well IRL-4 will occur within a jurisdictional water of the U.S. 2) Remedy and monitoring wells and associated piping/conduits will be installed in Bat Cave Wash, a jurisdictional water of the U.S. 3) Freshwater supply well HNWR-1A, contingent Site B well, associated equipment, and a portion of the freshwater pipeline will be installed within the 100-year floodplain of the Colorado River. 4) Riverbank Extraction Well RB-5, monitoring well MW-W, a portion of Pipeline C, and a portion of the ring road will be installed within the 100-year floodplain of the Colorado River. There are no practicable alternatives to locating the aforementioned infrastructure within waters of the U.S. In such cases where avoidance is not feasible, BMPs will be implemented to avoid and minimize temporary and permanent impacts for activities occurring within jurisdictional wetlands and non-wetland waters of the U.S. (for brevity, the detailed discussion on BMPs in the previous column is not repeated here). The *Preliminary Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California* was revised to incorporate review comments, and was submitted with the Construction/Remedial	2014o) and the revised *Havasu National Wildlife Refuge Habitat Restoration Plan* (CH2M HILL 2015g) were submitted with the Construction/Remedial Action Work Plan on September 8, 2014 (90% design) and submitted again on November 18, 2015 (final design). The revised *Preliminary Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California* was submitted with the Construction/Remedial Action Work Plan on November 18, 2015 (final design).

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						infrastructure and the USACE jurisdictional waters. In such cases where complete avoidance is not feasible, certain best management practices (BMPs) (Exhibit 6.1-1 at the end of this table) will be implemented to avoid and minimize temporary and permanent impacts for activities occurring within jurisdictional wetlands and non-wetland waters of the U.S. Although the USACE did not provide a list of measures that may be taken to reduce impacts to jurisdictional waters and wetlands, the California Department of Fish and Wildlife (CDFW) requires compliance with avoidance and mitigation measures (AMMs) for all work conducted in CDFW jurisdictional washes (the 2013 CDFW AMMs can be downloaded from www.dtsc-topock.com, under Document Library, Other and Environmental Impact Review, Approval Letters and Communications). The geographic extent of CDFW's jurisdiction is broader than the jurisdictional extent of the USACE under CWA 404 and thus, avoidance and mitigation measures applied to CDFW jurisdictional waters would as a geographic consequence also be applied to CWA 404 waters. While Arizona does not have a similar state program, PG&E will also implement the same AMMs in Arizona identified by CDFW for California as well to ensure appropriate protection to CWA 404 jurisdictional areas in the project area, including those in Arizona. In addition to the CDFW AMMs, PG&E has identified additional BMPs for implementation during remedy construction, operation and maintenance, as well as decommissioning. The additional BMPs are described in the *Protocol for Compliance with EIR Mitigation and Monitoring Reporting Program BIO-1 and Applicable or Relevant and Appropriate Requirement (ARAR) #32*	Action Work Plan concurrently with the final design.	

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						at the Topock Compressor Station (see Exhibit 6.1-1 presented at the end of this table). A Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (CH2M HILL 2014o) was also prepared and included in an appendix of the Construction/Remedial Action Work Plan. A technical memorandum titled the *Preliminary Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California* (CH2M HILL 2015e) was prepared to identify potential riparian revegetation areas where mitigation vegetation could be planted to offset potential plant impacts that may occur during construction of the remedy. The memo was completed on January 27, 2015 and included in Appendix V of the Supplemental 90% for review and comment.		
Biological Resources	BIO-1 (continued)	If during the design process it is shown that complete avoidance of habitats under CDFG jurisdiction (such as changes to the natural flow and/or bed and bank of a waterway) is infeasible, a Section 1602 streambed alteration agreement shall be obtained from CDFG and affected habitats shall be replaced and/or rehabilitated. If complete avoidance of identified riparian habitat is not feasible, the acreage of riparian habitat that would be removed shall be replaced or rehabilitated on a no-net-loss basis in accordance with CDFG regulations and, if applicable, as specified in the streambed alteration agreement, if needed. Habitat restoration, rehabilitation, and/or replacement shall be at a location and by methods agreeable to CDFG and consistent with the purpose and intent of applicable county policies and codes, as well as those policies outlined under the respective federal agency guidance documents. Minimization and compensation measures adopted through the permitting process shall also be implemented. Restoration of any disturbed areas shall include measures to achieve “no-net-loss” of habitat functions and values existing before project implementation. These measures shall be achieved by developing and implementing a habitat	Havasu National Wildlife Refuge Habitat Restoration Plan, Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats	During the preliminary (30%) design, it has been determined that complete avoidance of habitats under CDFG jurisdiction (e.g., Bat Cave Wash) is not feasible. PG&E will work with the CDFG to determine and complete the Section 1600 permitting process or the substantive equivalent per CERCLA Section 121(e)(1).	Figure 2.4-5 in the 60% BOD Report shows the overlaps between remedy infrastructure and the CDFW jurisdictional waters/wetlands. As shown in Figure 2.4-5, complete avoidance of washes is not feasible due to the need to install remediation and monitoring wells, and associated pipes and components in washes (e.g., a wash in the Upland, Bat Cave Wash). The CDFG is now the California Department of Fish and Wildlife, and thus is referred to as CDFW in this report. On December 11, 2012, PG&E consulted with CDFW District Regional Manager and his staff at the Blythe, California office regarding the substantive requirements of the CDFW Section 1602 and the application of the CERCLA 121(e)(1) permit exemption to the Topock remediation project. On February 21, 2013, CDFW staff from the Blythe office conducted a field review of the project. On March 6, 2013, the CDFW	During the design, a process similar to the above was also conducted to avoid and minimize impacts to CDFW jurisdictional waters/wetlands. CDFW jurisdictional waters in the project area were delineated and mapped. A technical memorandum titled *Riparian Vegetation and California Department of Fish and Wildlife Jurisdiction for the Topock Compressor Station Groundwater Remediation Project* (CH2M HILL 2014i) was prepared to summarize the delineation results. The memo was submitted to the CDFW on 5/9/14, and to DTSC on 5/21/14, and is also included in Appendix A3 of the 90% BOD Report. In support of the Supplemental 90% design, PG&E conducted surveys for USACE jurisdictional waters and wetlands and habitats under CDFW jurisdiction in the 6.74-acre Construction Headquarters and soil management area at Moabi Regional Park on November 19, 2014. The	During the design, a process similar to the above was also conducted to avoid and minimize impacts to CDFW jurisdictional waters/wetlands. 1) The locations of CDFW jurisdictional areas have been incorporated into the design. At the final design stage, the final remedy avoids almost all permanent impacts within CDFW jurisdictional areas with the following exceptions (see Figure 2.4-5A of this BOD Report): Inner Recirculation Loop Well IRL-4 will occur within a jurisdictional water of the State. 2) Remedy and monitoring wells and associated piping/conduits will be installed in Bat Cave Wash, a jurisdictional water of the State. 3) Freshwater supply well HNWR-1A, contingent Site B well, associated equipment, and a portion of the freshwater pipeline will be installed within	On March 6, 2013, CDFW issued a letter confirming that CERCLA 121(e)(1) permit exemption applies to response actions conducted onsite as part of the Topock remediation project, and specified the substantive requirements in the form of AMMs that PG&E must comply with for the duration of the project. A technical memorandum summarizing the results of delineating CDFW jurisdictional waters in the project area (CH2M HILL 2014i) was submitted to CDFW on May 9, 2014, and to DTSC on May 21, 2014. The memo is included in Appendix A of this report. The Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (CH2M HILL 2014o) and the Havasu National Wildlife Refuge Habitat Restoration Plan (CH2M HILL

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		restoration plan submitted to CDFG, BLM, and USFWS that is agreeable to these agencies, or, alternately, through the implementation of a habitat restoration plan consistent with the substantive policies of CDFG, BLM, and USFWS. The plan shall include a revegetation seed mix or plantings design, a site grading concept plan, success criteria for restoration, a monitoring plan for achieving no net loss of habitat values and functions, and an adaptive management plan. Alternately, if CDFG declines to assert jurisdiction because it determines that CERCLA Section 121(e)(1) applies, and during the design process it is shown that complete avoidance of habitats under CDFG jurisdiction (such as changes to the natural flow and/or bed and bank of a waterway) is infeasible, the substantive mandates of a streambed alteration agreement shall be implemented, and affected habitats shall be replaced and/or rehabilitated. If complete avoidance of identified riparian habitat is not feasible, the acreage of riparian habitat that would be removed shall be replaced or rehabilitated on a "no-net-loss" basis in accordance with CDFG regulations and, if applicable. Habitat restoration, rehabilitation, and/or replacement shall be at a location and by methods agreeable to CDFG and consistent with the purpose and intent of applicable county policies and codes, as well as those policies outlined under the respective federal agency guidance documents. Minimization and compensation measures adopted through the permitting process shall also be implemented. Restoration of any disturbed areas shall include measures to achieve "no-net-loss" of habitat functions and values existing before project implementation. These measures shall be achieved by developing and implementing a habitat restoration plan developed consistent with the substantive policies of CDFG, BLM and USFWS. The plan shall include a revegetation seed mix or plantings design, a site grading concept plan, success criteria for restoration, a monitoring plan for achieving no net loss of habitat values and functions, and an adaptive management plan.			issued a letter to PG&E confirming that CERCLA 121(e)(1) applies to response actions conducted onsite at Topock, specifically soil and groundwater investigation activities and remedial actions at the site (CDFW 2013). As a result, no Lake or Stream Bed Alteration Agreement is required by CDFW. However, PG&E must still comply with substantive elements CDFW would require in such an Agreement for the duration of the project. In this case, the substantive elements are the avoidance and minimization measures (AMMs) attached to the March 6, 2013 letter (this letter can be viewed or downloaded from the DTSC Topock website at www.dtsc-topock.com), and any additional measures PG&E's biologist determines to be necessary.	survey results was summarized in a technical memorandum titled *Assessment of Biological Resources for the Proposed Soil Management Areas* (CH2M HILL 2015b), which was submitted with the Supplemental 90%. The locations of jurisdictional waters have been incorporated into the design. At the 90% design stage, the final remedy avoids almost all permanent impacts within USACE jurisdictional areas with the following exceptions. There is one planned well, IRL-4, that will occur within a jurisdictional waters of the US. There is also a freshwater pipeline that will be installed within an existing unpaved access road within the 100-year floodplain of the Colorado River. In addition, piping and conduits will be installed in two locations in Bat Cave Wash – one location in the Upland Area and one location near the TCS. However, complete avoidance of other CDFW jurisdictional non-wetland waters is not feasible for the same reasons described above for the USACE jurisdictional non-wetland waters. Figure 2.4-5A in the 90% BOD Report shows the unavoidable overlaps between planned remedy infrastructure and the CDFW jurisdictional waters. A Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats and a Havasu National Wildlife Refuge Habitat Restoration Plan were prepared and included as appendices of the Construction/Remedial Action Work Plan. A technical memorandum titled *Preliminary Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California* (CH2M HILL 2015e) identifies potential revegetation areas where mitigation vegetation could be planted to offset potential plant impacts that may occur during	the 100-year floodplain of the Colorado River. 4) Riverbank Extraction Well RB-5, monitoring well MW-W, a portion of Pipeline C, and a portion of the ring road will be installed within the 100-year floodplain of the Colorado River. There are no practicable alternatives to locating the aforementioned infrastructure within waters of the State. A Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats and a Havasu National Wildlife Refuge Habitat Restoration Plan were prepared and included as appendices of the Construction/Remedial Action Work Plan. The *Preliminary Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California* was revised to incorporate review comments, and was submitted with the Construction/Remedial Action Work Plan concurrently with the final design.	2015g) were submitted with the Construction/Remedial Action Work Plan on September 8, 2014 (90% design) and November 18, 2015 (final design). The revised *Preliminary Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California* was submitted with the Construction/Remedial Action Work Plan on November 18, 2015 (final design).

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						construction of the remedy, The memo was completed on January 27, 2015 and included in Appendix V of the Supplemental 90% for review and comment.		
Biological Resources	BIO-2a	**Disturbance of Special-Status Birds and Loss of Habitat.** To the extent feasible, the project implementation plans shall be designed to minimize removal of habitat for special-status birds. During the design process and before ground disturbing activities (except within the East Ravine as described in the Revised Addendum and unless otherwise required as noted below), a qualified biologist shall coordinate with PG&E to ensure that the footprints of project elements and construction zones, staging areas, and access routes are designed to avoid direct or indirect effects on habitat and nesting habitat for other special-status species, to the extent feasible. DTSC will ensure compliance with all preconstruction and construction phase avoidance measures identified during this process and included in any design plans. Vegetation removal and other activities shall be timed to avoid the nesting season for special-status bird species that may be present. The nesting cycle for most birds in this region spans March 15 through September 30. **Preconstruction Measures**: Preconstruction breeding season surveys shall be conducted during the general nesting period, which encompasses the period from March 15 through September 30, if the final design of the project (including East Ravine investigation Sites I, K and L) could result in disturbance or loss of active nests of special-status bird species. If vegetation removal or other disturbance related to project implementation is required during the nesting season, focused surveys for active nests of special-status birds shall be conducted before such activities begin. A qualified biologist shall conduct preconstruction surveys to identify active nests that could be affected. The appropriate area to be surveyed and the timing of the survey may vary depending on the activity and species that could be affected. For the Yuma clapper rail, the preconstruction surveys shall specifically identify habitat within 300 feet of construction areas, in accordance with substantive policies of USFWS including those set out in USFWS protocols. **Construction Measures**: Before the initiation of project elements that could result in disturbance of active nests or nesting pairs of other special-status birds, a qualified biologist shall be consulted to identify appropriate measures to minimize adverse	Avoidance and Minimization Plan; Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Plan for Decommissioning of Remedy Facilities and Restoration	A qualified biologist will coordinate to ensure that the footprints of project elements and construction zones, staging areas, and access routes are designed to avoid direct or indirect effects on habitat and nesting habitat for other special-status species, to the extent feasible, at the intermediate (60%) stage. An Avoidance and Minimization Plan for special-status birds will be developed in consultation with the USFWS, and is subject to agreement from DTSC.	The Yuma clapper rail/California black rail surveys consist of six focused surveys between March 14 and May 19, 2012.The southwestern willow flycatcher (SWFL) surveys were conducted May 21 through 25 and June 4 through 8; June 18 through 22; and June 26 through 30, 2012. The 2012 SWFL survey report was submitted to BLM and USFWS on January 31, 2013 (CH2M HILL 2013a). The results of the Yuma clapper rail/California black rail survey will be summarized in a forthcoming report. An Avoidance and Minimization Plan for special status birds is under preparation, in consultation with the USFWS.	PG&E submitted the Final Bird Impact Avoidance and Minimization Plan (CH2M HILL 2014d), which addresses minimization and avoidance of disturbance of special-status birds and loss of their habitat in the Topock remediation project area, on April 30, 2014. The plan is also included as an appendix of the Construction/Remedial Action Work Plan. Results of the 2012 Yuma clapper rail/California black rail survey were summarized in a report titled *2012 Focused Survey for the Yuma clapper rail and the California black rail at the PG&E Groundwater Remediation Project Site, Needles, California* (CH2M HILL 2013g). The SWFL surveys were conducted on May 20-23, June 3-6; June 16-19; July 1-3, and July 15-17, 2014. Surveys for the western yellow-billed cuckoo were conducted June 16-17; July 2-3; July 16-17; and August 6-8, 2014.	Additional western yellow-billed cuckoo (WYBC) surveys were conducted on June 23-25, July 7-9, July 20-23 and August 4-6, 2015. On June 24-25, 2015, in conformance with direction from DTSC, PG&E conducted biological surveys (including general surveys for wildlife, including surveys for special status birds and their habitat) of an additional 35-acre area on the west side of Moabi Regional Park. The survey results were summarized in a technical memorandum titled *Assessment of Biological Resources for a 35-acre Area on the West Side of Moabi Regional Park* (CH2M HILL 2015d). This memorandum provides updates to the January 2015 memorandum as well as information on the natural resources observed within the larger 35-acre area, and is also included in Appendix A10 of this report.	The Final Bird Impact Avoidance and Minimization Plan (CH2M HILL 2014d) was submitted on April 30, 2014. The C/RAWP was submitted on November 18, 2015. The Revised IM-3 Decommissioning Plan was included in the C/RAWP as Appendix F and as part of the CIMP in Appendix H. The 2014 Southwestern Willow Flycatcher Presence/Absence Surveys for the PG&E Topock Compressor Station report was submitted on October 29, 2014. The 2014 Western Yellow-Billed Cuckoo Presence/Absence Surveys for the PG&E Topock Compressor Station report was submitted on December 22, 2014.

TABLE 6.1-1
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		impacts during the construction phase of the project. If deemed appropriate for the final project design because of the potential for impacts, minimization measures will include focusing construction activities that must be conducted during the nesting season to less- sensitive periods in the nesting cycle, implementing buffers around active nests of special-status birds to the extent practical and feasible to limit visual and noise disturbance, conducting worker awareness training, and conducting biological monitoring (including noise monitoring to determine if construction noise at the edge of suitable nesting habitat is elevated above 60 dBA Leq or ambient levels). An avoidance and minimization plan for special status bird species, as defined in Table 4.3-3 of the EIR and those species protected under the federal Migratory Bird Treaty Act, including the Yuma clapper rail, shall be developed and implemented in consultation with USFWS, and agreed upon by DTSC. Avoidance and impact minimization measures, such as prohibiting construction near or in sensitive bird habitat, limiting construction during breeding seasons, and requiring an on-site biological monitor, shall be included in the design plan and implemented to the extent necessary to avoid significant impacts on sensitive bird species.						

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Biological Resources	BIO-2b	**Disturbance of Desert Tortoise and Loss of Habitat.** **Preconstruction Measures:** In areas where impacts to potential desert tortoise habitat are unavoidable, measures outlined in the Programmatic Biological Assessment (PBA) and in the USFWS letter concurring with the PBA, shall be implemented, as described below. To the extent feasible, project construction shall be designed to minimize removal of habitat for the desert tortoise. Before any ground-disturbing project activities begin, and except within the East Ravine for which potential effects to the tortoise have been considered per the PBA), a USFWS-authorized desert tortoise biologist shall identify potential desert tortoise habitat in areas that could be affected by the final project design. Through coordination with the authorized biologist, PG&E shall ensure that the footprints of project elements and construction zones, staging areas, and access routes are designed to avoid direct or indirect effects on potential desert tortoise habitat to the extent feasible. These measures include the presence of a USFWS-authorized desert tortoise biologist onsite or designated agent in accordance with the PBA who will examine work areas and vehicles for the presence of desert tortoises, and who will conduct preconstruction desert tortoise surveys in areas where unavoidable impacts to tortoise habitat would occur. If feasible, the preconstruction desert tortoise surveys would coincide with one of the two peak periods of desert tortoise activity (i.e., if feasible, the surveys should be conducted in either the period from April through May, or from September through October). The preconstruction surveys shall be in full accordance with the substantive requirements of USFWS protocols. **Construction Measures**: Before the initiation of project elements that could result in disturbance of desert tortoises or desert tortoise habitat, a USFWS-authorized desert tortoise biologist shall be consulted to identify appropriate measures to minimize adverse impacts. Minimization measures are likely to include micro-siting structures, pipelines, and access roads in previously disturbed areas or in areas with sparse scrub vegetation, conducting worker awareness	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Plan for Decommissioning of Remedy Facilities and Restoration	PG&E, USFWS, and DOI are coordinating on the PBA for the final groundwater remedy. Goal is to complete the PBA in time for the completion of ESA Section 7 consultation prior to the approval of the Construction/Remedial Action Work Plan. Measures outlined in the forthcoming PBA and associated USFWS determination letter will be implemented before and during construction activities.	On September 25, 2012, the USFWS authorized two biologists, Melanie Day and Gabriel Valdes, to conduct activities described in this mitigation measure, pursuant to the PG&E Topock groundwater remediation project. Specifically, these two authorized biologists may survey, provide work area and vehicles inspection, and direct (pre)construction activities to avoid impacts on desert tortoise or their potential habitat, and to provide worker's awareness training for the groundwater remediation project. Gabriel Valdes identified the potential desert tortoise habitat shown in Figure 2.4-10 in the 60% BOD Report. Through coordination with the biologists (Gabriel Valdes and Melanie Day), the footprints of remediation wells, monitoring wells, piping, electrical transformers, access routes and pathways have been designed to avoid direct and indirect effects on potential desert tortoise habitat. PG&E, USFWS, and DOI continue to coordinate on the PBA for the final groundwater remedy. The goal is to complete the PBA in time for the completion of ESA Section 7 consultation prior to the approval of the Construction/Remedial Action Work Plan. Measures outlined in the forthcoming PBA and associated USFWS determination letter will be implemented before and during construction activities.	On April 1-2 and May 12-13, 2013, USFWS authorized biologist Gabriel Valdes conducted additional protocol surveys for desert tortoise in support of the design including the freshwater supply sites. Gabriel Valdes identified the potential desert tortoise habitat shown in Figure 2.4-10 in the 90% BOD Report. Through coordination with the biologists, the footprints of remediation wells, monitoring wells, piping, electrical transformers, access routes and pathways have been designed to avoid direct and indirect effects on potential desert tortoise habitat. PG&E, USFWS, BLM, and DOI coordinated on the PBA for the final groundwater remedy. This ESA Section 7 consultation was concluded with receipt of USFWS concurrency letter on July 7, 2014 which preceded the approval of the Construction/Remedial Action Work Plan. Measures outlined in the PBA and associated USFWS determination letter will be implemented before and during construction activities.	On January 29, 2015, another USFWS-approved biologist William Lee of Transcon Environmental, Inc. conducted a non-protocol survey for desert tortoise for proposed groundwater remedy activities around the Compressor Station Evaporation Ponds and access roadway. On June 24-25, 2015, in conformance with direction from DTSC, PG&E conducted biological surveys (including non-protocol surveys for desert tortoise) in an additional 35-acre area on the west side of Moabi Regional Park. Survey results were summarized in a technical memorandum titled *Assessment of Biological Resources for a 35-acre Area on the West Side of Moabi Regional Park* (CH2M HILL 2015d), which is included in Appendix A10 of this report.	The federal Endangered Species Act (ESA) Section 7 consultation on the PBA was concluded with receipt of USFWS concurrence letter on July 7, 2014 (USFWS 2014). The C/RAWP was submitted on November 18, 2015. The revised IM-3 Decommissioning Plan was included in the C/RAWP as Appendix F and as part of the CIMP in Appendix H. The *Assessment of Biological Resources for a 35-acre Area on the West Side of Moabi Regional Park: Final Groundwater Remedy, Topock Compressor Station, California* was completed on September 8, 2015.

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Biological Resources	BIO-2c	**Disturbance of Special-Status Species and Loss of Habitat Caused by Decommissioning.** To avoid impacts on special-status species that may occur within the project area as a result of decommissioning activities, an avoidance and minimization plan shall be developed and implemented through consultation with CDFW, BLM, and USFWS. These measures shall be based on surveys conducted prior to decommissioning, and during the breeding season (as previously defined in this EIR for each species or suite of species). Restoration of any disturbed areas shall include measures to achieve no net loss of habitat functions and values existing before project implementation. These measures shall be achieved by developing and implementing a habitat restoration plan submitted to CDFW, BLM, and USFWS that is agreeable to these agencies. The plan shall include a revegetation seed mix or plantings design, a site grading concept plan, success criteria for restoration, a monitoring plan for achieving no net loss of habitat values and functions, and an adaptive management plan.	Avoidance and Minimization Plan	During planning of the IM-3 Decommissioning and Site Restoration Plan, an Avoidance and Minimization Plan and a Habitat Restoration Plan will be developed and implemented through consultation with CDFW, BLM, and USFWS.	The IM-3 Decommissioning Work Plan will describe the general procedures for restoration of the land and habitats. The Avoidance and Minimization Plan and Habitat Restoration Plan associated with decommissioning activities will be based on surveys conducted prior to decommissioning, and during the breeding season; therefore these Plans will be prepared in the future, prior to decommissioning (note that PG&E will prepare a separate Habitat Restoration Plan in compliance with the Consent Decree; this Plan will be developed in coordination with the USFWS Havasu National Wildlife Refuge (HNWR) Manager and submitted with the Construction/Remedial Action Work Plan).	<u>Avoidance and Minimization Associated with Decommissioning of IM-3 Facilities and Site Restoration:</u> A detailed Avoidance and Minimization Plan to minimize disturbance to special status species and their habitats associated with the decommissioning of IM-3 facilities will be developed based on surveys conducted prior to decommissioning, and during the breeding seasons closest to the start date of decommissioning; therefore, this Plan will be prepared in the future, prior to decommissioning. <u>Avoidance and Minimization Associated with Decommissioning of Remedial Facilities and Site Restoration:</u> In compliance with this mitigation measure, a detailed Avoidance and Minimization Plan to minimize disturbance to special status species and their habitats associated with decommissioning of remedial facilities will be developed based on surveys conducted prior to decommissioning, and during the breeding seasons closest to the start date of decommissioning; therefore, this Plan will be prepared in the future, prior to decommissioning. General procedures and protocols for restoring the environment to its preconstruction conditions upon decommissioning of remedial facilities were developed and are included as part of the CIMP (CUL-1a-8e). Also in compliance with the CD, a separate Habitat Restoration Plan for the Refuge was prepared and included as an appendix of the Construction/Remedial Action Work Plan.	<u>Avoidance and Minimization Associated with Decommissioning of IM-3 Facilities and Site Restoration:</u> A detailed Avoidance and Minimization Plan to minimize disturbance to special status species and their habitats associated with the decommissioning of IM-3 facilities will be developed based on surveys conducted prior to decommissioning, and during the breeding seasons closest to the start date of decommissioning; therefore, this Plan will be prepared in the future, prior to decommissioning, when the data necessary to complete the Plan can be collected. <u>Avoidance and Minimization Associated with Decommissioning of Remedial Facilities and Site Restoration:</u> In compliance with this mitigation measure, a detailed Avoidance and Minimization Plan to minimize disturbance to special status species and their habitats associated with decommissioning of remedial facilities will be developed based on surveys conducted prior to decommissioning, and during the breeding seasons closest to the start date of decommissioning; this Plan will also be prepared in the future, prior to decommissioning, when the data necessary to complete the Plan can be collected. General procedures and protocols for restoring the environment to its preconstruction conditions upon decommissioning of remedial facilities were developed and are included in the Cultural Impact Mitigation Program Section 2.5 (see also CUL-1a-8e), which is included in Appendix H of the Construction/Remedial Action Work Plan. In compliance with the CD, a separate Habitat Restoration Plan for the Refuge was prepared and included in Appendix G of the Construction/ Remedial Action Work Plan.	The CIMP and the Habitat Restoration Plan for the Refuge are included in Appendices H and G of the C/RAWP, respectively. The C/RAWP was submitted concurrently with the final design on November 18, 2015.

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Biological Resources	BIO-3a	**Potential Impacts to Aquatic Habitat Related to Turbidity, Erosion, Sedimentation, and Overall Water Quality during Construction of the Intake Structure.** Hydrology & Water Quality Mitigation Measure HYDRO-1 shall be implemented in order to reduce water quality impacts related to erosion and pollutant runoff through implementation of BMPs. In addition, installing the cofferdam and dewatering a portion of the proposed intake structure site during fish screen construction may result in fish stranding. PG&E and its contractor shall coordinate with a qualified fisheries biologist to develop and implement a fish rescue plan. The fish rescue effort would be implemented during the dewatering of the area behind the cofferdam and would involve capturing those fish and returning them to suitable habitat within the river. The fish rescue plan shall identify and describe the following items: collection permits needed, fish capture zones, staffing, staging areas, fish collection and transport methods, species prioritization, resource agency contacts, fish handling protocols, fish relocation zones, site layout and progression of dewatering and fish rescue, and records and data. To ensure compliance, a fisheries biologist shall be present on-site during initial pumping (dewatering) activities and to oversee the fish rescue operation.		No further action is required. The preliminary (30%) design does not include a river water intake structure.	In response to comments on the 30% design submittals, PG&E prepared a technical memorandum to present additional details on three freshwater sources (groundwater from California, groundwater from Arizona, and Colorado River water). No further action is required. The intermediate (60%) design does not include a river water intake structure.	No further action is required. The pre-final (90%) design does not include a river water intake structure.	No further action is required. A river water intake is no longer considered as a potential source of fresh water for the remedy.	
Biological Resources	BIO-3b	**Potential Loss or Degradation of Aquatic Habitat.** To restore, replace, or rehabilitate habitat impacted by the intake structure, PG&E shall implement the measures described below. Unless as provided below, PG&E shall confer with CDFW regarding potential disturbance to fish habitat and shall obtain a streambed alteration agreement, pursuant to Section 1602 of the California Fish and Game Code, for construction work associated with intake structure construction; PG&E shall also confer with CDFW pursuant to the California Endangered Species Act (CESA) regarding potential impacts related to the loss of habitat or other operational impacts on state-listed fish species, respectively. PG&E shall comply with all requirements of the streambed alteration agreement and any CESA permits to protect fish or fish habitat or to restore, replace, or rehabilitate any important habitat on a "no-net-loss" basis. Alternatively, if CDFW declines to assert jurisdiction because it determines that CERCLA Section 121(e)(1) applies, the project proponent shall consult with CDFW regarding potential disturbance to fish habitat and shall meet the substantive policies of a streambed alteration agreement and of the CESA for		No further action is required. The preliminary (30%) design does not include a river water intake structure.	In response to comments on the 30% design submittals, PG&E prepared a technical memorandum to present additional details on three freshwater sources (groundwater from California, groundwater from Arizona, and Colorado River water). No further action is required. The intermediate (60%) design does not include a river water intake structure.	No further action is required. The pre-final (90%) design does not include a river water intake structure.	No further action is required. A river water intake is no longer considered as a potential source of fresh water for the remedy.	

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		construction work associated with intake structure construction and operations. PG&E shall comply with all substantive requirements of the streambed alteration agreement and CESA to protect fish and fish habitat or to restore, replace, or rehabilitate any important habitat on a "no-net-loss" basis and to operate the facility in accordance with CESA to ensure no net loss of habitat function.						
Biological Resources	BIO-3b	Additionally, PG&E shall consult with USACE regarding the need to obtain permits under section 404 of the CWA and section 10 of the Rivers and Harbors Act. In conjunction with these permitting activities, the USACE must initiate consultation with USFWS under Section 7 of the federal ESA regarding potential impacts of the proposed project on federally listed fish species due to the loss of habitat on federally listed fish species. PG&E shall implement any additional measures developed through the ESA Section 7 processes, or its equivalent, to ensure "no-net loss" of habitat function. Alternatively, if USACE and/or USFWS decline to assert jurisdiction because it determines that CERCLA Section 121(e)(1) applies, PG&E shall confer with USFWS regarding potential disturbance to federally listed fish species and federally listed fish species habitat and shall meet the substantive mandates under Section 7 of the federal ESA regarding potential impacts to fish or to habitat of federally listed fish species. PG&E shall implement any additional measures developed through that processes, including compliance with the substantive requirements of all of what would be permit conditions if not exempt pursuant to CERCLA, and to ensure "no-net-loss" of habitat function. Because the type and extent of habitat potentially affected is unknown, PG&E shall have an instream habitat typing survey conducted in the area potentially affected by the intake construction. Further, cooperation with USFWS and other fisheries biologists shall determine suitable and acceptable location(s) for the intake structure(s) to avoid the spawning habitat of special-status fish species. PG&E shall avoid habitat modifications, especially to habitat that is preferred by native fishes for spawning or rearing including side channels, cobble or gravel bars, and shallow backwaters. If these habitat types cannot be avoided, any disturbed habitat will be restored or replaced to achieve "no-net-loss" of habitat types and values as described above.	Instream Habitat Typing Survey Report	No further action is required. The preliminary (30%) design does not include a river water intake structure.	In response to comments on the 30% design submittals, PG&E prepared a technical memorandum to present additional details on three freshwater sources (groundwater from California, groundwater from Arizona, and Colorado River water). As part of the preparation of the technical memorandum, an instream habitat survey was conducted on April 4, 2012 to determine the preferred locations for spawning and rearing of the razorback sucker and bonytail chub. Survey results were presented in a technical memorandum entitled *Instream Habitat Typing Survey, Topock Compressor Station, Colorado River* (CH2M HILL 2012a). The report was provided to DTSC on May 25, 2012, and is included in Appendix A6 of this BOD report.	No further action is required. The pre-final (90%) design does not include a river water intake structure.	No further action is required. A river water intake is no longer considered as a potential source of fresh water for the remedy.	The Instream Habitat Typing Survey Technical Memorandum (CH2M HILL 2012a) was completed on May 25, 2012.

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Biological Resources	BIO-3c	**Potential Fish Entrainment and Impingement during Operation of the Intake Structure.** Both screened and unscreened diversions can entrain larval life stages of fish. For example, adverse effects to early life stages of fish could occur if diversions coincide with planktonic larval life stages that occur during summer months, a period of high entrainment vulnerability. Prior to operation of the intake structure, PG&E shall consult with USFWS and CDFW to determine the most vulnerable time of the year for entrainment or impingement of razorback sucker and bonytail chub eggs or larvae. PG&E shall install a state-of-the-art positive-barrier fish screen that would minimize fish entrainment and impingement at the intake structure. The fish screen shall be designed in accordance with CDFW and the National Marine Fisheries Service criteria, with specific consideration given to minimizing harm to fish eggs and other early life stages. To ensure that the fish screen operates as intended and reduce the risk of impacts, long-term monitoring of the operations and maintenance of the positive-barrier screen shall be conducted. Monitoring at the onset of diversions through the intake shall include approach velocity measurements immediately after the positive-barrier screen operations begin, with fine-tuning of velocity control baffles or other modifications as necessary, to achieve uniform velocities in conformance with the screen criteria established by regulatory agencies.		No further action is required. The preliminary (30%) design does not include a river water intake structure.	In response to comments on the 30% design submittals, PG&E prepared a technical memorandum to present additional details on three freshwater sources (groundwater from California, groundwater from Arizona, and Colorado River water). No further action is required. The intermediate (60%) design does not include a river water intake structure.	No further action is required. The pre-final (90%) design does not include a river water intake structure.	No further action is required. A river water intake is no longer considered as a potential source of fresh water for the remedy.	

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Cultural Resources	CUL-1a	**During Design, Construction, O&M, and Decommissioning Implement Measures to Avoid, Minimize, or Mitigate Impacts on Cultural Resources.** Establishment of a cultural impact mitigation program and a Corrective Measures Implementation Workplan (CMI Workplan), with specific activities stipulated for each phase of the project, will reduce the potential for impacts on historical resources within the project area, and will help preserve the values of and access to the Topock Cultural Area for local Tribal users. As detailed below, measures will be implemented to avoid known resources, re-use existing disturbed areas to the extent feasible, allow for Tribal input to the final design and maintain access for Tribal users during design, construction, operation, and decommissioning activities, as appropriate. During construction, a Worker Education Program and regular archaeological and Tribal monitoring will be implemented, and measures intended to reduce the potential for incursion by outside parties will be strengthened. This measure does not apply to the activities included as part of the East Ravine Revised Addendum, Groundwater Investigation (dated December 31, 2010).	Corrective Measure Implementation Work Plan (CMI) and Cultural Impact Mitigation Program (CIMP)	The Corrective Measure Implementation Work Plan (CMI Work Plan) was completed in November 2011. Work on the Cultural Impact Mitigation Program (CIMP) commenced in May 2011, the CIMP will be submitted with the final design (due 2012) as directed.	Work on the CIMP commenced in May 2011, and the CIMP will be submitted with the 90% design (due late 2013).	PG&E started work on the CIMP in May 2011, in coordination with Interested Tribes during face- to-face meetings or teleconference calls held once per month. On July 8, 2013, PG&E provided a preliminary draft CIMP (including the IM-3 Decommissioning Plan) to Interested Tribes. Tribes provided comments on the draft CIMP in October 2013. PG&E reviewed and discussed select comments and responses with the Tribes during the March and April 2014 Tribal Monthly Updates (TMUs). At DTSC's and Tribes' request, the CIMP (PG&E 2014) was submitted on May 1, 2014, in advance of the 90% design (see paragraph below for submittal dates related to the IM-3 Decommissioning Plan). PG&E incorporated select Tribes' comments in the May 1, 2014 CIMP, and sent Tribes a letter to explain why certain comments were not incorporated. <u>IM-3 Decommissioning Plan (Appendix B of CIMP)</u> A preliminary draft IM-3 Decommissioning Plan was submitted to the Fort Mojave Indian Tribe (FMIT) in April 2013. The FMIT provided comments on the preliminary draft Plan in June 2013. PG&E updated the draft Plan and submitted it to Interested Tribes as an appendix to the CIMP on July 8, 2013. The FMIT and the Hualapai Tribe provided comments on the updated Plan in October 2013. PG&E sent letters to respond to the Tribes' comments on July 8, 2014 and discussed the responses during the July TMU. PG&E incorporated select Tribes' comments and submitted a revised Plan with the 90% design on September 8, 2014.	Minor editorial updates (e.g., change 90% to final design) were made to the CIMP (PG&E 2015). The updated CIMP was included in Appendix H to the C/RAWP, which is submitted concurrently with the final design.	The Revised Groundwater CMI/RD Work Plan (CH2M HILL 2011a) was completed on November 2, 2011. The Cultural Impact Mitigation Program was included in Appendix H to the C/RAWP, which is submitted concurrently with the final design on November 18, 2015.

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Cultural Resources	CUL-1a-1	During development of the final design and the construction, operation, and decommissioning phases of the project, PG&E shall carry out and require all subcontractors to carry out all investigative, testing, and remediation activities, including all supporting operations and maintenance activities, in ways that avoid, minimize, and mitigate significant adverse effects to historically significant cultural and historic resources, consistent with the CEQA Guidelines, and including the Topock Cultural Area, to the maximum extent feasible as determined by DTSC.	Training material for cultural resources	Implementation of this measure will be carried out in a manner that respects cultural and historic resources, to the maximum extent feasible as determined by DTSC.	PG&E remediation resources specialist Glenn Caruso participated in field reviews of planned remedial facilities with the design team on April 23-24 and June 20, 2012. The purpose of these field reviews along with in-office reviews is to ensure that the footprints of planned facilities are designed in ways that avoid, minimize, and mitigate significant adverse effects to historically significant cultural and historic resources.	PG&E Cultural Resources Expert Glenn Caruso participated in field reviews of planned remedial facilities and construction footprints with the design team on April 7-10, 2014. He also led in-office reviews of locations of planned facilities and construction footprints. The purpose of these field reviews along with in-office reviews is to ensure that the footprints of planned facilities are designed in ways that avoid, minimize, and mitigate significant adverse effects to historically significant cultural and historic resources.	PG&E Cultural Resources Expert Glenn Caruso participated in field review of planned remedial facilities and temporary construction footprints at Moabi Regional Park in late 2014 and early 2015. Glenn Caruso also led in-office review of planned facilities and temporary construction-related footprints in September 2015. The purpose of the field review along with in-office reviews is to ensure that project footprints are designed in ways to avoid and minimize impacts on cultural and historical resources, consistent with the CEQA Guidelines, to the maximum extent feasible.	
Cultural Resources	CUL-1a-2	As part of the CMI Workplan, PG&E shall develop a written access plan to preserve Tribal members' access to, and use of, the project area for religious, spiritual, or other cultural purposes. This plan will allow access to the extent PG&E has the authority to facilitate such access, and be consistent with existing laws, regulations, and agreements governing property within the project area. The access plan may place restrictions on access into certain areas, such as the Compressor Station and the existing evaporation ponds, subject to DTSC review with regard to health and safety concerns and to ensure noninterference with approved remediation activities. This access plan may be developed in coordination with the federal agencies with land management responsibilities in the project area (e.g., BLM and USFWS) in accordance with the related stipulation (General Principle I.C) contained in the Programmatic Agreement (Appendix PA). PG&E shall demonstrate a good faith effort to coordinate with Interested Tribes[1] by including communication logs as part of the CMI Workplan. [1]*"Interested Tribes" means, for purposes of this EIR and the mitigation measures contained herein, the six Tribes that have substantially participated in the various administrative processes surrounding remediation of the site with DTSC, PG&E, and DOI, including throughout development of the final remedy. Interested Tribes include the Chemehuevi Indian Tribe, Cocopah Indian Tribe, Colorado River Indian Tribes, Fort Mojave Indian Tribe, Fort Yuma-Quechan Indian Tribe, and Hualapai Indian Tribe.*	Access Plan; Communication Log with Tribes (part of the EIR mitigation measure compliance reports)	In its June 17, 2011 comment on the Draft CMI Work Plan, DTSC stated that "Although DTSC specified that the site access and security plan are to be developed as part of the CMI Work Plan, DTSC acknowledges that the full scope of the plan cannot be accomplished without completion of the design. Therefore, DTSC agrees that PG&E can provide conceptual ideas within the CMI Work Plan for the development of a detailed plan as part of the final design." At the time of this writing, PG&E has been in contact with the BLM who has responsibility for preparing the Access Plan required by the PA. BLM has indicated that they are planning to complete their Access Plan by Fall 2011. Given the majority of land within the area is federal land, PG&E is waiting for BLM to complete their Access Plan in order to avoid the potential for inconsistencies. PG&E will then prepare an Access Plans for the lands not under federal management, for submittal with the final design (target late 2012).	PG&E has initiated work on an Access Plan for the lands not under federal management, taking into consideration the information in the BLM Access Plan, for submittal with the final design (target 2013). Communication logs with Tribes are submitted to DTSC quarterly as part of the quarterly EIR mitigation measures compliance reports (see Table 6.1-2 in the 60% BOD Report)	On October 21, 2013, PG&E provided the Tribes a draft of the Access Plan for lands not under federal management for review and comment. Tribal comments were received on November 22, 2013. PG&E has updated and discussed the plan at the July 24, 2014 TMU. The Access Plan is included as an appendix of the Construction/ Remedial Action Work Plan. Communication logs with Tribes are submitted to DTSC quarterly as part of the quarterly EIR mitigation measures compliance reports (the last quarterly report was submitted on July 31, 2014; the next quarterly report is due October 31, 2014).	The Access Plan to preserve Tribal members' access to and use of the project area for religious, spiritual, and other cultural purposes is included as an appendix of the Construction/Remedial Action Work Plan, which was submitted concurrently with the final design documents. Communication logs documenting efforts to coordinate with Tribes on the Access Plan have been submitted to DTSC quarterly as part of the quarterly EIR mitigation measures compliance reports.	The Access Plan is included in Appendix P (Cultural Resources Protocols) of the Construction/ Remedial Action Work Plan, which is submitted concurrently with the final design documents on November 18, 2015. Communication logs with Tribes are submitted to DTSC quarterly as part of the quarterly EIR mitigation measures compliance reports.

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Cultural Resources	CUL-1a-3	PG&E shall enhance existing measures to prevent and reduce incursions from recreational and/or other outside users from affecting unique archeological and historically significant resources, including resources within the Topock Cultural Area, by:		This mitigation measure will be met through actions taken to comply with CUL-1a-3a through 3d (see below).	This mitigation measure will be met through actions taken to comply with CUL-1a-3a through 3d (see below).	This mitigation measure will be met through actions taken to comply with CUL-1a-3a through 3d (see below).	This mitigation measure will be met through actions taken to comply with CUL-1a-3a through 3d (see below).	See CUL-1a-3a and CUL-1a-3d.
Cultural Resources	CUL-1a-3a	a. Retaining a Qualified Cultural Resource Consultant to implement the Mitigation Monitoring and Reporting Program (MMRP) and conducting yearly inspections (or less frequently upon approval by DTSC) of identified historical resources, including inspections of the Topock Cultural Area, to determine if substantial adverse changes have occurred relative to the condition of the historical resources during the past year or prior to the implementation of the proposed project. PG&E shall offer to retain a Tribal monitor at historic rates of compensation or Tribal representatives designated by the Tribal Council or chairperson, if so requested, to accompany the Qualified Cultural Resources Consultant during the inspections. The Qualified Cultural Resource Consultant shall be a person who is acceptable to DTSC and who is also a qualified archaeologist with a graduate degree in archaeology, anthropology or closely related field, plus at least 3 years of full-time professional experience in general North American archaeological research and fieldwork, with expertise/experience in the Southwest preferred.	Annual cultural resources monitoring report	PG&E has retained qualified cultural resources consultants for implementation of the MMRP, subject to DTSC's approval.	On January 27, 2012, PG&E nominated Applied Earthworks, Inc. (AE) as the qualified cultural resource consultant for the groundwater remedy project and requested DTSC's consideration and approval of AE. On March 2, 2012, DTSC accepted PG&E's nomination and approved AE as the qualified cultural resource consultant for the groundwater remedy project. In 2012, the Annual Cultural Monitoring event was conducted November 5 through 7, 2012.	The 2013 annual report titled "*Topock Compressor Station Groundwater Remediation Project: Condition Assessments at Sixty-Nine Archaeological and Historical Sites*" (AE 2014a) was submitted to DTSC on March 12, 2014. On December 2, 2014, AE as PG&E's Qualified Cultural Resource Consultant conducted archaeological and historical field surveys of the locations considered for project features in Moabi Regional Park. A brief summary of the survey results was included in Appendix A11 of the Supplemental 90%.	The 2014 annual archaeological monitoring of the identified sites within the groundwater remedy project area was conducted December 11-19, 2014. The report was submitted to DTSC on March 2, 2015 (AE 2015). On June 24-26, 2015, PG&E conducted field surveys of the additional locations considered for remedy features in Moabi Regional Park. Survey results were summarized in a technical memorandum submitted on September 2, 2015.	DTSC accepted PG&E's nomination and approved AE as the qualified cultural resource consultant for the groundwater remedy project on March 2, 2012. PG&E has offered to retain Tribal monitors at historical rates of compensation.
Cultural Resources	CUL-1a-3b	b. Developing a site security plan as part of the CMI Workplan. The site security plan shall include, but not be limited to, instructions for PG&E personnel to inspect the project site routinely during construction and report any human-caused disturbance to project facilities and the surrounding environment to DTSC and the appropriate landowner, such as BLM, USFWS, or FMIT, as appropriate, depending on the ownership of the property involved in the incursion. Notification shall be within a specified period, as established in the site security plan for the event, and shall also be summarized as part of the periodic implementation status report, as approved by DTSC for remedy implementation. This measure does not impose any obligation on PG&E to perform law-enforcement duties on federal or private lands, but is intended to provide increased observation of potential intrusions into the project area during construction and operation of the final remedy that may impact significant cultural resources. PG&E staff, or assigned agents, should be instructed to report any outside disturbance to the environment personally observed over the course of the working	Site security plan	In its June 17, 2011 comment on the Draft CMI Work Plan, DTSC stated that "Although DTSC specified that the site access and security plan are to be developed as part of the CMI Work Plan, DTSC acknowledges that the full scope of the plan cannot be accomplished without completion of the design. Therefore, DTSC agrees that PG&E can provide conceptual ideas within the CMI Work Plan for the development of a detailed plan as part of the final design." PG&E provided concepts of security provisions in the CMI Work Plan (Section 4.2.3). PG&E will prepare a site security plan for submittals as part of the final design (target late 2012).	Work on the site security plan has begun. The site security plan is planned for submittal as part of the 90% design (target late 2013).	A site security plan titled *"Groundwater Remedial Action Site Security Plan"* is included in an appendix of the Construction/ Remedial Action *Work Plan.* Also, PG&E will summarize any reports of human-caused disturbance to project facilities and the surrounding environment in the EIR mitigation monitoring compliance reports to be prepared quarterly during construction and annually during operations.	The Site Security Plan was revised in response to comments and included as Appendix Q of the Construction/ Remedial Action Work Plan. PG&E will summarize any reports of human-caused disturbance to project facilities and the surrounding environment in the EIR mitigation monitoring compliance reports to be prepared quarterly during construction and annually during operations.	A site security plan titled *Revised Groundwater Remedial Action Site Security Plan* is included in Appendix Q of the Construction/ Remedial Action Work Plan, which is submitted concurrently with the final design on November 18, 2015.

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		day. Information shall be reported within a specific period, as established in the site security plan, to DTSC and the appropriate landowners, such as BLM, USFWS, or FMIT, depending on the ownership of the property intruded upon. The site security plan may also include the use of PG&E security cameras at major ingress/egress gates into the project site. Finally, if requested by the FMIT the plan may include the use of private security personnel to patrol the FMIT-owned parcel within the project area to prevent outside incursions.						
Cultural Resources	CUL-1a-3c	c. Coordinating with BLM and San Bernardino County to facilitate an outreach effort to the staff at Moabi Regional Park, requesting that they communicate to visitors the parts of the project area that are off limits to off-road vehicle usage because of health and safety concerns, public lands management plans, or landowner requests. PG&E shall make a good faith effort to involve the surrounding Tribes in this outreach effort, providing Interested Tribes with the opportunity to comment on outreach materials or provide a Tribal cultural resources specialist the opportunity to participate in the outreach activities. As part of this outreach effort, PG&E shall work with Moabi Regional Park and offer to design, develop, and fund the installation of an informational kiosk within Moabi Regional Park that informs visitors of the work being done at the project site. PG&E shall involve the Tribes to the maximum extent feasible, as determined by DTSC, in the design and development of the informational kiosk.	Design submittals	PG&E is currently in the process of implementing this mitigation measure.	PG&E is currently in the process of implementing this mitigation measure and has discussed with Interested Tribes at the monthly meetings on November 22, 2011, December 22, 2011, January 26, 2012, and March 22, 2012. To date, Tribal inputs have been received for this measure. PG&E is coordinating with BLM and San Bernardino County on constructing an information kiosk within Moabi Regional Park and posting signage to communicate restrictions to off-road vehicle usage in part of the project area and inform visitors of the work being done at the site.	PG&E has prepared a protocol for a) outreach to Moabi Regional Park staff regarding communication to visitors about the restrictions for off-road vehicle use, and b) establishing an information kiosk. The protocol was included as an appendix of the Construction/Remedial Action Work Plan.	PG&E has prepared a protocol for outreach to Moabi Regional Park staff regarding communication to visitors about the restrictions for off-road vehicle use, and establishing an information kiosk. The protocol is included in Appendix P of the Construction/Remedial Action Work Plan, which is submitted concurrently with the final design. The protocol includes the requirement that PG&E communicate with the surrounding Tribes on the outreach materials, providing Interested Tribes the opportunity to comment on outreach materials.	A protocol was developed in compliance with this measure, and included in Appendix P of the Construction/Remedial Action Work Plan, which is submitted concurrently with the final design on November 18, 2015.
Cultural Resources	CUL-1a-3d	d. Posting signage to indicate those parts of the project area that are off limits to off-road vehicle usage due to possible health and safety concerns and to reduce potential damage to environmental resources. If agreed to by land owners and/or local, state, or federal management entities within the project area, PG&E shall work with the relevant land owner or land management entity to develop, design, and fund the installation of easily visible and clear signage. This may include coordination with BLM to install signage noting the designation of the area as an Area of Critical Environmental Concern owing to its biological and cultural resources, while ensuring that signs are placed in a way that does not draw unwanted attention to specific resources.	Design submittals	PG&E will seek to work with land owners and land management entities (BLM, the Refuge, USFWS) during the design so that the signage can be established prior to commencing construction activities; implementation of this measure may take longer, however, depending upon requirements of land owners and land management entities.	PG&E will seek to work with land owners and land management entities (BLM, the Refuge, USFWS) during the design so that the signage can be established prior to commencing construction activities; implementation of this measure may take longer, however, depending upon requirements of land owners and land management entities.	PG&E has prepared a protocol to establish signage to indicate areas that are off limits to off-road vehicle usage in coordination with BLM and other relevant landowners. The protocol was included as an appendix of the Construction/ Remedial Action Work Plan.	PG&E has prepared a protocol to establish signage to indicate areas that are off limits to off-road vehicle usage in coordination with BLM and other relevant landowners. The protocol was included in Appendix P of the Construction/Remedial Action Work Plan, which is submitted concurrently with the final design.	A protocol was developed in compliance with this measure, and included in Appendix P of the Construction/Remedial Action Work Plan is submitted concurrently with the final design on November 18, 2015.

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Cultural Resources	CUL-1a-4	PG&E shall work with representative members of the Interested Tribes to convene and retain a multidisciplinary panel of independent scientific and engineering experts as part of a Technical Review Committee (TRC). The TRC shall be made up of not more than five multidisciplinary experts who will be on call to review project-related documents, participate in project-related meetings, and advise interested Tribal members on technical matters relating to the final design and remedy. The TRC shall include only persons with technical expertise, including but not limited to geology, hydrology, water quality, engineering, paleontology, toxicology, chemistry, biology, or botany. Before July 1, 2011, PG&E shall post an open grant or Request for Qualifications (RFQ) and retain members of the TRC at rates comparable to those paid historically to Tribal experts by PG&E for the remediation project. TRC members shall be selected by majority vote of one representative from each participating Interested Tribe. PG&E shall provide Interested Tribes at least 30-days' notice of the meeting to select TRC members and to review TRC candidate qualifications. For the purposes of contracting, the grant may be awarded to one Tribal government to manage or, alternatively, PG&E may reimburse the Tribe or TRC members directly. The entirety of the monies shall be used to fund the scientific and engineering team exclusively, and shall not be used to fund other Tribal government expenses or used to support legal counsel. A stipulation of the open grant shall be that the scientific and engineering team shall provide all deliverables and results to all involved Tribes, despite a possible contract agreement with only one Tribe or with PG&E. Upon conclusion of the construction phase of the project, the necessity and dollar value of the TRC shall be assessed by PG&E and, with the approval of DTSC, shall either be extended, reduced, or terminated under the operations and maintenance phase. An annual activity report shall be sent to DTSC for review and to ensure PG&E is in compliance.	EIR mitigation measures compliance reports (quarterly during design/ construction, annual during operation)	In compliance with this measure, PG&E posted a Request for Qualifications on several job boards, TRC members have been retained, and the TRC has been convened.	In March 2012, PG&E expanded the TRC scope to include review of documents related to the soil investigation at locations outside the Compressor Station. As directed by this measure, an annual activity report was submitted to DTSC on June 29, 2012. In addition, TRC activities are summarized and included in the quarterly EIR mitigation measures compliance reports.	As directed by this measure, the second annual activity report titled "*Annual Report Technical Review Committee Activities, Topock Compressor Station Groundwater Remediation Project, San Bernardino County, California"* (HDR 2013) was submitted on November 26, 2013. In addition, TRC activities are summarized and included in the quarterly EIR mitigation measures compliance reports (the last quarterly report was submitted on July 31, 2014; the next quarterly report is due October 31, 2014).	TRC activities are summarized and included in the quarterly EIR mitigation measures compliance reports. The 2014 annual TRC report was submitted in January 2015 (HDR 2015). PG&E continues to fund TRC members at rates comparable to those historically paid to Tribal experts by PG&E for the remediation project through an open grant. Upon conclusion of the construction phase of the project, the necessity and dollar value of the TRC will be assessed by PG&E and, with the approval of DTSC, shall either be extended, reduced, or terminated during the operations and maintenance phase.	The TRC was convened on July 1, 2011. The first annual activity report was submitted on June 29, 2012. The second annual activity report was submitted on November 26, 2013. The third annual activity report was submitted in January 2015.

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Cultural Resources	CUL-1a-5	Should any indigenous plants of traditional cultural significance and listed in Appendix PLA of this FEIR be identified within the project area, PG&E shall avoid, protect, and encourage the natural regeneration of the identified plants when developing the remediation design, final restoration plan, and IM-3 decommission plan. In the event that impacts on the identified plants cannot be avoided and such plants will be displaced, PG&E shall retain a qualified botanist who shall prepare a plant transplantation/monitoring plan which can be included as part of the Cultural Impact Mitigation Program (CIMP) referenced in CUL-1a-8 either by (1) transplanting such indigenous plants to an on-site location, or (2) providing a 2:1 ratio replacement to another location decided upon between PG&E and members of the Interested Tribes. Plans to transplant or replace such plants shall be approved by DTSC. In coordination with the qualified botanist, PG&E shall monitor all replanted and replacement plants for at least 5 years, and shall ensure at least a 75 percent survivorship during that time. This mitigation measure is not meant to replace or subsume any actions required by state or federal entities with regard to the protection of species listed as rare, threatened, or endangered.	Mitigation and monitoring plan for culturally sensitive plants	A floristic survey was completed on November 1 through 8, 2011 to establish a comprehensive inventory of plant species that occur in the EIR project area, identify sensitive plants species and to comply with this mitigation measure, which requires PG&E to avoid, protect, and encourage the regeneration of ethnobotanically significant plants listed in Appendix PLA of the EIR. The survey methodology is summarized in a technical memorandum entitled "*Topock Groundwater Remediation Project, Floristic Survey Methodology*" (CH2M HILL 2011c) and is included in Appendix A3 of this Basis of Design Report. Another round of floristic survey will held in the Spring 2012, however, the exact timing of the survey will be determined by a qualified botanist. A map will be prepared to document the survey results.	A continuation of the Fall 2011 floristic survey was conducted from March 12 to 20, 2012. Additional floristic survey was conducted from March 12 through 14 2013. On March 29, 2013 PG&E submitted two reports related to plant surveys: a) The first report titled "Topock Groundwater Remediation Project Floristic Survey Report" summarizes the floristic survey results from 2011 and 2012; this report is included in Appendix A5 of this BOD report. Results from 2013 are planned to be included in the next design deliverable associated with the freshwater source details. b) The second report titled "Topock Groundwater Remediation Project Ethnobotany Survey Report" summarizes the survey results for ethnobotanically sensitive plants from 2011 and 2012; this report is included in Appendix A7 of this BOD report. Results from 2013 are planned to be included in the next design deliverable associated with the freshwater source details. In addition, PG&E is working with interested Tribes on the plant transplantation/monitoring plan required under this measure, as part of the CIMP.	A Revised Floristic Survey Report (CH2M HILL 2013h) summarizing survey results from 2011 through 2013, including freshwater supply sites, was submitted on December 30, 2013. The report is also included in Appendix A5 of the 90% BOD. A Revised Ethnobotany Survey Report (CH2M HILL 2014e) summarizing survey results from 2011 through 2013 was submitted on January 15, 2014. The report is also included in Appendix A7 of the 90% BOD. The *Supplemental Ethnobotanical Plant Surveys for the Pacific Gas and Electric Company's Topock Compressor Station, San Bernardino, California* report (CH2M HILL 2014f) summarizing the December 2013 Survey results was submitted on February 28, 2014. The supplemental report is also included in Appendix A7 of the 90% BOD. In compliance with this measure, a mitigation and monitoring plan for culturally sensitive plants was prepared and included as Appendix A of the CIMP. In support of the Supplemental 90% design, PG&E conducted biological surveys of the 6.74-acre Construction Headquarters and soil management area at Moabi Regional Park on November 19, 2014 to identify existing mature plant specimens and indiginous plants of traditional cultural significance. The survey results were summarized in a technical memorandum titled *Assessment of Biological Resources for the Proposed Soil Management Areas* (CH2M HILL 2015b); this memorandum provides general information of the flora and fauna observed in the areas added to the original project area, and also supplements information on the biological resources presented in prior project documents related to mature vegetation, ethnobotanical plants, and jurisdictional wetlands	On January 30, 2015, PG&E conducted biological surveys (including indigenous plants of traditional cultural significance) of the area proposed for remedy use at Moabi Regional Park. On June 24-25, 2015, in conformance with direction from DTSC, PG&E conducted biological surveys (including indigenous plants of traditional cultural significance) of an additional 35-acre area on the west side of Moabi Regional Park. The survey results were summarized in a technical memorandum titled *Assessment of Biological Resources for a 35-acre Area on the West Side of Moabi Regional Park* (CH2M HILL 2015d). This memorandum provides updates to the January 2015 memorandum as well as information on the natural resources observed within the larger 35-acre area, and is also included in Appendix A10 of this report. In addition, a technical memorandum titled *Assessment of Biological Resources for the Proposed Sewer and Firewater Lines for the Construction Headquarters, Final Groundwater Remedy, Topock Compressor Station, California* (CH2M HILL 2015c) was prepared to provide a general assessment of biological and cultural resources (including indigenous plants of traditional cultural significance) that could be affected by the proposed sewer and fire water lines that may be installed in the future and are associated with the construction headquarters facilities that would be located to the west of Moabi Regional Park, south of the National Trails Highway. The memo was completed on August 5, 2015 and submitted for review during the 90% RTC process and is included in Appendix A10 of this report. The Preliminary Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station,	The survey methodology technical memorandum was completed on October 31, 2011, and provided to Interested Tribes on November 8, 2011. The revised Final Floristic Survey Report was completed on December 30, 2013. The revised Final Ethnobotany Survey Report was completed on January 15, 2014. A supplemental report was completed on February 28, 2014. A mitigation and monitoring plan for culturally sensitive plants was prepared and included as Appendix A of the CIMP. The Assessment of Biological Resources for the Proposed Soil Management Areas was completed on January 19, 2015, and submitted with the Supplemental 90% on February 5, 2015. The *Assessment of Biological Resources for the Proposed Sewer and Firewater Lines for the Construction Headquarters, Final Groundwater Remedy, Topock Compressor Station, California* was completed on August 5, 2015 and submitted for review during the 90% RTC process. The *Assessment of Biological Resources for a 35-acre Area on the West Side of Moabi Regional Park: Final Groundwater Remedy, Topock Compressor Station, California* was completed on September 8, 2015. The revised *Preliminary Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California* (CH2M HILL 2015c) was submitted with the Construction/ Remedial Action Work Plan on November 18, 2015.

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						and waters. The technical memorandum was included in Appendix A10 of the Supplemental 90%. A technical memorandum titled *Preliminary Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California* (CH2M HILL 2015e) identifies potential revegetation areas where mitigation vegetation could be planted to offset potential plant impacts that may occur during construction of the remedy. The memo was completed on January 27, 2015 and included in Appendix V of the Supplemental 90% for review and comment.	California was revised to incorporate review comments, and was submitted with the Construction/Remedial Action Work Plan concurrently with the final design.	
Cultural Resources	CUL-1a-6	All additional phone calls and alarms associated with remediation activities or facilities shall not be routed through PG&E's existing alarm system utilized at the compressor station. The notification system for remediation-related alerts and/or phone calls shall not introduce additional noise to the project area, to the maximum extent feasible, provided there is ongoing compliance with applicable safety regulations or standards of the Federal Energy Regulatory Commission, Occupational Safety and Health Administration, and other agencies. (See Mitigation Measure NOISE-3 for additional mitigation related to the Topock Cultural Area).	Design submittals	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of this Basis of Design Report for the preliminary design. In addition, the detailed specification for phone calls and alarms associated with remediation activities will also be included the intermediate (60%) design.	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of the BOD Report for the intermediate (60%) design.	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of the BOD Report for the pre-final (90%) design.	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of this Final BOD Report for the final design.	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of the BOD Report for the final design, submitted on November 18, 2015.
Cultural Resources	CUL-1a-7	Nighttime construction-related activities shall be limited to work that cannot be disrupted or suspended until the following day, such as, but not limited to, well drilling and development or decommissioning activities. Lighting considerations, including the potential use of solar power for some lighting, shall be included as part of the remedial design plan to be developed with involvement of Interested Tribes and the U.S. Department of the Interior. To minimize construction and operations-related lighting impacts, the lighting in the remedial design plan shall include, at a minimum: (1) shrouding/shielding for portable lights needed during construction and operational activities; (2) installation of portable lights at the lowest allowable height and in the smallest number feasible to maintain adequate night lighting for safety; (3) shielding and orientation of lights such that off-site visibility of light sources, glare, and light from construction activities is minimized to the extent	Design submittals	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of this Basis of Design Report for the preliminary design (see C.5.2). In addition, the detailed specification for lighting will also be included the intermediate (60%) design.	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of the BOD Report for the intermediate (60%) design. PG&E discussed this measure with interested Tribes in the monthly meetings on April 26, 2012, July 27, 2012, October 25, 2012, and November 9, 2012.	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of the BOD Report for the pre-final (90%) design.	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of this BOD Report for the final design.	The requirements of this mitigation measure were incorporated into the design criteria in Appendix C of the final design, submitted on November 18, 2015. The protocol for implementing CUL-1a-7 was included in Appendix P of the C/RAWP, which was submitted on November 18, 2015.

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		feasible. No additional permanent poles shall be installed for lighting. This mitigation measure is not meant to replace or subsume any actions required by the County or state or federal entities with regard to lighting required for minimum security and safety purposes.						
Cultural Resources	CUL-1a-8	Prior to commencement of construction, PG&E shall submit as part of the final Remedial Design, a CIMP developed in coordination with Interested Tribes for DTSC's review and approval. The CIMP may be developed in coordination with the federal agencies with land management responsibilities in the project area (e.g., BLM and USFWS) in accordance with the Programmatic Agreement (Appendix PA). The CIMP shall include, at a minimum and to DTSC's satisfaction, the following:	CIMP	Work on the CIMP commenced in May 2011. The CIMP will be submitted as part of final design as directed.	Work on the CIMP is ongoing. PG&E has been working collaboratively with interested Tribes on various sub-measures under the CIMP. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	PG&E started work on the CIMP in May 2011, in coordination with Interested Tribes during face- to-face meetings or teleconference calls held once per month. On July 8, 2013, PG&E provided a preliminary draft CIMP (including the IM-3 Decommissioning Plan) to Interested Tribes. Tribes provided comments on the draft CIMP in October 2013. PG&E reviewed and discussed select comments and responses with the Tribes during the March and April 2014 TMUs. At DTSC's and Tribes' request, the CIMP (PG&E 2014) was submitted on May 1, 2014, in advance of the 90% design (see paragraph below for submittal dates related to the IM-3 Decommissioning Plan). PG&E incorporated select Tribes' comments in the May 1, 2014 CIMP, and sent Tribes a letter to explain why certain comments were not incorporated. <u>IM-3 Decommissioning Plan (Appendix B of CIMP)</u> A preliminary draft IM-3 Decommissioning Plan was submitted to the FMIT in April 2013. The FMIT provided comments on the preliminary draft Plan in June 2013. PG&E updated the draft Plan and submitted to Interested Tribes as an appendix to the CIMP on July 8, 2013. The FMIT and the Hualapai Tribe provided comments on the updated Plan in October 2013. PG&E sent letters to respond to the Tribes' comments on July 1 and discussed the responses during the July TMU. PG&E incorporated select Tribes' comments and submitted a revised Plan with the 90% design on September 8, 2014.	Minor editorial updates (e.g., change 90% to final design) were made to the CIMP (PG&E 2015). The updated CIMP was included in Appendix H to the C/RAWP, which is submitted concurrently with the final design.	The Cultural Impact Mitigation Program was included in Appendix H to the C/RAWP, which was submitted concurrently with the final design on November 18, 2015.

TABLE 6.1-1
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Groundwater Remedy Basis of Design Report/Final (100%) Design
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Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)				Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design	
Cultural Resources	CUL-1a-8a	a. Protocols for continued communication. Consistent with past practice and the communication processes previously entered into by PG&E with Interested Tribes, the company shall continue to communicate with Interested Tribes during the design, construction, operation, and decommissioning of the project. Prior to implementation of construction, PG&E shall communicate with Interested Tribes that place cultural significance on the Topock Cultural Area. Outreach efforts between the Tribes and PG&E shall be communicated by PG&E to DTSC quarterly during the design and construction phase for review and input, and annually during project operations.	EIR mitigation measures compliance reports (quarterly during design/ construction, annual during project operation)	Outreach efforts have been and are ongoing. Table 7-2 of the 30% BOD Report contains a log of Tribal communications for the specified time period. With the completion of the CMI Work Plan in November 2011, PG&E will start to submit quarterly reports to DTSC, starting with the first report (Q4 2011) in January 2012.	Outreach efforts have occurred and are ongoing. Protocols for continued communication are being developed as part of the CIMP. This measure was discussed with interested Tribes at the monthly meeting on May 24, 2012 and December 4, 2012. As required by DTSC, a log of communications with interested Tribes has been maintained and included in the quarterly EIR mitigation measure compliance reports since January 2012. The last quarterly report was submitted to DTSC on January 31, 2013. Table 6.1-2 of the 60% BOD Report contains a log of Tribal communications since the start of Q1 2013 through March 19, 2013.	Outreach efforts have occurred and are ongoing (e.g., monthly TMUs). Protocols for continued communication were developed and included as part of the CIMP. As required by DTSC, a log of communications with interested Tribes has been maintained and included in the quarterly EIR mitigation measure compliance reports since January 2012. The last quarterly report was submitted on July 31, 2014; the next quarterly report is due October 31, 2014.	Communication with Interested Tribes has occurred and is ongoing (e.g., monthly TMUs). Protocols for continued communication were developed and included as part of the CIMP. As required by DTSC, a log of communications with interested Tribes has been maintained and included in the quarterly EIR mitigation measure compliance reports since January 2012. The last quarterly report was submitted on October 31, 2015; the next quarterly report is due January 31, 2016.	Outreach efforts have occurred and are ongoing (e.g., monthly TMUs). Protocols for continued communication were developed and included as part of the CIMP, included as Appendix H of the C/RAWP submitted on November 18, 2015. As required by DTSC, a log of communications with interested Tribes has been maintained and included in the quarterly EIR mitigation measure compliance reports since January 2012.
Cultural Resources	CUL-1a-8b	b. Protocols for the appropriate treatment of archaeological materials that may be disturbed or discovered during implementation of the final remedy, including protocols for the repatriation of significant items of cultural patrimony that may be recovered during the project, and protocols for the curation of cultural materials recovered during the project. Treatment of archaeological sites may include data recovery or capping. If data recovery is proposed, a Research Design following California Office of Historic Preservation guidelines or federal guidelines, as applicable, shall be prepared and reviewed and approved by DTSC.	CIMP	The required protocols will be developed and included in the CIMP. The CIMP will be submitted with the final design as directed.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on March 23 2012. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meeting on June 28, 2012 and December 4, 2012. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	Protocols for the appropriate treatment of archaeological materials that may be disturbed or discovered during implementation of the final remedy were developed and included as part of the CIMP.	Protocols for the appropriate treatment of archaeological materials that may be disturbed or discovered during implementation of the final remedy were developed and included as part of the CIMP.	Protocols were included as part of the CIMP and submitted on November 18, 2015.
Cultural Resources	CUL-1a-8c	c. Protocols for the review of cultural resource-related documents throughout the design, construction, and operational phases.	CIMP	Draft protocols for review of cultural resource-related documents were included in the CMI Work Plan (Section 4.8), and will also be included in the CIMP. The CIMP will be submitted with the final design as directed.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on March 23 2012. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meeting on June 28, 2012, August 23, 2012, September 19, 2012, September 27, 2012, and January 15, 2013. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	Protocols for the review of cultural resource-related documents throughout the design, construction, and operational phases were developed and included as part of the CIMP.	Protocols for the review of cultural resource-related documents throughout the design, construction, and operational phases were developed and included as part of the CIMP.	Protocols were included as part of the CIMP and submitted on November 18, 2015.

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Cultural Resources	CUL-1a-8d	d. Protocols for the review of project design documents before the beginning of construction, including reviews of project design documents throughout the design process (e.g., Preliminary [approximately 30% completed], Intermediate [approximately 60% completed] and Pre-final design).	CIMP	Draft protocols for review of project design documents were included in the CMI Work Plan (Section 4.8), and will also be included in the CIMP. The CIMP will be submitted with the final design as directed.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on March 23 2012. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meetings on February 23, 2012, March 22, 2012, April 26, 2012, May 24, 2012, and January 15, 2013. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	Protocols for the review of project design documents were developed and included as part of the CIMP.	Protocols for the review of project design documents were developed and included as part of the CIMP.	Protocols were included as part of the CIMP and submitted on November 18, 2015.
Cultural Resources	CUL-1a-8e	e. Protocols for the appropriate methods to be used to restore the environment to its preconstruction condition upon decommissioning of individual groundwater remedy facilities.	CIMP	The required protocols will be developed and included in the CIMP. The CIMP will be submitted with the final design as directed.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on March 23 2012. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with Interested Tribes at the monthly meeting on January 15, 2013. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	Protocols for the appropriate methods to be used to restore the environment to its preconstruction condition upon decommissioning of individual groundwater remedy facilities were developed and included as part of the CIMP.	Protocols for the appropriate methods to be used to restore the environment to its preconstruction condition upon decommissioning of individual groundwater remedy facilities were developed and included as part of the CIMP.	Protocols were included as part of the CIMP and submitted on November 18, 2015.
Cultural Resources	CUL-1a-8f	f. A plan for the decommissioning and removal of the IM-3 Facility and proposed restoration of the site (to be an appendix to the CIMP).	Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration	The plan for the decommissioning and removal of the IM-3 Facility and Site Restoration will be included as an appendix to the CIMP. The CIMP will be submitted with the final design as directed.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on March 23 2012. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	The plan for the decommissioning and removal of the IM-3 Facility and site restoration was developed and included in Appendix B of the CIMP and also as an appendix of the Construction/Remedial Action Work Plan.	The plan for the decommissioning and removal of the IM-3 Facility and site restoration was revised to incorporate comments. The revised plan is included in Appendix B of the CIMP and also as an appendix of the Construction/Remedial Action Work Plan.	The revised IM-3 Decommissioning Plan was submitted as Appendix B of the CIMP, and submitted as Appendix F of the C/RAWP on November 18, 2015.

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Cultural Resources	CUL-1a-8g	g. Protocols for the repatriation of clean soil cuttings generated during construction activities and during drilling associated with repair/replacement activities during operations and maintenance phases. The soil cuttings shall be managed in compliance with applicable laws and regulations on site.	CIMP	Discussions regarding repatriation of soils have been and are ongoing since early 2011. The required protocols will be developed and included in the CIMP. The CIMP will be submitted with the final design as directed.	Discussions regarding protocols for the repatriation of soils have been and are ongoing since early 2011. Agencies and Tribal members reviewed and provided inputs on the draft *Management Protocol for Handling and Disposition of Displaced Site Material*, as well as participated in conference calls (January 9, 2012, April 10, 2012, June 15, 2012, and August 2012) to discuss comments. A revised protocol along with responses to comments (RTCs) was sent to Agencies and Tribes for review on August 28, 2012. FMIT sent a comment letter on the revised protocol and RTCs on September 7, 2012. DTSC responded to FMIT on September 18, 2012. Tribes and Agencies met on October 16, 2012 to further discuss RTC process. Subsequent to this meeting, DTSC issued directives for implementation of an updated RTC process. On January 14, 2013, the revised protocol was reissued along with updated RTCs (that reflected the updated RTC process) as part of the Final Soil RCRA Facility Investigation/Remedial Investigation Work Plan (CH2M HILL 2013b). The revised protocol is also included in Appendix B of the Soil Management Plan (Volume 4 of the Draft O&M Manual), and will again be included in the CIMP. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	The revised *Management Protocol for Handling and Disposition of Displaced Site Material* was included in Appendix C of the CIMP, Appendix B of the Soil Management Plan (Volume 4 of the Revised O&M Manual), and also as an appendix of the Construction/Remedial Action Work Plan. Detailed procedures to implement the management protocol are included in the Soil Management Plan.	The revised *Management Protocol for Handling and Disposition of Displaced Site Material* (PG&E 2015b), which is the protocol for the repatriation of clean soils cuttings generated during construction and O&M, was revised in response to 90% comment #803. A draft redline of the protocol was provided for discussion during the 90% RTC process at the July 23, August 19, and August 26, 2015 Technical Working Group (TWG) meetings. The revised protocol is included in Appendix C of the CIMP, Appendix B of the Soil Management Plan (Volume 4 of the Revised O&M Manual), and also as an appendix of the Construction/Remedial Action Work Plan. Detailed procedures to implement the management protocol are included in the Soil Management Plan.	The revised protocol was included as part of the CIMP and submitted on November 18, 2015.

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Cultural Resources	CUL-1a-8h	h. Protocols for the appropriate methods, consistent with Mitigation Measure NOISE-3, to reduce auditory impacts.	CIMP	The required protocols will be developed and included in the CIMP. The CIMP will be submitted with the final design as directed.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on March 23 2012. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval. This measure was discussed with interested Tribes at the monthly meeting on February 19, 2013.	Protocols for the appropriate methods, consistent with Mitigation Measure NOISE-3, to reduce auditory impacts, were developed and included as part of the CIMP.	Protocols for the appropriate methods, consistent with Mitigation Measure NOISE-3, to reduce auditory impacts, were developed and included as part of the CIMP. Specifically, the following communication protocols developed as part of the CIMP noise protocol (Section 2.8.4) will be implemented. All project construction activities will be communicated to nearby noise-sensitive receptors and Interested Tribes. Elements of this communication include: • A detailed project schedule is established and published for all stakeholders. • Monthly notification to agencies and Tribes of scheduled field activities. During periods of extensive construction activity, these notifications will be issued more frequently – weekly and/or daily, as appropriate. • After issuing these notifications, notify the nearby noise-sensitive receptors and Tribes of any schedule changes. • Provide an open-communication process for Tribal representatives to seek more information about Project noise-generating activities. PG&E welcomes Tribal input on timing of Project noise-generating activities and on potential noise-reducing methods. Per CUL-1a-8k, if ceremonies are requested by any Tribe during construction, then PG&E will follow the protocol to accommodate such requests, which could include monitoring to ensure that construction noise does not exceed the normally acceptable exterior noise level standard in San Bernardino County for places of worship. • The contact information for the disturbance coordinator will be posted in a conspicuous location near the construction areas. This information will also be mailed to	Protocols were included as part of the CIMP and submitted on November 18, 2015.

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							all nearby noise-sensitive receptors and Interested Tribes. • In addition to the communication methods described above, PG&E will also consider posting construction schedule information at the information kiosk (CUL-1a-3c). PG&E may also decide to use other communication processes, including a Project website (a Project website could list Project activity schedules and other Project related information) that could be accessed by computer or smartphone and/or other simple push applications that apply to mobile devices.	
Cultural Resources	CUL-1a-8i	i. Protocols for the appropriate methods, consistent with Mitigation Measures AES-1 and AES-2, to reduce visual intrusions.	CIMP	The required protocols will be developed and included in the CIMP. The CIMP will be submitted with the final design as directed.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on March 23 2012. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meeting on June 28, 2011, October 25, 2012, November 9, 2012, and March 19, 2013. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	Protocols for the appropriate methods, consistent with Mitigation Measures AES-1 and AES-2, to reduce visual intrusion were developed and included as part of the CIMP.	Protocols for the appropriate methods, consistent with Mitigation Measures AES-1 and AES-2, to reduce visual intrusion were developed and included as part of the CIMP.	Protocols were included as part of the CIMP and submitted on November 18, 2015.
Cultural Resources	CUL-1a-8j	j. Protocols for Tribal notification in advance of project-related activities that the Interested Tribes may feel have the potential to cause adverse impacts to sensitive cultural resources.	CIMP	The required protocols will be developed and included in the CIMP. The CIMP will be submitted with the final design as directed.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on March 23 2012. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with Interested Tribes at the monthly meeting on September 27, 2012, October 10, 2012, November 9, 2012, and March 19, 2013. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	Protocols for Tribal notification in advance of project-related activities were developed and included as part of the CIMP.	Protocols for Tribal notification in advance of project-related activities that have the potential to cause adverse impacts to sensitive cultural resources were developed and included as part of the CIMP.	Protocols were included as part of the CIMP and submitted on November 18, 2015.

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Cultural Resources	CUL-1a-8k	k. Protocols to be followed by project personnel to accommodate, if feasible as determined by DTSC, key Tribal ceremonies that involve the Topock Cultural Area.	CIMP	Project personnel will accommodate, if feasible as determined by DTSC, key Tribal ceremonies that involve the Topock Cultural Area, provided that such Tribal ceremonies may not interfere with the expeditious implementation of the remedy or create health and safety concerns. This protocol will be included in the CIMP. The CIMP will be submitted with the final design as directed.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on March 23 2012. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meeting on May 24, 2012, September 27, 2012, October 10, 2012, November 9, 2012, and February 19, 2013. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	Protocols to be followed by project personnel to accommodate key Tribal ceremonies that involve the Topock Cultural Area were developed and included as part of the CIMP.	Protocols to be followed by project personnel to accommodate key Tribal ceremonies that involve the Topock Cultural Area were developed and included as part of the CIMP.	Protocols were included as part of the CIMP and submitted on November 18, 2015.
Cultural Resources	CUL-1a-8l	l. Provisions affording sufficient Tribal monitors to observe ground-disturbing activities and/or other scientific surveying (e.g., biological surveys) that may occur in preparation for construction activities. Ground-disturbing activities include trenching, excavation, grading, well excavation/drilling, decommissioning of the IM-3 Facility and subsurface pipeline, or other construction-related activities.	CIMP	Tribal monitors will be invited to observe ground-disturbing activities. This provision will be included in the CIMP. The CIMP will be submitted with the final design as directed.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on March 23 2012. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meeting on May 24, 2012, December 18, 2012, and February 19, 2013. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	Protocols for Tribal monitors to observe ground- disturbing activities were developed and included as part of the CIMP.	Protocols for affording sufficient Tribal monitors to observe ground-disturbing activities and/or other scientific surveying done in preparation of construction were developed and included as part of the CIMP.	Protocols were included as part of the CIMP and submitted on November 18, 2015.
Cultural Resources	CUL-1a-8m	m. Provisions of reasonable compensation for Tribal monitors consistent with historical rates.	CIMP	Tribal monitors will receive reasonable compensation consistent with agreed upon historical rates. This provision will be included in the CIMP. The CIMP will be submitted with the final design as directed.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on March 23 2012. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meeting on May 24, 2012, December 18, 2012, and March 19, 2013. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	Provisions required in this mitigation measure were developed and included as part of the CIMP.	Provisions for reasonable compensation for Tribal monitors consistent with historical rates were developed and included as part of the CIMP.	Protocols were included as part of the CIMP and submitted on November 18, 2015.

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Cultural Resources	CUL-1a-8n	n. Locations requiring specific protective devices, such as temporary fencing, flagging, or other type of demarcation during construction.	CIMP	Locations requiring specific protective devices, such as temporary fencing, flagging, or other type of demarcation during construction will be included in the CIMP.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on March 23 2012. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meeting on April 26, 2012, August 23, 2012, September 19, 2012, and March 19, 2013. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	Protocols for protective measures for archaeological/historical sites during construction were developed and included as part of the CIMP.	Protocols for determining the locations requiring specific protective devices for protection of cultural resources during construction and protocols for the protective measures were developed and included as part of the CIMP.	Protocols were included as part of the CIMP and submitted on November 18, 2015.
Cultural Resources	CUL-1a-8o	o. Protocols for the reporting of discoveries of cultural importance consistent with existing statutes and regulations.	CIMP	The required protocols will be developed and included in the CIMP. The CIMP will be submitted with the final design as directed.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on March 23 2012. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meeting on June 28, 2012, September 27, 2012, October 10, 2012, and November 9, 2012. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	Protocols for the reporting of discoveries of cultural importance were developed and included as part of the CIMP.	Protocols for the reporting of discoveries of cultural importance were developed and included as part of the CIMP.	Protocols were included as part of the CIMP and submitted on November 18, 2015.
Cultural Resources	CUL-1a-8p	p. Protocols for the inspection of remediation facilities and/or staging areas throughout the construction phase.	CIMP	The required protocols will be developed and included in the CIMP. The CIMP will be submitted with the final design as directed.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on March 23 2012. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meeting on June 28, 2012 and December 4, 2012. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	Protocols for the inspection of remediation facilities and/or staging areas during construction were developed and included as part of the CIMP.	Protocols for the inspection of remediation facilities and/or staging areas during construction were developed and included as part of the CIMP.	Protocols were included as part of the CIMP and submitted on November 18, 2015.

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Cultural Resources	CUL-1a-9	During selection of the design and specific locations for physical remediation facilities, PG&E shall, in communication with the Interested Tribes (and subject to their review), and to the maximum extent feasible, as determined by DTSC, give: (1) priority to previously disturbed areas for the placement of new physical improvements; and (2) priority to re-use of existing physical improvements, such as but not limited to wells and pipelines, but not including IM-3 facilities. "Disturbed" areas in this context means those areas outside of documented archaeological site boundaries that have experienced ground disturbance in the last 50 years. PG&E shall produce an aerial map of these disturbed areas to guide project design, and PG&E shall make a good faith effort to provide Tribes with an opportunity to review and comment on the information displayed on the map in determining "disturbed" areas.	Aerial map of disturbed areas	As directed, PG&E prepared an aerial map of disturbed areas to guide project design and made a good faith effort to provide Tribes with an opportunity to review and comment. PG&E provided the disturbed areas map to Interested Tribes for review and comment on May 26, 2011. Written comments on the map were received from the FMIT on July 5, 2011 and the Hualapai Tribe on July 1, 2011. PG&E responded to the Hualapai and the FMIT in July 2011 with an invitation to a site walk for discussion of the comments and ground-truth the map. To date, three Tribes have attended site walks/onsite meetings to discuss the map -- the site walk/meeting with the Colorado River Indian Tribes (CRIT) occurred on June 7, 2011, the site walk/meeting with the FMIT occurred on October 4, 2011, and the site walk/meeting with the Hualapai Tribe occurred on October 26, 2011. Additional discussions regarding the aerial map are planned. A current version of the aerial map is included in Appendix A2 of this Basis of Design Report. In compliance with the directive to give priority to re-use of existing physical improvements and to previously disturbed areas for new physical improvements, the preliminary (30%) design proposes the following: • The freshwater supply for the remedy will be the existing HNWR-1 well. If needed, this water supply can be supplemented by the current Compressor Station water supply (by existing Topock-2 and Topock-3 wells in Arizona). • The freshwater supply storage will be the existing water storage tanks at the Compressor Station.	The design has been and is carried out in a manner that gives: (1) priority to previously disturbed areas for the placement of new physical improvements; and (2) priority to re-use of existing physical improvements, including but not limited to wells and pipelines, but not including IM-3 facilities. In compliance with the directive to give priority to re-use of existing physical improvements and to previously disturbed areas for new physical improvements, the intermediate (60%) design proposes the following: • All existing monitoring wells have been incorporated into the monitoring well network for the remedy, thereby reducing the need for drilling new monitoring wells. • The freshwater supply for the remedy will be the existing HNWR-1 well. • The freshwater supply storage will be the existing water storage tanks at the Compressor Station. • The remedy-produced water treatment plant and the freshwater pre-injection treatment system will be located entirely within the footprint of Compressor Station. • The central maintenance facility for the remedy will be located entirely on PG&E property, at the Transwestern Bench. By centralizing maintenance functions into one location, this reduces the footprint of remedy structure outside of PG&E property.	The aerial map of disturbed areas was updated to include areas with planned facilities associated with freshwater supply in Arizona, and areas west of Moabi Regional Park associated with soil storage. The updated map is included in Appendix A2 of the 90% BOD Report. In compliance with the directive to give priority to re-use of existing physical improvements and to previously disturbed areas for new physical improvements, the pre-final (90%) design proposes the following: • All existing monitoring wells have been incorporated into the monitoring well network for the remedy, thereby reducing the need for drilling new monitoring wells. • The piping corridor is located almost entirely in existing roadways, right- of- ways and previously disturbed areas. • Most of the existing access roads have been incorporated into the 90% design. • The remedy-produced water conditioning plant and the contingent systems (arsenic treatment and dissolved metals removal) are located entirely within the footprint of the Compressor Station. • The operation building and carbon storage/amendment facilities are located on the existing Transwestern Bench and MW-20 Bench. • All of the proposed soil storage and construction staging areas are located on previously disturbed areas. • The main construction headquarters and staging area is located on previously disturbed areas at Moabi Regional Park.	The aerial map of disturbed areas was updated to include areas with planned facilities associated with freshwater supply in Arizona, and areas west of Moabi Regional Park associated with soil storage. The updated map is included in Appendix A2 of this report. In compliance with the directive to give priority to re-use existing physical improvements and to use previously disturbed areas for new physical improvements to the maximum extent feasible as determined by DTSC, the final design proposes the following: • Incorporating all existing monitoring wells into the monitoring well network for the remedy, thereby reducing the need for drilling new monitoring wells. • Locating the piping corridor almost entirely in existing roadways, right-of-ways and previously disturbed areas. • Incorporating most of the existing access routes into the design. • Locating the remedy-produced water conditioning plant and the contingent systems (arsenic treatment and dissolved metals removal) entirely within the footprint of the Compressor Station. • Locating the operation building on the existing Transwestern Bench. • Locating the consolidated carbon storage/amendment facilities on the MW-20 Bench. • Locating all of the proposed soil processing and construction staging areas on previously disturbed areas. • Locating the main construction headquarters and staging area on previously disturbed areas (at Moabi Regional Park). In compliance with this measure, PG&E communicated with the Interested Tribes regarding designing the remedy in a manner that located	A current version of the aerial map of disturbed areas was submitted on November 18, 2011. An update of the aerial map of disturbed areas is included in Appendix A2 of this Final BOD Report.

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				• The remedy-produced water treatment plant will be located entirely within the footprint of Compressor Station and much of it will replace existing structures within the maintenance shop area.			infrastructure in previously disturbed areas and reused existing physical improvements, including providing the 30%, 60%, and 90% design documents to the Interested Tribes for their review and comment.	
Cultural Resources	CUL-1a-10	PG&E shall consider the location of Loci A, B, and C of the Topock Maze during the design and approval of the physical facilities necessary for the final remedy and is prohibited from creating any direct physical impact on the Topock Maze, as it is manifested archaeologically. Through the design, PG&E shall prevent all indirect (e.g. noise, aesthetics) impacts on the Topock Maze, to the maximum extent feasible as determined by DTSC.	Design submittals	The design has been and is carried out in a manner that excluded direct impacts on Loci A, B, and C of the Topock Maze. Prevention of indirect impacts to the Maze will be incorporated into the design to the maximum extent feasible as determined by DTSC.	The design has been and is carried out in a manner that avoids any direct impacts on Loci A, B, and C of the Topock Maze. PG&E Remediation Resources Specialist Glenn Caruso participated in field reviews of planned remedial facilities with the design team on April 23-24 and June 20, 2012. The purpose of these field reviews along with in-office reviews is to ensure that the footprints of planned facilities do not create direct physical impact on the Topock Maze, as it is manifested archaeologically. There are no remedy facilities inside the Topock Maze. Prevention of indirect impacts to the Maze will be incorporated into the design to the maximum extent feasible as determined by DTSC.	The design was carried out in a manner that avoids any direct impacts on Loci A, B, and C of the Topock Maze. PG&E Cultural Resources Expert Glenn Caruso participated in field review of planned remedial facilities and temporary construction footprints with the design team on April 7-10, 2014. Glenn Caruso also led in-office reviews of planned facilities and temporary construction-related footprints. The purpose of the field review along with in-office reviews is to ensure that project footprints do not create direct physical impact on the Topock Maze, as it is manifested archaeologically. There are no remedy facilities inside the Topock Maze. Prevention of indirect impacts (e.g., noise, aesthetics) to the Maze has been incorporated into the design as follows: <u>Noise/Vibration</u> a) In compliance with EIR mitigation measure NOISE-1a, there is no proposed remediation or new monitoring wells within 45 feet of vibration-sensitive receptors (i.e., homes/structures) or within 30 feet and 275 feet of vibration-sensitive land uses (i.e., homes) in California and Arizona, respectively. b) During the design, PG&E conducted site visits with Agencies, Tribes, and Stakeholders to view and obtain inputs on locations of planned facilities including new remediation, new monitoring wells, and piping corridors. c) In response to Tribes' comments on the 60% design, PG&E moved all remedy wells and vaults from the west side of NTH to the east side. In	The design was carried out in a manner that avoids any direct impacts on the Topock Maze as it is manifested archaeologically. PG&E Cultural Resources Expert Glenn Caruso led in-office reviews of planned facilities and temporary construction-related footprints. The purpose of the reviews is to ensure that project footprints do not create direct physical impact on the Topock Maze as it is manifested archaeologically. There are no remedy facilities inside the Topock Maze as it is manifested archaeologically. Prevention of indirect impacts (e.g., noise, aesthetics) to the Maze has been incorporated into the design to the maximum extent feasible as follows: <u>Noise/Vibration</u> a) During the design, PG&E conducted site visits with Agencies, Tribes, and Stakeholders to view and obtain inputs on locations of planned facilities including new remediation, new monitoring wells, and piping corridors. b) In response to Tribes' comments about noise and vibration impacts on the Maze during the 60% design, PG&E moved all remedy wells and vaults from the west side of NTH to the east side. In addition, PG&E will not use the east side (side that is closer to Maze A) of the TCS evaporation ponds for remedy construction staging. c) As indicated in the 60% RTC #319, the Noise Engineer has reviewed the selection of aboveground transformers and air conditioning units for the enclosures of aboveground communication/control panels for conformance with the	This measure was incorporated in the final design, which was submitted on November 18, 2015.

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						addition, PG&E will not use the east side (side that is closer to Maze A) of the TCS evaporation ponds for remedy construction staging. d) As indicated in the 60% RTC #319, the Noise Engineer has reviewed the selection of aboveground transformers and air conditioning units for the enclosures of aboveground communication/control panels for conformance with the project noise design criteria (Appendix C of the 90% BOD Report). e) Mitigation measure NOISE-2 to reduce auditory impacts related to project-generated construction-related noise has been incorporated into the Construction/Remedial Action Work Plan (Section 4) for implementation during construction. f) PG&E has developed protocols to reduce auditory impacts, consistent with EIR mitigation measure NOISE-3, as part of the CIMP, and has included those protocols in the Construction/Remedial Action Work Plan (Section 4) for implementation. <u>Aesthetics</u> a) During the design, PG&E conducted site visits with Agencies, Tribes, and Stakeholders to view and obtain inputs on locations of planned remedial facilities. b) PG&E implemented additional design protocols to reduce visual intrusions, as outlined in Section 2.9.2 of the CIMP. c) PG&E has and will continue to provide opportunities for Agency, Tribal, and Other Stakeholder input on the visual nature of project design through inclusion of visualizations of select remedy components in design documents (CIMP protocol, see Section 2.9.3). d) PG&E has developed protocols to reduce visual intrusion, consistent with mitigation measures AES-1 and AES-2, as part of the CIMP, and has included these protocols in the	project noise design criteria (Appendix C of the Final BOD Report) and found them to be in compliance. d) Mitigation measure NOISE-2 to reduce auditory impacts related to project-generated construction-related noise has been incorporated into the Construction/Remedial Action Work Plan (Section 4) for implementation during construction. e) PG&E has developed protocols to reduce auditory impacts in the Topock Cultural Area, consistent with EIR mitigation measure NOISE-3, as part of the CIMP, and has included those protocols in the Construction/ Remedial Action Work Plan (Section 4) for implementation. <u>Aesthetics</u> a) During the design, PG&E conducted site visits with Agencies, Tribes, and Stakeholders to view and obtain inputs on locations of planned remedial facilities. b) PG&E implemented additional design protocols to reduce visual intrusions, as outlined in Section 2.9.2 of the CIMP. c) PG&E has provided opportunities for Agency, Tribal, and Other Stakeholder input on the visual nature of project design through inclusion of visualizations of select remedy components in design documents (Section 2.9.3 of the CIMP). d) PG&E has developed protocols to reduce visual intrusion, consistent with mitigation measures AES-1 and AES-2, as part of the CIMP (Section 2.9), and has included these protocols in the Construction/Remedial Action Work Plan (Section 4) for implementation. e) In response to Tribes' comments on the 90% design, PG&E changed the design of the Bat Cave Wash crossing in the Uplands to directly bury pipes/ conduits in the wash (instead of in the road), thereby eliminating the concrete box culverts. Concurrently, PG&E changed the design of the Bat	

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						Construction/Remedial Action Work Plan (Section 4) for implementation.	Cave Wash crossing near TCS to directly bury pipes/conduits in the wash, thereby eliminated the aerial crossing. The revised design was submitted for review and comment during the 90% RTC process and is included in the final design.	
Cultural Resources	CUL-1a-11	PG&E shall provide an open grant for two part-time cultural resource specialist/project manager positions during the design and construction phases of the remediation project. The positions shall be filled by qualified members of an Interested Tribe as nominated by a majority vote of their Tribal Council(s) and appointed by DTSC's project manager if more than two members are nominated. The award of the grants is for continued involvement in review of project documents and participation in project-related meetings, including TRC meetings, at rates of historic compensation. Additionally, in light of FMIT's ownership of land in the project area and historical involvement in the environmental process, additional funding is guaranteed for one full-time FMIT position upon submission of an application by a qualified FMIT member who shall be appointed by the FMIT council, provided such funding is not duplicative of the services and funding provided by PG&E pursuant to the Settlement Agreement between PG&E and the FMIT in Fort Mojave Indian *Tribe v. Dept. of Toxic Substances Control, et al.*, Case No. 05CS00437 for a position with the FMIT's AhaMakav Culture Society. The payment of grant monies shall be timed to the awarded Tribes' fiscal cycles so that the Tribes are not forced to front funds for long periods of time. These positions shall act as cultural resources contacts and project managers for interactions between the Tribes, PG&E, and DTSC to ensure coordination for review and comment of subsequent project and/or environmental documents related to the design and implementation of the groundwater remediation project to avoid, reduce, or otherwise mitigate impacts on historical resources, as defined by CEQA. This funding is separate from provisions for Tribal monitor positions and shall not be used for routine Tribal business or legal counsel. For review and approval, PG&E shall provide DTSC with the names of the selected grant recipients and an annual report that summarizes activities associated with the grant program. Upon the conclusion of the construction phase of the project, the necessity and dollar value of the grant program shall be assessed by PG&E and, with the approval of DTSC, shall either be extended	Administrative step - no technical document required	A notice of the open grant for funding of two part-time cultural resource specialist/project manager positions was sent to Interested Tribes by a letter dated April 20, 2011. To date, PG&E has not received any responses to the April 20, 2011 letter from Tribes.	As of the submittal of the 60% design, PG&E has funded a second project manager position for the Cocopah Indian Tribe. The first funded position was for the Chemehuevi Indian Tribe.	There was no change since the 60% design.	There was no change since the 90% design.	As of the time of this writing, PG&E has funded a second project manager position for the Cocopah Indian Tribe. The first funded position was for the Chemehuevi Indian Tribe.

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		or terminated under the operations and maintenance phase.						
Cultural Resources	CUL-1a-12	PG&E shall provide sufficient opportunity, as determined by DTSC, for Interested Tribes to provide a traditional healing/cleansing ceremony (or ceremonies) before and after ground disturbing construction activities occur.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	PG&E will offer interested Native American Tribes the opportunity to provide a traditional healing/cleansing ceremony (or ceremonies) before and after ground disturbing activities occur.	PG&E will offer interested Native American Tribes the opportunity to provide a traditional healing/cleansing ceremony (or ceremonies) before and after ground disturbing activities occur.	PG&E will offer interested Native American Tribes the opportunity to provide a traditional healing/ cleansing ceremony (or ceremonies) before and after ground disturbing activities occur.	PG&E will provide sufficient opportunity for interested Native American Tribes to provide a traditional healing/cleansing ceremony (or ceremonies) before and after ground disturbing activities occur by following the protocols in Sections 2.10 and 2.11 of the CIMP.	This measure is satisfied by the CIMP, which is Appendix H of the C/RAWP and was submitted on November 18, 2015.
Cultural Resources	CUL-1a-13	PG&E shall, in communication with Interested Tribes, develop as part of the CMI Workplan, a worker cultural sensitivity education program. The program shall be implemented before commencement of construction and throughout construction and operations as personnel are added. This program may include information provided directly by Tribal entities either in written form or on video, in a manner consistent with Appendix C in the existing BLM Programmatic Agreement. The worker cultural sensitivity education program shall ensure that every person working on the project as an employee or contractor, before participating in design or outdoor activities at the project site, is informed regarding: the cultural significance of the Topock Cultural Area, appropriate behavior to use within the Topock Cultural Area, activities that are to be avoided in the Topock Cultural Area, and consequences in the event of noncompliance.	Worker Cultural Sensitivity Education Program	As described in the CMI Work Plan (Section 4.2.1), the education on cultural/historical resources sensitivity for Topock currently occurs via periodic training and project initiation meetings. Sensitivity training classes are conducted at least annually, and are attended by all workers available to participate. Sensitivity training/education is also provided at project initiation meetings, typically held at the site prior to field work. The training is provided by the Site Operations Manager, the Project Archaeologist, and Interested Tribal members who attend the meetings. In compliance with this measure, a training/education manual will be prepared using existing and new material, as available.	As described in Section 4.2.1 of the CMI/RD Work Plan (CH2M HILL 2011a), the education on cultural/historical resources sensitivity for Topock currently occurs via periodic training and project initiation meetings. Sensitivity training classes are conducted at least annually, and are attended by all workers available to participate. Sensitivity training/education is also provided at project initiation meetings, typically held at the site prior to field work. The training is provided by the Site Operations Manager, the Project Remediation Resources Specialist, and Interested Tribal members who attend the meetings. In compliance with this measure, PG&E and Tribes are collaborating on a training/education manual to educate workers. This measure was discussed with interested Tribes at the monthly meeting on April 26, 2012, August 23, 2012 and September 19, 2012.	PG&E has prepared, in coordination with agencies and Tribes, educational materials used in Orientation sessions for the Topock project. In addition, PG&E has prepared, in compliance with this measure, a protocol for the development of a cultural sensitivity education program to educate workers (included as an appendix to the Construction/Remedial Action Work Plan). Implementation of this protocol is underway.	PG&E has prepared, in coordination with agencies and Tribes, cultural sensitivity educational materials used in Orientation sessions for the Topock project. In addition, PG&E has prepared a protocol for the development of a cultural sensitivity education program to educate workers (included as an appendix to the Construction/Remedial Action Work Plan). Implementation of this protocol is underway.	The protocol for implementing CUL-1a-13 was included in Appendix P of the C/RAWP, which was submitted on November 18, 2015.

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Cultural Resources	CUL-1b and 1c	**During Design, Construction, O&M, and Decommissioning Consider the Location of Historical Resources and Implement Measures to Avoid Resources to the Extent Feasible.** The following actions will reduce the potential for impacts on identified historically significant resources (other than the Topock Cultural Area, which is separately addressed in CUL-1a) within the project area. As detailed below, these actions include consideration of the location of historical resources, preparation of a cultural resources study, and preparation of a treatment plan. Monitoring of ground-disturbing activities during project construction will further protect historically significant resources. Protective actions are also described pertaining to the discovery of any previously unidentified potentially significant cultural resources.	Design submittals	This mitigation measure will be met through actions taken to implement CUL-1b/c-1 through c-4 (see below). In addition, the aerial map of disturbed areas (CUL-1a-9) provides a first cut at protecting and avoiding archaeological and historical sites.	This mitigation measure will be met through actions taken to implement CUL-1b/c-1 through c-4 (see below). In addition, the aerial map of disturbed areas (CUL-1a-9) provides a first cut at protecting and avoiding archaeological and historical sites. PG&E remediation resources specialist Glenn Caruso participated in field reviews of planned remedial facilities with the design team on April 23-24 and June 20, 2012. The purpose of these field reviews along with in office reviews is to ensure that the footprints of planned facilities are designed in ways to avoid, minimize, or mitigate impacts on historical and archaeological resources to the maximum extent feasible.	This mitigation measure will be met through actions taken to implement CUL-1b/c-1 through c-4 (see below). In addition, the aerial map of disturbed areas (CUL-1a-9) provides a first cut at protecting and avoiding archaeological and historical sites. PG&E Cultural Resources Expert Glenn Caruso participated in field review of planned remedial facilities and temporary construction footprints with the design team on April 7-10, 2014. Glenn Caruso also led in-office reviews of planned facilities and temporary construction-related footprints. The purpose of the field review along with in-office reviews is to ensure that project footprints are designed in ways to avoid, minimize, or mitigate impacts on historical and archaeological resources to the maximum extent feasible.	This mitigation measure will be met through actions taken to implement CUL-1b/c-1 through c-4 (see below). In addition, the aerial map of disturbed areas (CUL-1a-9) provides a first cut at protecting and avoiding archaeological and historical sites. PG&E Cultural Resources Expert Glenn Caruso participated in field review of planned remedial facilities and temporary construction footprints at Moabi Regional Park in late 2014 and early 2015. Glenn Caruso also led in-office review of planned facilities and temporary construction-related footprints in September 2015. The purpose of the field review along with in-office reviews is to ensure that project footprints are designed in ways to avoid and minimize impacts on historical and archaeological resources to the maximum extent feasible.	
Cultural Resources	CUL-1b/c-1	PG&E shall consider the locations of the identified historic resources described above (EIR Table 4.4-3) during the design of the physical improvements necessary for the proposed project and avoid, minimize, or mitigate impacts on historical and archaeological resources to the maximum extent feasible, as determined by DTSC. The final design plans for the project will be submitted to DTSC for review and approval.	Design submittals	The design has been and is carried out to avoid impacts to historical and archaeological resources to the maximum extent practicable as determined by DTSC. The final design will be submitted to DTSC as directed.	PG&E remediation resources specialist Glenn Caruso participated in field reviews of planned remedial facilities with the design team on April 23-24 and June 20, 2012. The purpose of these field reviews along with in office reviews is to ensure that the footprints of planned facilities are designed in ways to avoid, minimize, or mitigate impacts on historical and archaeological resources to the maximum extent feasible.	PG&E Cultural Resources Expert Glenn Caruso participated in field review of planned remedial facilities and temporary construction footprints with the design team on April 7-10, 2014. Glenn Caruso also led in-office reviews of planned facilities and temporary construction-related footprints. The purpose of the field review along with in-office reviews is to ensure that project footprints are designed in ways to avoid, minimize, or mitigate impacts on historical and archaeological resources to the maximum extent feasible. As noted above under CUL-1a-3a, on December 2, 2014, AE as PG&E's Qualified Cultural Resource Consultant conducted archaeological and historical field surveys of the locations considered for project features in Moabi Regional Park. A brief summary of the survey results was included in Appendix A11 of the Supplemental 90%.	As noted above under CUL-1a-3a, on June 24-26, 2015, PG&E conducted field surveys of the additional locations considered for remedy features in Moabi Regional Park. Survey results were summarized in a technical memorandum submitted on September 2, 2015. PG&E Cultural Resources Expert Glenn Caruso participated in field review of planned remedial facilities and temporary construction footprints at Moabi Regional Park in late 2014 and early 2015. Glenn Caruso also led in-office review of planned facilities and temporary construction-related footprints in September 2015. The purpose of the field review along with in-office reviews is to ensure that project footprints are designed in ways to avoid and minimize impacts on historical and archaeological resources to the maximum extent feasible.	The final design was submitted on November 18, 2015.

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Cultural Resources	CUL-1b/c-2	During preparation of the final design, and consistent with CUL-1 a-3, PG&E shall retain a Qualified Cultural Resources Consultant to prepare a cultural resources study that assesses the potential for the construction, operations, or decommissioning of specific proposed improvements to result in significant impacts on identified historically significant resources described in Impacts CUL-1b and CUL-1c. This may include a geoarchaeological investigation and/or non-destructive remote-sensing surveys of potentially disturbed areas to determine if a potential exists for buried historical and archaeological resources. "Significant impacts" as used here means the potential for construction to demolish or materially alter in an adverse manner those physical characteristics of a resource that convey its historical significance and that justify its inclusion in, or eligibility for, inclusion in the CRHR. The study will be submitted to DTSC for review and evaluation to determine if existing mitigation measures are appropriate.	Cultural resources study/Geoarchaeological investigation report	Consistent with CUL-1a-3, PG&E has retained qualified cultural resources consultants to prepare a cultural resources study. The study will commence at the intermediate (60%) design stage, after the locations of remedial facilities are confirmed.	This measure was discussed with interested Tribes at the monthly meeting on April 26, 2012. Geoarchaeological investigations were conducted on June 5-8, 2012 by Dr. Roland Brady of Brady and Associates Geological Services (BAGS) and Pat Maloney of Applied Earthworks (AE); Pat Maloney is the qualified cultural resources consultant. Participants from Interested Tribes include Wirlene Fischer-Holt (CRIT), Dr. Leo Leonhart (Consultant to the FMIT), and Dr. Margaret Eggers (TRC). A geoarchaeological investigation report is forthcoming.	The geoarchaeological investigation report titled *Geoarchaeological Assessment for the Topock Remediation Project, Mohave County, AZ, and San Bernardino County, CA* was completed and submitted to DTSC on February 28, 2014 (BAGS and AE 2014). The information in this report has been used to inform the design (i.e., via reviews by PG&E Cultural Resources Expert) and incorporated into the Construction/Remedial Action Work Plan as protocols to be followed during construction activities (Section 4).	The *Geoarchaeological Assessment for the Topock Remediation Project, Mohave County, AZ, and San Bernardino County, CA* was revised to incorporate comments from DTSC. The report was submitted on September 15, 2015 (BAGS and AE 2015). The information in the report has been used to inform the design (i.e., via reviews by PG&E Cultural Resources Expert) and incorporated into the Construction/Remedial Action Work Plan as protocols to be followed during construction activities (Section 4).	The revised geoarchaeological investigation report (BAGS and AE 2015) was completed on September 15, 2015, and included in Appendix A12 of the Final BOD and T of the C/RAWP. The C/RAWP was submitted concurrently with the final design on November 18, 2015.
Cultural Resources	CUL-1b/c-3	If the cultural resources study determines that the construction of physical improvements would result in significant impacts on identified historically significant resources described in Impacts CUL-1b and CUL-1c, and avoidance of the resource is not feasible, PG&E shall prepare a treatment plan that identifies measures to reduce these impacts (see above description of the CIMP) for DTSC's review and approval. The treatment plan shall identify which criteria for listing on the CRHR contribute to the affected resource's significance and which aspects of significance would be materially altered by construction, operations, or decommissioning and shall provide for reasonable efforts to be made to permit the resource to be preserved in place or left in an undisturbed state. Methods of accomplishing this may include capping or covering the resource with a layer of soil. To the extent that a resource cannot feasibly be preserved in place or left in an undisturbed state, excavation as mitigation shall be restricted to those parts of the resource that would be damaged or destroyed by the project. Excavation as mitigation shall not be required for a historically significant resource if the treatment plan determines that testing or studies already completed have adequately recovered the scientifically consequential information from and about the resource. The plan shall require communication with all Interested Tribes with	Cultural resources treatment plan	Implementation of this measure is dependent upon the cultural resources study conducted under CUL-1b/c-2.	This measure was discussed with Interested Tribes at the monthly meeting on October 25, 2012 and November 9, 2012.	A Cultural Resources Treatment Plan will be prepared and submitted to DTSC shortly after submission of the 90% design.	A Cultural and Historical Property Treatment Plan, which includes a requirement to communicate with all Interested Tribes with respect to their perspectives and wishes for the treatment of resources, was prepared and submitted to DTSC on September 12, 2014 (AE 2014b).	A Cultural and Historical Property Treatment Plan was prepared and submitted to DTSC on September 12, 2014 (AE 2014b).

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		regard to their perspectives and wishes for the treatment of the resources.						
Cultural Resources	CUL-1b/c-4	Consistent with CUL-1a-3a above, PG&E shall retain a Qualified Cultural Resources Consultant to observe ground-disturbing activities and shall be required to request the participation of Tribal monitors during those activities, including steps necessary during operations and decommissioning activities to ensure that historically significant resources are avoided to the maximum extent feasible, as determined by DTSC, during actual construction (see the description of the CMI Workplan, above). The Qualified Cultural Resources Consultant shall provide training to construction personnel on the locations of identified resources, values associated with the identified resources, responsibility for reporting suspected historic resources, and procedures for suspension of work in the immediate vicinity of the discovery, and shall use exclusionary fencing, flagging, or other appropriate physical barriers to mark the boundaries of identified resources. The Qualified Cultural Resources Consultant shall invite participation from Interested Tribal members to participate in the training. In the event that previously unidentified potentially significant cultural resources are discovered during ground-disturbing activities, the Qualified Cultural Resources Consultant shall have the authority to divert or temporarily halt ground-disturbing activities in the area of discovery to allow evaluation of the potentially significant cultural resources. If such discoveries occur on land managed by a federal agency, Stipulation IX (Discoveries) of the Programmatic Agreement shall apply and are deemed adequate by DTSC. If a discovery occurs on other lands within the project area, the Qualified Cultural Resources Consultant shall contact the PG&E and DTSC project managers at the time of discovery and, in consultation with DTSC and Tribal monitors, shall evaluate the resource before construction activities will be allowed to resume in the affected area. For significant cultural resources, and before construction activities are allowed to resume in the affected area, the resource(s) shall be recovered with coordination of the Tribal monitors and DTSC. Recovery may include a Research Design and/or Data Recovery Program submitted to DTSC for review and approval. The Qualified Cultural Resources Consultant (and Tribal monitors) shall determine the amount of material to be recovered for an adequate sample for analysis or data recovery. Any concerns or recommendations regarding the ground-disturbing activities or the		Consistent with CUL-1a-3, PG&E has retained qualified cultural resources consultants to observe ground-disturbing activities and provide training as required.	Consistent with CUL-1a-3, PG&E has retained AE, a consulting firm with qualified cultural resources consultants, to observe ground-disturbing activities and provide training as required. This measure was discussed with Interested Tribes at the monthly meeting on October 25, 2012 and November 9, 2012.	Consistent with CUL-1a-3, PG&E has retained AE, a consulting firm with qualified cultural resources consultants, to observe ground-disturbing activities and provide training as required.	Consistent with CUL-1a-3, PG&E has retained AE, a consulting firm with qualified cultural resources consultants, to observe ground-disturbing activities and provide training as required. PG&E has included the requirement to request participation of Tribal monitors during those activities in CIMP Section 2.12.	PG&E retained AE, which DTSC determined was a Qualified Cultural Resources Consultant, on March 2, 2012.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
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				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design	
		handling of cultural resources shall be directed to the Qualified Cultural Resources Consultant or PG&E's site supervisor.						
Cultural Resources	CUL-2	**During Project Design Consider the Location of Unique Archaeological Resources and Avoid Resources to the Maximum extent Feasible.** Cultural resources that qualify as unique archaeological sites in the project area would probably also meet one or more of the criteria for historical resources and would be subject to Mitigation Measures CUL-1b/c-2 and CUL-1b/c-3. The mitigation measures under this identified impact are the same as listed for Impact CUL-1b and CUL-1c. These mitigation measures would reduce the potential for impacts on unique archaeological resources.	Cultural resources study/ Geoarchaeological investigation report; Cultural resources treatment plan	The requirements of this mitigation measure will be met by implementation of CUL-1b/c-2 and CUL-1b/c-3.	The requirements of this mitigation measure will be met by implementation of CUL-1b/c-2 and CUL-1b/c-3. This measure was discussed with interested Tribes at the monthly meeting on May 24, 2012.	The requirements of this mitigation measure have been met by implementation of CUL-1b/c-2 and CUL-1b/c-3.	The requirements of this mitigation measure have been met by implementation of CUL-1b and CUL-1c.	See CUL-1b and CUL-1c.
Cultural Resources	CUL-3	**Conduct Survey and Construction Monitoring**. A **paleontological investigation**, **including a detailed survey of the project area** by a qualified paleontologist, shall be conducted to refine the potential impacts on unique paleontological resources within the final design area and determine whether preconstruction recovery of sensitive resources and/or construction monitoring would be warranted. If construction monitoring is determined to be warranted, ground-altering activity would be monitored by a qualified paleontologist to assess, document, and recover unique fossils. Monitoring shall include the inspection of exposed surfaces and microscopic examination of matrix in potential fossil bearing formations. In the event microfossils are discovered, the monitor shall collect matrix for processing. In the event paleontological resources are encountered during earthmoving activities, recovered specimens shall be prepared by the paleontologist to a point of identification and permanent preservation. PG&E shall retain a Qualified Paleontologist to observe ground-disturbing activities where determined necessary based on the results of the paleontological investigation and shall be required to request the participation of Tribal monitors during those activities, including steps necessary during operations and decommissioning activities to ensure that historically significant resources are avoided to the maximum extent feasible, as determined by DTSC, during actual construction (see above description of the CMI Workplan). Paleontological resources of scientific value shall be identified and curated into an established, accredited, professional museum repository in the region with permanent retrievable paleontological storage. This measure	Paleontological investigation report	PG&E has retained a paleontologist to conduct the investigation, planning for this investigation is currently underway. A draft report has been prepared and is being reviewed by PG&E.	This measure was discussed with interested Tribes at the monthly meeting on January 26, 2012. A paleontological investigation was conducted on July 25, 2012. The outcome of the survey was provided in a report completed in December 2012; this report is currently being revised to incorporate comments received.	The paleontological investigation results were summarized in a report titled "*Paleontological Resources Management Plan: MMRP CUL-3*" (Parus 2014) and submitted to DTSC on February 28, 2014. The plan is also included in an appendix of the Construction/Remedial Action Work Plan.	The *Paleontological Resources Management Plan: MMRP CUL-3* was revised to incorporate DTSC's comments and submitted on October 9. 2015 and is included in Appendix A9 of this report. The plan is also included in Appendix J of the Construction/Remedial Action Work Plan. As a result of the July 2012 survey, the paleontologist determined that paleontological monitoring would not be required during grading and trenching activities. Even though borings would have a low potential to produce significant fossils, the paleontologist recommended that paleontological resources awareness training be completed by field personnel and that a paleontologist be on call to respond if fossils are encountered during drilling. PG&E has hired Qualified Paleontologists from AE to be on call during construction activities. See CUL-1a-8l for provisions related to Tribal Monitors during ground-disturbing activities.	The revised paleontological investigation report (Parus 2015) was completed on October 9, 2015, and included in Appendices A9 of the Final BOD and J of the C/RAWP, respectively.

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		does not apply to the activities included as part of the East Ravine Revised Addendum, Groundwater Investigation.						
Cultural Resources	CUL-4	**With Discovery of Human Remains or Burials Suspend Work, Protect Remains, and Comply with Local, State, and Federal Laws Regarding Discoveries During Ground-Disturbing Activities.** Ground-disturbing activities may disturb as-yet undiscovered human remains or Native American burials and associated grave goods. PG&E shall retain a Qualified Cultural Resource Consultant and request designated Tribal monitor(s) to train construction personnel in the identification of human remains so that they may aid in the identification of such resources (see above description of the CIMP). A Qualified Cultural Resource Consultant and Tribal monitor(s) shall be in place to adequately oversee all ground-disturbing activities. In the event human remains are uncovered over the course of project construction, operation and maintenance, and/or decommissioning activities, the following procedures shall be followed to ensure compliance with all applicable local, state, and federal laws.	Training material for the identification of human remains	PG&E will retain Qualified Cultural Resources Consultants prior to construction to prepare training material for the identification of human remains, provide training and oversee ground-disturbing activities as required. All of the provisions of this measure will remain in effect during construction, and will be implemented as directed in the event any human remains are uncovered during construction.	PG&E has retained AE and prior to construction monitoring AE will prepare training material for the identification of human remains, provide training and oversee ground-disturbing activities as required by this mitigation measure. All of the provisions of this measure will remain in effect during construction, and will be implemented as directed in the event any human remains are uncovered during construction.	PG&E has retained AE as the qualified cultural resource consultant and prior to construction monitoring, AE will prepare training material for the identification of human remains, provide training, and oversee ground-disturbing activities as required by this mitigation measure. All of the provisions of this measure will remain in effect during construction, and will be implemented as directed in the event any human remains are uncovered during construction. Procedures for implementing this measure are included in an appendix of the Construction/Remedial Action Work Plan.	PG&E has retained AE as the qualified cultural resource consultant and prior to construction monitoring, AE will prepare training material for the identification of human remains and provide the training required by this mitigation measure. PG&E also will request designated Tribal monitors to train construction personnel in the identification of human remains. AE and the Tribal monitors shall be in place to oversee ground disturbing activities. These requirements are in Appendix P of the C/RAWP. All of the provisions of this measure will remain in effect during construction, and will be implemented as directed in the event any human remains are uncovered during construction.	Procedures for implementing this measure are included in Appendix P of the Construction/Remedial Action Work Plan, submitted on November 18, 2015.
Cultural Resources	CUL-4f	f) The construction contractor shall immediately suspend work within the vicinity of the discovery and determine if the remains discovered are human or nonhuman. This determination shall be made by the Qualified Cultural Resources Consultant, a qualified archaeologist and/or physical anthropologist with expert skill in the identification of human osteological (bone) remains.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be met by actions to be taken under CUL-4.	This requirement will be met by actions to be taken under CUL-4.	This requirement will be met by actions taken under CUL-4.	The training and monitoring required by CUL-4 will ensure that this requirement is met.	This measure was incorporated into the O&M Manual (see Exhibit L2.2-1), the C/RAWP (see Table 2.3-1), and the IM-3 Decommissioning Plan (see Table 6-1). These documents were submitted on November 18, 2015.
Cultural Resources	CUL-4g	g) The Qualified Cultural Resources Consultant (and Tribal monitor), or construction contractor, shall protect discovered human remains and/or burial goods remaining in the ground from additional disturbance.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be met by actions to be taken under CUL-4.	This requirement will be met by actions to be taken under CUL-4.	This requirement will be met by actions taken under CUL-4.	This requirement was incorporated into the O&M Manual (see Exhibit L2.2-1), the C/RAWP (see Table 2.3-1), and the IM-3 Decommissioning Plan (see Table 6-1). Further, the training and monitoring required by CUL-4 will ensure that this requirement is met.	This measure was incorporated into the O&M Manual (see Exhibit L2.2-1), the C/RAWP (see Table 2.3-1), and the IM-3 Decommissioning Plan (see Table 6-1). These documents were submitted on November 18, 2015.

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Cultural Resources	CUL-4h	h) The Qualified Cultural Resources Consultant, archaeologist, or construction site supervisor shall contact the San Bernardino County Coroner, and the PG&E and DTSC project managers immediately. In California, all subsequent action shall conform to the protocols established in the Health and Safety Code and regulations. In Arizona, the Qualified Cultural Resources Consultant or PG&E construction site supervisor will follow Arizona laws and the implementing regulations. Human remains found on federal land would require the notification of the BLM Havasu City field office and compliance with applicable federal laws and regulations, including the Native American Graves Protection and Repatriation Act if the remains are determined to be of Native American origin. The Qualified Cultural Resources Consultant shall coordinate the interaction between Interested Tribes, PG&E, the County, and DTSC to determine proper treatment and disposition of any remains.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be met by actions to be taken under CUL-4.	This requirement will be met by actions to be taken under CUL-4.	This requirement will be met by actions taken under CUL-4.	These requirements were incorporated into the O&M Manual (see Exhibit L2.2-1), the C/RAWP (see Table 2.3-1), and the IM-3 Decommissioning Plan (see Table 6-1). The training and monitoring required by CUL-4 will ensure that this requirement is met.	This measure was incorporated into the O&M Manual (see Exhibit L2.2-1), the C/RAWP (see Table 2.3-1), and the IM-3 Decommissioning Plan (see Table 6-1). These documents were submitted on November 18, 2015.
Cultural Resources	CUL-4i	i) The San Bernardino County Coroner will determine if the remains are of recent origin and if an investigation of the cause of death is required (California Health and Safety Code Section 7050.5). If the coroner determines that the human remains are not Native American and not evidence of a crime, project personnel shall coordinate with the Qualified Cultural Resources Consultant (s) to develop an appropriate treatment plan. This may include contacting the next of kin to solicit input on subsequent disposition of the remains. If there is no next-of-kin, or recommendations by the next-of-kin are considered unacceptable by the landowner, the landowner will reinter the remains with appropriate dignity in a location outside the project area and where they would be unlikely to be disturbed in the future.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be met by actions to be taken under CUL-4.	This requirement will be met by actions to be taken under CUL-4.	This requirement will be met by actions taken under CUL-4.	These requirements were incorporated into the O&M Manual (see Exhibit L2.2-1), the C/RAWP (see Table 2.3-1), and the IM-3 Decommissioning Plan (see Table 6-1). The training and monitoring required by CUL-4 will ensure that this requirement is met.	This measure was incorporated into the O&M Manual (see Exhibit L2.2-1), the C/RAWP (see Table 2.3-1), and the IM-3 Decommissioning Plan (see Table 6-1). These documents were submitted on November 18, 2015.
Cultural Resources	CUL-4j	j) In the event that the San Bernardino County Coroner determines that the human remains are Native American and not evidence of a crime, project personnel shall contact the NAHC so that a most likely descendent (MLD) can be identified as required under California Public Resources Code Section 5097.98.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be met by actions to be taken under CUL-4.	This requirement will be met by actions to be taken under CUL-4.	This requirement will be met by actions taken under CUL-4.	This requirement was incorporated into the O&M Manual (see Exhibit L2.2-1), the C/RAWP (see Table 2.3-1), and the IM-3 Decommissioning Plan (see Table 6-1). The training and monitoring required by CUL-4 will ensure that this requirement is met.	This measure was incorporated into the O&M Manual (see Exhibit L2.2-1), the C/RAWP (see Table 2.3-1), and the IM-3 Decommissioning Plan (see Table 6-1). These documents were submitted on November 18, 2015.

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Cultural Resources	CUL-4k	k) The MLD(s) shall inspect the area in which the human remains were found and provide treatment recommendations to the landowner and PG&E site manager in accordance with the provisions of PRC Section 5097.98. The treatment may include reburial, scientific removal of the discovered human remains and relinquishment to the MLD(s), nondestructive analysis of human remains and/or other culturally appropriate treatment. If the MLD(s) so requests, the landowner would reinter the remains with the appropriate dignity in a location outside the area of disturbance in a location unlikely to be disturbed in the future.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be met by actions to be taken under CUL-4.	This requirement will be met by actions to be taken under CUL-4.	This requirement will be met by actions taken under CUL-4.	This requirement was incorporated into the O&M Manual (see Exhibit L2.2-1), the C/RAWP (see Table 2.3-1), and the IM-3 Decommissioning Plan (see Table 6-1). The training and monitoring required by CUL-4 will ensure that this requirement is met.	This measure was incorporated into the O&M Manual (see Exhibit L2.2-1), the C/RAWP (see Table 2.3-1), and the IM-3 Decommissioning Plan (see Table 6-1). These documents were submitted on November 18, 2015.
Cultural Resources	CUL-4l	l) To the maximum extent feasible, Mitigation Measure CUL-4 shall be implemented in a manner that is consistent with mitigation required by local, state, and federal requirements.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be met by actions to be taken under CUL-4.	This requirement will be met by actions to be taken under CUL-4.	This requirement will be met by actions to be taken under CUL-4.	This requirement was incorporated into the O&M Manual (see Exhibit L2.2-1), the C/RAWP (see Table 2.3-1), and the IM-3 Decommissioning Plan (see Table 6-1). The training and monitoring required by CUL-4 will ensure that this requirement is met.	This measure was incorporated into the O&M Manual (see Exhibit L2.2-1), the C/RAWP (see Table 2.3-1), and the IM-3 Decommissioning Plan (see Table 6-1). These documents were submitted on November 18, 2015.
Geology & Soils	**GEO-1a**	**Construction, Operation and Maintenance, and Decommissioning Impacts Related to Erosion of Soils.**						
Geology & Soils	GEO-1a-a	a) A DTSC-approved grading and erosion control plan, prepared by a California Registered Civil Engineer, shall be completed prior to implementation of any grading in areas of the site where there is a potential for substantial erosion or loss of top soils. The plan shall outline specific procedures for controlling erosion or loss of topsoil during construction, operation and maintenance, and decommissioning.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration; O&M Manual	A grading and erosion control plan will be prepared and included in the Construction/Remedial Action Work Plan for DTSC review and approval.	A grading and erosion control plan will be prepared and included in the Construction/Remedial Action Work Plan, which will be submitted as part of the final design for DTSC review and approval.	Grading plans including erosion control are included in Appendix D of the 90% BOD. Erosion control measures to be implemented during construction are also included in the Construction/Remedial Action Work Plan.	Grading plans including specific erosion control procedures were prepared by a California registered engineer and are included in Appendix D of this Final BOD. In addition to the grading and erosion control plan(s) required by this measure, other measures to control soil erosion are included in: • The Final BOD (Appendix C – Design Criteria). • The C/RAWP (Appendix F – IM-3 Decommissioning Work Plan [Appendix G, Construction BMPs Plan] and Appendix M – BMPs Plan). • Volume 1 of the O&M Manual (Appendix B – SOPs, Appendix D – SWPPP for O&M activities, and Section 7.4 – BMPs for maintenance of roads and access pathways). • Volume 2 of the O&M Manual (Appendix A – SOPs). These are discussed below as well.	The grading and erosion control plan (Appendix D of the BOD) was submitted on November 18, 2015.

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Geology & Soils	GEO-1a-b	b) To ensure soils do not directly or indirectly discharge sediments into surface waters as a result of construction, operation and maintenance, or decommission activities, PG&E shall develop a SWPPP as discussed in mitigation measure HYDRO-1 of the "Hydrology and Water Quality" section of this EIR. The SWPPP shall identify best management practices (BMPs) that would be used to protect stormwater runoff and minimize erosion during construction. PG&E shall prepare plans to control erosion and sediment, prepare preliminary and final grading plans, and shall prepare plans to control urban runoff from the project site during construction, consistent with the substantive requirements of the San Bernardino County Building and Land Use Services Department for erosion control.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	PG&E will prepare a BMP Plan prior to construction activities that will be included in the Construction/Remedial Action Work Plan.	PG&E will prepare a BMP Plan prior to construction activities that will be included in the Construction/Remedial Action Work Plan, to be submitted concurrently with the 90% design.	In compliance with mitigation measure HYDRO-1, a BMPs Plan for construction activities was prepared and is included in Section 4.10 of the Construction/Remedial Action Work Plan, as well as an appendix. In addition, an industrial SWPPP was also prepared in compliance with mitigation measure HYDRO-1 and included in Appendix E of the O&M Plan (Volume 1 of the O&M Manual). The SWPPP includes BMPs related to operation and maintenance activities of the remedy.	In compliance with mitigation measure HYDRO-1, PG&E developed a BMPs Plan to minimize erosion during construction activities (see HYDRO-1). This is included in Section 4.10 of the Construction/Remedial Action Work Plan, as well as Appendix M to the C/RAWP. PG&E will follow the General SWPPP for all construction activities. In addition, PG&E has prepared plans to control erosion and sediment runoff, consistent with the County's erosion control requirements, requiring the use of BMPs during construction, operations, and decommissioning. The BMPs for construction activities are located in Appendix G to the IM-3 Decommissioning Plan and Appendix M of the C/RAWP. The SWPPP (including BMPs) for operation and maintenance activities is included in Appendix E of the O&M Plan (Volume 1 of the O&M Manual). In addition, PG&E has prepared grading plans, which are included in Appendix D of this Final BOD.	Appendix G to the IM-3 Decommissioning Plan and Appendix M of the C/RAWP include BMPs to protect storm water runoff and minimize erosion during decommissioning and construction, respectively. In addition, a SWPPP for O&M activities was prepared and included in Appendix D of the O&M Manual Volume 1. The O&M Manual and the C/RAWP (which includes the IM-3 Decommissioning Plan) were submitted on November 18, 2015.
Geology & Soils	GEO-1a-c	c) During road preparation activities, loose sediment shall be uniformly compacted consistent with the substantive San Bernardino County Building and Land Use Services Department requirements to aid in reducing wind erosion. Ongoing road maintenance including visual inspection to identify areas of erosion and performing localized road repair and regrading, installation and maintenance of erosion control features such as berms, silt fences, or straw wattles, and grading for road smoothness shall be performed as needed to reduce potential for erosion.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed, to aid in reducing wind erosion.	This measure will be implemented as directed to aid in reducing wind erosion.	This measure will be implemented as directed to aid in reducing wind erosion (see BMPs Plan, in Section 4.10 and an appendix of the Construction/Remedial Action Work Plan). Section 6.4 of the O&M Plan (Volume 1 of the O&M Manual) discusses general guidelines for maintenance of access roads and pathways, from visual assessment, local repairs, soil stabilization, and installation/ maintenance of erosion controls, to grading.	The requirements, consistent with County requirements, to uniformly compact loose sediment and to provide ongoing road maintenance (including visual inspection to identify areas of erosion and performing localized road repair and regrading; installation and maintenance of erosion control features such as berms, silt fences, or straw wattles; and grading for road smoothness) to reduce the potential for erosion during road preparation activities have been included as BMPs in the BMPs Plan (Section 4.10 and Appendix M, Section 1.1.3 of the C/RAWP) and are included in Appendix G to the IM-3 Decommissioning Work Plan. This measure will be implemented as directed to aid in reducing wind erosion (see BMPs Plan, in Section 4.10 and an appendix of the Construction/Remedial Action Work Plan).	Appendix G to the IM-3 Decommissioning Work Plan and Appendix M of the C/RAWP include BMPs to protect storm water runoff and minimize erosion during decommissioning and construction, respectively. In addition, Section 7.4 of the O&M Manual Volume 1 contains BMPs for ongoing maintenance of roads and pathways. The O&M Manual and the C/RAWP (which includes the IM-3 Decommissioning Work Plan) were submitted on November 18, 2015.

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							In addition, Section 7.4 of the O&M Plan (Volume 1 of the O&M Manual) discusses general guidelines for maintenance of access roads and pathways, from visual assessment, local repairs, soil stabilization, and installation/maintenance of erosion controls, to grading.	
Geology & Soils	GEO-1a-d	d) Regarding the potential for contaminated soils to be eroded and contribute contamination into receiving waters, Mitigation Measures GEO-2 and HAZ-2 shall be implemented. Mitigation Measure GEO-2 provides the provisions for mitigating erosion through BMPs which shall be implemented. Mitigation Measure HAZ-2 provides the provisions for safe work practices and handling of contaminated soils as investigation derived wastes.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This mitigation measure will be met through actions to be taken to implement Mitigation Measures GEO-2 and HAZ-2 to prevent contaminated soils to be eroded and contribute contamination into receiving waters.	This mitigation measure will be met through actions to be taken to implement Mitigation Measures GEO-2 and HAZ-2 to prevent contaminated soils to be eroded and contribute contamination into receiving waters.	This mitigation measure will be met through actions to be taken to implement Mitigation Measures GEO-2 and HAZ-2 to prevent contaminated soils from being eroded and contributing contamination into receiving waters.	This mitigation measure will be met through implementation of mitigation measure HAZ-2 to prevent contaminated soils from being eroded and contributing contamination into receiving waters.	This mitigation measure was incorporated into the Health and Safety Plan for O&M activities (included as Volume 5 of the O&M Manual) and construction activities (included as Appendix D of the C/RAWP). Both the O&M Manual and C/RAWP were submitted on November 18, 2015.
Geology & Soils	**GEO-1b**	**Construction, Operation and Maintenance, and Decommissioning Impacts Related to Differential Compaction of Soils.**						
Geology & Soils	GEO-1b-a	a) BMPs shall be implemented during construction, operation and maintenance, and decommissioning activities to minimize impacts on the affected areas. Such BMPs could include, but would not be limited to, the following: uniform compaction of roadways created for accessing the project area as per San Bernardino County Building and Land Use Services Department requirements, returning areas adversely affected by differential compaction to preexisting conditions when these areas are no longer needed, and continuing maintenance of access roads, wellhead areas, and the treatment plant areas.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed. The BMPs will be identified in the Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration, as appropriate.	This measure will be implemented as directed. The BMPs will be identified in the Construction/Remedial Action Work Plan and Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration which will be submitted as part of the 90% design, as well as the Closure Plan for Decommissioning of Remedy Facilities and Restoration, which will be submitted prior to decommissioning.	This measure will be implemented as directed (see BMPs Plan Section 4.10 and in an appendix of the Construction/Remedial Action Work Plan; Section C2.2, Earthwork, in Appendix C (Design Criteria) of the 90% BOD; and Section 7.4, Access Road and Pathway Maintenance, of the O&M Plan (O&M Manual Volume 1).	BMPs will be implemented as directed (see BMPs Plan in Section 4.10 and Appendix M of the Construction/ Remedial Action Work Plan; Section C2.2, Earthwork, in Appendix C (Design Criteria) of the Final BOD; and Section 7.4, Access Road and Pathway Maintenance, of the O&M Plan (O&M Manual Volume 1).	The BOD, O&M Manual, and the C/RAWP (which includes the IM-3 Decommissioning Work Plan) were submitted on November 18, 2015.
Geology & Soils	GEO-1b-b	b) Work area footprints shall be minimized to the greatest extent feasible to limit the areas exposed to differential compaction. Where possible, existing unpaved access roads and staging/working areas shall be reused and maintained for different stages of the construction. New graded areas for staging or for access roads shall be compacted to a uniform specification, typically on the order of 90 to 95% compaction and consistent with substantive San Bernardino County Building and Land Use Services Department requirements to reduce differential compaction and subsequent erosion of site soils.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed, to minimize work area footprints to the greatest extent feasible.	This measure will be implemented as directed, to minimize work area footprints to the greatest extent feasible.	This measure has been and will be continue to be implemented as directed. PG&E will strive to minimize work area footprints to the maximum extent feasible, while maintaining a safe work zone and environment for all staffs, contractors, as well as monitors and observers. As discussed in CUL-1a-9, all of the soil storage and construction staging areas proposed in the 90% design are located on existing and/or previously used staging areas, as well as previously disturbed areas. All trench sections underneath roadways and shoulders are designed to be compacted to 95% and all other areas to at least 90%.	This measure has been and will continue to be implemented as directed. PG&E will strive to minimize work area footprints to the maximum extent feasible, while maintaining a safe work zone and environment for all staffs, contractors, as well as monitors and observers. Where possible, PG&E will reuse and maintain existing access routes and staging areas for different stages of construction. As discussed in CUL-1a-9, all of the soil storage and construction staging areas proposed in the final design are located on existing and/or previously used staging areas, as well as previously disturbed areas. Consistent with this measure and GEO-1a-c, all trench sections	The O&M Manual and the C/RAWP (which includes the IM-3 Decommissioning Work Plan) were submitted on November 18, 2015.

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							underneath roadways and shoulders are designed to be compacted to 95% and all other areas to at least 90%.	
Geology & Soils	GEO-1b-c	c) After the completion of the operation and maintenance phase, the disturbed areas which result in increased potential for compaction shall be returned to their respective preexisting condition by regrading consistent with the preconstruction slopes as documented through surveys that may include topographic surveys or photo surveys. The areas will be returned to the surrounding natural surface topography and compacted consistent with unaltered areas near the access roads or staging areas in question. The habitat restoration plan outlined in mitigation measure BIO-1 shall include restoration of native vegetation or other erosion control measures where revegetation would be infeasible or inadequate, for purposes of soil stabilization and erosion control of the project area.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed. The Habitat Restoration Plan, developed in compliance with BIO-1, will include the requirements under this measure.	This measure will be implemented as directed. The forthcoming Habitat Restoration Plan, to be developed in compliance with BIO-1, will include the requirements under this measure.	**<u>Resurfacing to Preconstruction Condition</u>** These requirements are included in the restoration guidelines for both the Plan for Decommissioning and Removal of the IM-3 Facility and Site Restoration (see Sections 8.1.2 and 8.1.3 of Appendix B of the CIMP) and measure CUL-1a-8e, Protocols for Restoring the Environment to its Preconstruction Conditions (see Sections 2.5.3 and 2.5.4 of the CIMP). **<u>Habitat Restoration and Revegetation</u>** In compliance with BIO-1, the Havasu National Wildlife Refuge Habitat Restoration Plan and the Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (both provided as appendices to the Construction/ Remedial Action Work Plan) include measures to address restoration of native vegetation.	**<u>Resurfacing to Preconstruction Condition</u>** The requirement to survey sloped areas that will be disturbed by the remedy and return such areas that have an increased potential for compaction to preexisting conditions is included in the restoration guidelines for both the Plan for Decommissioning and Removal of the IM-3 Facility and Site Restoration (see Sections 8.1.2 and 8.1.3 of Appendix B of the CIMP) and measure CUL-1a-8e, Protocols for Restoring the Environment to its Preconstruction Conditions (see Sections 2.5.3 and 2.5.4 of the CIMP). **<u>Habitat Restoration and Revegetation</u>** In compliance with BIO-1, the Havasu National Wildlife Refuge Habitat Restoration Plan and the Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (both provided as appendices to the Construction/Remedial Action Work Plan) evaluated restoration of native vegetation for the purpose of control erosion. As stated in Section 3.1 of the HNWR Habitat Restoration Plan and Section 2.1 of the Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats, the use of herbaceous vegetation covers as a soil stabilization technique is not being proposed for this project because this approach was not considered appropriate for this environment.	The C/RAWP (includes the CIMP) was submitted on November 18, 2015.

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Hazardous Materials	**HAZ-1a**	**Spills or Releases of Contaminants during Operation and Maintenance Activities.**						
Hazardous Materials	HAZ-1a-a	a) PG&E shall store, handle, and transport hazardous material in compliance with applicable local, state, and federal laws.	O&M Plan (Volume 1 of the O&M Manual)	This measure will be implemented as directed.	This measure will be implemented as directed. Storage and handling of hazardous materials will be discussed in the Hazardous Materials Business Plan (HMBP), the outline for which is presented in Appendix F of the O&M Plan, with the complete HMBP to be submitted as part of the 90% design.	This measure will be implemented as directed. Storage and handling of hazardous materials are discussed in the HMBP (Appendix F of the O&M Plan).	This measure will be implemented as directed. Storage, transport, and handling of hazardous materials are discussed in the HMBP (Appendix E of the O&M Plan) and will be followed during project implementation.	Volume 1 of the O&M Manual was submitted on November 18, 2015.
Hazardous Materials	HAZ-1a-b	b) All chemical storage and loading areas shall be equipped with proper containment and spill response equipment. BMPs to be implemented may include, but are not limited to, use of secondary containment in mixing and storage areas; availability of spill kits and spill containment booms, and appropriate storage containers for containment of the materials generated during the spill response.	O&M Plan (Volume 1 of the O&M Manual)	This measure will be implemented as directed.	This measure will be implemented as directed. Secondary containment for hazardous materials is described in the design criteria and drawings which are presented in Appendices C and D, respectively, of this BOD Report for the 60% design. Storage and handling of hazardous materials will be discussed in the HMBP, the outline for which is presented in Appendix F of the O&M Plan (Volume 1), with the complete HMBP to be submitted as part of the 90% design.	This measure will be implemented as directed. Secondary containment for hazardous materials is described in the design criteria and drawings which are presented in Appendices C and D, respectively, of the BOD Report for the 90% design. Storage and handling of hazardous materials are discussed in the HMBP (Appendix F of the O&M Plan).	This measure will be implemented as directed. The requirement for all chemical loading and storage areas to be equipped with proper containment and spill response equipment is in the design criteria and drawings which are presented in Appendices C and D, respectively, of this Final BOD Report. Storage and handling of hazardous materials are also discussed in the HMBP (Appendix F of the O&M Plan).	The BOD, including Volume 1 of the O&M Manual, was submitted on November 18, 2015.
Hazardous Materials	HAZ-1a-c	c) A project-specific HMBP, chemical standard operating procedure (SOP) protocols and contingency plans shall be developed to ensure that proper response procedures would be implemented in the event of spills or releases. Specifically, the HMBP and SOPs shall describe the procedures for properly storing and handling fuel on-site, the required equipment and procedures for spill containment, required personal protective equipment, and the measures to be used to reduce the likelihood of releases or spills during fueling or vehicle maintenance activities. BMPs to be implemented may include, but are not limited to, use of secondary containment in mixing and storage areas; availability of spill kits and spill containment booms, and appropriate storage containers for containment of the materials generated during the spill response. The field manager in charge of operations and maintenance activities shall be responsible for ensuring that these procedures are followed at all times.	Project-specific HBMP; O&M Plan (Volume 1 of the O&M Manual)	This measure will be implemented as directed. A project-specific HMBP, chemical standard operating procedure (SOP) protocols and contingency plans will be developed to ensure that proper response procedures would be implemented in the event of spills or releases.	This measure will be implemented as directed. Storage and handling of hazardous materials and spill response procedures will be discussed in the HMBP, the outline for which is presented in Appendix F of the O&M Plan (Volume 1), with the complete HMBP to be submitted as part of the 90% design.	This measure will be implemented as directed. Storage and handling of hazardous materials and spill response procedures will be discussed in the HMBP (Appendix F of O&M Plan).	Storage and handling of hazardous materials and spill response procedures are discussed in the HMBP (Appendix E of O&M Plan). The policy for safe fueling and proper handling of fuel on-site and measures to be used to reduce the likelihood of releases or spills during fueling are discussed in the Fuel SOP (Appendix F of the O&M Plan). The requirement to use appropriate personal protective equipment is contained in several locations in the O&M Manual, including Sections 6 and 7 of Volume 1 as well as Volume 5. The field manager in charge of operations and maintenance activities, or his/her designee, will be responsible for ensuring that safety procedures are followed at all times.	The project-specific HBMP was included as Appendix E in Volume 1 of the O&M Manual which was submitted on November 18, 2015.

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Hazardous Materials	**HAZ-1b**	**Spill or Release of Contaminants during Construction and Decommissioning Activities.**						
Hazardous Materials	HAZ-1b-a	a) Fueling areas and maintenance areas would be supplied with proper secondary containment and spill response equipment.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed. Fueling areas and maintenance areas will be supplied with proper secondary containment and spill response equipment.	This measure will be implemented as directed. Fueling areas and maintenance areas will be supplied with proper secondary containment and spill response equipment. BMPs/SOPs for fueling during construction will be described in the BMP Plan, which will be submitted at the 90% design stage as part of Corrective Measure Construction/Remedial Action Work Plan and Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration.	This measure will be implemented as directed. Fueling areas and maintenance areas will be supplied with proper secondary containment and spill response equipment. BMPs/SOPs for fueling during construction are described in the BMPs Plan in an appendix of the Construction/ Remedial Action Work Plan. Appendix C of the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration contains a safe fueling and fuel handling policy for activities during implementation of the Work Plan.	This measure will be implemented as directed. Fueling areas and maintenance areas will be supplied with proper secondary containment and spill response equipment. BMPs/SOPs for fueling during construction are described in the BMPs Plan in an appendix of the Construction/ Remedial Action Work Plan. Appendix C of the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration contains a safe fueling and fuel handling policy for activities during implementation of the Work Plan.	This mitigation measure is addressed in Section 3 of the Revised IM-3 Decommissioning Plan as well as Section 3.2.3.1 and Appendix M of the C/RAWP. Both documents were submitted on November 18, 2015.
Hazardous Materials	HAZ-1b-b	b) PG&E shall develop fueling SOP protocols and a contingency plan that would be implemented at all fueling areas on-site. The SOPs shall describe the procedures for properly storing and handling fuel on-site, the required equipment and procedures for spill containment, required PPE, and the measures to be used to reduce the likelihood of releases or spills during fueling or vehicle maintenance activities. Potential measures include but are not limited to, fuel storage in bermed areas, performing vehicle maintenance in paved and bermed areas, and availability of spill kits for containment and cleanup of petroleum releases. The field manager in charge of construction and decommissioning activities shall be responsible for ensuring that these procedures are followed at all times.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed. Fueling SOP protocols and a contingency plan will be developed for implementation at fueling areas on-site during construction.	This measure will be implemented as directed. Fueling areas and maintenance areas will be supplied with proper secondary containment and spill response equipment. BMPs/SOPs for fueling during construction will be described in the BMP Plan, which will be submitted at the 90% design stage as part of Corrective Measure Construction/Remedial Action Work Plan and Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration.	This measure will be implemented as directed. Fueling areas and maintenance areas will be supplied with proper secondary containment and spill response equipment. BMPs/SOPs for fueling during construction are described in the BMPs Plan in an appendix of the Construction/Remedial Action Work Plan. Appendix G (Construction BMPs Plan) of the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration contains BMPs for storage and handling of hazardous materials.	PG&E has developed fueling SOP protocols that meet the requirements of this measure (Appendix F of Volume 1 of the O&M Manual, Appendix B of the C/RAWP, and Appendix C of the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration).	This mitigation measure was incorporated into Appendix F of Volume 1 of the O&M Manual, Appendix B of the C/RAWP, and Appendix C of the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration. These documents were submitted on November 18, 2015.
Hazardous Materials	HAZ-1b-c	c) PG&E shall comply with local, state, and federal regulations related to the bulk storage and management of fuels.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed, for compliance with local, state, and federal regulations related to the bulk storage and management of fuels.	This measure will be implemented as directed. Fueling areas and maintenance areas will be supplied with proper secondary containment and spill response equipment. BMPs/SOPs for fueling during construction will be described in the BMP Plan, which will be submitted at the 90% design stage as part of Corrective Measure Construction/Remedial Action Work Plan and Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration.	This measure will be implemented as directed. Fueling areas and maintenance areas will be supplied with proper secondary containment and spill response equipment. BMPs/SOPs for fueling during construction are described in the BMPs Plan in Section 4 as well as an appendix of the Construction/ Remedial Action Work Plan. Appendix G (Construction BMPs Plan) of the IM-3 Decommissioning Plan contains BMPs addressing waste and materials storage and handling areas.	This measure will be implemented as directed. PG&E has a bulk storage tank for fuel at the TCS that is included in the TCS HMBP. The TCS HMBP is on file with the local Fire Department.	The TCS HMBP (February 2014) is on file with the local Fire Department.

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Hazardous Materials	HAZ-2	**Reasonably Foreseeable Releases of Chemicals from Excavated or Disturbed Soil** -- Before initiating ground-disturbing operations, a health and safety plan shall be developed and implemented by qualified environmental professionals to ensure health and safety precautions are being met. It is not possible to prepare the health and safety plan at this stage of the planning process because final construction plans and other design documents have not been finalized in sufficient detail. However, at a minimum, the health and safety plan shall include procedures to mitigate potential hazards, and such procedures shall include the use of PPE, measures that provide protection from physical hazards, measures that provide protection from chemical hazards that may be present at the site, decontamination procedures, and worker and health and safety monitoring criteria to be implemented during construction. The worker health and safety plan shall include protective measures and PPE that are specific to the conditions of concern and meet the requirements of the U.S. Occupational Safety and Health Administration's (OSHA's) construction safety requirements and Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120). In accordance with OSHA requirements, appropriate training and recordkeeping shall also be a part of the health and safety program. The worker health and safety plan shall be certified by a Certified Industrial Hygienist in accordance with OSHA regulations. The worker health and safety plan shall be explained to the construction workers and all workers shall be required to sign the plan, which will be kept on the construction site at all times. Worker safety training shall occur prior to initiation of ground disturbing activities. Training shall include the review of all health and safety measures and procedures. All workers and engineering inspectors at the site shall provide written acknowledgement that the soils management plan (discussed below), worker health and safety plan, and community health and safety plan were reviewed and training was received prior to commencement of construction activities. The following are specific elements and directives that shall be included in the health and safety plan and implemented by PG&E during construction, operation and maintenance, and decommissioning of this project:	Health and Safety Plan	This mitigation measure will be implemented as directed. A health and safety plan will be developed for O&M activities and will be submitted with the O&M Plan. Similarly, a health and safety plan will be developed for construction activities and will be submitted with the Construction/Remedial Action Work Plan. The plans will be implemented by qualified environmental professionals.	This mitigation measure will be implemented as directed. A health and safety plan will be developed for O&M activities and will be submitted at the 90% design stage. Similarly, a health and safety plan will be developed for construction activities and will be submitted with the Construction/Remedial Action Work Plan at the 90% design stage. The plans will be implemented by qualified environmental professionals.	This mitigation measure will be implemented as directed. A health and safety plan for O&M activities was developed and is included in Volume 5 of the O&M Manual. Similarly, a health and safety plan for construction activities was developed and is included in an appendix of the Construction/ Remedial Action Work Plan.	This mitigation measure will be implemented as directed. A health and safety plan and guidelines for O&M activities were developed and are included in Volume 5 of the O&M Manual. The final O&M health and safety plan that meets the requirements of this mitigation measure will be submitted during the start-up phase of the remedy. A health and safety plan for construction activities that meets the requirements of this mitigation measure was developed and is included in Appendix D of the Construction/Remedial Action Work Plan.	The O&M Manual and C/RAWP were submitted on November 18, 2015. The Construction Health and Safety Plan was certified by a Certified Industrial Hygienist in accordance with OSHA regulations on November 8, 2015.

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Hazardous Materials	HAZ-2a	a. Vehicles traveling on unpaved roadways or surfaces would be directed to avoid traveling in areas where contaminated soils are known to be present; vehicle speeds shall be controlled (e.g., limited to 15 mph or slower) to limit generation of dust; measures, such as wetting of surfaces, will be employed to prevent dust generation by vehicular traffic or other dust-generating work activities.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed. Vehicle movement will be controlled to avoid traveling in areas where contaminated soils are known to be present, and limit speeds to limit generation of dust.	This measure will be implemented as directed. Vehicle movement will be controlled to avoid traveling in areas where contaminated soils are known to be present, and speeds will be limited to limit generation of dust.	This measure will be implemented as directed. Vehicle movement will be controlled to avoid traveling in areas where contaminated soils are known to be present, and speeds will be limited to limit generation of dust.	This measure will be implemented as directed. Vehicle movement will be controlled to avoid traveling in areas where contaminated soils are known to be present, and speeds will be limited to limit generation of dust.	This mitigation measure was incorporated into the O&M Manual, the C/RAWP, and the IM-3 Decommissioning Plan. These documents were submitted on November 18, 2015.
Hazardous Materials	HAZ-2b	b. Pre-mobilization planning shall occur during which the likelihood of encountering contaminated soils shall be reviewed along with the HMBP, site-specific health and safety plan, and SOPs so that the procedures are followed and the contingencies for handling contaminated soils are in-place prior to implementing the field operations.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed. Pre-mobilization planning will be used to review the likelihood of encountering contaminated soils, the HMBP, site-specific health and safety plan, and SOPs so that the procedures are followed and the contingencies for handling contaminated soils are in-place.	This measure will be implemented as directed. Pre-mobilization planning will be used to review the likelihood of encountering contaminated soils, the HMBP, site-specific health and safety plan, and SOPs so that the procedures are followed and the contingencies for handling contaminated soils are in-place.	This measure will be implemented as directed, and included in the health and safety plans. Pre-mobilization planning will be used to review the likelihood of encountering contaminated soils, the HMBP, site-specific health and safety plan, and SOPs so that the procedures are followed and the contingencies for handling contaminated soils are in-place.	This measure will be implemented as directed, and has been included in the health and safety plans, which require pre-mobilization planning to review the likelihood of encountering contaminated soils. The HMBP, site-specific health and safety plan, and SOPs will be reviewed at a pre-mobilization meeting so that the procedures are followed and the contingencies for handling contaminated soils are in-place.	This mitigation measure was incorporated into the O&M Manual and the C/RAWP (including the IM-3 Decommissioning Plan). These documents were submitted on November 18, 2015.
Hazardous Materials	HAZ-2c	c. Should evidence of contaminated soil be identified during ground disturbing activities (e.g., noxious odors, discolored soil), work in this area will immediately cease until soil samples can be collected and analyzed for the presence of contaminants by the site supervisor or the site safety officer. Contaminated soil shall be managed and disposed of in accordance with a project-specific health and safety plan and soil management plan. The health and safety plan and soil management plan shall be approved by DTSC before beginning any ground disturbing activities. While the project is exempt from the requirements of the San Bernardino County Division of Environmental Health, the health and safety plan and soil management plan shall be prepared in general accordance with the substantive requirements of this agency.	Health and Safety Plan; Soil Management Plan (Volume 4 of O&M Manual)	This measure will be implemented as directed. A Health and Safety Plan and a Soil Management Plan will be prepared as part of the Construction/Remedial Action Work Plan and submitted to DTSC.	This measure will be implemented as directed. Project-specific Health and Safety Plans for construction and O&M activities will be prepared and submitted to DTSC at the 90% design stage. A Soil Management Plan (SMP) is included in Volume 4 of the O&M Manual, which is Appendix L to the 60% BOD report. The SMP includes procedures and protocols for the management and disposal of potentially contaminated soil displaced during drilling, construction, O&M of the groundwater remedy, and the decommissioning and removal of the IM-3 system.	This mitigation measure will be implemented as directed. A health and safety plan for O&M activities was developed and is included in Volume 5 of the O&M Manual, which is Appendix L to the 90% BOD. Similarly, a health and safety plan for construction activities was developed and is included in an appendix of the Construction/Remedial Action Work Plan. A Soil Management Plan (SMP) is included in Volume 4 of the O&M Manual. The SMP includes procedures and protocols for the management and disposal of displaced soil, including potentially contaminated soil, during drilling, construction, O&M of the groundwater remedy, and the decommissioning and removal of the IM-3 system.	This mitigation measure will be implemented as directed. Section 4.6.2.2 of the C/RAWP requires that if evidence of contaminated soil is identified during ground-disturbing activities, work will be halted until soil samples are analyzed. A Soil Management Plan (SMP) is included in Volume 4 of the O&M Manual. The SMP includes procedures and protocols for the management and disposal of displaced soil, including potentially contaminated soil, during drilling, construction, O&M of the groundwater remedy, and the decommissioning and removal of the IM-3 system.	This mitigation measure was incorporated into the C/RAWP and the O&M Manual. Both the O&M Manual and C/RAWP were submitted on November 18, 2015.

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Hazardous Materials	HAZ-2d	d. In the event that drilling sites must be located within areas of suspected soil contamination, the appropriate PPE shall be worn by all personnel working in these areas and methods specified in the health and safety plan used to control the generation of dust. When working in these areas, personnel shall be required to follow all guidance presented in the site-specific health and safety plan and soil management plan. The site-specific health and safety plan shall include provisions for site control such as, but not limited to, delineation of the exclusion, contaminant reduction and support zones for each work area, decontamination procedures, and procedures for the handling of contaminated soils and other investigation derived wastes. Soil that is excavated shall be loaded directly into containers such as roll-off bins; dust suppression methods shall be used prior to and during loading of soils into the bins. Suspected contaminated soils shall be segregated from suspected uncontaminated soils.	Health and Safety Plan	This measure will be implemented as directed. A Health and Safety Plan will be prepared as part of the Construction/Remedial Action Work Plan and submitted to DTSC.	This measure will be implemented as directed. Project-specific Health and Safety Plans for construction and O&M activities will be prepared and submitted to DTSC at the 90% design stage.	This mitigation measure will be implemented as directed. A health and safety plan for O&M activities was developed and is included in Volume 5 of the O&M Manual. Similarly, a health and safety plan for construction activities was developed and is included in an appendix of the Construction/ Remedial Action Work Plan.	This mitigation measure will be implemented as directed. The requirements of this mitigation measure are included in a health and safety plan for O&M activities (Volume 5 of the O&M Manual) and a health and safety plan for construction activities (Appendix D of the Construction/Remedial Action Work Plan). For example, delineation of the exclusion, contaminant reduction and support zones for each work area, and decontamination, are discussed in Section 6 of the HSP. The management and handling of potentially contaminated soil is included in the Soil Management Plan (Volume 4 of the O&M Manual).	The O&M Manual and the C/RAWP were submitted on November 18, 2015.
Hazardous Materials	HAZ-2e	e. Personnel working at the site shall be trained in Hazardous Waste Operations.	Health and Safety Plan	This measure will be implemented as directed. A Health and Safety Plan will be prepared as part of the Construction/Remedial Action Work Plan, and will include requirement for training of personnel working at the site in Hazardous Waste Operations.	This measure will be implemented as directed. Project-specific Health and Safety Plans for construction and O&M activities will be prepared and submitted to DTSC at the 90% design stage, and will include requirement for training of personnel working at the site in Hazardous Waste Operations.	This mitigation measure will be implemented as directed. A health and safety plan for O&M activities was developed and is included in Volume 5 of the O&M Manual. Similarly, a health and safety plan for construction activities was developed and is included in an appendix of the Construction/ Remedial Action Work Plan.	This mitigation measure will be implemented as directed. The requirement that personnel who will manage hazardous waste or potentially hazardous waste be trained in hazardous waste operations is included in Section 4.1 of the Soil Management Plan (Volume 4 of the O&M Manual), a health and safety plan and guideline for O&M activities (Volume 5 of the O&M Manual), and a health and safety plan for construction activities (Section 5, Appendix D of the C/RAWP).	The O&M Manual and C/RAWP were submitted on November 18, 2015.
Hazardous Materials	HAZ-2f	f. All soil excavated and placed in roll-off bins or trucks for transportation off-site shall be covered with a tarp or rigid closure before transporting, and personnel working in the area shall be positioned upwind of the loading location.	Soil Management Plan (Volume 4 of O&M Manual)	This measure will be implemented as directed. A Soil Management Plan will be prepared as part of the Construction/Remedial Action Work Plan, and will include requirement for soil excavated and placed in roll-off bins or trucks for transportation off-site to be covered with a tarp or rigid closure before transporting.	This measure will be implemented as directed. A Soil Management Plan (SMP) is included in Volume 4 of the O&M Manual, which is Appendix L to the 60% BOD report. The SMP includes requirement for soil excavated and placed in roll-off bins or trucks for transportation off-site to be covered with a tarp or rigid closure before transporting.	This measure will be implemented as directed. An SMP is included in Volume 4 of the O&M Manual, which is Appendix L to the 90% BOD report. The SMP includes requirement for soil excavated and placed in roll-off bins or trucks for transportation off-site to be covered with a tarp or rigid closure before transporting (see Section 4.6 of the SMP).	This measure will be implemented as directed. The requirements of this mitigation measure are included in the Soil Management Plan, which is included in Volume 4 of the O&M Manual, which is Appendix L to this Final BOD report. The Soil Management Plan includes the requirement for soil excavated and placed in roll-off bins or trucks for transportation off-site to be covered with a tarp or rigid closure before transporting (see Section 4.6 of the SMP). In general, personnel working in the area will be positioned upwind of construction activities including bin loading – this safety	The Soil Management Plan is included as Volume 4 of the O&M Manual, which was submitted on November 18, 2015. The Construction Health and Safety Plan was included as Appendix D of the C/RAWP which was submitted on November 18, 2015.

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							detail is usually covered under a Job Safety Analysis (JSA), which is also known as Activity Hazard Analysis (AHA)) or Job Hazard Analysis (JHA) (see Section 7.2 of the Construction Health and Safety Plan).	
Hydrology and Water Quality	HYDRO-1	**Exceedance of Water Quality Standards.** The project shall implement BMPs to meet the substantive criteria of NPDES General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities Order No. 2009-0009-DWQ NPDES No. CAS000002 (General Permit) (SWRCB 2009) as well as all other applicable federal, state, and local permit and regulatory requirements, even if a permit is not required pursuant to CERCLA, for purposes of ensuring the protection of receiving water quality. As such, a BMP plan shall be prepared and implemented for the project prior to construction and decommissioning phase activities. Impacts on water quality from pollutants, including soils from erosion, shall be controlled through use of the following types of BMPs, which shall be incorporated into the appropriate project-specific BMP plan. The General Permit requirements include specific BMPs as well as numeric effluent levels (NELs) and numeric action levels (NALs) to achieve the water quality standards (SWRCB 2009:3). Types of BMPs cited in the General Permit (SWRCB 2009:7) include: a) Scheduling of Activities; b) Prohibitions of Practices; c) Maintenance Procedures; d) Other Management Practices to Prevent or Reduce Discharge of Pollutants to Waters of the United States; e) Treatment Requirements; and f) Operating Procedures and Practice to Control Site Runoff, Spillage or Leaks, Sludge or Waste Disposal, or Drainage from Raw Materials Storage. Visual inspections and monitoring and sampling are required under the General Permit to evaluate the effectiveness of the BMPs and to determine whether modifying BMPs or implementing additional BMPs is required. The BMP designations cited below are based on those used by the California Stormwater Quality Association Construction BMP Handbook (California Stormwater Quality Association 2003) and are consistent with the types of BMPs referenced in the General Permit: g) Scheduling (SS-1): Proper scheduling assists in identifying ways to minimize disturbed areas, which allows for a reduction in the active project area requiring protection and also minimizes the length	BMP Plan	This measure will be implemented as directed. PG&E will prepare a BMP Plan prior to construction activities which will be included in the Construction/Remedial Action Work Plan.	This measure will be implemented as directed. PG&E will prepare a BMP Plan prior to construction activities (at the 90% design stage) which will be included in the Construction/Remedial Action Work Plan. On December 27, 2011, the Superior Court issued a judgment in response to litigation, and the State Water Board will be amending Order 2009-0009-DWQ (as modified by Order No. 2010-00014-DWQ) in accordance with the related peremptory writ of mandate. As a result, the Numeric Effluent Limits (NELs) are no longer in effect. In addition, further amendments to the permit are possible.	This measure will be implemented as directed. A BMP Plan was prepared and included in an appendix of the Construction/Remedial Action Work Plan. On July 17, 2012, the State Water Resources Control Board amended Order 2009-009-DWQ by adopting Order No. 2012-0006-DWQ NPDES NO. CAS000002. Order 2012-006-DWQ requires effluent monitoring and reporting for pH and turbidity in storm water discharges. The monitoring will be used to evaluate whether numeric action levels (NALs) and numeric effluent limitations (NELs) for Active Treatment Systems included in the Construction General Permit are exceeded. The Permit contains only narrative effluent limitations and does not contain numeric effluent limitations, except for Active Treatment Systems (ATSs).	This measure will be implemented as directed. A BMP Plan was prepared by Gino Nguyen, a Qualified SWPPP Developer, to meet the substantive criteria of the applicable General Permit (including the July 2012 requirements) and all other applicable federal, state, and local permit and regulatory requirements. The BMP Plan is Appendix M to the Construction/Remedial Action Work Plan. Section 2 of the BMP Plan requires visual inspections and monitoring and sampling to evaluate the effectiveness of the BMPs and determine whether modification is required.	This measure is incorporated into the C/RAWP (see Appendix M) and in the IM-3 Decommissioning Work Plan (see Appendix G).These documents were submitted on November 18, 2015.

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		of time disturbed soils are exposed to erosive processes. h) Preservation of Existing Vegetation (SS-2): Preserving existing vegetation to the maximum extent practicable facilitates protection of surfaces from erosion and can also help to control sediments. Sensitive areas should also be clearly identified and protected. i) Hydraulic Mulch (S S-3), Straw Mulch (S S-6), and Wood Mulching (SS-8): Using various mulches is a method for temporarily stabilizing soil and can be used on surfaces with little or no slope. j) Geotextiles, Plastic Covers, and Erosion Control Blankets/Mats (SS-7): These erosion control methods can be used on flat or, usually, sloped surfaces, channels, and stockpiles. k) Stabilized Construction Entrance/Exit (TC-1): A graveled area or pad located at points where vehicles enter and leave a construction site can be built. This BMP provides a buffer area where vehicles can drop their mud and sediment to avoid transporting it onto public roads, to control erosion from surface runoff, and to help control dust. l) Runoff Control Measures (SS-9, SS-10, and SC-10): These include graded surfaces to redirect sheet flow, diversion dikes or berms that force sheet flow around a protected area, and stormwater conveyances (swales, channels, gutters, drains, sewers) that intercept, collect, and redirect runoff. Diversions can be either temporary or permanent. Temporary diversions include excavation of a channel along with placement of the spoil in a dike on the downgradient side of the channel, and placement of gravel in a ridge below an excavated swale. Permanent diversions are used to divide a site into specific drainage areas, should be sized to capture and carry a specific magnitude of storm event, and should be constructed of more permanent materials. A water bar is a specific kind of runoff diversion that is constructed diagonally at intervals across a linear sloping surface such as a road or right-of-way that is subject to erosion. Water bars are meant to interrupt accumulation of erosive volumes of water through their periodic placement down the slope, and divert the resulting segments of flow into adjacent undisturbed areas for dissipation. m) Silt Fence (SC-1): A temporary sediment barrier consisting of fabric is designed to retain sediment from small disturbed areas by reducing the velocity of sheet flows. n) Gravel Bag Berm (SC-6) and Sand/Gravel Bag Barrier (SC-8): A temporary sediment barrier						

		consisting of gravel-filled fabric bags is designed to retain sediment from small disturbed areas by reducing the velocity of sheet flows. o) Desilting Basin (SC-2) and Sediment Trap (SC-3): Constructing temporary detention structures facilitates the removal of sediment from waters. The devices provide time for sediment particles to settle out of the water before runoff is discharged. Secondary concerns include potential pollutants from inappropriate material storage and handling procedures and nonstormwater discharges. These will be addressed through the following types of BMPs, which shall be incorporated into the stormwater BMP plan: p) Material Delivery and Storage (WM-1): Provide covered storage for materials, especially toxic or hazardous materials, to prevent exposure to stormwater. Store and transfer toxic or hazardous materials on impervious surfaces that will provide secondary containment for spills. Park vehicles and equipment used for material delivery and storage, as well as contractor vehicles, in designated areas. q) Spill Prevention and Control (WM-4): Ensure that spills and releases of materials are cleaned up immediately and thoroughly. Ensure that appropriate spill response equipment, preferably spill kits preloaded with absorbents in an overpack drum, is provided at convenient locations throughout the site. Spent absorbent material must be managed and disposed of in accordance with applicable regulations. In particular, absorbents used to clean up spills of hazardous materials or waste must be managed as hazardous waste unless characterized as nonhazardous. r) Solid Waste Management (WM-5): Provide a sufficient number of conveniently located trash and scrap receptacles to promote proper disposal of solid wastes. Ensure that the receptacles are provided with lids or covers to prevent windblown litter. s) Hazardous Waste Management (WM-6): Provide a sufficient number of proper receptacles to promote proper disposal of hazardous wastes. t) Concrete Waste Management (WM-8): Dispose of excess concrete in specific concrete washout facilities. u) Sanitary/Septic Waste Management (WM-9): Locate sanitary and septic waste facilities away from drainage courses and traffic areas. Maintain the facilities regularly. v) Vehicle and Equipment Cleaning (NS-8): Clean vehicles and equipment that regularly enter and leave the construction site. w) Vehicle and Equipment Fueling (NS-9): Fuel vehicles and equipment off- site whenever possible. If off-site fueling is not practical, establish a designated on-site fueling area with proper containment and spill cleanup materials.						

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		x) Vehicle and Equipment Maintenance (NS-10): Use off-site maintenance facilities whenever possible. Any on-site maintenance areas must be protected from stormwater runoff and on-site flooding.						
Hydrology and Water Quality	HYDRO-1	In addition to BMPs implemented to avoid or reduce impacts from the construction and decommissioning phases, BMPs shall also be implemented to avoid or reduce impacts from the operations and maintenance phases. To address potential violation of water quality standards caused by insufficient treatment, system failure at concentrations in excess of water quality standards, proper design shall include contingency measures such as safeguards to shut down the extraction wells in case of pipeline failure or malfunction. In addition, operation of the proposed project will be governed by and follow an O&M plan. PG&E will comply with all applicable water quality standards, the General Permit, and any SWRCB or RWQCB resolutions identified as ARAR, as well as a corrective action monitoring program. Under the corrective action monitoring program, data will be collected to measure performance of the remedy, compliance with standards, and progress of the remedial action as a part of the project description. In addition, the project will be operated to continually assess performance issues and to modify the type, method, and configuration of the treatment delivery systems to enhance performance of the remedy to attain the cleanup goals and to respond to site conditions and performance issues as described in the project description.	O&M Plan	This measure will be implemented as directed. An O&M Plan will be developed and will include BMPs to avoid or reduce impacts from the operations and maintenance phases, and a monitoring program in compliance with applicable water quality standards, the General Permit, and identified ARARs.	This measure will be implemented as directed. The Contingency Plan (Volume 3) of the O&M Manual, which is included in the 60% design, includes BMPs to avoid or reduce impacts from the operations and maintenance phases. The Sampling and Monitoring Plan (Volume 2) of the O&M Manual includes a monitoring program in compliance with applicable water quality standards, and identified ARARs. The O&M SWPPP (Appendix E of the O&M Plan) will include a storm water monitoring program in compliance with the General Permit. The outline for the O&M SWPPP is included in the Draft O&M Manual at the 60% design stage; the complete SWPPP will be provided at the 90% design stage.	This measure will be implemented as directed. The Contingency Plan (Volume 3) of the O&M Manual, which is included in the 90% design, includes BMPs to avoid or reduce impacts from the operations and maintenance phases. The Sampling and Monitoring Plan (Volume 2) of the O&M Manual includes a monitoring program in compliance with applicable water quality standards, and identified ARARs. The O&M (or industrial) SWPPP (Appendix E of the O&M Plan) includes a storm water monitoring program in compliance with the new Statewide Industrial Storm Water General Permit, which will become effective on July 1, 2015.	This measure will be implemented as directed. The Contingency Plan (Volume 3) of the O&M Manual, which is included in the final design, includes BMPs to avoid or reduce hydrology and water quality impacts from the operations and maintenance phases, including, but not limited to, protocols for shutting down the extraction wells in case of pipeline failure or malfunction. An O&M Manual has been prepared to govern the operation of the remedy. The Sampling and Monitoring Plan (Volume 2) of the O&M Manual includes a monitoring program in compliance with applicable water quality standards, the General Permit, and identified ARARs. The O&M (or industrial) SWPPP (Appendix D of the O&M Plan) includes a storm water monitoring program in compliance with the new Statewide Industrial Storm Water General Permit, which became effective on July 1, 2015.	This measure is incorporated into the Contingency Plan (Volume 3) of the O&M Manual and the Sampling and Monitoring Plan (Volume 2) of the O&M Manual, which was submitted on November 18, 2015.
Hydrology and Water Quality	HYDRO-1	A SWPPP will also be prepared for the proposed project, which will contain BMPs related to industrial activities (industrial SWPPP). The BMPs are designed to reduce pollutants in discharges that may affect receiving water quality during operations and maintenance of the proposed project. As noted above, BMP designations are based on those used by the *California Stormwater Quality Association Construction BMP Handbook* (California Stormwater Quality Association 2003) and those referenced in the General Permit The SWPPP will incorporate BMPs such as the following: y) Good Housekeeping: Maintain facility in a clean manner and train facility personnel to contribute to a safe, clean, and orderly environment by properly disposing of trash in designated containers, storing materials in appropriate locations, and keeping equipment clean and in good working condition. z) Preventative Maintenance: Prevent or minimize release of pollutants. Develop Standard Operating	Stormwater Pollution Prevention Plan (SWPPP)/ BMP Plan and Monitoring and Reporting	This measure will be implemented as directed. An industrial Storm Water Pollution Prevention Plan (SWPPP) will be developed as part of the O&M Plan and implemented to reduce pollutants in discharges that may affect receiving water quality during operations and maintenance of the remedy	This measure will be implemented as directed. The O&M SWPPP outline is included as Appendix E of the O&M Plan. The complete SWPPP will be submitted at the 90% design stage. The SWPPP will be developed in compliance with the Industrial Storm Water General Permit Order 97-03-DWQ (General Industrial Permit), or the relevant applicable requirements.	This measure will be implemented as directed. The industrial SWPPP was developed and included in Appendix E of the O&M Plan. The O&M (or industrial) SWPPP (Appendix E of the O&M Plan) includes a storm water monitoring program in compliance with the new Statewide Industrial Storm Water General Permit which will become effective on July 1, 2015.	This measure will be implemented as directed. The industrial SWPPP that complies with the requirements of this mitigation measure and the General Permit was developed and included in Appendix D of the O&M Plan. For example, the O&M (or industrial) SWPPP (Appendix D of the O&M Plan) includes a storm water monitoring program in compliance with the new Statewide Industrial Storm Water General Permit which became effective on July 1, 2015.	This measure is incorporated in Appendix D (Storm Water Pollution Prevention Plan for O&M Activities) of the O&M Manual, Volume 1, which was submitted on November 18, 2015.

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		Procedures for operation and maintenance of facility components and train employees to follow the procedures. aa) Non-Stormwater Discharges (SC-10): Ensure that used oil, used antifreeze, and hazardous chemical recycling programs are being implemented. Conduct regular inspections of high priority areas. bb) Spill Prevention, Control, and Cleanup (SC-1 1): Store materials properly to prevent spills from entering the storm drain system or surface waters. Ensure that spill cleanup materials are located on-site and are easily accessible. Clean up leaks and spills immediately using proper absorbent materials. Absorbents used to clean up hazardous materials must be disposed of as hazardous waste. Educate employees about spill prevention and cleanup. cc) Vehicle and Equipment Fueling (SC-20): Maintain clean fuel-dispensing areas using dry cleanup methods, such as sweeping or using rags and absorbents for leaks and spills. Cover the fueling area to prevent contact with stormwater. Train personnel in pollution prevention, focusing on containment of spills and leaks. dd) Outdoor Loading/Unloading (SC-30): Load and unload chemicals during dry weather, if possible, and load and unload in designated areas. Check equipment regularly for leaks. ee) Outdoor Liquid Container Storage (SC-3 1): Cover the storage area with a roof and provide secondary containment. Inspect storage areas regularly for leaks or spills. ff) Outdoor Equipment Operations (SC-32): Perform activities during dry weather, cover the work area with a roof, and use secondary containment. Train employees in proper techniques for spill containment and cleanup. gg) Waste Handling and Disposal (SC-34): Cover storage containers with leak-proof lids, check for leaks weekly, and clean storage areas regularly. Ensure that wastes are disposed of properly. hh) Tank Design System: Ensure that tank systems have sufficient strength to avoid collapse, rupture, or failure and that they are protected against physical damage and excessive stress. Provide adequate secondary containment.						
Hydrology and Water Quality	HYDRO-1	In conformance with the substantive requirements of General Permit (Order No. 2009-0009-DWQ, a monitoring and reporting program will be implemented to assess the effectiveness of BMPs and to modify BMPs and revise the SWPPP, if necessary, to continue to reduce pollutants and	Stormwater Pollution Prevention Plan (SWPPP)/ BMP Plan and Monitoring and Reporting	This measure will be implemented as directed. The SWPPP will include a monitoring and reporting program to assess the effectiveness of BMPs and to	This measure will be implemented as directed. The O&M SWPPP and BMP Plan, which will be submitted at the 90% design stage, will include a monitoring and reporting program to assess the effectiveness of BMPs and	This measure will be implemented as directed. The industrial SWPPP and BMP Plan include a monitoring and reporting program to assess the effectiveness of BMPs and to modify	This measure will be implemented as directed. The industrial SWPPP and BMP Plan include a monitoring and reporting program to assess the effectiveness of	This measure is incorporated in Appendix D (Storm Water Pollution Prevention Plan for O&M Activities) of the O&M manual, Volume 1; Appendix M of the C/RAWP; as well as Appendix G of

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		impacts on receiving waters. The monitoring program shall include the following minimum elements as per the General Permit: ii) quarterly, nonstormwater visual inspections, jj) storm-related visual inspections within 2 business days of a qualifying rain event (producing precipitation of one-half inch or more of discharge), kk) visual inspection after a storm event, ll) monitoring of nonvisual pollutants based on the calculated risk level for the project, with Risk Level 2 and 3 requiring a minimum of three samples per day during qualifying rain events (SWRCB 2009: Tables 5 and 6, 22–27), and mm) monitoring and reporting for linear projects as per Table 2.7-1A of the General Permit Results of this monitoring shall be reported annually to DTSC and to the Storm Water Multi-Application Reporting and Tracking System (SMARTS). The annual report shall include a summary and evaluation of all sampling and analysis results, original laboratory reports, and chain of custody forms; a summary of all corrective actions taken during the compliance year; and identification of any compliance activities or corrective actions that were not implemented. NEL Violation Reports and/or NAL Violation Reports are required for Risk Level 3 and linear underground/overhead project (LUP) Type 3 Discharges. Should the project meet these criteria, the respective reports shall be submitted within 5 days of the end of the storm event, as per General Permit requirements, and provide the required information identified (SWRCB 2009:26–27 and Table 2.7-1A). The implementation of stormwater plans shall include an education component to train workers on water quality concerns and proper BMP implementation, maintenance, and repair, in addition to stormwater management program training on the construction BMP plan and industrial SWPPP.		modify BMPs and revise the SWPPP, if necessary.	to modify BMPs and revise the SWPPP, if necessary. On December 27, 2011, the Superior Court issued a judgment in response to litigation, and the State Water Board will be amending Order 2009-0009-DWQ (as modified by Order No. 2010-00014-DWQ) in accordance with the related peremptory writ of mandate. As a result, the Numeric Effluent Limits (NELs) are no longer in effect. In addition, further amendments to the permit are possible.	BMPs and revise the SWPPP, if necessary. On July 17, 2012, The State Water Resources Control Board amended Order 2009-009-DWQ by adopting Order No. 2012-0006-DWQ NPDES NO. CAS000002. Order 2012-006-DWQ requires effluent monitoring and reporting for pH and turbidity in storm water discharges. The monitoring will be used to evaluate whether numeric action levels (NALs) and numeric effluent limitations (NELs) for Active Treatment Systems included in the Construction General Permit are exceeded. The Permit contains only narrative effluent limitations and does not contain numeric effluent limitations, except for Active Treatment Systems (ATSs).	BMPs and to modify BMPs and revise the SWPPP, if necessary.	the IM-3 Decommissioning Plan. These documents were submitted on November 18, 2015.
Hydrology and Water Quality	HYDRO-2	**Exceedance of Water Quality Standards and/or Waste Discharge Requirements** - Implement Mitigation Measure HYDRO-1. Implementation of appropriate BMPs defined in Mitigation Measure HYDRO-1 would minimize impacts on water quality by controlling erosion and siltation. Consequently, any impacts associated with erosion and siltation resulting from alterations of drainage and hydrology and water quality during construction, operation and maintenance, and decommissioning.	Stormwater Pollution Prevention Plan (SWPPP)/ BMP Plan and Monitoring and Reporting	This measure will be met through actions to be taken under HYDRO-1.	This measure will be met through actions to be taken under HYDRO-1.	This measure will be met through actions to be taken under HYDRO-1.	This measure will be met through actions to be taken under HYDRO-1.	See HYDRO-1.
Hydrology and Water Quality	HYDRO-3	**Exceedance of Water Quality Standards and/or Waste Discharge Requirements.** Implement Mitigation Measure HYDRO-1. Mitigation Measure HYDRO- 1 shall be implemented. Implementation of	Stormwater Pollution Prevention Plan (SWPPP)/ BMP Plan and	This measure will be met through actions to be taken under HYDRO-1.	This measure will be met through actions to be taken under HYDRO-1.	This measure will be met through actions to be taken under HYDRO-1.	This measure will be met through actions to be taken under HYDRO-1.	See HYDRO-1.

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		appropriate BMPs defined in Mitigation Measure HYDRO-1 would minimize impacts on water quality by controlling potential pollutants, including sediment, and runoff discharges from the project area. Consequently, any impacts associated with pollutants resulting from alterations of drainage and water quality during construction, operation and maintenance, and decommissioning.	Monitoring and Reporting					
Noise	**Noise-1**	**Short-Term Groundborne Noise and Vibration Levels Caused by Construction Activities near Sensitive Receptors.**						
Noise	Noise-1a	a) Construct new wells a minimum of 45 feet from vibration-sensitive receptors. Avoid constructing wells within 30 feet of vibration- sensitive land uses located in California and 275 feet of vibration-sensitive land uses located in Arizona;	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	The EIR defined the Topock Marina Mobile Home Park or single family residences (page 4.9-20) as vibration-sensitive receptors. Since the EIR does not define vibration-sensitive land uses, PG&E assumes that they are residential and mobile home parks. Based on this definition, none of the remediation wells presented in the preliminary (30%) design are located within 45 feet of vibration-sensitive receptors or within 30 feet and 275 feet of vibration-sensitive land uses in California and Arizona, respectively. Locations of new monitoring wells will be presented in the intermediate (60%) design, these wells will be placed to meet the requirements of this mitigation measure.	The EIR defined the Topock Marina Mobile Home Park or single family residences (page 4.9-20) as vibration-sensitive receptors. Based on the EIR discussion, PG&E assumes that vibration-sensitive land uses are residential and mobile home parks. Based on this definition, none of the proposed remediation or new monitoring wells presented in the 60% design is located within 45 feet of vibration-sensitive receptors or within 30 feet and 275 feet of vibration-sensitive land uses in California and Arizona, respectively.	PG&E understands that NOISE-1 analyzes whether construction may result in the exposure of sensitive receptors to groundborne noise and vibration levels that exceed the applicable standards of the San Bernardino County Development Code (83.01.090) and the Mohave County Zoning Ordinance**.** Potential significant impacts the measure is designed to mitigate are "annoyance and/or architectural/structural damage." For the purpose of NOISE-1, the EIR defined the Topock Marina Mobile Home Park or single family residences (page 4.9-20) as vibration-sensitive receptors. Based on this definition, none of the proposed remediation or new monitoring wells presented in the 90% design is located within 45 feet of vibration-sensitive receptors or within 30 feet and 275 feet of vibration-sensitive land uses in California and Arizona, respectively.	PG&E understands that NOISE-1 analyzes whether construction may result in the exposure of sensitive receptors to groundborne noise and vibration levels that exceed the applicable standards of the San Bernardino County Development Code (83.01.090) and the Mohave County Zoning Ordinance**.** Potential significant impacts the measure is designed to mitigate are "annoyance and/or architectural/structural damage." For the purpose of NOISE-1, the EIR defined the Topock Marina Mobile Home Park or single family residences (page 4.9-20) as vibration-sensitive receptors. Based on this definition, none of the proposed remediation or new monitoring wells presented in the final design is located within 45 feet of vibration-sensitive receptors or within 30 feet and 275 feet of vibration-sensitive land uses in California and Arizona, respectively.	This measure was incorporated into the final design, submitted on November 18, 2015.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)				Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design	
Noise	Noise-1b	b) A disturbance coordinator will be designated by the project applicant, which will post contact information in a conspicuous location near the entrance so that it is clearly visible to nearby receivers most likely to be disturbed. The coordinator will manage complaints resulting from the construction vibration. Reoccurring disturbances will be evaluated by a qualified acoustical consultant retained by the project applicant to ensure compliance with applicable standards. The disturbance coordinator will contact nearby vibration-sensitive receptors, advising them of the construction schedule.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	Noise disturbance coordinators have been designated to manage communication with nearby vibration-sensitive receptors, and noise/vibration issues and complaints.	Noise disturbance coordinators have been designated to manage communication with nearby vibration-sensitive receptors, and noise/vibration issues and complaints.	PG&E disturbance coordinators (Curt Russell and Chris Smith) have been designated to manage both noise and vibration concerns that may arise during construction. The disturbance coordinators will post their contact information in a conspicuous location near the construction trailer entrance so that it is clearly visible to nearby receivers. The disturbance coordinator will send the construction schedule to nearby vibration-sensitive receptors prior to commencement of that construction work. Should a concern about the actual noise generated by remedy construction arise, PG&E disturbance coordinator will thoroughly investigate and resolve the issue appropriately. A qualified acoustical consultant will evaluate all reoccurring disturbances for compliance with applicable standards. All noise complaints and their resolutions will be recorded, tracked, and reported to DTSC in the quarterly compliance reports.	PG&E disturbance coordinators (Curt Russell and Chris Smith) have been designated to manage both noise and vibration concerns that may arise during construction. The disturbance coordinators will post their contact information in a conspicuous location near the construction trailer entrance so that it is clearly visible to nearby receivers. The disturbance coordinator will send the construction schedule to nearby vibration-sensitive receptors prior to commencement of that construction work. Should a concern about the actual noise generated by remedy construction arise, the PG&E disturbance coordinator(s) will thoroughly investigate and resolve the issue appropriately. A qualified acoustical consultant will evaluate all reoccurring disturbances for compliance with applicable standards. All noise complaints and their resolutions will be recorded, tracked, and reported to DTSC in the quarterly compliance reports.	Disturbance coordinators were designated on November 18, 2011
Noise	**Noise-2**	**Project-Generated Construction-Related Noise Levels.**						
Noise	Noise-2a	a) Construction equipment shall be properly maintained per manufacturer specifications and fitted with the best available noise suppression devices (e.g., mufflers, silencers, wraps). All impact tools shall be shrouded or shielded, and all intake and exhaust ports on power equipment shall be muffled or shielded.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed. Construction equipment will be maintained and fitted with available noise suppression devices, impact tools will be shrouded or shielded, and all intake and exhaust ports on power equipment will be muffled or shielded.	This measure will be implemented as directed. Construction equipment will be maintained and fitted with available noise suppression devices, impact tools will be shrouded or shielded, and all intake and exhaust ports on power equipment will be muffled or shielded.	This measure will be implemented as directed. Construction equipment will be maintained and fitted with best available noise suppression devices, applicable impact tools will be shrouded or shielded, and all intake and exhaust ports on power equipment will be muffled or shielded.	This measure will be implemented as directed. Construction equipment will be maintained and fitted with best available noise suppression devices, applicable impact tools will be shrouded or shielded, and all intake and exhaust ports on power equipment will be muffled or shielded.	This measure was incorporated into the C/RAWP and the IM-3 Decommissioning Work Plan (Appendix F) which were submitted on November 18, 2015.
Noise	Noise-2b	b) Construction equipment shall not idle for extended periods of time (more than 15 minutes) when not being utilized during construction activities.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed. Construction equipment will not be left idle for extended periods of time (more than 15 minutes) when not being used.	This measure will be implemented as directed. Construction equipment will not be left idle for extended periods of time (more than 15 minutes) when not being used.	This measure will be implemented as directed. Construction equipment will not be left idle for extended periods of time (more than 15 minutes) when not being used.	This measure will be implemented as directed. The BMP Plan (Section 4.6.3 of the C/RAWP) and Appendix G to the IM-3 Decommissioning Work Plan BMPs (Appendix G to Appendix F of the C/RAWP) require construction equipment to not be left idle for extended periods of time (more than 15 minutes) when not being used.	The C/RAWP and the IM-3 Decommissioning Work Plan (Appendix F) were submitted on November 18, 2015.

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Noise	Noise-2c	c) Construction activities shall include the use of berms, stockpiles, dumpsters, and or bins to shield the nearest noise-sensitive receptor adjacent to construction activities to within acceptable non-transportation noise level standards. When construction activities are conducted within the distances outlined above (i.e., 1,850 feet and 5,830 feet from California receptors and 330 feet and 735 feet from Arizona receptors for daytime and nighttime noise, respectively) relative to noise-sensitive uses in the project area, noise measurements shall be conducted by a qualified acoustical consultant at the nearest noise-sensitive land use relative to the construction activities with a sound level meter that meets the standards of the American National Standards Institute (ANSI Section S14 1979, Type 1 of Type 2) to ensure that construction noise associated with the project component complies with applicable daytime and nighttime noise standards. If noise levels are still determined to exceed noise standards, temporary barriers shall be erected as close to the construction activities as feasible, breaking the line of sight between the source and receptor where noise levels exceed applicable standards. All acoustical barriers shall be constructed with material having a minimum surface weight of 2 pounds per square foot or greater and a demonstrated Sound Transmission Class (STC) rating of 25 or greater as defined by the American Society for Testing and Materials' Test Method E90. Placement, orientation, size, and density of acoustical barriers shall be specified by a qualified acoustical consultant.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed. The use of berms, stockpiles, dumpsters, and or bins to shield the nearest noise-sensitive receptor adjacent to construction activities will be implemented. When construction activities are within the distance outline, the additional requirements specified in this measure will be implemented.	This measure will be implemented as directed. PG&E interprets the acceptable non-transportation noise level standards cited in the mitigation measure to be San Bernardino County Development Code 83.01.080; specifically Table 83-2 specifies noise standards for stationary noise sources for residential land use to be 55 A-weighted decibels (dBA) from 7 am-10 pm and 45 dBA from 10 pm-7 am, other Commercial land use to be 60 dBA all day, and Industrial land use to be 70 dBA all day. In addition, Section (g) of the County Code 83.01.080 lists the noise sources that are exempted from the regulations which include a) motor vehicles not under the control of the commercial or industrial use, b) emergency equipment/vehicles/devices, and c) temporary construction, maintenance, repair, or demolition activities between 7 am and 7 pm, except Sundays and Federal holidays. The use of berms, stockpiles, dumpsters, and/or bins to shield the nearest noise-sensitive receptor adjacent to construction activities will be implemented as needed. When construction activities are within the distance outline, the additional requirements specified in this measure will be implemented.	This measure will be implemented as directed. PG&E interprets the acceptable non-transportation noise level standards cited in the mitigation measure to be San Bernardino County Development Code 83.01.080; specifically Table 83-2 specifies noise standards for stationary noise sources for residential land use to be 55 A-weighted decibels (dBA) from 7 am-10 pm and 45 dBA from 10 pm-7 am, other Commercial land use to be 60 dBA all day, and Industrial land use to be 70 dBA all day. In addition, Section (g) of the County Code 83.01.080 lists the noise sources that are exempted from the regulations which include a) motor vehicles not under the control of the commercial or industrial use, b) emergency equipment/vehicles/devices, and c) temporary construction, maintenance, repair, or demolition activities between 7 am and 7 pm, except Sundays and federal holidays. Figures in Section 4 of the Construction/Remedial Action Work Plan identify the noise sensitive receptors and potential construction activities that could trigger noise monitoring in accordance with the EIR mitigation measure Noise-2c. Although night-time construction is not planned, activities that could occur within specified distance from the sensitive receptors are identified on both figures for completeness. Noise monitoring locations will be the boundary of the noise receptors facing the project-related construction activities. The precise monitoring locations will be determined in the field by a qualified acoustical consultant. The use of berms, stockpiles, dumpsters, and/or bins to shield the nearest noise-sensitive receptor adjacent to construction activities will be implemented as needed, and is included in the	This measure will be implemented as directed. Based on the text in the 2011 EIR, PG&E interprets the acceptable non-transportation noise level standards cited in the mitigation measure to be San Bernardino County Development Code 83.01.080; specifically Table 83-2 specifies noise standards for stationary noise sources for residential land use to be 55 A-weighted decibels (dBA) from 7 am-10 pm and 45 dBA from 10 pm-7 am, other Commercial land use to be 60 dBA all day, and Industrial land use to be 70 dBA all day. In addition, Section (g) of the County Code 83.01.080 lists the noise sources that are exempted from the regulations which include a) motor vehicles not under the control of the commercial or industrial use, b) emergency equipment/vehicles/devices, and c) temporary construction, maintenance, repair, or demolition activities between 7 am and 7 pm, except Sundays and federal holidays. Figures in Section 4 of the Construction/Remedial Action Work Plan identify the noise sensitive receptors and potential construction activities that could trigger noise monitoring in accordance with the EIR mitigation measure Noise-2c. Although night-time construction is not planned, activities that could occur within specified distance from the sensitive receptors are identified on both figures for completeness. Noise monitoring locations will be the boundary of the noise receptors facing the project-related construction activities. The precise monitoring locations will be determined in the field by a qualified acoustical consultant. The use of berms, stockpiles, dumpsters, and/or bins to shield the nearest noise-sensitive receptor adjacent to construction activities will be implemented as needed, and is	This measure was incorporated into the C/RAWP and the IM-3 Decommissioning Work Plan (Appendix F) which were submitted on November 18, 2015.

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						Construction/Remedial Action Work Plan. When construction activities are within the distance outline, the additional requirements specified in this measure will be implemented (additional details are provided in the Construction/Remedial Action Work Plan).	included in the Construction/Remedial Action Work Plan. When construction activities are within the distance outline, the additional requirements specified in this measure will be implemented (additional details are provided in the Construction/Remedial Action Work Plan).	
Noise	Noise-2d	d) A disturbance coordinator will be designated by the project applicant, which will post contact information in a conspicuous location near construction areas so that it is clearly visible to nearby receivers most likely to be disturbed. In addition, mailing of the same information will be sent to nearby receptors and all Tribes. The coordinator will manage complaints resulting from the construction noise. Reoccurring disturbances will be evaluated by a qualified acoustical consultant retained by the project applicant to ensure compliance with applicable standards. The disturbance coordinator will contact nearby noise-sensitive receptors, advising them of the construction schedule.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	Noise disturbance coordinators have been designated to manage communication with nearby vibration-sensitive receptors, and noise/vibration issues and complaints.	Noise disturbance coordinators have been designated to manage communication with nearby vibration-sensitive receptors, and noise/vibration issues and complaints.	PG&E disturbance coordinators (Curt Russell and Chris Smith) have been designated to manage both noise and vibration concerns that may arise during construction. The disturbance coordinators will post their contact information in a conspicuous location near the construction trailer entrance so that it is clearly visible to nearby receivers. The disturbance coordinator will send the construction schedule to nearby noise-sensitive receptors prior to commencement of that construction work. Should a concern about the actual noise generated by remedy construction arise, PG&E disturbance coordinator will thoroughly investigate and resolve the issue appropriately. A qualified acoustical consultant will evaluate all reoccurring disturbances for compliance with applicable standards. All noise complaints and their resolutions will be recorded, tracked, and reported to DTSC in the quarterly compliance reports.	PG&E disturbance coordinators (Curt Russell and Chris Smith) have been designated to manage both noise and vibration concerns that may arise during construction. The disturbance coordinators will post their contact information in a conspicuous location near the construction trailer entrance so that it is clearly visible to nearby receivers. The disturbance coordinator will send the construction schedule to nearby noise-sensitive receptors prior to commencement of that construction work. Should a concern about the actual noise generated by remedy construction arise, the PG&E disturbance coordinator(s) will thoroughly investigate and resolve the issue appropriately. A qualified acoustical consultant will evaluate all reoccurring disturbances for compliance with applicable standards. All noise complaints and their resolutions will be recorded, tracked, and reported to DTSC in the quarterly compliance reports.	Disturbance coordinators were designated on November 18, 2011
Noise	**NOISE-3**	**Land Use Compatibility of Future Project Noise Levels with Places of Worship and the Topock Cultural Area.** Provided that the proposed project would be required to achieve the normally acceptable exterior noise level standard for places of worship, the following mitigation measure shall be incorporated in the project design:		This mitigation measure will be met through actions taken to implement NOISE-3a and 3b (see below).	This mitigation measure will be met through actions taken to implement NOISE-3a and 3b (see below).	The project has been designed to meet the normally acceptable exterior noise-level standard for places of worship during operation. This mitigation measure also will be met through actions taken to implement NOISE-3a and 3b (see below).	The project has been designed to meet the normally acceptable exterior noise-level standard for places of worship during operation. This mitigation measure also will be met through actions taken to implement NOISE-3a and 3b (see below).	

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Noise	NOISE-3a	a) Implement all of the mitigation measures outlined for Impact NOISE- 1 and Impact NOISE-2;		This measure will be met through actions to be taken under mitigation measures outlined for Impact NOISE- 1 and Impact NOISE-2.	This measure will be met through actions to be taken under mitigation measures outlined for Impact NOISE-1 and Impact NOISE-2.	This measure will be met through actions to be taken under mitigation measures outlined for Impact NOISE-1 and Impact NOISE-2.	This measure will be met through actions to be taken under mitigation measures outlined for Impact NOISE-1 and Impact NOISE-2.	See NOISE-1 and NOISE-2. A protocol to implement this measure was included in the CIMP (CUL-1a-8h). The CIMP was included as an appendix to the C/RAWP which was submitted on November 18, 2015.
Noise	NOISE-3b	b) Upon completion of detailed project design, the determination of remediation activities and the schedule established to achieve these activities shall be communicated to Native American Tribes. PG&E shall maintain a liaison with requesting Tribes to alert them to project activities that would generate new noise in the Topock Cultural Area on at least an annual basis.		This measure will be implemented as directed. A liaison with requesting Native American Tribes will alert them to project activities that would generate new noise in the Topock Cultural Area on at least an annual basis.	This measure will be implemented as directed. A liaison with requesting Native American Tribes will alert them to project activities that would generate new noise in the Topock Cultural Area on at least an annual basis.	This measure will be implemented as directed. A liaison with requesting Native American Tribes will alert them to project activities that would generate new noise in the Topock Cultural Area on at least an annual basis. In addition, the following communication protocols developed as part of the CIMP noise protocol CUL-1a-8h (Section 2.8.4) will also be implemented: All project construction activities will be communicated to nearby noise-sensitive receptors and Interested Tribes. Elements of this communication include: • A detailed project schedule is established and published for all stakeholders. • Monthly notification to agencies and Tribes of scheduled field activities. During periods of extensive construction activity, these notifications will be issued more frequently – weekly and/or daily, as appropriate. • After issuing these notifications, notify the nearby noise-sensitive receptors and Tribes of any schedule changes. • Provide an open-communication process for Tribal representatives to seek more information about Project noise-generating activities. PG&E welcomes Tribal input on timing of Project noise-generating activities and on potential noise-reducing methods. Per CUL-1a-8k, if ceremonies are requested by any Tribe during construction, then PG&E will follow the protocol to accommodate such requests, which could include monitoring to ensure that construction noise	This measure will be implemented as directed. The CIMP contains the requirement to communicate the remediation activities and schedule to the Tribes (see, e.g., CIMP sections 2.1, 2.4, and 2.10) and to maintain a liaison with requesting Native American Tribes to alert those Tribes to project activities that would generate new noise in the Topock Cultural Area on at least an annual basis (CIMP section 2.8.5). Mitigation Measure CUL-1a-8h addresses other measures to minimize impacts to cultural resources from project-related noise. See Mitigation Measure CUL-1a-8h for those measures.	A protocol to implement this measure was included in the CIMP (CUL-1a-8h). The CIMP was included as Appendix H to the C/RAWP which was submitted on November 18, 2015.

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				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design	
						does not exceed the normally acceptable exterior noise level standard in San Bernardino County for places of worship. • The contact information for the disturbance coordinator will be posted in a conspicuous location near the construction areas. This information will also be mailed to all nearby noise-sensitive receptors and Interested Tribes. In addition to the communication methods described above, PG&E will also consider posting construction schedule information at the information kiosk (CUL-1a-3c). PG&E may also decide to use other communication processes, including a Project website (a Project website could list Project activity schedules and other Project related information) that could be accessed by computer or smartphone and/or other simple push applications that apply to mobile devices.		
Water Supply	WATER-1	**Depletion of Groundwater.** To mitigate potentially significant effects on local groundwater levels associated with the freshwater extraction wells, in the event that freshwater is to be supplied from wells rather than from a surface intake, a hydrologic analysis shall be conducted during the design phase of the project to evaluate the proposed pumping rates for extraction, the potential cone of depression, and the extraction effect on any existing wells in proximity. Proximity shall be defined by the cone of depression boundary of any well to be used in the extraction process. Extraction well location and/or extraction rates shall be adjusted during project design based on this analysis to ensure that extraction does not substantially adversely affect the production rates of existing nearby wells (e.g., adversely affect well production such that existing land uses would not be supported). It shall be demonstrated using computer simulations or other appropriate hydrologic analysis that production rates of existing nearby wells will not be substantially affected before the installation of any new freshwater extraction wells.	Alternative Freshwater Sources Evaluation Technical Memorandum	Work on the required hydrologic analysis has commenced and will be reported in the intermediate (60%) design.	A plan for conducting a long-term constant-rate extraction test at HNWR-1 well is included in the *Revised Implementation Plan for Evaluation of Alternative Freshwater Sources* (CH2M HILL 2013c). Upon receipt of agencies' approval, PG&E will implement the plan. Data collected will be used to evaluate compliance with this measure.	A 72-hour constant-rate extraction test at Havasu National Wildlife Refuge (HNWR)-1 well was conducted in February 11-14, 2014 in accordance with the *Final Implementation Plan for Evaluation of Alternative Freshwater Sources* (CH2M HILL, 2013j). In addition, a 72-hour constant-rate extraction test was conducted at the Site B well from February 7 to 10, 2014. Test results indicated that existing nearby wells will not be substantially affected by pumping at the potential freshwater sites. PG&E presented the information to agencies, Tribes, and stakeholders at the March 19, 2014 TWG meeting, and summarized the results in a technical memorandum (CH2M HILL 2014b) for submittal to DTSC and DOI on April 2, 2014.	A 72-hour constant-rate extraction test at Havasu National Wildlife Refuge (HNWR)-1 well was conducted in February 11-14, 2014 in accordance with the *Final Implementation Plan for Evaluation of Alternative Freshwater Sources* (CH2M HILL, 2013j). In addition, a 72-hour constant-rate extraction test was conducted at the Site B well from February 7 to 10, 2014. Test results indicated that existing nearby wells will not be substantially affected by pumping at the potential freshwater sites. PG&E presented the information to agencies, Tribes, and stakeholders at the March 19, 2014 TWG meeting, and summarized the results in a technical memorandum (CH2M HILL 2014b) for submittal to DTSC and DOI on April 2, 2014.	A 72-hour constant rate extraction test was conducted at potential freshwater supply wells (HNWR-1 and Site B) in February 2014. Test results indicated that existing nearby wells will not be substantially affected by pumping at the potential freshwater sites. Results were summarized in a technical memorandum (CH2M HILL, 2014j) and submitted to DTSC and DOI on April 2, 2014. The memorandum is also included in Appendix N of this report.

Notes:
[1] The intent of this column is to identify what current or future document(s) are intended to satisfy this measure and be transparent on future forthcoming documentation. This column is not intended to document compliance with the mitigation measure.

EXHIBIT 6.1-1

PROTOCOL FOR COMPLIANCE WITH EIR MMRP MITIGATION MEASURE BIO-1 AND ARAR #32 AT THE TOPOCK COMPRESSOR STATION

Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Application of Section 404 of the Clean Water Act to the Project

Pacific Gas & Electric Company (PG&E) has prepared this protocol to identify procedures to be taken to ensure compliance with Section 404 of the Clean Water Act (CWA) and for the Topock Remediation Project (the project) located at the Topock Compressor Station in Needles, California. Section 404 of the CWA is an Applicable or Relevant and Appropriate Requirement (ARAR) for the project. Additionally, the Final Environmental Impact Report (EIR) Mitigation and Monitoring Reporting Program (MMRP; California Department of Toxic Substances Control [DTSC] 2011c) mitigation measure BIO-1 contains applicable mitigation requirements related to CWA Section 404.

The text of MMRP BIO-1 (excerpted) and ARAR #32 are as follows:

> **BIO-1:** "If during the design process it is shown that complete avoidance of habitats under U.S. Army Corps of Engineers (USACE) jurisdiction is not feasible, the Section 404 permitting process shall be completed, or the substantive equivalent per CERCLA Section 121(e)(1). In either event, the acreage of affected jurisdictional habitat shall be replaced and/or rehabilitated to ensure 'no-net-loss' Before any ground-disturbing Project activities begin in areas that contain potentially jurisdictional wetlands, the wetland delineation findings shall be documented in a detailed report and submitted to USACE for verification as part of the formal Section 404 wetland delineation process and to DTSC. For all jurisdictional areas that cannot be avoided as described above, authorization for fill of wetlands and alteration of waters of the United States shall be secured from USACE through the Section 404 permitting process before project implementation. Habitat restoration, rehabilitation, and/or replacement shall be at a location and by feasible methods agreeable to USACE and consistent with applicable county and agency policies and codes. Minimization and compensation measures adopted through any applicable permitting processes shall be implemented.
>
> Alternatively, if USACE declines to assert jurisdiction because it determines that CERCLA Section 121(e)(1) applies, the substantive equivalent of the Section 404 permitting process shall be complied with by ensuring that the acreage of jurisdictional wetland affected is replaced on a "no-net-loss" basis in accordance with the substantive provisions of USACE regulations. Habitat restoration, rehabilitation, and/or replacement shall be at a location and by feasible methods consistent with USACE methods, and consistent with the purpose and intent of applicable county and agency policies and codes. Minimization and compensation measures adopted through any applicable permitting processes shall be implemented. In any event, a report shall be submitted to DTSC to document compliance with these mandates."
>
> **ARAR #32**: "This section of the Clean Water Act prohibits certain activities with respect to on-site wetlands and waterways. No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed activity which would have less adverse impact to the aquatic ecosystem." Federal Water Pollution Control Act (Clean Water Act), 33 USC § 1344, 40 CFR 230.10.

Under CWA Section 404, activities that discharge dredged or fill material into waters of the United States typically require a CWA Section 404 permit from the USACE.

PG&E has determined that the Topock Remediation Project would result in a discharge of dredged or fill material into jurisdictional waters and wetlands. However, the project is a CERCLA response action, and therefore the permit exemption at CERCLA Section 121(e)(1) applies to the project's on-site activities.[9] Therefore, PG&E is not required to

[9] *See* 42 U.S.C. 9921(e)(1) ("No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site where such remedial action is selected and carried out in compliance with this section."); DOI Memorandum, dated November 16, 2007.

comply with the procedural permitting requirements under Section 404. Although no CWA Section 404 permit is required for the Project, PG&E must still comply with the substantive requirements of the CWA Section 404.

PG&E received a letter from the USACE Los Angeles District Regulatory Program, dated July 10, 2013 (USACE 2013a), which stated that no permit is required for the Topock Remediation Project because the project is proceeding pursuant to the U.S. Department of the Interior's (DOI) CERCLA authority. Further, the USACE confirmed that no "substantive requirements or applicable conditions" were provided and the USACE would not verify PG&E's wetland delineation because no permit is required for the CERCLA action (USACE 2013b).

Section 404(b)(1) of the CWA requires that alternatives (or proposed actions) be designed to avoid or minimize adverse impacts to aquatic resources and waters of the United States. Compliance with the 404(b)(1) Guidelines can be achieved generally through the use of appropriate and practicable mitigation measures to minimize or compensate for potential adverse impacts of the discharge on the aquatic ecosystem (40 CFR 230.10(d)). Compensatory mitigation is considered after other appropriate and practicable options have been addressed to avoid and minimize adverse impacts to the aquatic environment. "Practicable" is defined in 40 CFR 230.3(q) to mean "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes."

Further, Section 404(b)(1) requires the least environmentally damaging practicable alternative be selected. During the course of the groundwater remedy design (including the Alternative Freshwater Source Evaluation), efforts were undertaken to avoid and minimize impacts to jurisdictional waters of the United States. However, it has been determined that in order to meet the goals of protection of human health and the environment, to meet the RAOs for the remedy, to monitor remedy performance, to gather data for demonstration of compliance, as well as in response to resolution of design comments with the Tribes, infrastructure (remediation, monitoring wells, and associated piping/conduits) must be installed in certain washes. There are no practicable alternatives to locating certain infrastructure within waters of the United States. For example, monitoring well Q is sited in a wash because it is designed to monitor the effects of injection from well IRL-4, which was placed in a wash as a result of comment resolution at 30% design. Also, to minimize new infrastructure, the remedy design incorporates all existing monitoring wells into the remedy monitoring program. Some of the existing wells are located in Bat Cave Wash and the East Ravine.

1. Avoidance of Adverse Impacts to Wetlands and Non-Wetland Waters of the U.S.

In order to achieve the goal of no-net loss of jurisdictional waters of the U.S., including wetlands, avoidance and minimization measures (AMMs) have been and will continue to be implemented during implementation of the remedy. PG&E prepared a Final Wetlands and Waters of the U.S. Delineation Report (CH2M HILL 2014c), delineating jurisdictional waters of the U.S., that was submitted to DTSC and DOI in April 2014, and has taken the location of jurisdictional waters of the U.S. into consideration in the design of the groundwater remedy in order to avoid impacts to jurisdictional wetlands and waters of the U.S. to the extent practicable.

During the design phase, PG&E's design team consulted the Wetlands and Waters of the U.S. Delineation Report while considering the location of remedy infrastructure. PG&E's design team prioritized avoidance of all wetland and non-wetland waters of the U.S. During the design, PG&E implemented avoidance, to the extent practicable, and impacts to jurisdictional waters would occur only when there is no practicable alternative available.

2. Minimization of Adverse Impacts to Wetlands and Non-Wetland Waters of the U.S.

Consistent with 40 CFR 230.10(d) and Subpart H of Part 40 CFR 230 requirements to minimize the adverse effects of the discharge of dredged or fill material associated with the Topock Remediation Project, PG&E has implemented AMMs during the design phase and will continue to implement best management practices (BMPs) during construction of the remedy in order to minimize adverse impacts to wetlands and non-wetland waters of the U.S.

Minimization measures will be implemented to minimize impacts to wetland and non-wetland waters of the United States within the Project area. All efforts will be taken to avoid jurisdictional resources to the extent practicable. Although the USACE did not provide a list of measures that may be taken to reduce impacts to jurisdictional waters and wetlands, the California Department of Fish and Wildlife (CDFW) requires compliance with AMMs in lieu of a Lake or Streambed Alteration Agreement pursuant to CERCLA Section 121(e) for all work conducted in CDFW jurisdictional washes (CDFW 2013). The geographic extent of CDFW's jurisdiction under California law is broader than the

jurisdictional extent of the USACE under CWA 404 and thus avoidance and mitigation measures applied to CDFW jurisdictional waters would as a geographic consequence also be applied to CWA 404 waters. While Arizona does not have a similar state program, PG&E has implemented and will continue to implement the same AMMs in Arizona identified by CDFW for California to ensure appropriate protection to CWA 404 jurisdictional areas in the project limits, including those in Arizona. Thirty-four AMMs are to be implemented by PG&E for CDFW jurisdictional washes. Actions taken by PG&E, including in the design phase, to avoid and minimize impacts to jurisdictional wetlands and waters will be recorded in a table and maintained by PG&E for the Project.

Remedy Construction, Operation, Maintenance, and Decommissioning BMPs. During construction, operation, maintenance, and decommissioning, certain best management practices would be implemented to avoid and minimize temporary and permanent impacts for activities occurring within jurisdictional wetlands and non-wetland waters of the U.S. These techniques include flagging or fencing around jurisdictional resources, reducing soil erosion/runoff, sediment controls, spill controls, and other BMPs as described in Best Management Practices and Wetlands Avoidance Measures (see Attachment 1 on the following page) and the CDFW AMMs.

3. Compensatory Mitigation

Under the *2008 Compensatory Mitigation for Losses of Aquatic Resources, Final Rule*, compensatory mitigation requires actions that offset the unavoidable adverse impacts to wetlands, streams, and other aquatic resources authorized by Department of the Army permits. Compensatory mitigation is only considered when all appropriate and practicable steps have been taken to avoid and minimize adverse impacts to the aquatic ecosystem. Compensatory mitigation can be implemented by restoration, enhancement, establishment, or preservation. Restoration involves restoring a previously-existing wetland or aquatic site, enhancement involves improving or enhancing the functions of an existing aquatic site, establishment is the creation of a new aquatic site, and preservation involves an existing aquatic site. Compensatory mitigation can be provided by three methods: permittee-responsible compensatory mitigation, mitigation banks, and in-lieu fee mitigation. Further, compensatory mitigation should be commensurate with the amount and type of impact associated with the project.

PG&E will calculate temporary and permanent impacts to jurisdictional waters of the United States resulting from project activities prior to construction and periodically thereafter if additional impacts occur. Temporary impacts to waters of the United States will be restored on site, where possible. Otherwise, impacts will be treated as permanent impacts.

At the Topock Remediation Project, PG&E plans to implement mitigation bank compensatory mitigation for permanent loss of waters of the U.S. at the project site, where reasonably available. Mitigation banks involve off-site compensation under the direction of a third party who ensures that compensation is completed and that no-net loss of wetlands and non-wetland waters is successful. Mitigation bank credits are the preferred option for successfully providing compensatory mitigation under the Final Rule. Restoration is the preferred method of mitigation, and PG&E will attempt to fund a mitigation bank that provides restoration of wetlands at a 1:1 ratio of impact to wetlands, where possible. If a wetland restoration bank is unavailable then an enhancement or preservation bank, or other appropriate option, would be suitable. PG&E will also provide compensatory mitigation for impacts to non-wetland waters of the U.S. at a 1:1 ratio.

ATTACHMENT 1 TO PROTOCOL FOR PG&E COMPLIANCE WITH EIR MMRP MITICATION MEASURE BIO-1 AND ARAR #32 AT THE TOPOCK COMPRESSOR STATION

Best Management Practices and Wetlands Avoidance Measures

The potential impacts to jurisdictional waters associated with implementation of the Final Groundwater Remedy at the Topock Compressor Station may be permanent or temporary. Permanent impacts are those that are associated with the construction of the new remedy facilities themselves, which will remain in place during the operation phase until decommissioning and removal. These facilities include new wells, pipelines, and ancillary facilities (e.g., drainage features, remote monitoring equipment, and security fencing). Temporary impacts are those that are associated with construction activities that may require removal of vegetation or soil disturbance from construction activities (i.e., access roads) but will not result in permanent modifications to the bed, bank or channel of waterways.

The following wetland avoidance measures and Best Management Practices (BMPs) will be employed for the Topock Final Remedy Project:

1. A delineation of wetlands and waters of the United States has been prepared for the proposed project area, and submitted to DTSC (CH2M HILL 2014c). This delineation has informed the remedial design and was used to avoid or minimize impacts to sensitive resources. In addition to the mapping of federal jurisdictional wetlands and waters of the U.S., there was also a determination of the areas that are jurisdictional by CDFW under Section 1600. The CERCLA Section 121(e) exemption for the Topock Program obviates the need to secure permits from the U.S. Army Corps of Engineers or from CDFW, however, the substantive requirements of applicable state and federal laws are satisfied. A March 6, 2013 letter from CDFW confirming application of the CERCLA Section 121(e) exemption to the Topock Final Remedy Project and stating that PG&E need not obtain a Lake or Streambed Alteration Agreement, was accompanied by a list of Avoidance and Minimization Measures for the Project.

2. When planned work activities occur near or within jurisdictional wetland and waters, a biological monitor will provide a worker environmental awareness training to construction crews. The training will include information on sensitive biological resources that may occur in construction areas and the requirements to protect those resources. The training will also include information about BMPs to avoid potential indirect impacts to water quality at the project location or in downstream areas as described in the CDFW AMMs. PG&E's construction foreman will be responsible for verifying that all construction workers completed the training prior to beginning work at the project site.

3. Where boundaries of jurisdictional wetlands or waters are found in close proximity to planned construction activities, these features will be clearly demarcated in the field using flagging or brightly colored mesh fencing in order to ensure that they are not inadvertently impacted. The demarcation will be conducted under the supervision of a qualified biologist. The biologist will also survey any vegetation areas prior to clearing or cutting to ensure that there are no sensitive biological resources (such as active bird nests) that might be affected. The pre-construction survey will also include photographic documentation of pre-project conditions.

4. Access routes that pass through jurisdictional wetlands and waters, if needed, will be identified in order to minimize the impacts to perennial vegetation (e.g., trees and shrubs). Where impacts cannot be avoided to arrowweed stands within the historical floodplain, the stems of these plants will be cut to approximately 1 to 1 ½ feet above the ground surface. Then plastic sheeting or a tarp will be placed over the cut stems prior to crossing the area with construction vehicles. This approach will favor ready re-growth of the cut plants after the completion of construction activities. Any protected perennial trees or shrubs that are removed as a result of this project will be mitigated as part of the revegetation planning process.

5. Pre-construction surveys for listed species or actively nesting birds will be conducted immediately prior to the start of construction and after demarcation. Should any listed individuals or active nests be identified, the PG&E biologist will contact the United States Fish and Wildlife Service (USFWS) to determine an appropriate response. Only a biologist with an active Section 10(a) permit will be authorized to remove any individuals from the construction areas to a USFWS-approved release location.

6. The boundaries of the construction work zones and staging (supporting) areas including access routes will follow existing routes as much as possible. All construction work zones will be shown on detail site maps and demarcated in the field. No construction activities, vehicular access, equipment storage, stockpiling, or significant human intrusion will be allowed outside of the designated construction work zone and staging areas.

7. Equipment will not be operated in areas of ponded or flowing water, and no wet excavations will be performed during construction. Construction vehicles and equipment will be checked periodically to ensure that they are in proper working condition and that there are no apparent oil or fuel leaks. Onsite refueling or lubrication of vehicles and cleaning of equipment, or other activities that involve the use of fuels, lubricants, or solvents, will occur only in locations that are away from jurisdictional wetlands and waters.

8. Compliance with the above AMMs within jurisdictional waters will be tracked and reported to DTSC in the quarterly EIR mitigation measures compliance reports.

9. At project completion, the designated biological monitor will return to the site to document the post-construction conditions at the site. Information on the pre-and post-construction conditions will be documented in the Remedial Action Construction Completion Report. Post-construction conditions will be documented with photographs.

TABLE 6.1-2
Summary of Compliance with Cultural Impact Mitigation Program (CIMP) Protocols
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in CIMP Document	Protocols/Relevant Excerpts from Document	Action (Compliance Status)	
			Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
1	Section 2.1	CUL-1a-8a: Protocols for Continuation of Tribal Communications This protocol requires that communication be consistent with past practices and communication processes previously entered into by PG&E with Interested Tribes, and that PG&E would continue to communicate with Interested Tribes during the design, construction, operation, and decommissioning of the project. Prior to implementation of construction. For examples of communication procedures consistent with past practices, see CIMP Section 2.1. Prior to implementation of construction, PG&E shall communicate with Interested Tribes that place cultural significance on the Topock Cultural Area. Outreach efforts between the Tribes and PG&E shall be communicated by PG&E to DTSC quarterly during the design and construction phase for review and input, and annually during project operations.	PG&E has communicated with the Interested Tribes and will continue to communicate with them during all phases of the Project from design and construction through operation and maintenance as well as decommissioning. Tribes were invited to attend monthly meetings to review pieces of the design as they are prepared and to receive updates on the progress of the project. PG&E also held field meetings with Tribes (e.g., meetings to site well locations, etc.) to assist in Tribal understanding of the remedy design. During construction, PG&E will continue to communicate regularly and will also provide updates on field activities so that Tribal monitors may also participate. Outreach efforts are communicated to DTSC on a quarterly basis during design, and will continue to occur quarterly during construction. As required by DTSC, a log of communications with interested Tribes has been maintained and included in the quarterly EIR mitigation measure compliance reports since January 2012.	PG&E has communicated with the Interested Tribes and will continue to communicate with them during all phases of the Project from design and construction through operation and maintenance as well as decommissioning. During construction, PG&E will continue to communicate regularly and will also provide updates on field activities so that Tribal monitors may also participate. Outreach efforts were communicated to DTSC on a quarterly basis during design, and will continue to occur quarterly during construction. As required by DTSC, a log of communications with interested Tribes has been maintained and included in the quarterly EIR mitigation measure compliance reports since January 2012.
2	Section 2.2	CUL-1a-8b: Protocols for Appropriate Treatment of Archaeological Materials These protocols include the following components: • Protocols for the appropriate treatment of archaeological materials that may be disturbed or discovered during implementation of the final remedy – Avoidance is preferred (by PG&E and Tribes) means of treatment in a discovery situation. If PG&E recommends that avoidance is not feasible and the Agencies make a determination that it is not feasible, then the protocols of Discovery Plan of the CHPMP will be followed for appropriate treatment of discoveries. • Protocols for the repatriation of significant items of cultural patrimony that may be recovered during the project • Protocols for the curation of cultural materials recovered during the project. • Treatment of archaeological sites, if data recovery is proposed	During design and construction, if discoveries are made, avoidance is the preferred method of treatment of discoveries. If, however, Agencies make a determination that avoidance is not feasible, PG&E will provide treatment of archaeological materials as outlined in Appendix C (Discovery Plan) of the CHPMP. As described in the protocol, during design and construction, Native American human remains and/or archaeological materials from federal or Tribal land that are funerary objects, or ceremonial objects, or objects of cultural patrimony will be treated as prescribed in the Native American Graves Protection and Repatriation Act (NAGPRA) and its implementing regulations (43 Code of Federal Regulations [CFR] 10), and as discussed in Section 8.2 (Treatment of Any Human Remains, Funerary Objections, Ceremonial Objects and Items of Cultural Patrimony) and Appendix D (Plan of Action) of the CHPMP (BLM 2012). If data recovery is proposed for treatment of an archaeological site, PG&E will follow the steps outlined in Section 2.2.3 of the CIMP.	During design and construction, if discoveries are made, avoidance is the preferred method of treatment of discoveries. If, however, Agencies make a determination that avoidance is not feasible, PG&E will provide treatment of archaeological materials as outlined in Appendix C (Discovery Plan) of the CHPMP. As described in the protocol, during design and construction, Native American human remains and/or archaeological materials from federal or Tribal land that are funerary objects, or ceremonial objects, or objects of cultural patrimony will be treated as prescribed in the Native American Graves Protection and Repatriation Act (NAGPRA) and its implementing regulations (43 Code of Federal Regulations [CFR] 10), and as discussed in Section 8.2 (Treatment of Any Human Remains, Funerary Objections, Ceremonial Objects and Items of Cultural Patrimony) and Appendix D (Plan of Action) of the CHPMP (BLM 2012). If data recovery is proposed for treatment of an archaeological site, PG&E will follow the steps outlined in Section 2.2.3 of the CIMP.
3	Section 2.3	CUL-1a-8c: Protocols for the Review of Cultural Resource-Related Documents These protocols apply to the extent that the BLM has not consulted with Tribes under the consultation process in the Programmatic Agreement and referenced in the CHPMP, and include the following: • Review of cultural resource related documents, including timelines and procedures are specified in detail at Section 2.3.2. • PG&E will afford the Tribes an opportunity to review and comment on Project cultural resource-related documents • Standards as stipulated in the Programmatic Agreement Section XI will be implemented. (Section 2.3.4)	To date, the review of cultural resource related documents has occurred under the procedures identified by the Programmatic Agreement and referenced in the CHPMP. Certain EIR-required cultural resource related documents have also been sent to DTSC for review.	To date, the review of cultural resource related documents has occurred under the procedures identified by the Programmatic Agreement and referenced in the CHPMP. Certain EIR-required cultural resource related documents have also been sent to DTSC for review.
4	Section 2.4	CUL-1a-8d: Protocols for the Review of Project Design Documents These protocols provide for the review of the Topock Compressor Station Groundwater Remediation Project (Project) Design Documents at the Preliminary, Intermediate, and Pre-final phases. In general, at the preliminary phase of each design, PG&E will submit the design document to DTSC/DOI who will then submit to reviewers and invite their initial comments. See CIMP Figure 2-1 for a complete overview of the review process during design.	PG&E has followed the protocols outlined in Figure 2-1 of the CIMP regarding the review of design documents at the 30%, 60%, and 90% design phases.	Pursuant to 90% RTC #7, PG&E understands that there will not be a comment/review process for the final design.

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5	Section 2.5	CUL-1a-8e: Protocols for Restoring the Environment to Its Preconstruction Conditions Upon Decommissioning The protocol presents the general approach for restoration of the areas affected by the groundwater remediation facilities. Restoration activities include grading, contouring, and revegetating the site. The restoration approach will be informed by documentation of the pre-construction condition (e.g., ground photographic records, topographic/aerial maps, disturbed area map, archaeological surveys, historical resource surveys, biological surveys). PG&E will seek ways to restore the affected areas to the conditions prior to construction, as closely as possible. Discussions will take place with the Tribes to develop an understanding of the different restoration techniques and expectations for different environments. For additional details, see Sections 2.5.3 (Restoration Guidelines) and 2.5.4 (Habitat Restoration and Revegetation).	A Plan for Decommissioning of Remedy Facilities and Restoration will be completed within 120 days of DOI's certification of completion of the remediation and a determination by DOI that removal of such facilities is protective of human health and the environment. This Restoration Plan will be developed in consultation with the land owners and managers, including FMIT, U.S. Bureau of Reclamation (USBR), and BLM. The BLM will consult with Signatories, Tribes, and Invited Signatories to the PA on the Restoration Plan. PG&E will implement the Plan to restore the site to conditions existing prior to the construction of the groundwater remediation facilities to the maximum extent practicable.	A Plan for Decommissioning of Remedy Facilities and Restoration will be completed within 120 days of DOI's certification of completion of the remediation and a determination by DOI that removal of such facilities is protective of human health and the environment. This Restoration Plan will be developed in consultation with the land owners and managers, including FMIT, U.S. Bureau of Reclamation (USBR), and BLM. The BLM will consult with Signatories, Tribes, and Invited Signatories to the PA on the Restoration Plan. PG&E will implement the Plan to restore the site to conditions existing prior to the construction of the groundwater remediation facilities to the maximum extent practicable.
6	Section 2.6	CUL-1a-8f: IM-3 Decommissioning Plan	The IM-3 Decommissioning, Removal, and Restoration Work Plan is included as Appendix B of the CIMP and also as an appendix of the Construction/Remedial Action Work Plan.	The IM-3 Decommissioning, Removal, and Restoration Work Plan was revised to incorporate comments and is included as Appendix B of the CIMP and also as an appendix of the Construction/Remedial Action Work Plan.
7	Section 2.7	CUL-1a-8g: Protocols for Repatriation of Clean Soils During Construction Specifically, the management protocol for Handling and Disposition of Displaced Site Material requires work plans that involve activities that displace site material (and that are finalized subsequent to the development of the protocol) to include the following information: • The process for soliciting and considering the inputs of Tribe(s) regarding the management of the material that is displaced as a result of the work. • Details on material handling and short-term/long-term storage (including an inventory of materials displaced by the work). • Process for assessing contamination assessment. • Final disposition alternatives for displaced material.	The Soil Management Plan (SMP) (Volume 4 of the O&M Manual) contains procedures and protocols for the management and disposal of displaced soil including potentially contaminated soil, during drilling, construction, operation, and maintenance of the remedy as well as decommissioning of IM-3 facilities. The procedures and protocols included soil and waste characterization, screening and classification of soils, handling and short-term storage of soils, long-term storage of soils, transportation and disposal of hazardous wastes, and record keeping. Additional procedures and protocols for handling, management, and disposal of other waste streams that could be generated from remedy construction and start-up are included in the Waste Management Plan in an appendix of the Construction/ Remedial Action Work Plan.	The Soil Management Plan (SMP) (Volume 4 of the O&M Manual) was revised to incorporate comments. Additional procedures and protocols for handling, management, and disposal of other waste streams that could be generated from remedy construction and start-up are included in the Waste Management Plan in an appendix of the Construction/ Remedial Action Work Plan.
8	Section 2.8	CUL-1a-8h: Noise Protocols <u>Pre-Construction (Section 2.8.3)</u> a) Establish a disturbance coordinator, who will coordinate both noise and vibration concerns that may arise during construction. b) Identify and coordinate activities where Noise-2 requires noise monitoring. Noise-2 states that noise monitoring will be conducted when construction activities are conducted within 1,850 feet and 5,830 feet from California receptors and 330 feet and 735 feet from Arizona receptors for daytime and nighttime noise, respectively. c) If noise monitoring during construction is required, noise monitoring locations will be selected in coordination with the Tribes. The EIR MMRP requires that noise measurements be conducted at the nearest noise-sensitive land use relative to the construction activities. d) Examples of noise barriers that could be used during construction to mitigate noise concerns (e.g., berms, stockpiles, dumpsters, bins, and engineered acoustical barriers), and approaches for implementation, will be included in the Construction/Remedial Action Work Plan for review and comment by Tribes and agencies. In the unlikely event that engineered acoustical barriers are required during construction, they will comply with requirements of the EIR. <u>Construction (Section 2.8.3)</u> e) If noise monitoring finds that the relevant noise thresholds are exceeded, temporary noise barriers will be erected. f) Maintain all construction equipment according to manufacturer guidelines. Equipment will be fitted with the best available noise suppression devices. All impact tools will be shrouded or shielded, and all intake or exhaust ports on power equipment will be muffled or shielded. g) Construction equipment will not be allowed to idle for extended periods of time (more than 15 minutes) when not being used for construction.	<u>Pre-Construction</u> a) PG&E disturbance coordinators, Curt Russell and Chris Smith, will coordinate both noise and vibration concerns that may arise during construction. b) Noise monitoring locations will be the boundary of noise receptors as defined by EIR MMRP NOISE-2 facing the project-related construction activities. The precise monitoring locations will be determined in the field by a qualified acoustical consultant in coordination with the Tribes. c) Section 4 of the Construction/Remedial Action Work Plan contains examples of noise barriers that could be used during construction to mitigate noise concerns. Protocols during construction, operation and maintenance, and decommissioning will be adhered to during implementation of each phase. Compliance actions will be documented and reported to DTSC in the quarterly compliance reports.	<u>Pre-Construction</u> a) PG&E disturbance coordinators, Curt Russell and Chris Smith, will coordinate both noise and vibration concerns that may arise during construction. b) Noise monitoring locations will be the boundary of noise receptors as defined by EIR MMRP NOISE-2 facing the project-related construction activities. The precise monitoring locations will be determined in the field by a qualified acoustical consultant in coordination with the Tribes. c) Section 4 of the Construction/Remedial Action Work Plan contains examples of noise barriers that could be used during construction to mitigate noise concerns. Protocols during construction, operation and maintenance, and decommissioning will be adhered to during implementation of each phase. Compliance actions will be documented and reported to DTSC in the quarterly compliance reports.

TABLE 6.1-2
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		h) Should a concern about the actual noise generated by remedy construction arise, PG&E disturbance coordinator will thoroughly investigate and resolve the issue appropriately. A qualified acoustical consultant (INCE Board Certified or Professional Engineer in Acoustics) will evaluate all reoccurring disturbances for compliance with applicable standards. Noise measurements will be in accordance with the Topock Sound Measurement Protocol in the Basis of Design Report and the forthcoming Remedial Action Work Plan. All noise complaints and its resolutions will be recorded, tracked, and reported to DTSC in the quarterly compliance reports. Operation and Maintenance (Section 2.8.3) i) Should a concern about the actual noise generated by remedy operation arise, PG&E disturbance coordinator will thoroughly investigate and resolve the issue appropriately. A qualified acoustical consultant will evaluate all reoccurring disturbances for compliance with applicable standards. Noise measurements will be in accordance with the Topock Project Sound Measurement Protocol. All noise complaints and their resolutions will be recorded, tracked, and reported to DTSC in the quarterly compliance reports. j) If a new well needs to be installed or an existing well has to rebuilt during the operation phase, these activities are considered short-term construction activities and all noise protocols for pre-construction and construction phases will apply. Decommissioning (Section 2.8.3) k) Decommissioning are considered short-term construction activities. All noise protocols for pre-construction and construction phases will also apply to the decommissioning phase. Communication (Section 2.8.4) -All Project construction activities shall be communicated to nearby noise-sensitive receptors and Interested Tribes. Elements of this communication include: • A detailed project schedule is established and published for all stakeholders. • Monthly notification to agencies and Tribes of scheduled field activities. During periods of extensive construction activity, these notifications will be issued more frequently – weekly and/or daily, as appropriate. • After issuing these notifications, notify the nearby noise-sensitive receptors and Tribes of any schedule changes. • Provide an open-communication process for Tribal representatives to seek more information about Project noise-generating activities. PG&E welcomes Tribal input on timing of Project noise-generating activities and on potential noise-reducing methods. • The contact information for the disturbance coordinator will be posted in a conspicuous location near the construction areas. This information will also be mailed to all nearby noise-sensitive receptors and Interested Tribes. In addition to the communication methods described above, PG&E will also consider posting construction schedule information at the information kiosk (CUL-1a-3c). PG&E may also decide to use other communication processes, including a Project website (a Project website could list Project activity schedules and other Project related information) that could be accessed by computer or smartphone and/or other simple push applications that apply to mobile devices.	Communication (Section 2.8.4) • A detailed construction schedule is established and included in the Construction/Remedial Action Work Plan for review by agencies, stakeholders, and Tribes. • Monthly notification to agencies and Tribes of scheduled field activities has been and will continue to be sent by PG&E (Curt Russell or his designee). During periods of extensive construction activity, these notifications will be issued more frequently – weekly and/or daily, as appropriate. This element has been incorporated into the overall communication framework for construction and start-up (see Table 2.3-1 of the Construction/Remedial Action Work Plan). • After issuing these notifications, PG&E will notify the nearby noise-sensitive receptors and Tribes of any schedule changes. Nearby noise-sensitive receptors are residents of the mobile home park at Moabi Regional Park and the Topock Marina, as well as private residents in Topock Marina area. When construction activities occur within 1,850 feet of noise-sensitive receptors to the east, PG&E will post contact information in a conspicuous location near construction areas so that it is clearly visible to nearby sensitive receptors. In addition, mailing of the same information will be sent to those receptors and all Tribes (see Table 2.3-1 of the Construction/Remedial Action Work Plan). • Provide an open-communication process for Tribal representatives to seek more information about Project noise-generating activities. PG&E welcomes Tribal input on timing of Project noise-generating activities and on potential noise-reducing methods. Per CUL-1a-8k, if ceremonies are requested by any Tribe during construction, then PG&E will follow the protocol to accommodate any requests for Tribal ceremonies, which could include monitoring to ensure that construction noise does not exceed the normally acceptable exterior noise level standard in San Bernardino County for places of worship. • The contact information for the Project disturbance coordinators (Curt Russell and Chris Smith) will be posted in a conspicuous location near the construction areas. This information will also be mailed to all nearby noise-sensitive receptors and Interested Tribes. Nearby noise-sensitive receptors include residents at Moabi Regional Park and the Topock Marina area.	Communication (Section 2.8.4) • A detailed construction schedule is established and included in the Construction/Remedial Action Work Plan for review by agencies, stakeholders, and Tribes. • Monthly notification to agencies and Tribes of scheduled field activities has been and will continue to be sent by PG&E (Curt Russell or his designee). During periods of extensive construction activity, these notifications will be issued more frequently – weekly and/or daily, as appropriate. This element has been incorporated into the overall communication framework for construction and start-up (see Table 2.3-1 of the Construction/ Remedial Action Work Plan). • After issuing these notifications, PG&E will notify the nearby noise-sensitive receptors and Tribes of any schedule changes. Nearby noise-sensitive receptors are residents of the mobile home park at Moabi Regional Park and the Topock Marina, as well as private residents in Topock Marina area. When construction activities occur within 1,850 feet of noise-sensitive receptors to the east, PG&E will post contact information in a conspicuous location near construction areas so that it is clearly visible to nearby sensitive receptors. In addition, mailing of the same information will be sent to those receptors and all Tribes (see Table 2.3-1 of the Construction/Remedial Action Work Plan). • Provide an open-communication process for Tribal representatives to seek more information about Project noise-generating activities. PG&E welcomes Tribal input on timing of Project noise-generating activities and on potential noise-reducing methods. Per CUL-1a-8k, if ceremonies are requested by any Tribe during construction, then PG&E will follow the protocol to accommodate any requests for Tribal ceremonies, which could include monitoring to ensure that construction noise does not exceed the normally acceptable exterior noise level standard in San Bernardino County for places of worship. • The contact information for the Project disturbance coordinators (Curt Russell and Chris Smith) will be posted in a conspicuous location near the construction areas. This information will also be mailed to all nearby noise-sensitive receptors and Interested Tribes. Nearby noise-sensitive receptors include residents at Moabi Regional Park and the Topock Marina area.

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9	Section 2.9	CUL-1a-8i: Protocols for the Appropriate Methods, consistent with Mitigation Measures, AES-1 and AES-2, to Reduce Visual Intrusion Additional Design Protocols that PG&E May Employ to Reduce Visual Intrusions (Section 2.9.2) In addition to the specific requirements identified in AES-1 and AES-2, PG&E may employ various feasible design concepts identified by PG&E, Tribes, or other interested parties prior to implementation of a Project activity to reduce visual intrusions of the Project design. Potential design concepts include: • Construction of aboveground facilities within existing facilities, when appropriate. • Building designs that are harmonious with existing buildings and nearby landforms, including low profiles when available. • Flush-mount or below-ground installations whenever feasible. • Construction within existing transportation corridors. • Working only within previously-disturbed sites, whenever possible. • Placing aboveground facilities away from traffic, where feasible (i.e., areas where the introduction of the facilities would not create safety issues or visual impacts), to reduce the need for traffic barricades. • Design the lighting associated with above ground facilities to minimize glare and to focus lighting within a facility (e.g., using shields on lighting to reflect light downward and focused within a facility). Opportunity for Agency, Tribal, and Other Stakeholder Input on the Visual Nature of Project Design (Section 2.9.3) Within the design packages, PG&E will include visualizations of various design features described within the text and drawings in the package. Although the visualizations will not be comprehensive of the entire project, they will include many of the aboveground facilities that may be visible to stakeholders after construction. Potential Temporary Visual Intrusions Identified During Remedy Implementation (Section 2.9.4) During the course of remedy implementation, if agencies, Tribes, or other stakeholders identify temporary visual intrusions that should be addressed by PG&E, they should notify the Project Disturbance Coordinator(s), who will be responsible for resolving the issue or coordinating resolution of the issue with the Tribes, DTSC, other agencies, and/or stakeholders.	See response to EIR mitigation measures AES-1 and AES-2 in Table 6.1-1 for compliance actions. Examples of where the additional protocols were employed during the design to reduce visual intrusions: Building designs that are harmonious with existing buildings and nearby landforms, including low profiles when available. For example, the remedy building inside the compressor station and the TW Bench are designed to be compatible with existing buildings and/or the environment. Flush-mount or below-ground installations whenever feasible. For example, most well head completion is flush-mount and most piping installations are below ground. Construction within existing transportation corridors. For example, the majority of piping corridors are within existing roads. Working only within previously-disturbed sites, whenever possible. For example, all proposed construction staging areas and yard are located in previously-disturbed areas. Design the lighting associated with above ground facilities to minimize glare and to focus lighting within a facility (e.g., using shields on lighting to reflect light downward and focused within a facility). This design concept is followed in all building design for the project. Opportunity for Agency, Tribal, and Other Stakeholder Input on the Visual Nature of Project Design (Section 2.9.3) As was done at the 60% design stage, visualizations of various design components are provided in the 90%/Supplemental 90% BOD Report to facilitate review. In addition, photos of typical construction equipment are provided in the Construction/Remedial Action Work Plan to facilitate review of the document. Potential Temporary Visual Intrusions Identified During Remedy Implementation (Section 2.9.4) During the course of remedy implementation, if agencies, Tribes, or other stakeholders identify temporary visual intrusions that should be addressed by PG&E, they should notify Curt Russell and Chris Smith, the Project Disturbance Coordinator(s), who will be responsible for resolving the issue or coordinating resolution of the issue with the Tribes, DTSC, other agencies, and/or stakeholders.	See response to EIR mitigation measures AES-1 and AES-2 in Table 6.1-1 for compliance actions. In addition to the examples implemented during the 90% stage, PG&E also provided to agencies, Tribes, and stakeholders for review and comment during the 90% RTC process, various figures/maps revised to incorporate comments, and a visualization of the revised design of the Construction Headquarters at its new location at Moabi Regional Park.
10	Section 2.10	CUL-1a-8j: Protocols for Tribal Notification in advance of Project-Related Activities Protocols for Tribal notification in advance of project-related activities that the Interested Tribes may feel have the potential to cause adverse impacts to sensitive cultural resources - PG&E will take care in these advance notifications to identify the field activities that have the potential to be ground disturbing. Examples of field activities which may include potentially ground-disturbing aspects include grading, trenching, boring, drilling, or other excavation for new injection, extraction or monitoring wells. In addition, construction of new pipelines, new treatment facilities, new access roads, new staging areas, other new transportation facilities, or other new Project components may include ground-disturbing aspects. PG&E will use communication methods specified in Section 2.10, and will provide two weeks advance notice of covered activities when possible.	PG&E has provided advance notice of ground-disturbing activities to Tribes during pre-construction phases such as the Freshwater Implementation Plan and Utility Potholing. PG&E also sends monthly emails to Tribes and Agencies that outline the field activities occurring at the Topock Compressor Station for the month. PG&E provides a two week advance notice where possible. PG&E will continue to provide advance notice to Tribes during any other ground-disturbing activities that may occur pre-construction. PG&E will also continue to follow this protocol during construction of the remedy and during operation, maintenance, and decommissioning.	PG&E has and will continue to send monthly emails to Tribes and Agencies that outline the field activities occurring at the Topock Compressor Station for the month. PG&E will provide a two week advance notice where possible. PG&E will continue to provide advance notice to Tribes during any other ground-disturbing activities that may occur prior to the start of remedy construction. PG&E will also continue to follow this protocol during construction of the remedy and during operation, maintenance, and decommissioning.

TABLE 6.1-2
Summary of Compliance with Cultural Impact Mitigation Program (CIMP) Protocols
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in CIMP Document	Protocols/Relevant Excerpts from Document	Action (Compliance Status)	
			Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
11	Section 2.11	CUL-1a-8k: Protocols to Accommodate Tribal Ceremonies or Activities involving the Topock Cultural Area Protocols to be followed by project personnel to accommodate, if feasible as determined by DTSC, key Tribal ceremonies that involve the Topock Cultural Area. Under the protocol, any Tribe(s) wishing to perform such a ceremony may contact PG&E's Site Manager at the Topock Compressor Station by telephone, email, or in writing to discuss the specific request. PG&E will communicate directly with the requester (by telephone or in person) as soon as the request has been evaluated. PG&E will indicate if all of the requests can be accommodated and, if not, suggest alternatives that PG&E can accommodate. The requestor and PG&E will also discuss the details of other services that PG&E may agree to provide for the benefit of the ceremonial activity, including, power, water, parking, signage, or other support. PG&E will also identify any reasonable and necessary stipulations regarding health and safety, logistical, communication, or site access procedures to be followed in the Topock Compressor Station Groundwater Remediation Project (Project) Area. One stipulation will clearly state that the Topock Compressor Station is excluded, and that access to it cannot be provided.	No requests to conduct Tribal ceremonies have been submitted. If ceremonies are requested during design, construction, operation and maintenance, then PG&E will follow the protocol to accommodate any requests for Tribal ceremonies.	To date, in 2015, PG&E has received one request from Tribes to conduct a Tribal ceremony. This Tribal request was accommodated by PG&E. If ceremonies are requested during construction, operation and maintenance, PG&E will follow the protocol to accommodate any requests for Tribal ceremonies.
12	Section 2.12	CUL-1a-8l: Protocols for Tribal Monitors to Observe Ground Disturbance Activities Provisions affording sufficient Tribal monitors to observe ground disturbing activities and/or other scientific surveying (e.g., biological surveys) that may occur in preparation for construction activities. Ground-disturbing activities include trenching, excavation, grading, well excavation/drilling, decommissioning the IM-3 Facility and subsurface pipeline, or other construction-related activities. Pacific Gas and Electric Company (PG&E) will notify the Interested Tribes (Tribes) as defined by the Environmental Impact Report (EIR) of planned ground-disturbing activities and other scientific surveying that is conducted in anticipation of construction activities. This provides the opportunity for Tribes to send Tribal monitors to the site to observe these activities, if they wish. While on site, Tribal monitors will have the opportunity to discuss their concerns directly with the PG&E project team while the activities are proceeding, as well as reporting their observations and any issues of concern directly to the Tribe(s) that they represent. Sufficient time (a minimum of 1 week notice) will be allowed between the notification and the beginning of the field activity that the Tribe(s) will be able to prepare adequately without undue haste and arrange for one or more monitors.	PG&E has provided notification to Tribes in advance of ground-disturbing activities during the design phase, including during the Alternative Freshwater Evaluation and Utility potholing activities. PG&E will continue to notify Tribes in accordance with the protocol throughout the remainder of the design, construction, operation and maintenance, and decommissioning.	PG&E will continue to notify Tribes in accordance with the protocol throughout remedy implementation including construction, operation and maintenance, and decommissioning.
13	Section 2.13	CUL-1a-8m: Provision of Reasonable Compensation for Tribal Monitors Provisions of reasonable compensation for Tribal monitors consistent with historical rates. PG&E will provide reasonable compensation for Tribal monitors who work on the Project. PG&E will negotiate with Tribes, taking into account the requirements of any pertinent MOUs or other legal agreements, to establish pay rates for monitors consistent with historical rates. The negotiated compensation rates will then be formalized in a separate MOU, or in amendments to an existing MOU, with each Tribe that will be supplying the services of one or more monitors.	PG&E has been operating under MOUs and has provided compensation for Tribal monitors currently and will continue to provide compensation during construction, operation and maintenance, and decommissioning phases.	PG&E has been operating under MOUs and has provided compensation for Tribal monitors currently and will continue to provide compensation during construction, operation and maintenance, and decommissioning phases.
14	Section 2.14	CUL-1a-8n: Protocols for Protective Measures for Archaeological/Historical Sites During Construction Locations requiring specific protective devices, such as temporary fencing, flagging, or other type of demarcation during construction. 2.14.1 Pre-Construction Measures to Identify Sites Requiring Protection. Pre-construction planning efforts will: (1) identify the location and boundaries of any archaeological, historical, and other cultural sites requiring protective measures during construction; and (2) establish zones within which construction may proceed. PG&E and BLM will consult with the Tribes during this process. 2.14.2 Identification of Protective Measures Prior to Construction. Avoidance will be implemented. Avoidance of known cultural sites/sensitive areas may be accomplished by using existing or approved routes of travel, and by carefully avoiding archaeological and historical sites when selecting laydown, access, and temporary work areas appurtenant to construction activities. 2.14.3 Measures to Identify New Sites Requiring Protection during Construction. PG&E's qualified archaeologist would inspect and evaluate any previously unidentified or suspected archaeological or historical resources found during construction, operation, or decommissioning. If resources are discovered, earth-disturbing activities will be temporarily suspended at the location of the find. The find will then be treated by modifying the extent of the construction zone to avoid and protect the resource(s). Thereafter, earth-moving activities may resume within the modified construction zone. Tribal notification will occur under requirements of the CHPMP and PA. 2.14.4 Implementation of Protective Measures. If warranted, protective measures may be employed on or around the archaeological or historical site to protect the resource from disturbance. These measures may include, but are not limited to, protective coverings of soil or riprap, onsite personnel to prevent access to sensitive areas, use of flagging, blaze orange mesh fencing secured to steel posts, bollards, natural barriers of rocks or piled brush, cables suspended between secure posts, and/or signage (e.g., "This Area Closed" or "Exclusion Zone: Keep Out"). Any such measures will be temporary (only as needed during construction), and will, to the extent practicable, not call undue attention to the nature of the resource being protected. Ongoing work within the established construction zone may continue. PG&E, in consultation with DTSC and BLM (if Federal and/or Tribal land is involved) and the Tribes, will determine the appropriate protective measures on a case-by- case basis, and may increase or reduce the size of the Environmentally Sensitive Area (ESA) or Exclusion Zone (EZ) if agreed to by representatives of these parties in the field. The protective measures set forth in this section will be thoroughly covered in the Worker Education Program.	PG&E will implement the protocols for protective measures for archaeological/historical sites during the construction of the remedy. As stated in the protocol, avoidance is the preferred protective measure and will be implemented where any identified archaeological, historical, or other cultural sites require protective measures during construction. If protective measures are used, the measures identified in Section 2.14.4 would be implemented. PG&E's archaeologist would monitor the installation and removal of all protective measures, and Tribal monitors would also be invited to monitor installation and removal. After removal, restoration would occur to pre-construction conditions.	PG&E will implement the protocols for protective measures for archaeological/historical sites during the construction of the remedy. As stated in the protocol, avoidance is the preferred protective measure and will be implemented where any identified archaeological, historical, or other cultural sites require protective measures during construction. If protective measures are used, the measures identified in Section 2.14.4 would be implemented. PG&E's archaeologist would monitor the installation and removal of all protective measures, and Tribal monitors would also be invited to monitor installation and removal. After removal, restoration would occur to pre-construction conditions.

TABLE 6.1-2
Summary of Compliance with Cultural Impact Mitigation Program (CIMP) Protocols
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in CIMP Document	Protocols/Relevant Excerpts from Document	Action (Compliance Status)	
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		2.14.5 Installation and Inspection of Protective Measures during Construction. PG&E's qualified archaeologists will monitor the installation of all protective measures and their removal after construction. Similarly, Tribal Monitors will be notified and invited to monitor the installation of all protective measures and their removal. PG&E construction inspectors will conduct and document systematic inspections of the integrity of protective measures during the entire period of construction activity. 2.14.6 Protection of New Sites Discovered during Construction. PG&E's qualified archaeologist will inspect and evaluate any new sites that may be discovered during construction and will notify Tribal Monitors of the discovery. Tribal Monitors will then inspect and evaluate the new site(s). Every effort will be made to avoid adverse effects on the discovered site(s) to the maximum extent practicable. Details on the initial inspection procedures are provided in Section 2.14.6. 2.14.7 Restoration After Removal of Protective Measures. After removal of protective measures (e.g., fencing, poles), the areas will be restored to pre-construction conditions. For details on documentation of pre-construction condition and post-construction condition, see Section 2.14.7.		
15	Section 2.15	CUL-1a-8o: Protocols for Reporting Discoveries of Cultural Importance Protocols for the reporting of discoveries of cultural importance consistent with existing statutes and regulations. In the event that any previously unidentified or suspected historic or archeological resource, such as human remains and/or associated funerary objects or graves, is discovered during construction, PG&E will immediately notify the DTSC, BLM, and Tribal representatives if the resource is Native American, consistent with the CHPMP and the EIR Chapter 5.1.1. Human remains, items of cultural patrimony, or funerary objects that may be found shall be handled with utmost cultural and religious sensitivity. As specified in Section 2.2.1, avoidance of cultural resources is preferred over excavation, removal, or further disturbance, particularly in discoveries involving human remains, items of cultural patrimony, or funerary objects. Where human remains and funerary objects, ceremonial items, and items of cultural patrimony are discovered, PG&E will implement the reporting protocols provided in Appendix D (Plan of Action [POA]) of the CHPMP and consistent with Mitigation Measure CUL-4 in EIR Chapter 5.1.1. During initial inspection, PG&E's qualified Cultural Resources Consultant (as specified in CUL-1a-3(a)) will document the discovery. Tribal monitors will be invited to assist in the preparation of the documentation and identification of Tribal cultural values. Discoveries identified as having cultural importance will be documented in a culturally sensitive manner acceptable to the Interested Tribe(s). PG&E will consult with the BLM, and BLM will consult with the Tribal representatives if the resource is Native American in nature, to define the nature and extent of any further studies that may be required.	PG&E will follow the protocol for reporting discoveries, in addition to complying with the CHPMP and PA.	PG&E will follow the protocol for reporting discoveries, in addition to complying with the CHPMP and PA.
16	Section 2.16	CUL-1a-8p: Protocols for Inspecting Remediation Facilities and/or Staging Areas During Construction Protocols for the inspection of remediation facilities and/or staging areas throughout the construction phase. The locations of remediation facilities and staging areas will be examined for cultural resources throughout the construction phase. This process will include advance notification of interested parties, including Interested Tribes, implementation of procedures for the review of Project design documents, selecting previously impacted land wherever feasible for re-use as staging areas and/or for the siting of remediation facilities, and avoiding direct physical impacts to the Topock Maze as it is manifested archaeologically. PG&E's qualified archaeologist, in coordination with the Tribes, will perform background research and field verification to identify and evaluate any cultural, historical, or archaeological resources within the location of remediation facilities and/or staging areas. Any resources present will be avoided to the extent feasible during construction and use of staging areas and/or remediation facilities pursuant to CUL-1b/c and CUL-2. Further, construction monitoring and treatment of any unanticipated discoveries will be as specified in CUL-1b/c-4 and CUL- 1a-8o. Accordingly, archaeological and Native American monitors will be invited to observe all earth-disturbing activities at remediation facilities and/or staging areas during construction. These monitors will at all times comply with Project-wide and job site-specific safety requirements.	PG&E has included Tribes in review of project design documents at the 30% and 60% phases, and PG&E has selected previously disturbed land for staging areas and siting of remediation facilities wherever feasible. PG&E's remedial design avoids direct impact to the Topock Maze as it is manifested archaeologically. During construction, PG&E will implement the procedures of the protocol to identify and evaluate any cultural, historical, or archaeological resources within the vicinity of staging areas and remediation facilities. Avoidance will then be implemented for any identified resources, and monitoring and treatment in the case of unanticipated discoveries. PG&E will invite Tribal monitors to observe all earth-disturbing activities.	PG&E has included Tribes in review of project design documents at the 90% phase, and PG&E has selected previously disturbed land for staging areas and siting of remediation facilities wherever feasible. PG&E's remedial design avoids direct impact to the Topock Maze as it is manifested archaeologically by avoiding it. During construction, PG&E will implement the procedures of the protocol to identify and evaluate any cultural, historical, or archaeological resources within the vicinity of staging areas and remediation facilities. Avoidance will then be implemented for any identified resources, and monitoring and treatment in the case of unanticipated discoveries. PG&E will invite Tribal monitors to observe all earth-disturbing activities.

Summary of Compliance with Identified ARARs
(On CD-ROM only)

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Item No.[1]	Category[1]	Citation[1,2]	Determination[1,2]	Description in DOI's ARARs Table[1,2]	Triggering Event	Compliance Responsibility	Which existing/ future document(s) will document continued compliance with this ARAR?[4]	Action (Compliance Status)			
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
Chemical-Specific											
1	Federal Chemical-Specific	Federal Safe Drinking Water Act - 42 USC § 300f, et seq.; 40 CFR 141 -- Subpart F– Maximum Contaminant Level Goals (MCLGs)	ARAR Relevant and Appropriate	MCLGs are not federally enforceable drinking water standards, but CERCLA § 121(d) identifies MCLGs as relevant and appropriate requirements.	Remedy Implementation	PG&E	Quarterly progress reports during remedy O&M Other data/reports requested by agencies	Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer to a concentration below the federal maximum contaminant level goal (MCLG) for Cr(T) of 100 µg/L. There is no federal MCLG for Cr(VI) and the RAO has been established based on the regional background concentration of 32 µg/L Cr(VI) at the conclusion of remedy implementation. Although concentrations of Cr(VI) and in-situ byproducts (e.g., arsenic, manganese) may fluctuate within the treatment area during remedy implementation, institutional controls will prevent use of affected groundwater as a drinking water source until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that the RAOs have been achieved at the conclusion of remedy implementation and prior to removing the institutional control.	Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer to a concentration below the federal MCLG for Cr(T) of 100 µg/L. There is no federal MCLG for Cr(VI) and the RAO has been established based on the regional background concentration of 32 µg/L Cr(VI) at the conclusion of remedy implementation. Although concentrations of Cr(VI) and in-situ byproducts (e.g., arsenic, manganese) may fluctuate within the treatment area during remedy implementation, institutional controls will prevent use of affected groundwater as a drinking water source until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that the RAOs have been achieved at the conclusion of remedy implementation and prior to removing the institutional control.	Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer to a concentration below the federal MCLG for Cr(T) of 100 µg/L. There is no federal MCLG for Cr(VI) and the RAO has been established based on the regional background concentration of 32 µg/L Cr(VI) at the conclusion of remedy implementation. Although concentrations of Cr(VI) and in-situ byproducts (e.g., arsenic, manganese) may fluctuate within the treatment area during remedy implementation, institutional controls will prevent use of affected groundwater as a drinking water source until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that the RAOs have been achieved at the conclusion of remedy implementation and prior to removing the institutional control.	Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer to a concentration below the federal MCLG for Cr(T) of 100 µg/L. There is no federal MCLG for Cr(VI) and the RAO has been established based on the regional background concentration of 32 µg/L Cr(VI) at the conclusion of remedy implementation. Although concentrations of Cr(VI), arsenic from freshwater injection, and in-situ byproducts (e.g., arsenic, manganese) should increase or fluctuate within or immediately adjacent to the plume during remedy implementation, institutional controls will prevent use of affected groundwater as a drinking water source until the remedy is complete. At the completion of the remedy, any elevated concentrations resulting from PG&E's activities should have reverted back to values below MCLGs that are set at levels above zero, MCLs, RAOs, or background concentrations.

TABLE 6.2-1
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2	Federal Chemical-Specific	Federal Safe Drinking Water Act - 42 USC § 300g-1; 40 CFR 141 -- Subpart G – National Primary Drinking Water Regulations (MCLs)	ARAR Relevant and Appropriate	These MCLs are relevant and appropriate standards, which establish the maximum permissible level of contaminants (e.g., chromium) in sources (or potential sources) of drinking water. MCLs may be applicable where water at a CERCLA site is delivered through a public water supply system.	Remedy Implementation	PG&E	Quarterly progress reports during remedy O&M Other data/reports requested by agencies	Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer below the federal maximum contaminant level (MCL) for Cr(T) of 100 µg/L. There is no federal MCL for Cr(VI) and the RAO has been established based on the regional background concentration of 32 µg/L at the conclusion of remedy implementation. Although concentrations of Cr(VI) and in-situ by-products (e.g., arsenic, manganese) may fluctuate within the treatment area during remedy implementation, institutional controls will prevent use of affected groundwater as a drinking water source until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that RAOs have been achieved at the conclusion of remedy implementation and prior to removing the institutional controls.	Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer below the federal MCL for Cr(T) of 100 µg/L. There is no federal MCL for Cr(VI) and the RAO has been established based on the regional background concentration of 32 µg/L at the conclusion of remedy implementation. Concentrations of Cr(VI) and in-situ by-products (e.g., arsenic, manganese) may fluctuate within the treatment area during remedy implementation. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally occurring arsenic concentration in water from the well exceeds the MCL of 10 µg/L, which is typical of water quality in the vicinity of Topock, Arizona**,** and will be removed to below MCL prior to injection**.** Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation are localized, will attenuate under site conditions and will return to pre-remedy baseline levels after the end of active remediation. Institutional controls will prevent use of affected groundwater as a drinking water source until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that RAOs have been achieved at the conclusion of remedy implementation and prior to removing the institutional controls.	Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer below the federal MCL for Cr(T) of 100 µg/L. There is no federal MCL for Cr(VI) and the RAO has been established based on the regional background concentration of 32 µg/L at the conclusion of remedy implementation. Concentrations of Cr(VI) and in-situ by-products (e.g., arsenic, manganese) may fluctuate within the treatment area during remedy implementation. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally occurring arsenic concentration in water from the well exceeds the MCL of 10 µg/L, which is typical of water quality in the vicinity of Topock, Arizona**.** Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation and freshwater injection are localized, will attenuate under site conditions and will return to pre-remedy baseline levels after the end of active remediation and the cessation of freshwater injection, respectively. Institutional controls will prevent use of affected groundwater as a drinking water source until the remedy is complete. Groundwater monitoring will be used to	Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer below the federal MCL for Cr(T) of 100 µg/L. There is no federal MCL for Cr(VI) and the RAO has been established based on the regional background concentration of 32 µg/L at the conclusion of remedy implementation. Concentrations of Cr(VI) and in-situ by-products (e.g., arsenic, manganese) may fluctuate within the treatment area during remedy implementation. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally occurring arsenic concentration in water from the well exceeds the MCL of 10 µg/L, which is typical of water quality in the vicinity of Topock, Arizona**.** Modeling indicates that elevated arsenic concentrations generated from in-situ remediation and freshwater injection are localized, will attenuate under site conditions, and will return to pre-remedy baseline levels approximately 10 years after the end of active remediation and the cessation of freshwater injection, respectively. Institutional controls will prevent use of affected groundwater as a drinking water source until the remedy is complete. Groundwater monitoring will be used to track performance of the

TABLE 6.2-1
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								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
										track performance of the remedy and verify that RAOs have been achieved at the conclusion of remedy implementation and prior to removing the institutional controls.	remedy and verify that RAOs have been achieved at the conclusion of remedy implementation and prior to removing the institutional controls.
3	Federal Chemical-Specific	Federal Water Pollution Control Act (Clean Water Act) - 33 USC §§ 1251-1387; 40 CFR 131.38	ARAR Applicable	These are federally promulgated Water Quality Standards for surface waters. Such water quality standards include specific criteria for water bodies in California, including standards for hexavalent chromium.	Remedy Implementation	PG&E	Quarterly progress reports during remedy O&M Other data/reports requested by agencies	Surface water sampling in the Colorado River near the site shows concentrations less than the federal water quality criteria (California Toxics Rule) for Cr(VI) of 11 µg/L. Reducing Cr(VI) concentrations in groundwater by implementation of the remedy will increase the level of certainty that surface water quality will continue to remain below this level. The remedy is designed to prevent migration of contaminants to the Colorado River that would result in an exceedance of California Toxics Rule criteria.	Surface water sampling in the Colorado River near the site shows concentrations less than the federal water quality criteria (California Toxics Rule) for Cr(VI) of 11 µg/L. Reducing Cr(VI) concentrations in groundwater by implementation of the remedy will prevent any and all discharges to the Colorado River from the groundwater contamination. The remedy is designed to prevent migration of contaminants to the Colorado River that would result in an exceedance of applicable water quality standards.	Surface water sampling in the Colorado River near the site shows concentrations less than the federal water quality criteria (California Toxics Rule) for Cr(VI) of 11 µg/L. Reducing Cr(VI) concentrations in groundwater by implementation of the remedy will prevent any and all discharges to the Colorado River from the groundwater contamination. The remedy is designed to prevent migration of contaminants to the Colorado River that would result in an exceedance of applicable water quality standards, including federal, California, and Arizona standards.	Surface water sampling in the Colorado River near the site shows concentrations less than the federal water quality criteria (California Toxics Rule) for Cr(VI) of 11 µg/L. Reducing Cr(VI) concentrations in groundwater by implementation of the remedy will prevent any and all discharges to the Colorado River from the groundwater contamination. The remedy is designed to prevent migration of contaminants to the Colorado River that would result in an exceedance of applicable water quality standards, including federal, California, and Arizona standards.

TABLE 6.2-1
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52	California Chemical-Specific	California Safe Drinking Water Act - Title 22, CCR, Div 4, Ch 15, §64431, §64444	ARAR Applicable	Maximum Contaminant Levels (MCLs) which shall not be exceeded in the water supplied to the public. California state MCLs for drinking water standards are more stringent than primary federal standards.	Remedy Implementation	PG&E	Quarterly progress reports during remedy O&M Other data/reports requested by agencies	Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer to a concentration below the state MCL for Cr(T) of 50 µg/L. There is no state MCL for Cr(VI) and the RAO has been established based on the regional background concentration of 32 µg/L at the conclusion of remedy implementation. Although concentrations of Cr(VI) and in-situ byproducts (e.g., arsenic, manganese) may fluctuate during remedy implementation, institutional controls will prevent use of affected groundwater as a drinking water source until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that the RAOs have been achieved at the conclusion of remedy implementation and prior to removing the institutional control.	Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer to a concentration below the state MCL for Cr(T) of 50 µg/L. There is no state MCL for Cr(VI) and the RAO has been established based on the regional background concentration of 32 µg/L at the conclusion of remedy implementation. Concentrations of Cr(VI) and in-situ byproducts (e.g., arsenic, manganese) may fluctuate during remedy implementation. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally occurring arsenic concentration in water from the well exceeds the MCL of 10 µg/L, which is typical of water quality in the vicinity of Topock, Arizona**,** and will be removed to below MCL prior to injection**.** Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation are localized, will attenuate under site conditions and will return to pre-remedy baseline levels after the end of active remediation. Institutional controls will prevent use of affected groundwater as a drinking water source until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that the RAOs have been achieved at the conclusion of remedy implementation and prior to removing the institutional control.	Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer to a concentration below the state MCL for Cr(T) of 50 µg/L. The state MCL for Cr(VI) is 10 µg/L. The RAO has been established based on the regional background concentration of 32 µg/L at the conclusion of remedy implementation. Concentrations of Cr(VI) and in-situ byproducts (e.g., arsenic, manganese) may fluctuate during remedy implementation. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally occurring arsenic concentration in water from the well exceeds the MCL of 10 µg/L, which is typical of water quality in the vicinity of Topock, Arizona. Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation and freshwater injection are localized, will attenuate under site conditions and will return to pre-remedy baseline levels after the end of active remediation and the cessation of freshwater injection, respectively. Institutional controls will prevent use of affected groundwater as a drinking water source until the remedy is complete. Groundwater monitoring will be used to track performance of the	Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer to a concentration below the state MCL for Cr(T) of 50 µg/L. The state MCL for Cr(VI) is 10 µg/L, but the RAO has been established based on the Alluvial Aquifer regional background concentration of 32 µg/L at the conclusion of remedy implementation. Concentrations of Cr(VI) and in-situ byproducts (e.g., arsenic, manganese) may fluctuate during remedy implementation. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally occurring arsenic concentration in water from the well exceeds the MCL of 10 µg/L, which is typical of water quality in the vicinity of Topock, Arizona. Modeling indicates that elevated arsenic concentrations generated from in-situ remediation and freshwater injection are localized, will attenuate under site conditions and will return to pre-remedy baseline levels approximately 10 years after the end of active remediation and the cessation of freshwater injection, respectively. Institutional controls will prevent use of affected groundwater as a drinking water source until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that the

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										remedy and verify that the RAOs have been achieved at the conclusion of remedy implementation and prior to removing the institutional control.	RAOs have been achieved at the conclusion of remedy implementation and prior to removing the institutional control.
53	California Chemical-Specific	Secondary MCLs list for drinking water - Title 22, CCR, Div 4, Ch 15, §64449	ARAR Relevant and Appropriate	State secondary MCLs for drinking water standards are more stringent than federal standards. These secondary MCLs are relevant and appropriate standards, which establish the maximum permissible level of contaminants in sources (or potential sources) of drinking water. These secondary MCLs would be applicable if water at the site was used as drinking water and delivered through a community water supply system.	Remedy Implementation	PG&E	Quarterly progress reports during remedy O&M Other data/reports requested by agencies	There is no secondary MCL for Cr(VI) or Cr(T). Secondary MCLs are community acceptance standards for constituents that may adversely affect the taste, odor or appearance of drinking water. An institutional control will be enforced throughout the chromium plume area during implementation of the remedial action to prohibit use of the groundwater as a drinking water source.	There is no secondary MCL for Cr(VI) or Cr(T). Secondary MCLs are community acceptance standards for constituents that may adversely affect the taste, odor or appearance of drinking water. Concentrations of in-situ by-products (arsenic, manganese [secondary MCL of 50 µg/L]) may fluctuate within the treatment area during remedy implementation. Institutional control will be enforced throughout the chromium plume area during implementation of the remedial action to prohibit use of the groundwater as a drinking water source. Additionally, there are currently no municipal or private wells in the chromium plume area, to PG&E's knowledge.	There is no secondary MCL for Cr(VI) or Cr(T). Secondary MCLs are community acceptance standards for constituents that may adversely affect the taste, odor or appearance of drinking water. Concentrations of in-situ by-products (arsenic, manganese [secondary MCL of 50 µg/L]) may fluctuate within the treatment area during remedy implementation. Institutional control will be enforced throughout the chromium plume area during implementation of the remedial action to prohibit use of the groundwater as a drinking water source. Additionally, there are currently no municipal or private wells in the chromium plume area, to PG&E's knowledge.	There is no secondary MCL for Cr(VI) or Cr(T). Secondary MCLs are community acceptance standards for constituents that may adversely affect the taste, odor or appearance of drinking water. Concentrations of in-situ by-products (arsenic, manganese [secondary MCL of 50 µg/L]) may fluctuate within the treatment area during remedy implementation. Institutional controls will be enforced throughout the chromium plume area during implementation of the remedial action to prohibit use of the groundwater as a drinking water source. Additionally, there are currently no municipal or private wells in the chromium plume area, to PG&E's knowledge.
55	California Chemical-Specific	Groundwater and vadose zone protection standards - Title 22, CCR, Div 4.5, Ch 15, Article 6, §66265.94	ARAR Applicable	RCRA hazardous waste Interim Status TSD facilities shall comply and ensure that hazardous constituents entering the groundwater, surface water, and soil from a regulated unit do not exceed the concentration limit from contaminants of concern in the uppermost aquifer underlying the waste management area beyond the point of compliance.	Remedy Implementation	PG&E	N/A. No further action required unless post-design approval change triggers.	Compliance with this requirement will be achieved by reducing the concentration of Cr(VI) in the affected aquifer to the regional background concentration of 32 µg/L at the conclusion of remedy implementation. Although concentrations of Cr(VI) and in-situ byproducts (e.g., arsenic, manganese) may fluctuate during remedy implementation, institutional controls will prevent use of affected groundwater until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that the RAOs have been achieved at the conclusion of remedy implementation.	Compliance with this requirement will be achieved by reducing the concentration of Cr(VI) in the affected aquifer to the regional background concentration of 32 µg/L at the conclusion of remedy implementation. Although concentrations of Cr(VI) and in-situ byproducts (e.g., arsenic, manganese) may fluctuate during remedy implementation, institutional controls will prevent use of affected groundwater until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that the RAOs have been achieved at the	Compliance with this requirement will be achieved by reducing the concentration of Cr(VI) in the affected aquifer to the regional background concentration of 32 µg/L at the conclusion of remedy implementation. Although concentrations of Cr(VI) and in-situ byproducts (e.g., arsenic, manganese) may fluctuate during remedy implementation, institutional controls will prevent use of affected groundwater until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that	DOI has determined that the specific regulations under this ARAR do not currently apply to the RCRA corrective action that is being conducted at the site (see RTC #391). Therefore, no further action is required.

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									conclusion of remedy implementation.	the RAOs have been achieved at the conclusion of remedy implementation.	
Action-Specific											
31	Federal Action-Specific	Federal Safe Drinking Water Act - 42 USC §300f, et seq. Part C – Protection of Underground Sources of Drinking Water; 40 CFR 144-148	ARAR Applicable	These Underground Injection Control Regulations assure that any underground injection performed on-site will not endanger drinking water sources. Substantive requirements include, but are not limited to, regulation of well construction and well operation. These requirements will be applicable if underground injection is proposed as a part of a site remedy.	Underground injection activities	PG&E	Filing of inventory of injection wells	Injection wells are classified as Class V injection wells and will be registered with USEPA prior to installation. The injection wells will be monitored to ensure they will not endanger drinking water sources. An institutional control will be enforced throughout the chromium plume area during implementation of the remedial action to prohibit use of the groundwater as a drinking water source. All injection wells will be properly closed upon completion of the remedy.	Injection wells are classified as Class V injection wells and will be registered with USEPA prior to installation. The injection wells will be monitored to ensure they will not endanger drinking water sources. An institutional control will be enforced throughout the chromium plume area during implementation of the remedial action to prohibit use of the groundwater as a drinking water source. All injection wells will be properly closed upon completion of the remedy.	Injection wells are classified as Class V injection wells and will be registered with USEPA prior to installation. An institutional control will be enforced throughout the chromium plume area during implementation of the remedial action to prohibit use of the groundwater as a drinking water source. All injection wells will be properly closed upon completion of the remedy.	Injection wells are classified as Class V injection wells and will be registered with USEPA prior to installation. An institutional control will be enforced throughout the chromium plume area during implementation of the remedial action to prohibit use of the groundwater as a drinking water source. All injection wells will be properly closed upon completion of the remedy.
32	Federal Action-Specific	Federal Water Pollution Control Act (Clean Water Act) - 33 USC § 1344 ; 40 CFR 230.10	ARAR Applicable	This section of the Clean Water Act prohibits certain activities with respect to on-site wetlands and waterways. No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed activity which would have less adverse impact to the aquatic ecosystem.	Activities that occur in the Colorado River or in jurisdictional waters of the United States that result in discharge of dredged or fill material.	PG&E	N/A. No further action required unless post-design approval change triggers.	The preliminary (30%) design includes facilities in the jurisdictional water of the U.S. (see Figure 2-16 of the 30% BOD Report). PG&E will work with the USACE to ensure compliance with the substantive requirements of Section 404 per CERCLA Section 121(e)(1). It is anticipated that a wetland delineation will be conducted in the Spring of 2012.	The intermediate (60%) design includes facilities in the jurisdictional waters of the U.S. (see Figure 2.4-5 in the 60% BOD Report document). PG&E will work with the USACE to ensure compliance with the substantive requirements of Section 404 per CERCLA Section 121(e)(1). A wetlands delineation was completed in March 2012 and is to be revised in April 2013; results will be summarized in a forthcoming report for DTSC review.	A report titled "*Wetlands and Waters of the United States Final Delineation Report for the Topock Compressor Station Groundwater Remediation Project, San Bernardino County, California"* (CH2M HILL 2014c) was prepared to summarize results of efforts to delineate jurisdictional areas in the project area, and was submitted to DTSC and DOI on April 18, 2014. The report is also included in Appendix A3 of the 90% BOD Report. In support of the Supplemental 90% design, PG&E conducted surveys for jurisdictional waters and wetlands in the 6.74-acre and soil management area at Moabi Regional Park on November 19, 2014. The survey results were summarized in a technical memorandum titled *Assessment of Biological Resources for the Proposed Soil Management Areas* (CH2M HILL 2015b), which was	On January 30, 2015, PG&E conducted biological surveys (including mature plants and culturally significant plants) of the area proposed for remedy use at Moabi Regional Park. On June 24-25, 2015, in conformance with direction from DTSC, PG&E conducted biological surveys (including mature plants and culturally significant plants) of an additional 35-acre area on the west side of Moabi Regional Park. The survey results were summarized in a technical memorandum titled *Assessment of Biological Resources for a 35-acre Area on the West Side of Moabi Regional Park* (CH2M HILL 2015d). This memorandum provides updates to the January 2015 memorandum as well as information on the natural resources observed within the larger 35-acre area, and is also included in Appendix A10 of this report.

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										submitted with the Supplemental 90%. On July 10, 2013, the USACE confirmed that CERCLA 121(e)(1) permit exemption applies to the Topock remediation project, and therefore, PG&E is not required to comply with the administrative and procedural elements of Section 404 of the Clean Water Act, however PG&E is obligated to comply with the substantive elements of Section 404 of the Clean Water Act. The locations of jurisdictional wetlands and waters have been incorporated into the design. At the 90%/ Supplemental 90% design stage, the final remedy avoids almost all permanent impacts within USACE jurisdictional areas with the following exceptions. There is one planned well, IRL-4, that will occur within a jurisdictional waters of the US. There is also a freshwater pipeline that will be installed within an existing unpaved access road within the 100-year floodplain of the Colorado River. In addition, piping and conduits will be installed in two locations in Bat Cave Wash – one location in the Upland Area and one location near the TCS. However, complete avoidance of other jurisdictional non-wetland waters is not feasible. It has been determined that in order to meet the goals of protection of human health and the environment, to meet the RAOs for the remedy, to monitor remedy performance, to gather data for	In addition, a technical memorandum titled *Assessment of Biological Resources for the Proposed Sewer and Firewater Lines for the Construction Headquarters, Final Groundwater Remedy, Topock Compressor Station, California* (CH2M HILL 2015c) was prepared to provide a general assessment of biological resources that could be affected by the proposed sewer and fire water lines that may be installed in the future and are associated with the construction headquarters facilities that would be located to the west of Moabi Regional Park, south of the National Trails Highway. The memo was completed on August 5, 2015 and submitted for review during the 90% RTC process and is included in Appendix A10 of this report. The locations of jurisdictional waters have been considered in the design. At the final design stage, the final remedy avoids almost all permanent impacts within USACE jurisdictional areas with the following exceptions: 1) Inner Recirculation Loop well IRL-4 will occur within a jurisdictional water of the U.S. 2) Remedy and monitoring wells and associated piping/conduits will be installed in Bat Cave Wash, a jurisdictional water of the U.S. 3) Freshwater supply well HNWR-1A, contingent Site B well, associated equipment, and a portion of the freshwater pipeline will be

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										demonstration of compliance, as well as in response to resolution of design comments with the Tribes, infrastructure (remediation, monitoring wells, and associated piping/conduits) must be installed in certain washes. There are no practicable alternatives to locating certain infrastructure within waters of the United States. Figure 2.4-5 in the 90% BOD Report shows the unavoidable overlaps between planned remedy infrastructure and the USACE jurisdictional waters. In such cases where complete avoidance is not feasible, certain best management practices (BMPs) will be implemented to avoid and minimize temporary and permanent impacts for activities occurring within jurisdictional wetlands (if any) and non-wetland waters of the U.S. Although the USACE did not provide a list of measures that may be taken to reduce impacts to jurisdictional waters and wetlands, the California Department of Fish and Wildlife (CDFW) requires compliance with avoidance and mitigation measures (AMMs) for all work conducted in CDFW jurisdictional washes. The geographic extent of CDFW's jurisdiction is broader than the jurisdictional extent of the USACE under CWA 404 and thus, avoidance and mitigation measures applied to CDFW jurisdictional waters would as a geographic consequence also be applied to CWA 404 waters. While Arizona does not have a similar	installed within the 100-year floodplain of the Colorado River. 4) Riverbank Extraction Well RB-5, monitoring well MW-W, a portion of Pipeline C, and a portion of the ring road will be installed within the 100-year floodplain of the Colorado River. Complete avoidance of jurisdictional areas is not feasible. It has been determined that in order to meet the goals of protection of human health and the environment, to meet the RAOs for the remedy, to monitor remedy performance, to gather data for demonstration of compliance, as well as in response to resolution of design comments with the Tribes, infrastructure (remediation, monitoring wells, and associated piping/conduits) must be installed in certain washes. There are no practicable alternatives to locating certain infrastructure within the waters of the United States. Figure 2.4-5 in this Final BOD Report shows the unavoidable overlaps between planned remedy infrastructure and the USACE jurisdictional waters. In such cases where complete avoidance is not feasible, BMPs will be implemented to avoid and minimize temporary and permanent impacts for activities occurring within jurisdictional wetlands and non-wetland waters of the U.S (for brevity, the detailed discussion on BMPs in the previous column is not repeated here).

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										state program, PG&E will also implement the same AMMs in Arizona identified by CDFW for California as well to ensure appropriate protection to CWA 404 jurisdictional areas in the project area, including those in Arizona. In addition to the CDFW AMMs, PG&E has identified additional BMPs for implementation during remedy construction, operation and maintenance, as well as decommissioning. The additional BMPs are described in the *Protocol for Compliance with EIR Mitigation and Monitoring Reporting Program BIO-1 and Applicable or Relevant and Appropriate Requirement (ARAR) #32 at the Topock Compressor Station* (see Exhibit 6.1-1 at the end of Table 6.1-1). A Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (CH2M HILL 2014o) was also prepared and submitted as an appendix of the Construction/Remedial Action Work Plan.	
33	Federal Action-Specific	Federal Water Pollution Control Act (Clean Water Act) - 33 USC § 1342; 40 CFR 122; 40 CFR 125	ARAR Applicable	These National Pollutant Discharge Elimination System (NPDES) requirements regulate discharges of pollutants from any point source into waters of the United States.	Point source discharges to waters of the US.	PG&E	N/A. No further action required unless post-design approval change triggers.	No further action required. The remedy as presented in the preliminary (30%) design does not result in point source discharges to waters of the United States that will require an NPDES permit.	No further action required. The remedy as presented in the 60% design does not result in point source discharges to waters of the United States that will require an NPDES permit.	No further action required. The remedy as presented in the 90% design does not result in point source discharges to waters of the United States that will require an NPDES permit.	No further action required. The remedy as presented in the final design does not result in point source discharges to waters of the United States that will require an NPDES permit.

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34	Federal Action-Specific	Federal Water Pollution Control Act (Clean Water Act) -40 CFR 122.26	ARAR Applicable	These regulations define the necessary requirements with respect to the discharge of storm water under the NPDES program. These regulations will apply if proposed remedial actions result in storm water runoff which comes in contact with any construction activity from the site remediation.	Ground disturbance as a result of construction is > 1 acre	PG&E	SWPPP, BMP Plans and Monitoring & Reporting, Construction/ Remedial Action Work Plan, Plan for Decommissioning and Removal of IM-3 and Site Restoration, Decommissioning Plan for Remedy Facilities and Restoration	PG&E will prepare a BMP Plan prior to construction activities that will be included in the Construction/Remedial Action Work Plan.	PG&E will prepare a BMP Plan to address construction activities which will be included in the Construction/Remedial Action Work Plan and the IM-3 Decommissioning Work Plan that will be submitted as part of the 90% design. In addition, PG&E will prepare an industrial or O&M SWPPP that will include a storm water monitoring program in compliance with the General Permit. The outline for the O&M SWPPP is included in Appendix E of the O&M Plan (Volume 1) at the 60% design stage; the complete industrial SWPPP will be provided at the 90% design stage.	A BMP Plan for construction activities was prepared and is included as an appendix in the Construction/Remedial Action Work Plan and the IM-3 Decommissioning Work Plan. In addition, an industrial SWPPP was also prepared and included in Appendix E of the O&M Plan (Volume 1). The SWPPP includes BMPs for O&M activities and a storm water monitoring program in compliance with the General Permit.	A BMP Plan for construction activities was prepared and is included as an appendix in the Construction/Remedial Action Work Plan and the IM-3 Decommissioning Work Plan. In addition, an industrial SWPPP was also prepared and included in Appendix E of the O&M Plan (Volume 1). The SWPPP includes BMPs for O&M activities and a storm water monitoring program in compliance with the General Permit.
35	Federal Action-Specific	River and Harbor Act of 1899 - 33 USC §§ 401 and 403	ARAR Applicable	This Act prohibits the creation of any obstruction in navigable waters, in addition to banning activities such as depositing refuse, excavating, filling, or in any manner altering the course, condition, or capacity of navigable waters. These requirements will apply if proposed activities at the Topock site have the potential of affecting any navigable waters on the site.	Activities with the potential to affect any navigable waters on the site	PG&E	N/A. No further action required unless post-design change approval triggers.	No further action required. The remedy, as presented in the preliminary (30%) design, will not affect navigable waters.	No further action required. The remedy, as presented in the 60% design, will not affect navigable waters.	No further action required. The remedy, as presented in the 90% design, will not affect navigable waters.	No further action required. The remedy, as presented in the final design, will not affect navigable waters.
38	Federal Action-Specific	Clean Air Act - USC §§ 7401, et seq. (National Emission Standards for Hazardous Air Pollutants (NESHAP)); 40 CFR 61; 40 CFR 63	ARAR Applicable	NESHAPs are regulations which establish emissions standards for certain hazardous air pollutants (HAPs) identified in the regulations. NESHAPs will apply if remediation activities on the site produce identified HAP emissions.	Activities produce identified HAP emissions	PG&E	N/A. No further action required unless post-design approval change triggers.	No further action required. The remedy, as presented in the preliminary (30%) design does not include activities subject to NESHAPs.	No further action required. The remedy, as presented in the 60% design does not include activities subject to NESHAPs.	No further action required. The remedy, as presented in the 90% design does not include activities subject to NESHAPs.	No further action required. The remedy, as presented in the final design does not include activities subject to NESHAPs.

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39	Federal Action-Specific	Religious Freedom Restoration Act - 42 USC § 2000bb	ARAR Applicable	Pursuant to this Act, the government shall not substantially burden a person's exercise of religion, unless the application of the burden is in furtherance of a compelling government interest, and it is the least restrictive means of furthering that interest. To constitute a "substantial burden" on the exercise of religion, a government action must (1) force individuals to choose between following the tenets of their religion and receiving a governmental benefit or (2) coerce individuals to act contrary to their religious beliefs by the threat of civil or criminal sanctions. If any remedial action selected imposes a substantial burden on a person's exercise of religion, it must be in furtherance of a compelling government interest and be the least restrictive means of achieving that interest.	Activities with the potential to impose a substantial burden on a person's exercise of religion.	DOI/BLM	Design submittals, Construction/ Remedial Action Work Plan, O&M Plan, Progress Reports, Decommissioning Plan	The remedy, as presented in the preliminary (30%) design does not substantially burden a person's exercise of religion. Additionally, in compliance with the PA, a Tribal Access Plan is being developed for Tribal access to areas within the Topock site for traditional religious, cultural, or spiritual purposes during implementation of the Remedy. BLM is also developing a *Cultural and Historic Properties Management Plan* (CHPMP) to avoid, minimize and mitigate potential affects to historic properties, including the Topock TCP during implementation of the Remedy. BLM distributed a draft CHPMP on November 1, 2011. Comments on the draft CHPMP are due December 5, 2011. The BLM is anticipating that the final CHPMP will be issued by January 20, 2012 The preliminary (30%) design was submitted on November 18, 2011. PG&E will prepare future design submittals, a Construction/Remedial Action Work Plan, a Plan for decommissioning, removal, and restoration of IM-3 facility, and a Decommissioning Plan for Remedy Facilities and Restoration. The other documents will be prepared and submitted.	The remedy, as presented in the intermediate (60%) design, does not substantially burden a person's exercise of religion. Additionally, in compliance with the PA, a Tribal Access Plan (BLM 2011) was completed for Tribal access to lands under federal management within the Topock site for traditional religious, cultural, or spiritual purposes during implementation of the Remedy. PG&E has initiated work on an Access Plan for the lands not under federal management, taking into consideration the information in the BLM Access Plan, for submittal with the final design (target 2013). BLM also developed the CHPMP to avoid, minimize and mitigate potential affects to historic properties, including the Topock TCP, during implementation of the Remedy. BLM issued the final CHPMP on January 20, 2012. The CHPMP can be modified and updated, as needed, to address new information and ongoing activities related to the project. Therefore, subsequently to the issuance of the CHPMP, BLM continues to hold periodic working meetings on the CHPMP. It should be noted that treatment measures are included in the CHPMP and a treatment plan will continue to be developed throughout the design to address mitigation measures. The intermediate (60%) design was submitted on April 5, 2013. PG&E will prepare and submit future design submittals; a Construction/Remedial Action Work Plan; a plan for decommissioning, removal, and restoration of the IM-3 facility; and a Decommissioning Plan for Remedy Facilities and Restoration.	The remedy, as presented in the 90% design, does not substantially burden a person's exercise of religion. Additionally, in compliance with the PA, a Tribal Access Plan (BLM 2011) was completed for Tribal access to lands under federal management within the Topock site for traditional religious, cultural, or spiritual purposes during implementation of the Remedy. On October 21, 2013, PG&E provided the Tribes a draft of the Access Plan for lands not under federal management for review and comment. Tribal comments were received on November 22, 2013. PG&E has updated and discussed the plan at the July 24, 2014 TMU. The Access Plan is included in an appendix of the Construction/Remedial Action Work Plan. BLM also developed the CHPMP to avoid, minimize and mitigate potential affects to historic properties, including the Topock TCP, during implementation of the Remedy. BLM issued the final CHPMP on January 20, 2012. The CHPMP can be modified and updated, as needed, to address new information and ongoing activities related to the project. Therefore, subsequently to the issuance of the CHPMP, BLM continues to hold periodic working meetings on the CHPMP. It should be noted that treatment measures are included in the CHPMP and a treatment plan will be prepared and submitted to	The remedy, as presented in the final design, does not substantially burden a person's exercise of religion. Additionally, in compliance with the PA, a Tribal Access Plan (BLM 2011) was completed for Tribal access to lands under federal management within the Topock site for traditional religious, cultural, or spiritual purposes during implementation of the remedy. PG&E has prepared an Access Plan in coordination with Tribes, for the lands not under federal management, taking into consideration the information in the BLM Access Plan. The Access Plan is included in an appendix of the Construction/Remedial Action Work Plan and was submitted on November 18, 2015. PG&E's Tribal Access Plan preserves Tribal members' access to, and use of, the project area for religious, spiritual, or other cultural purposes, to the extent that PG&E has the authority to facilitate such access, consistent with the requirements of EIR mitigation measure CUL-1a-2. BLM also developed the CHPMP to avoid, minimize and mitigate potential affects to historic properties, including the Topock TCP, during implementation of the Remedy. BLM issued the final CHPMP on January 20, 2012. The CHPMP can be modified and updated, as needed, to address new information and ongoing activities related to the project. Therefore, subsequently to the issuance

TABLE 6.2-1
Summary of Compliance with Identified ARARs
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Item No.[1]	Category[1]	Citation[1,2]	Determination[1,2]	Description in DOI's ARARs Table[1,2]	Triggering Event	Compliance Responsibility	Which existing/ future document(s) will document continued compliance with this ARAR?[4]	Action (Compliance Status)			
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
										DTSC shortly after submission of the 90% design. The 90% design was submitted on September 8, 2014. A Construction/Remedial Action Work Plan and a plan for decommissioning, removal, and restoration of the IM-3 facility were submitted concurrently with the 90% design. In compliance with the CD (Appendix C Scope of Work, Item 9), a Decommissioning Plan for Remedy Facilities will be submitted within 120 days of receipt of DOI's certification of completion of the RA and a determination by DOI that removal of such facilities is protective of human health and the environment.	of the CHPMP, BLM continues to hold periodic working meetings on the CHPMP. It should be noted that treatment measures are included in the CHPMP and also in the Cultural and Historical Property Treatment Plan submitted to DTSC and DOI with the 90% design submittal. The final design was submitted on November 18, 2015. A Construction/Remedial Action Work Plan and a plan for decommissioning, removal, and restoration of the IM-3 facility were submitted concurrently with the final design. In compliance with the CD (Appendix C Scope of Work, Item 9), a Decommissioning Plan for Remedy Facilities will be submitted within 120 days of receipt of DOI's certification of completion of the RA and a determination by DOI that removal of such facilities is protective of human health and the environment.

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40	Federal Action-Specific	Endangered Species Act of 1973 - 16 USC §§ 1531-1544;50 CFR 402	ARAR Applicable	The ESA makes it unlawful to remove or "take" threatened and endangered plants and animals and protects their habitats by prohibiting certain activities. Examples of such species in or around the Topock site may include, but are not limited to, southwestern willow flycatcher, Mojave Desert tortoise, Yuma clapper rail, Colorado pike minnow, razorback sucker, and bonytail chub. Any remedial action selected for the Topock site will not result in the take of, or adverse impacts to, threatened and endangered species or their habitats, as determined based on consultation with the Fish and Wildlife Service under section 7 of the ESA.	Extension of existing PBA through December 31, 2017 or construction of remedy, whichever is sooner	DOI/USFWS/ PG&E	PBA, Construction/ Remedial Action Work Plan, Plan for decommissioning, removal, and restoration of IM-3 facility, Plan for Decommissioning of Remedy Facilities and Restoration.	PG&E, USFWS, and DOI are coordinating on the Programmatic Biological Assessment (PBA) for the final groundwater remedy. Goal is to complete the PBA in time for the completion of ESA Section 7 consultation prior to the approval of the Construction/Remedial Action Work Plan.	Preparation of the PBA for the final groundwater remedy and coordination with USFWS and DOI are ongoing. Goal is to complete the PBA in time for the completion of ESA Section 7 consultation prior to the approval of the Construction/Remedial Action Work Plan.	The Final Groundwater Remedy PBA was prepared to support informal consultations for actions to be conducted under the remedial action, including activities located on BLM and U.S. Fish and Wildlife Service administered lands. Coordination with USFWS, BLM, and DOI on the PBA had occurred. This ESA Section 7 consultation was concluded with receipt of USFWS concurrency letter on July 7, 2014 which preceded the approval of the Construction/ Remedial Action Work Plan.	The Final Groundwater Remedy PBA was prepared to support informal consultations for actions to be conducted under the remedial action, including activities located on BLM and U.S. Fish and Wildlife Service administered lands. Coordination with USFWS, BLM, and DOI on the PBA occurred. This ESA Section 7 consultation was concluded with receipt of USFWS concurrence letter on July 7, 2014 which preceded the approval of the Construction/ Remedial Action Work Plan.
41	Federal Action-Specific	Migratory Bird Treaty Act - 16 USC 703-712	ARAR Applicable	This Act makes it unlawful to "take, capture, kill," or otherwise impact a migratory bird or any nest or egg of a migratory bird. The Havasu National Wildlife Refuge, which is part of the Topock site, was created as a refuge and breeding ground for migratory birds and other wildlife, therefore, there is potential for contact with migratory birds during proposed remediation activities. Any remedial action selected for the Topock site will be designed and implemented so as to not take, capture, kill, or otherwise impact a migratory bird, nest, or egg.	Remedial action for Topock site	PG&E	Construction/ Remedial Action Work Plan, Plan for decommissioning, removal, and restoration of IM-3 facility, Plan for Decommissioning of Remedy Facilities and Restoration	Avoidance and minimization measures will be included in the Construction/Remedial Action Work Plan to the extent necessary to not take, capture, kill, or otherwise impact a migratory bird, nest, or egg.	Avoidance and minimization measures will be included in the Construction/Remedial Action Work Plan, which will be submitted as part of the 90% design, to the extent necessary to not take, capture, kill, or otherwise impact a migratory bird, nest, or egg. Regarding decommissioning activities, the Avoidance and Minimization Plan and Habitat Restoration Plan will be based on surveys conducted prior to decommissioning, and during the breeding season; therefore these Plans will be prepared in the future, prior to decommissioning. The IM-3 Decommissioning Work Plan will describe the general procedures for restoration of the land and habitats.	PG&E submitted the Final Bird Impact Avoidance and Minimization Plan (CH2M HILL, 2014d) on April 30, 2014. The plan is also included as an appendix of the Construction/Remedial Action Work Plan, and Appendix I of the IM-3 Decommissioning Work Plan. Regarding decommissioning activities, the Avoidance and Minimization Plan will be based on surveys conducted prior to decommissioning, and during the breeding season; therefore this Plan will be prepared in the future, prior to decommissioning.	PG&E submitted the Final Bird Impact Avoidance and Minimization Plan (CH2M HILL 2014d) on April 30, 2014. The plan is also included as an appendix of the Construction/Remedial Action Work Plan, and Appendix I of the IM-3 Decommissioning Work Plan. Regarding decommissioning activities, another Avoidance and Minimization Plan will be based on surveys conducted prior to decommissioning, and during the breeding season; therefore this Plan will be prepared in the future, prior to decommissioning.

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45	Arizona Action-Specific	Arizona Well Standards - A.A.C. R-12-15-850	ARAR	These requirements on the placement of wells will apply if the selected remedy includes placement of wells in Arizona.	During project design and construction of wells in Arizona	PG&E		The preliminary (30%) design assumes that freshwater supply comes from the existing irrigation well (HNWR-1) on the Refuge in Arizona. If the Refuge irrigation well is not used in the final design, placement of new freshwater supply wells will be needed. In addition, new monitoring wells may also be constructed in Arizona, the locations of the monitoring wells will be presented in the intermediate (60%) design. Wells constructed in Arizona will comply with the Arizona Well Standards	The 60% design assumes that freshwater supply comes from the existing well (HNWR-1) on the Refuge in Arizona, and does not include any new monitoring wells in Arizona. If the Refuge irrigation well is not used in the final design, placement of new freshwater supply wells will be needed. If any new wells are constructed in Arizona they will comply with the Arizona Well Standards.	While the 90% design includes freshwater supply from existing wells in Arizona, these supply wells are part of the alternative freshwater source evaluation (also known as the Fresh Water Implementation Plan [FWIP]). Compliance with ARARs, including the Arizona Well Standards, for the supply wells are included in the FWIP. If additional wells in Arizona are required, they will comply with the Arizona Well Standards.	While the final design includes freshwater supply (planned and contingent) from existing wells in Arizona, two of these supply wells (HNWR-1A and Site B) are part of the alternative freshwater source evaluation (also known as the Fresh Water Implementation Plan [FWIP]). Compliance with ARARs, including the Arizona Well Standards, for these supply wells are included in the FWIP. If additional wells in Arizona are required, they will comply with the Arizona Well Standards.
46	Arizona Action-Specific	Design criteria for treatment units - A.A.C. R18-5-(501-502)	ARAR	These minimum design criteria will apply if the selected remedy includes construction of a groundwater treatment plant.	Construction of treatment plant in Arizona	PG&E	N/A. No further action required unless post-design approval change triggers.	No further action is required. The preliminary (30%) design does not involve the construction of a groundwater treatment plant in Arizona.	No further action is required. The 60% design does not involve the construction of a groundwater treatment plant in Arizona.	No further action is required. The 90% design does not involve the construction of a groundwater treatment plant in Arizona.	No further action is required. The final design does not involve the construction of a groundwater treatment plant in Arizona.
47	Arizona Action-Specific	Requirements for wells, groundwater withdrawal, treatment, and reinjection -A.R.S. §45-454.01	ARAR	This statute exempts new well construction, withdrawal, treatment, and reinjection into a groundwater aquifer as a part of a CERCLA Remedial Action from the requirements of the Arizona Groundwater Code, except that they must comply with the substantive requirements of A.R.S. 45-594, 45-595, 45-596, and 45-600. If groundwater that is withdrawn is not reinjected into the aquifer, the groundwater shall be put to reasonable and beneficial use.	Construction of wells in Arizona	PG&E		This remediation project is a CERCLA remedial action. If a new freshwater supply well or additional monitoring wells in Arizona are required they will be constructed in conformance with State construction standards (A.R.S 45-594) by a State-licensed well driller (A.R.S. 45-595). A notice of intention to drill will be filed (A.R.S. 45-596), and a well driller's report will be filed within 30 days of completion of drilling (A.R.S. 45-600). Most of the groundwater that is withdrawn will be reinjected into the aquifer. Any groundwater that is withdrawn but not reinjected into the aquifer shall be put to reasonable and beneficial use.	This remediation project is a CERCLA remedial action. The 60% design assumes that freshwater supply comes from the existing irrigation well (HNWR-1) on the Refuge in Arizona, and does not include any new monitoring wells in Arizona. If a new freshwater supply well or additional monitoring wells in Arizona are required they will be constructed in conformance with State construction standards (A.R.S. 45-594) by a State-licensed well driller (A.R.S. 45-595). A notice of intention to drill will be filed (A.R.S. 45-596), and a well driller's report will be filed within 30 days of completion of drilling (A.R.S. 45-600). Most of the groundwater that is withdrawn will be reinjected into the aquifer. Any groundwater that is withdrawn but not reinjected into the aquifer	While the 90% design includes freshwater supply from existing wells in Arizona, these supply wells are part of the alternative freshwater source evaluation (also known as the Fresh Water Implementation Plan [FWIP]). Compliance with ARARs, including the Arizona Well Standards, for the supply wells are included in the FWIP. If a new freshwater supply well or additional monitoring wells in Arizona are required they will be constructed in conformance with State construction standards (A.R.S. 45-594) by a State-licensed well driller (A.R.S. 45-595). A notice of intention to drill will be filed (A.R.S. 45-596), and a well driller's report will be filed within 30 days of completion of drilling (A.R.S. 45-600). Most of the groundwater that is	While the final design includes freshwater supply (planned and contingent) from existing wells in Arizona, two of these supply wells (HNWR-1A and Site B) are part of the alternative freshwater source evaluation (also known as the Fresh Water Implementation Plan [FWIP]). Compliance with ARARs for these supply wells are included in the FWIP. Most of the groundwater that is withdrawn will be reinjected into the aquifer. Any groundwater that is withdrawn but not reinjected into the aquifer shall be put to reasonable and beneficial use. If additional wells in Arizona are required, they will be constructed in conformance with state construction standards (A.R.S. 45-594) by a

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								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
									shall be put to reasonable and beneficial use.	withdrawn will be reinjected into the aquifer. Any groundwater that is withdrawn but not reinjected into the aquifer shall be put to reasonable and beneficial use.	state-licensed well driller (A.R.S. 45-595). A notice of intention to drill will be filed (A.R.S. 45-596), and a well driller's report will be filed within 30 days of completion of drilling (A.R.S. 45-600).
48	Arizona Action-Specific	Well construction standards -A.R.S. §45-594 and 595	ARAR	These provisions identify the well construction standards and requirements for new well construction in the State of Arizona. These requirements will apply if the selected remedy involves the construction of wells in Arizona.	Construction of wells in Arizona	PG&E		The preliminary (30%) design assumes that freshwater supply comes from the existing irrigation well (HNWR-1) on the Refuge in Arizona. If the Refuge irrigation well is not used in the final design, placement of new freshwater supply wells will be needed. In addition, new monitoring wells may also be constructed in Arizona, the locations of the monitoring wells will be presented in the intermediate (60%) design. If a new freshwater supply well or additional monitoring wells in Arizona are required they will be constructed in conformance with State construction standards (A.R.S 45-594) by a State-licensed well driller (A.R.S. 45-595).	The 60% design assumes that freshwater supply comes from the existing irrigation well (HNWR-1) on the Refuge in Arizona, and does not include any new monitoring wells in Arizona. If the Refuge irrigation well is not used in the final design, placement of new freshwater supply wells will be needed. If a new freshwater supply well or additional monitoring wells in Arizona are required they will be constructed in conformance with State construction standards (A.R.S. 45-594) by a State-licensed well driller (A.R.S. 45-595).	While the 90% design includes freshwater supply from existing wells in Arizona, these supply wells are part of the alternative freshwater source evaluation (also known as the Fresh Water Implementation Plan [FWIP]). Compliance with ARARs, including the Arizona Well Standards, for the supply wells are included in the FWIP. If a new freshwater supply well or additional monitoring wells in Arizona are required they will be constructed in conformance with State construction standards (A.R.S. 45-594) by a State-licensed well driller (A.R.S. 45-595).	While the final design includes freshwater supply (planned and contingent) from existing wells in Arizona, two of these supply wells (HNWR-1A and Site B) are part of the alternative freshwater source evaluation (also known as the Fresh Water Implementation Plan [FWIP]). Compliance with ARARs for these supply wells are included in the FWIP. If a new freshwater supply well or additional monitoring wells in Arizona are required they will be constructed in conformance with state construction standards (A.R.S. 45-594) by a state-licensed well driller (A.R.S. 45-595).
49	Arizona Action-Specific	Notice of intention to drill - A.R.S. §45-596	ARAR	Substantive requirements will apply if the selected remedy involves the construction of wells in Arizona.	Construction of wells in Arizona	PG&E		The preliminary (30%) design assumes that freshwater supply comes from the existing irrigation well (HNWR-1) on the Refuge in Arizona. If the Refuge irrigation well is not used in the final design, placement of new freshwater supply wells will be needed. In addition, new monitoring wells may also be constructed in Arizona, the locations of the monitoring wells will be presented in the intermediate (60%) design. If a new freshwater supply well or additional monitoring wells in Arizona are required, a notice of intention to drill will be filed (A.R.S. 45-596).	The 60% design assumes that freshwater supply comes from the existing irrigation well (HNWR-1) on the Refuge in Arizona, and does not include any new monitoring wells in Arizona. If the Refuge irrigation well is not used in the final design, placement of new freshwater supply wells will be needed. If a new freshwater supply well or additional monitoring wells in Arizona are required, a notice of intention to drill will be filed (A.R.S. 45-596).	While the 90% design includes freshwater supply from existing wells in Arizona, these supply wells are part of the alternative freshwater source evaluation (also known as the Fresh Water Implementation Plan [FWIP]). Compliance with ARARs, including the Arizona Well Standards, for the supply wells are included in the FWIP. If a new freshwater supply well or additional monitoring wells in Arizona are required, a notice of intention to drill will be filed (A.R.S. 45-596).	While the final design includes freshwater supply (planned and contingent) from existing wells in Arizona, two of these supply wells (HNWR-1A and Site B) are part of the alternative freshwater source evaluation (also known as the Fresh Water Implementation Plan [FWIP]). Compliance with ARARs for these supply wells are included in the FWIP. If a new freshwater supply well or additional monitoring wells in Arizona are required, a notice of intention to drill will be filed (A.R.S. 45-596).

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50	Arizona Action-Specific	Report by driller - A.R.S. §45-600	ARAR	Substantive requirements will apply if the selected remedy involves the construction of wells in Arizona.	Construction of wells in Arizona	PG&E		The preliminary (30%) design assumes that freshwater supply comes from the existing irrigation well (HNWR-1) on the Refuge in Arizona. If the Refuge irrigation well is not used in the final design, placement of new freshwater supply wells will be needed. In addition, new monitoring wells may also be constructed in Arizona, the locations of the monitoring wells will be presented in the intermediate (60%) design. If a new freshwater supply well or additional monitoring wells in Arizona are required, a well driller's report will be filed within 30 days of completion of drilling (A.R.S. 45-600).	The 60% design assumes that freshwater supply comes from the existing irrigation well (HNWR-1) on the Refuge in Arizona, and does not include any new monitoring wells in Arizona. If the Refuge irrigation well is not used in the final design, placement of new freshwater supply wells will be needed. If a new freshwater supply well or additional monitoring wells in Arizona are required, a well driller's report will be filed within 30 days of completion of drilling (A.R.S. 45-600).	While the 90% design includes freshwater supply from existing wells in Arizona, these supply wells are part of the alternative freshwater source evaluation (also known as the Fresh Water Implementation Plan [FWIP]). Compliance with ARARs, including the Arizona Well Standards, for the supply wells are included in the FWIP. If a new freshwater supply well or additional monitoring wells in Arizona are required, a well driller's report will be filed within 30 days of completion of drilling (A.R.S. 45-600).	While the final design includes freshwater supply (planned and contingent) from existing wells in Arizona, two of these supply wells (HNWR-1A and Site B) are part of the alternative freshwater source evaluation (also known as the Fresh Water Implementation Plan [FWIP]). Compliance with ARARs for these supply wells are included in the FWIP. If a new freshwater supply well or additional monitoring wells in Arizona are required, a well driller's report will be filed within 30 days of completion of drilling (A.R.S. 45-600).
51	Arizona Action-Specific	Arizona Remedial Action Requirements - A.R.S. §49-282.06(A)(2)	ARAR	Any treatment of groundwater must be conducted in a manner to provide for the maximum beneficial use of the waters of the state.	Treatment of groundwater in Arizona	PG&E	Not applicable. No further action required unless post-design approval change triggers.	No further action is required. The preliminary (30%) design does not involve treatment of groundwater in Arizona.	No further action is required. The intermediate (60%) design does not involve treatment of groundwater in Arizona.	No further action is required. The pre-final (90%) design does not involve treatment of groundwater in Arizona.	No further action is required. The final design does not involve treatment of groundwater in Arizona.
74	California Action-Specific	Hazardous Waste Control Act (HWCA) - Standards applicable to generators of hazardous waste Title 22, CCR, Div 4.5, Ch 12, Article 1, §66262.11	ARAR Applicable	Owners or operators who generate waste shall determine whether waste is a hazardous waste. Applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities are hazardous shall be made when the wastes are generated.	Activity that generates waste that could potentially be hazardous	PG&E	O&M Plan, Construction/ Remedial Action Work Plan, Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	PG&E will prepare an O&M Plan, a Construction/Remedial Action Work Plan, and a Plan for Decommissioning of IM-3 Facility prior to construction activities. These plans will describe waste management procedures. Waste generated during construction and operation of the remedy will be evaluated when the wastes are generated to determine if they are hazardous wastes.	PG&E will prepare an O&M Plan, a Construction/Remedial Action Work Plan, and a Plan for Decommissioning of IM-3 Facility prior to construction activities. These plans will describe waste management procedures. Waste management is described in Section 6 of the O&M Plan (Volume 1), which is included in this BOD Report for the 60% design as Appendix L. The Construction/Remedial Action Work Plan will be submitted as part of the 90% design. The Plan for Decommissioning of the IM-3 Facility will also be submitted as part of the 90% design. Waste generated during construction and operation of the remedy will be evaluated when the wastes are generated to determine if they are hazardous wastes.	Waste management procedures are described in the following documents: 1) O&M Plan (Volume 1 of O&M Manual), Section 6, Waste Management Plan and Recoverable Materials, describes procedures for the collection, characterization, storage, transportation, and disposal of waste generated during operation and maintenance of the remedy. 2) Soil Management Plan (Volume 4 of O&M Manual), includes procedures and protocols for the management and disposal of potentially contaminated or contaminated soils displaced during drilling, construction, operation and maintenance of the remedy, and decommissioning and removal of IM-3 facilities.	Waste management procedures are described in the following documents: 1) O&M Plan (Volume 1 of O&M Manual), Section 6, Waste Management Plan and Recoverable Materials, describes procedures for the collection, characterization, storage, transportation, and disposal of waste generated during operation and maintenance of the remedy. 2) Soil Management Plan (Volume 4 of O&M Manual) includes procedures and protocols for the management and disposal of potentially contaminated or contaminated soils displaced during drilling, construction, operation and maintenance of the remedy, and decommissioning and removal of IM-3 facilities.

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										3) The Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan includes procedures for the management of wastes (other than soil) generated during construction and startup of the remedy. 4) IM-3 Decommissioning, Removal, and Restoration Work Plan, Section 5, Waste Management Plan and Recoverable Materials includes procedures for collection, characterization, storage, transportation, and disposal of wastes (other than soil) generated during the decommissioning and removal of IM-3 facilities.	3) The Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan includes procedures for the management of wastes (other than soil) generated during construction and startup of the remedy. 4) IM-3 Decommissioning, Removal, and Restoration Work Plan, Section 5, Waste Management Plan and Recoverable Materials includes procedures for collection, characterization, storage, transportation, and disposal of wastes (other than soil) generated during the decommissioning and removal of IM-3 facilities.
75	California Action-Specific	Hazardous Waste Control Act (HWCA) -Title 22, CCR, Div 4.5, Ch 12, Article 1, §66262.12	ARAR Applicable	A generator shall not treat, store, dispose of, transport or offer for transportation, hazardous waste without having received an identification number. Substantive requirements will be applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities are hazardous shall be made when the wastes are generated.	Activity that generates waste that could potentially be hazardous	PG&E	USEPA ID Number	Hazardous waste generated by the final remedy will be managed under the existing USEPA ID number for the Topock groundwater remediation area, CAR000151118.	Hazardous waste generated by the final remedy will be managed under the existing USEPA ID number for the Topock groundwater remediation area, CAR000151118.	Hazardous waste generated by the final remedy will be managed under the existing USEPA ID number for the Topock groundwater remediation area, CAR000151118.	Hazardous waste generated by the final remedy will be managed under the existing USEPA ID number for the Topock groundwater remediation area, CAR000151118.

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76	California Action-Specific	Hazardous Waste Control Act (HWCA) - Standards for owners and operators of hazardous waste transfer and TSD facilities Title 22, CCR, Div 4.5, Ch 14, Article 2	ARAR Applicable	Establish requirements for a hazardous waste treatment facility to have a plan for waste analysis, develop a security system, conduct regular inspections, provide training to facility personnel, and use a quality assurance program during construction. The requirements may be applicable if CERCLA response action includes treatment, storage, or disposal as defined under RCRA, or may be relevant and appropriate if the requirements address problems or situations sufficiently similar to the specific circumstances at the site that their usage will be well suited.	Activity associated with construction and operation of a treatment facility or long term (longer than 90 days) storage of hazardous waste. If waste is simply removed, stored in appropriate containers after characterization, and removed off-site within 90 days, PG&E will be required to follow the substantive requirements of PG&E of a generator, including use of manifests, record keep, segregation of incompatibles, etc.	PG&E	O&M Plan, Construction/ Remedial Action Work Plan, Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	In-situ treatment of contaminated groundwater or conditioning of remedy-produced water does not comprise a hazardous waste treatment facility as defined in the hazardous waste regulations. However, a variety of these provisions will be addressed in documents such as the O&M Plan, Soil Management Plan prepared under EIR mitigation measure HAZ-2c, and the Security Plan prepared under EIR mitigation measure CUL-1a-3b. Waste analysis procedures will be addressed in standard operating procedures for the treatment/conditioning process that will be developed.	In-situ treatment of contaminated groundwater or conditioning of remedy-produced water does not comprise a hazardous waste treatment facility as defined in the hazardous waste regulations. However, a variety of these provisions will be addressed in documents such as the O&M Plan, Soil Management Plan prepared under EIR mitigation measure HAZ-2c, and the Security Plan prepared under EIR mitigation measure CUL-1a-3b. Waste management, including waste analysis, is described in Section 6 of the O&M Manual, which is included in this BOD Report for the 60% design as Appendix L. The Soil Management Plan is also included in the O&M Manual (Volume 4).	In-situ treatment of contaminated groundwater or conditioning of remedy-produced water does not comprise a hazardous waste treatment facility as defined in the hazardous waste regulations. However, a variety of these provisions are addressed in documents such as the O&M Plan, the Soil Management Plan prepared under EIR mitigation measure HAZ-2c, the Construction/ Remedial Action Work Plan (including the Construction Quality Assurance Project Plan), and the Security Plan prepared under EIR mitigation measure CUL-1a-3b. Waste management, including waste analysis, is described in: a) Section 6 of the O&M Plan, which is included in the BOD Report for the 90% design as Volume 1 of the O&M Manual (Appendix L), b) The Soil Management Plan, which is included in Volume 4 of the O&M Manual (Appendix L), c) The Waste Management Plan, which is included as an appendix of the Construction/ Remedial Action Work Plan, and d) Section 5 of the IM-3 Decommissioning, Removal, and Restoration Work Plan (appendix to the CIMP and to the Construction/Remedial Action Work Plan).	In-situ treatment of contaminated groundwater or conditioning of remedy-produced water does not comprise a hazardous waste treatment facility as defined in the hazardous waste regulations. However, a variety of these provisions are addressed in documents such as the O&M Plan, the Soil Management Plan prepared under EIR mitigation measure HAZ-2c, the Construction/ Remedial Action Work Plan (including the Construction Quality Assurance Project Plan), and the Security Plan prepared under EIR mitigation measure CUL-1a-3b. Waste management, including waste analysis, is described in: a) Section 6 of the O&M Plan, which is included in the BOD Report for the final design as Volume 1 of the O&M Manual (Appendix L), b) The Soil Management Plan, which is included in Volume 4 of the O&M Manual (Appendix L), c) The Waste Management Plan, which is included as an appendix of the Construction/ Remedial Action Work Plan, and d) Section 5 of the IM-3 Decommissioning, Removal, and Restoration Work Plan (appendix to the CIMP and to the Construction/Remedial Action Work Plan).

TABLE 6.2-1
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Item No.[1]	Category[1]	Citation[1,2]	Determination[1,2]	Description in DOI's ARARs Table[1,2]	Triggering Event	Compliance Responsibility	Which existing/ future document(s) will document continued compliance with this ARAR?[4]	Action (Compliance Status)			
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77	California Action-Specific	Hazardous Waste Control Act (HWCA) - Standards applicable to generators of hazardous waste Title 22, CCR, Div 4.5, Ch 12, Article 2, §66262.20, §66262.22	ARAR Applicable	A generator of hazardous waste who transports or offers hazardous waste for transportation shall prepare a manifest. Substantive requirements will be applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities are hazardous shall be made when the wastes are generated.	Preparation of offsite shipment of hazardous waste	PG&E	O&M Plan, Construction/ Remedial Action Work Plan, Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	PG&E will prepare an O&M Plan, a Construction/Remedial Action Work Plan, and a Plan for Decommissioning of IM-3 Facility prior to construction activities. These plans will describe waste management procedures. Hazardous waste manifests will be prepared for each off-site shipment of hazardous waste.	Waste management is described in Section 6 of the O&M Plan (Volume 1), which is included in this BOD Report for the 60% design as Appendix L. Waste management will also be described in the Construction/Remedial Action Work Plan and the Plan for Decommissioning of the IM-3 Facility that will be submitted as part of the 90% design. Hazardous waste manifests will be prepared for each off-site shipment of hazardous waste.	Waste management procedures are described in the following documents: 1) O&M Plan (Volume 1 of O&M Manual), Section 6, Waste Management Plan and Recoverable Materials describes procedures for the collection, characterization, storage, transportation, and disposal of waste generated during operation and maintenance of the remedy. 2) Soil Management Plan (Volume 4 of O&M Manual) includes procedures and protocols for the management and disposal of potentially contaminated or contaminated soils displaced during drilling, construction, operation and maintenance of the remedy, and decommissioning and removal of IM-3 facilities. 3) The Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan includes procedures for the management of wastes (other than soil) generated during construction and startup of the remedy. 4) IM-3 Decommissioning, Removal, and Restoration Work Plan, Section 5, Waste Management Plan and Recoverable Materials includes procedures for collection, characterization, storage, transportation, and disposal of wastes (other than soil) generated during the decommissioning and removal of IM-3 facilities. Hazardous waste manifests will be prepared for each off-site shipment of hazardous waste.	Waste management procedures are described in the following documents: 1) O&M Plan (Volume 1 of O&M Manual), Section 6, Waste Management Plan and Recoverable Materials describes procedures for the collection, characterization, storage, transportation, and disposal of waste generated during operation and maintenance of the remedy. 2) Soil Management Plan (Volume 4 of O&M Manual) includes procedures and protocols for the management and disposal of potentially contaminated or contaminated soils displaced during drilling, construction, operation and maintenance of the remedy, and decommissioning and removal of IM-3 facilities. 3) The Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan includes procedures for the management of wastes (other than soil) generated during construction and startup of the remedy. 4) IM-3 Decommissioning, Removal, and Restoration Work Plan, Section 5, Waste Management Plan and Recoverable Materials includes procedures for collection, characterization, storage, transportation, and disposal of wastes (other than soil) generated during the decommissioning and removal of IM-3 facilities. Hazardous waste manifests will be prepared for each off-site shipment of hazardous waste.

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78	California Action-Specific	Hazardous Waste Control Act (HWCA) - Standards applicable to generators of hazardous waste Title 22, CCR, Div 4.5, Ch 12, Article 3, §66262.30, §66262.31, §66262.32, §66262.33	ARAR Applicable	Before transporting hazardous waste or offering hazardous waste for transportation off-site, the generator must do the following in accordance with DOT regulations: package the waste, label and mark each package of hazardous waste, and ensure that the transport vehicle is correctly placarded.	Preparation of offsite shipment of hazardous waste	PG&E	O&M Plan, Construction/ Remedial Action Work Plan, Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	PG&E will prepare an O&M Plan, a Construction/Remedial Action Work Plan, and a Plan for Decommissioning of IM-3 Facility prior to construction activities. These plans will describe waste management procedures. Hazardous waste will be managed in accordance with Title 22 CCR Div 4.5, Ch 12, Article 3, §66262.30, §66262.31, §66262.32, and §66262.33..	Waste management is described in Section 6 of the O&M Plan (Volume 1), which is included in this BOD Report for the 60% design as Appendix L. Waste management will also be described in the Construction/Remedial Action Work Plan and the Plan for Decommissioning of the IM-3 Facility that will be submitted as part of the 90% design. Hazardous waste will be managed in accordance with Title 22 CCR Div 4.5, Ch 12, Article 3, §66262.30, §66262.31, §66262.32, and §66262.33.	Waste management procedures are described in the following documents: 1) O&M Plan (Volume 1 of O&M Manual), Section 6, Waste Management Plan and Recoverable Materials, describes procedures for the collection, characterization, storage, transportation, and disposal of waste generated during operation and maintenance of the remedy. 2) Soil Management Plan (Volume 4 of O&M Manual), includes procedures and protocols for the management and disposal of potentially contaminated or contaminated soils displaced during drilling, construction, operation and maintenance of the remedy, and decommissioning and removal of IM-3 facilities. 3) The Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan includes procedures for the management of wastes (other than soil) generated during construction and startup of the remedy. 4) IM-3 Decommissioning, Removal, and Restoration Work Plan, Section 5, Waste Management Plan and Recoverable Materials includes procedures for collection, characterization, storage, transportation, and disposal of wastes (other than soil) generated during the decommissioning and removal of IM-3 facilities.	Waste management procedures are described in the following documents: 1) O&M Plan (Volume 1 of O&M Manual), Section 6, Waste Management Plan and Recoverable Materials, describes procedures for the collection, characterization, storage, transportation, and disposal of waste generated during operation and maintenance of the remedy. 2) Soil Management Plan (Volume 4 of O&M Manual), includes procedures and protocols for the management and disposal of potentially contaminated or contaminated soils displaced during drilling, construction, operation and maintenance of the remedy, and decommissioning and removal of IM-3 facilities. 3) The Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan includes procedures for the management of wastes (other than soil) generated during construction and startup of the remedy. 4) IM-3 Decommissioning, Removal, and Restoration Work Plan, Section 5, Waste Management Plan and Recoverable Materials includes procedures for collection, characterization, storage, transportation, and disposal of wastes (other than soil) generated during the decommissioning and removal of IM-3 facilities.

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79	California Action-Specific	Hazardous Waste Control Act (HWCA) - Standards applicable to generators of hazardous waste Title 22, CCR, Div 4.5, Ch 12, Article 3, §66262.34	ARAR Applicable	Requirements with respect to accumulation of waste on-site.	Accumulation of hazardous waste onsite	PG&E	O&M Plan, Construction/ Remedial Action Work Plan, Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration; Operations documents (e.g., manifests, inspection records)	PG&E will prepare an O&M Plan, a Construction/Remedial Action Work Plan, and a Plan for Decommissioning of IM-3 Facility prior to construction activities. These plans will describe waste management procedures. Hazardous waste generated onsite will meet the accumulation requirements of 22 CCR §66262.34.	Waste management is described in Section 6 of the O&M Plan (Volume 1), which is included in this BOD Report for the 60% design as Appendix L. Waste management will also be described in the Construction/Remedial Action Work Plan and the Plan for Decommissioning of the IM-3 Facility that will be submitted as part of the 90% design. Hazardous waste generated onsite will meet the accumulation requirements of 22 CCR §66262.34.	Waste management procedures (including accumulation requirements) are described in the following documents: 1) O&M Plan (Volume 1 of O&M Manual), Section 6, Waste Management Plan and Recoverable Materials, describes procedures for the collection, characterization, storage, transportation, and disposal of waste generated during operation and maintenance of the remedy. 2) Soil Management Plan (Volume 4 of O&M Manual), includes procedures and protocols for the management and disposal of potentially contaminated or contaminated soils displaced during drilling, construction, operation and maintenance of the remedy, and decommissioning and removal of IM-3 facilities. 3) The Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan includes procedures for the management of wastes (other than soil) generated during construction and startup of the remedy. 4) IM-3 Decommissioning, Removal, and Restoration Work Plan, Section 5, Waste Management Plan and Recoverable Materials includes procedures for collection, characterization, storage, transportation, and disposal of wastes (other than soil) generated during the decommissioning and removal of IM-3 facilities.	Waste management procedures (including accumulation requirements) are described in the following documents: 1) O&M Plan (Volume 1 of O&M Manual), Section 6, Waste Management Plan and Recoverable Materials, describes procedures for the collection, characterization, storage, transportation, and disposal of waste generated during operation and maintenance of the remedy. 2) Soil Management Plan (Volume 4 of O&M Manual), includes procedures and protocols for the management and disposal of potentially contaminated or contaminated soils displaced during drilling, construction, operation and maintenance of the remedy, and decommissioning and removal of IM-3 facilities. 3) The Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan includes procedures for the management of wastes (other than soil) generated during construction and startup of the remedy. 4) IM-3 Decommissioning, Removal, and Restoration Work Plan, Section 5, Waste Management Plan and Recoverable Materials includes procedures for collection, characterization, storage, transportation, and disposal of wastes (other than soil) generated during the decommissioning and removal of IM-3 facilities.

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80	California Action-Specific	Hazardous Waste Control Act (HWCA) - Standards applicable to generators of hazardous waste Title 22, CCR, Div 4.5, Ch 12, Article 4, §66262.40, §66262.41	ARAR Applicable	Establishes requirements for record keeping of manifests, test results, waste analyses, and Biennial Reports. Any substantive requirements shall be attained.	Activity generating hazardous waste	PG&E	O&M Plan, Construction/ Remedial Action Work Plan, Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration, Operations documents (e.g., manifests, waste profiling records)	PG&E will prepare an O&M Plan, a Construction/Remedial Action Work Plan, and a Plan for Decommissioning of IM-3 Facility prior to construction activities. These plans will describe waste management procedures. Hazardous waste generated onsite will meet the recordkeeping requirements of 22 CCR §66262.40, §66262.41.	Waste management is described in Section 6 of the O&M Plan (Volume 1), which is included in this BOD Report for the 60% design as Appendix L. Waste management will also be described in the Construction/Remedial Action Work Plan and the Plan for Decommissioning of the IM-3 Facility that will be submitted as part of the 90% design. Hazardous waste generated onsite will meet the recordkeeping requirements of 22 CCR §66262.40, §66262.41.	Waste management procedures (including record keeping requirements) are described in the following documents: 1) O&M Plan (Volume 1 of O&M Manual), Section 6, Waste Management Plan and Recoverable Materials, describes procedures for the collection, characterization, storage, transportation, and disposal of waste generated during operation and maintenance of the remedy. 2) Soil Management Plan (Volume 4 of O&M Manual), includes procedures and protocols for the management and disposal of potentially contaminated or contaminated soils displaced during drilling, construction, operation and maintenance of the remedy, and decommissioning and removal of IM-3 facilities. 3) The Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan includes procedures for the management of wastes (other than soil) generated during construction and startup of the remedy. 4) IM-3 Decommissioning, Removal, and Restoration Work Plan, Section 5, Waste Management Plan and Recoverable Materials includes procedures for collection, characterization, storage, transportation, and disposal of wastes (other than soil) generated during the decommissioning and removal of IM-3 facilities.	Waste management procedures (including record keeping requirements) are described in the following documents: 1) O&M Plan (Volume 1 of O&M Manual), Section 6, Waste Management Plan and Recoverable Materials, describes procedures for the collection, characterization, storage, transportation, and disposal of waste generated during operation and maintenance of the remedy. 2) Soil Management Plan (Volume 4 of O&M Manual), includes procedures and protocols for the management and disposal of potentially contaminated or contaminated soils displaced during drilling, construction, operation and maintenance of the remedy, and decommissioning and removal of IM-3 facilities. 3) The Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan includes procedures for the management of wastes (other than soil) generated during construction and startup of the remedy. 4) IM-3 Decommissioning, Removal, and Restoration Work Plan, Section 5, Waste Management Plan and Recoverable Materials includes procedures for collection, characterization, storage, transportation, and disposal of wastes (other than soil) generated during the decommissioning and removal of IM-3 facilities.

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81	California Action-Specific	Corrective Action - Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.100 (a) through (d), (f), (g)(1), and (h)	ARAR Relevant and Appropriate	The owner or operator is required to take corrective action under Title 22, CCR, §66264.91 to remediate releases from the regulated unit and to ensure that the regulated unit achieves compliance with the water quality protection standard. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.	Remedy implementation	PG&E	Not applicable. No further action required unless post-design approval change triggers.	PG&E will prepare an O&M Plan, a Construction/Remedial Action Work Plan, and a Plan for Decommissioning of IME Facility prior to construction activities. These plans will describe spill control and response procedures and will incorporate requirements of mitigation measure HAZ-1a, HAZ-1b, and HYDRO-1for spill prevention, control, and cleanup during O&M, construction, and decommissioning activities.. In addition the O&M Plan will include a sampling and monitoring plan for groundwater.	The O&M Manual, which is included in this BOD Report for the 60% design as Appendix L, includes a Sampling and Monitoring Plan in Volume 2 to ensure that the regulated unit achieves compliance with the water quality protection standard, and a Contingency Plan in Volume 3 to address circumstances that may adversely affect the operation of the remedy.	The O&M Manual, which is included in the BOD Report for the 90% design as Appendix L, includes a Sampling and Monitoring Plan in Volume 2 to ensure that the regulated unit achieves compliance with the water quality protection standard, and a Contingency Plan in Volume 3 to address circumstances that may adversely affect the operation of the remedy.	DOI has determined that the specific regulations under this ARAR do not currently apply to the RCRA corrective action that is being conducted at the site (see RTC #393). Therefore, no further action is required.
82	California Action-Specific	Corrective Action for Waste Management Units -Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.101	ARAR Relevant and Appropriate	The owner or operator is required to take corrective action to remediate releases from any solid or hazardous waste management unit at the facility to protect public health and the environment. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.	Remedy implementation	PG&E	O&M Plan (sampling and monitoring plan, contingency plan), Progress Reports, Construction/ Remedial Action Completion Report	PG&E will prepare O&M Plan and a Construction/Remedial Action Work Plan. These plans will describe spill control and response procedures and will incorporate requirements of mitigation measure HAZ-1a, HAZ-1b, and HYDRO-1for spill prevention, control, and cleanup during O&M and construction activities. In addition, the O&M Plan will include a sampling and monitoring plan for groundwater.	The O&M Manual, which is included in this BOD Report for the 60% design as Appendix L, includes a Sampling and Monitoring Plan in Volume 2 to ensure that the regulated unit achieves compliance with the water quality protection standard, and a Contingency Plan in Volume 3 to address circumstances that may adversely affect the operation of the remedy.	The O&M Manual, which is included in the BOD Report for the 90% design as Appendix L, includes a Sampling and Monitoring Plan in Volume 2 to ensure that the regulated unit achieves compliance with the water quality protection standard, and a Contingency Plan in Volume 3 to address circumstances that may adversely affect the operation of the remedy.	The O&M Manual, which is included in the Final BOD Report as Appendix L, includes a Sampling and Monitoring Plan in Volume 2 to ensure that the regulated unit achieves compliance with the water quality protection standard, and a Contingency Plan in Volume 3 to address circumstances that may adversely affect the operation of the remedy.
83	California Action-Specific	Closure and post-closure care -Title 22, CCR, Div 4.5, Ch 14, Article 7, §66264.111, §66264.112, §66264.115 through 120	ARAR Applicable	Owners and operators shall close a facility and perform post-closure care when contaminated subsurface soil cannot be practically removed or decontaminated. Contaminated soil, residues, or groundwater from remedial action at a site will achieve clean closure; otherwise, post-closure care requirements will be relevant and appropriate.	Decommissioning	PG&E	Not applicable. No further action required unless post-design approval change triggers.	PG&E will prepare a Decommissioning Plan for Remedy Facility and Site Restoration. Achievement of RAOs will be considered clean closure and that will remove any post-closure care obligations.	PG&E will prepare a Decommissioning Plan for Remedy Facility and Site Restoration that will be submitted prior to decommissioning. Achievement of RAOs will be considered clean closure and that will remove any post-closure care obligations.	The IM-3 Decommissioning, Removal, and Restoration Work Plan was prepared and is included in Appendix B of the CIMP and also as an appendix of the Construction/Remedial Action Work Plan. Achievement of RAOs will be considered clean closure and that will remove any post-closure care obligations. In compliance with the CD (Appendix C Scope of Work, Article 9), PG&E will prepare a site-specific Plan for Decommissioning and Restoration of remedy facilities within 120 days of DOI's certification of remedial action completion and a determination by DOI that removal of such facilities is	DOI has determined that the specific regulations under this ARAR do not currently apply to the RCRA corrective action that is being conducted at the site (see RTC #394). Therefore, no further action is required.

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										protective of human health and the environment.	
84	California Action-Specific	Use and management of containers -Title 22, CCR, Div 4.5, Ch 14, Article 9	ARAR Applicable	Containers used for the transfer or storage of hazardous waste must be in good condition, compatible with the waste, kept closed except to add or remove materials and be inspected weekly. The area used to store the containers must provide adequate secondary containment and be designed with runoff controls. Also, appropriate closure of the containers must take place.	Design and management of hazardous waste containers	PG&E	Design Submittals; O&M Plan; Construction/ Remedial Action Work Plan.	PG&E will prepare an O&M Plan, and a Corrective Measure/Remedial Action Construction Work Plan. These plans will describe waste management procedures. Containers used to transfer, store or treat hazardous waste will comply with requirements in 22 CCR §66262.171-§66262.179.	Waste management is described in Section 6 of the O&M Plan (Volume 1), which is included in this BOD Report for the 60% design as Appendix L. Waste management will also be described in the Construction/Remedial Action Work Plan and the Plan for Decommissioning of the IM-3 Facility that will be submitted as part of the 90% design. Containers used to transfer, store or treat hazardous waste will comply with requirements in 22 CCR §66262.171-§66262.179.	Waste management procedures (including containers requirements) are described in the following documents: 1) O&M Plan (Volume 1 of O&M Manual), Section 6, Waste Management Plan and Recoverable Materials, describes procedures for the collection, characterization, storage, transportation, and disposal of waste generated during operation and maintenance of the remedy. 2) Soil Management Plan (Volume 4 of O&M Manual), includes procedures and protocols for the management and disposal of potentially contaminated or contaminated soils displaced during drilling, construction, operation and maintenance of the remedy, and decommissioning and removal of IM-3 facilities. 3) The Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan includes procedures for the management of wastes (other than soil) generated during construction and startup of the remedy. 4) IM-3 Decommissioning, Removal, and Restoration Work Plan, Section 5, Waste Management Plan and Recoverable Materials includes procedures for collection, characterization, storage, transportation, and disposal of wastes (other than soil) generated during the decommissioning and removal of IM-3 facilities.	Waste management procedures (including containers requirements) are described in the following documents: 1) O&M Plan (Volume 1 of O&M Manual), Section 6, Waste Management Plan and Recoverable Materials, describes procedures for the collection, characterization, storage, transportation, and disposal of waste generated during operation and maintenance of the remedy. 2) Soil Management Plan (Volume 4 of O&M Manual), includes procedures and protocols for the management and disposal of potentially contaminated or contaminated soils displaced during drilling, construction, operation and maintenance of the remedy, and decommissioning and removal of IM-3 facilities. 3) The Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan includes procedures for the management of wastes (other than soil) generated during construction and startup of the remedy. 4) IM-3 Decommissioning, Removal, and Restoration Work Plan, Section 5, Waste Management Plan and Recoverable Materials includes procedures for collection, characterization, storage, transportation, and disposal of wastes (other than soil) generated during the decommissioning and removal of IM-3 facilities.

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85	California Action-Specific	Tank systems - Title 22, CCR, Div 4.5, Ch 14, Article 10	ARAR Applicable	The remedial activities may involve storage and/or treatment in tanks. These tanks are required to have secondary containment, be monitored and inspected, be provided with overfill and spill protection controls, and operated with adequate freeboard. Also, appropriate closure must take place.	During project design, operation and maintenance activities where tank systems are used to transfer, store or treat hazardous waste	PG&E	Design Submittals; O&M Plan	PG&E will prepare O&M Plan, and Corrective Measure/Remedial Action Construction Work Plan. Tank systems used to transfer, store or treat hazardous waste will comply with requirements in 22 CCR §66262.192-§66262.195.	At the 60% design stage, there is no transfer, storage and/or treatment of hazardous waste in tank systems.	At the 90% design stage, there are two design elements that could trigger compliance with this ARAR: **Sampling Purge Water Holding Tank in MW-20 Bench Carbon Amendment Building** If the purge water or decon pad water accumulated in this tank exhibits hazardous waste characteristics, the water tank and any ancillary equipment handling hazardous waste will comply with the requirements for hazardous waste tank systems. It will be labeled as a hazardous waste tank, be equipped with secondary containment and overfill prevention controls, daily inspections will be performed and documented, and an engineer's assessment of the tank system's integrity will be performed. **Portable Treatment Unit for Well Rehabilitation at Well Head** Treatment of well rehabilitation water with a pH below 2.0 at the well head may be performed in a portable treatment unit that is subject to the requirements for a fixed treatment unit (FTU) operating under the Conditional Authorization permit tier if it operates entirely onsite, or to the requirements for a transportable treatment unit (TTU) operating under the Permit By Rule permit tier if it operates at multiple sites. If the treatment unit includes tanks that accumulate or treat waste with hazardous characteristics, the tanks and any ancillary equipment that	At the final design stage, there are two design elements that could trigger compliance with this ARAR: **Sampling Purge Water Holding Tank in MW-20 Bench Carbon Amendment Building** If the purge water or decon pad water accumulated in this tank exhibits hazardous waste characteristics, the water tank and any ancillary equipment handling hazardous waste will comply with the requirements for hazardous waste tank systems. It will be labeled as a hazardous waste tank, be equipped with secondary containment and overfill prevention controls, daily inspections will be performed and documented, and an engineer's assessment of the tank system's integrity will be performed. **Portable Treatment Unit for Well Rehabilitation at Well Head** Treatment of well rehabilitation water with a pH below 2.0 at the well head may be performed in a portable treatment unit that is subject to the requirements for a fixed treatment unit (FTU) operating under the Conditional Authorization permit tier if it operates entirely onsite, or to the requirements for a transportable treatment unit (TTU) operating under the Permit By Rule permit tier if it operates at multiple sites. If the treatment unit includes tanks that accumulate or treat waste with hazardous characteristics, the tanks and

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										handles hazardous waste will comply with the requirements for hazardous waste tank systems, including labeling, having secondary containment and overfill prevention controls, being subject to documented daily inspections, and having an engineer's assessment of the tank system's integrity performed. If the treatment unit operates as a TTU, compliance will be the obligation of the TTU owner.	any ancillary equipment that handles hazardous waste will comply with the requirements for hazardous waste tank systems, including labeling, having secondary containment and overfill prevention controls, being subject to documented daily inspections, and having an engineer's assessment of the tank system's integrity performed. If the treatment unit operates as a TTU, compliance will be the obligation of the TTU owner.
86	California Action-Specific	Waste piles - Title 22, CCR, Div 4.5, Ch 14, Article 12	ARAR Applicable	The waste piles should be placed upon a lined foundation or base with a leachate system, protected from precipitation and wind dispersal, designed to prevent run on and run off. Also, closure and post-closure care requirements. Remedial action may involve soil excavation and the compiling of soil in a temporary waste pile. This requirement is applicable if the excavated waste meets RCRA hazardous waste criteria.	Under broad application, a triggering event could be any temporary stockpiling of haz soil	PG&E	Soil Management Plan (Volume 4 of O&M Manual)	PG&E will prepare a Soil Management Plan in conformance with EIR mitigation measures HAZ-2 and HAZ-2f to describe management procedures in the event that evidence of contaminated soil is identified during ground disturbing activities (e.g., noxious odors, discolored soil). It is not anticipated that regulated waste piles will be constructed.	A Soil Management Plan is included in Volume 4 of the O&M Manual as part of the 60% design. In conformance with EIR mitigation measures HAZ-2 and HAZ-2f, the Soil Management Plan describes management procedures in the event that evidence of contaminated soil is identified during ground disturbing activities (e.g., noxious odors, discolored soil). It is not anticipated that long-term storage of soil requiring construction of a waste pile meeting Chapter 14, Article 12 requirements for soil exhibiting RCRA hazardous waste characteristics will occur. If necessary to facilitate characterization or staging for offsite transportation, RCRA and non-RCRA hazardous waste soil will be temporarily accumulated in a staging pile that meets the design standards specified in California Health and Safety Code Section 25123.3 for up to 90 days prior to transportation to a permitted offsite disposal facility.	A Soil Management Plan is included in Volume 4 of the O&M Manual as part of the 90% design. In conformance with EIR mitigation measures HAZ-2 and HAZ-2f, the Soil Management Plan describes management procedures in the event that evidence of contaminated soil is identified during ground disturbing activities (e.g., noxious odors, discolored soil). It is not anticipated that long-term storage of soil requiring construction of a waste pile meeting Chapter 14, Article 12 requirements for soil exhibiting RCRA hazardous waste characteristics will occur. If necessary to facilitate characterization or staging for offsite transportation, RCRA and non-RCRA hazardous waste soil will be temporarily accumulated in a staging pile that meets the design standards specified in California Health and Safety Code Section 25123.3 for up to 90 days prior to transportation to a permitted offsite disposal facility.	A Soil Management Plan is included in Volume 4 of the O&M Manual as part of the final design. In conformance with EIR mitigation measures HAZ-2 and HAZ-2f, the Soil Management Plan describes management procedures in the event that evidence of contaminated soil is identified during ground disturbing activities (e.g., noxious odors, discolored soil). Long-term storage of soil requiring construction of a waste pile meeting Chapter 14, Article 12 requirements for soil exhibiting RCRA hazardous waste characteristics will not occur. If necessary to facilitate characterization or staging for offsite transportation, RCRA and non-RCRA hazardous waste soil will be temporarily accumulated in a staging pile that meets the design standards specified in California Health and Safety Code Section 25123.3 for up to 90 days prior to transportation to a permitted offsite disposal facility.

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87	California Action-Specific	Landfills - Title 22, CCR, Div 4.5, Ch 14, Article 14	ARAR Relevant and Appropriate	The requirements for landfills include the design and operation, action leakage rate, monitoring and inspection, response actions, surveying and recordkeeping and closure and post-closure care.	Design, construct, O&M, and closure of landfills (66260.10 defines "Landfill" as a disposal facility or part of a facility where hazardous waste is placed in or on land and which is not a pile, a land treatment facility, a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground mine, a cave, or a corrective action management unit.)	PG&E	N/A. No further action required unless post-design approval change triggers.	No further action is required. The preliminary (30%) design does not include construction of a landfill.	No further action is required. The 60% design does not include construction of a landfill.	No further action is required. The 90% design does not include construction of a landfill.	No further action is required. The final design does not include construction of a landfill.
88	California Action-Specific	Miscellaneous Units - Title 22, CCR, Div 4.5, Ch 14, Article 16	ARAR Applicable	Applies to waste management unit not otherwise regulated under RCRA. It may include pumps, auxiliary equipment, air strippers, etc. The substantive requirements include design, construction, operation, maintenance and closure of the unit that will ensure protection of human health and the environment. The actions include general inspections for safety and operation efficiency, testing and maintenance of the equipment (including testing of warning systems). Applicable if pumps are used for extraction and treatment of leachate that meets RCRA hazardous waste criteria.	Design, construct, O&M, and closure of waste management units not otherwise regulated under RCRA	PG&E	Design Submittals; O&M Plan; Construction/ Remedial Action Work Plan	No further action is required. The preliminary (30%) design assumes that the only pumps used for extraction of groundwater meeting RCRA hazardous waste criteria are submersible well pumps in the IRZ wells along National Trails Highway.	No further action is required. The 60% design assumes that the only pumps used for extraction of groundwater meeting RCRA hazardous waste criteria are submersible well pumps in the IRZ wells along National Trails Highway.	No further action is required. The 90% design assumes that the only pumps used for extraction of groundwater meeting RCRA hazardous waste criteria are submersible well pumps in the IRZ wells along National Trails Highway.	No further action is required. The final design assumes that the only pumps used for extraction of groundwater meeting RCRA hazardous waste criteria are submersible well pumps in the IRZ wells along National Trails Highway.

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89	California Action-Specific	Land Disposal Restrictions (LDR) for RCRA wastes and non-RCRA wastes -Title 22, CCR, Div 4.5, Ch 18, Articles 1, 3, 4, 10, 11	ARAR Applicable	Movement of hazardous waste to new locations and placed in or on land will trigger LDR. General applicability, dilution prohibited, waste analysis and record keeping, and special rules apply for wastes that exhibit a characteristic waste. Best Demonstrated Available Technology (BDA) standards for each hazardous constituent in each listed waste, if residual is to be disposed. Utilize treatment standards table when necessary. Where applicable, hazardous waste generated from remedial activities must comply with LDR and meet the treatment standards or notify the disposal facility of the treatment standards before disposal at an appropriate offsite disposal facility.	Activity that generates hazardous waste	PG&E	O&M Plan, Construction/ Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	PG&E will prepare an O&M Plan, a Construction/Remedial Action Work Plan, and a Plan for Decommissioning of IM-3 Facility prior to construction activities. These plans will describe waste management procedures during construction, operation, and decommissioning. The remedy is not expected to involve onsite placement of hazardous waste that will trigger the LDR requirements. Hazardous waste generated will be characterized to determine if LDR treatment standards are exceeded. A notification will be submitted to the disposal facility indicating whether the waste is restricted from land disposal and whether it exceeds an applicable treatment standard.	Waste management is described in Section 6 of the O&M Plan (Volume 1), which is included in this BOD Report for the 60% design as Appendix L. Waste management will also be described in the Construction/ Remedial Action Work Plan and the Plan for Decommissioning of the IM-3 Facility that will be submitted as part of the 90% design. The remedy is not expected to involve onsite placement of hazardous waste that will trigger the LDR requirements. Hazardous waste generated will be characterized to determine if LDR treatment standards are exceeded. A notification will be submitted to the disposal facility indicating whether the waste is restricted from land disposal and whether it exceeds an applicable treatment standard.	Waste management is described in Section 6 of the O&M Plan (Volume 1), which is included in this BOD Report for the 90% design as Appendix L. Waste management is also be described in the Construction/Remedial Action Work Plan and the Plan for Decommissioning of the IM-3 Facility that was submitted as part of the 90% design. The remedy is not expected to involve onsite placement of hazardous waste that will trigger the LDR requirements. Hazardous waste generated will be characterized to determine if LDR treatment standards are exceeded. A notification will be submitted to the disposal facility indicating whether the waste is restricted from land disposal and whether it exceeds an applicable treatment standard.	Waste management is described in Section 6 of the O&M Plan (Volume 1 of the O&M Manual), which is included in this BOD Report as Appendix L. Waste management is also described in the Construction/Remedial Action Work Plan and the Plan for Decommissioning of the IM-3 Facility that was submitted as part of the final design. The remedy is not expected to involve onsite placement of hazardous waste that will trigger the LDR requirements. Hazardous waste generated will be characterized to determine if LDR treatment standards are exceeded. A notification will be submitted to the disposal facility indicating whether the waste is restricted from land disposal and whether it exceeds an applicable treatment standard.
90	California Action-Specific	Hazardous Waste Control Act (HWCA) - Standards for owners and operators of hazardous waste transfer and TSD facilities, Title 22, CCR, Div 4.5, Ch 14, Articles 3 and 4	ARAR Applicable	Establish requirements for a facility to plan for emergency conditions. In addition, the design and operation of the facility must be done to prevent releases. Other requirements include testing and maintenance of equipment and incorporation of communication and alarm systems and contingency plan. The requirements may be applicable if CERCLA response action includes treatment, storage, or disposal as defined under RCRA, or may be relevant and appropriate if the requirements address problems or situations	Design, construction, operation and maintenance of the remedy	PG&E	Design submittals; Project-specific HMBP; O&M Plan; Construction/ Remedial Action Work Plan	PG&E will prepare a Project-specific HMBP; an O&M Plan; and a Construction/Remedial Action Work Plan that will address procedures for emergencies.	The Contingency Plan (Volume 3) of the O&M Manual includes contingency planning for potential failure modes (including large releases), assess and mitigate risks, and prioritize risk management in order to prevent problems before they arise. The O&M Plan (Volume 1) of the O&M Manual covers routine O&M activities which includes testing and maintenance of communication and alarm. Project-specific HMBP and a Construction/Remedial Action Work Plan will address procedures for emergencies. The outline for the HMBP is presented in Appendix F of the O&M Plan, which is included in the 60% design. The complete HMBP and Construction/Remedial Action	The Contingency Plan (Volume 3) of the O&M Manual includes contingency planning for potential failure modes (including large releases), assessing and mitigating risks, and prioritizing risk management in order to prevent problems before they arise. The O&M Plan (Volume 1) of the O&M Manual covers routine O&M activities which includes testing and maintenance of communication and alarm systems. Section 5 of the Construction/Remedial Action Work Plan includes contingency planning for failure modes during construction (including large	The Contingency Plan (Volume 3) of the O&M Manual includes contingency planning for potential failure modes (including large releases), assessing and mitigating risks, and prioritizing risk management in order to prevent problems before they arise. The O&M Plan (Volume 1) of the O&M Manual covers routine O&M activities which includes testing and maintenance of communication and alarm systems. Section 5 of the Construction/ Remedial Action Work Plan includes contingency planning for failure modes during construction (including large releases), assessing and

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				sufficiently similar to the specific circumstances at the site that their usage will be well suited.					Work Plan will be included in the 90% design.	releases), assess and mitigate risks, and prioritize risk management in order to prevent problems before they arise. The project-specific HMBP (Appendix F of the O&M Plan) also addresses procedures for emergencies. Communication protocols including contacts and notification in emergency conditions are presented in Exhibit L2.2-1 of the O&M Manual, Table 2.3-1 of the Construction/Remedial Action Work Plan, and the HMBP.	mitigating risks, and prioritizing risk management in order to prevent problems before they arise. The project-specific HMBP (Appendix F of the O&M Plan) also addresses procedures for emergencies. Communication protocols including contacts and notification in emergency conditions are presented in Exhibit L2.2-1 of the O&M Manual, Table 2.3-1 of the Construction/Remedial Action Work Plan, and the HMBP.
91	California Action-Specific	Hazardous Waste Control Act (HWCA) - Groundwater monitoring and response, Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.91 (a) and (c)	ARAR Relevant and Appropriate	Owners or operators of a RCRA surface impoundment, waste pile, land treatment unit, or landfill shall conduct a monitoring and response program for each regulated unit. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.	Design, construction, operation and maintenance of the remedy	PG&E	No further action required unless post-design approval change triggers.	PG&E will prepare a project-specific HMBP; an O&M Plan (include sampling and monitoring plan); and a Construction/Remedial Action Work Plan. The preliminary (30%) design does not include regulated units.	PG&E will prepare a project-specific HMBP; an O&M Manual (including a sampling and monitoring plan); and a Construction/Remedial Action Work Plan. The O&M Manual, which includes a sampling and monitoring plan for groundwater and surface water, is included as Appendix L in this BOD Report for the 60% design. The outline for the HMBP is presented in Appendix F of the O&M Plan, which is included in the 60% design. The complete HMBP and Construction/Remedial Action Work Plan will be included in the 90% design. Although the 60% design does not include regulated units, these plans present a monitoring and response program that is functionally equivalent and will provide a level of protection to water quality equivalent to the cited requirement.	Although the 90% design does not include regulated units, the following plans present a monitoring and response program that is functionally equivalent and will provide a level of protection to water quality equivalent to the cited requirement: 1) Appendix E of the O&M Plan (Volume 1 of the O&M Manual) includes an industrial SWPPP that involves BMPs designed to reduce pollutants in discharges that may affect receiving water quality during operations and maintenance of the remedy. 2) Volume 2 of the O&M Manual includes a sampling and monitoring plan for groundwater and surface water. 3) The Construction/Remedial Action Work Plan includes a BMP Plan for construction activities that involves visual inspections and monitoring and sampling for purposes of ensuring the protection of receiving water quality.	DOI has determined that the specific regulations under this ARAR do not currently apply to the RCRA corrective action that is being conducted at the site (see RTC #393). Therefore, no further action is required.

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										4) The project-specific HMBP addresses procedures for emergencies.	
92	California Action-Specific	Hazardous Waste Control Act (HWCA) - Monitoring, Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.97 (b), (c), (d) and (e)(1) through (e)(5)	ARAR Relevant and Appropriate	Requirements for monitoring groundwater, surface water, and vadose zone. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.	Design, operation and maintenance of the remedy	PG&E	No further action required unless post-design approval change triggers.	PG&E will prepare an O&M Plan and Progress Reports. The O&M Plan will include a sampling and monitoring plan for groundwater and surface water.	The O&M Manual, which includes a sampling and monitoring plan for groundwater and surface water, is included as Appendix L in this BOD Report for the 60% design. PG&E will prepare Progress Reports that presents the results and analysis of monitoring data.	The O&M Manual, which includes a sampling and monitoring plan for groundwater and surface water, is included as Appendix L in the BOD Report for the 90% design. PG&E will prepare quarterly Progress Reports that presents the results and analysis of monitoring data.	DOI has determined that the specific regulations under this ARAR do not currently apply to the RCRA corrective action that is being conducted at the site (see RTC #393). Therefore, no further action is required.
93	California Action-Specific	Hazardous Waste Control Act (HWCA) - Detection Monitoring Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.98	ARAR Relevant and Appropriate	Requires the owner or operator of a regulated unit to develop a detection monitoring program that will provide reliable indication of a release. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.	Design, operation and maintenance of the remedy	PG&E	No further action required unless post-design approval change triggers.	PG&E will prepare an O&M Plan and Progress Reports. The O&M Plan will include a sampling and monitoring plan for groundwater and surface water that provides a level of protection equivalent to a detection monitoring program that will provide reliable indication of a release	PG&E will prepare an O&M Manual and Progress Reports. The O&M Manual, which includes a sampling and monitoring plan for groundwater and surface water, is included as Appendix L in this BOD Report for the 60% design. Although the 60% design does not include regulated units, the programs described in these documents provide a level of protection equivalent to a detection monitoring program that will provide reliable indication of a release.	Although the 90% design does not include regulated units, the programs described in the sampling and monitoring plan for groundwater and surface water (Volume 2 of the O&M Manual) and future quarterly progress reports provide a level of protection equivalent to a detection monitoring program that will provide reliable indication of a release.	DOI has determined that the specific regulations under this ARAR do not currently apply to the RCRA corrective action that is being conducted at the site (see RTC #393). Therefore, no further action is required.
94	California Action-Specific	Hazardous Waste Control Act (HWCA) - Evaluation Monitoring, Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.99	ARAR Relevant and Appropriate	Requires the owner or operator of a regulated unit to develop an evaluation monitoring program that can be used to assess the nature and extent of a release from the unit. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.	Design, operation and maintenance of the remedy	PG&E	No further action required unless post-design approval change triggers.	PG&E will prepare an O&M Plan and Progress Reports. The O&M Plan will include a sampling and monitoring plan for groundwater and surface water that provides a level of protection equivalent to an evaluation monitoring program, based on site-specific conditions.	PG&E will prepare an O&M Plan and Progress Reports. Reports. The O&M Manual, which includes a sampling and monitoring plan for groundwater and surface water, is included as Appendix L in this BOD Report for the 60% design. Although the 60% design does not include regulated units, the programs described in these documents provide a level of protection equivalent to an evaluation monitoring program, based on site-specific conditions.	Although the 90% design does not include regulated units, the programs described in the sampling and monitoring plan for groundwater and surface water (Volume 2 of the O&M Manual) and future quarterly progress reports provide a level of protection equivalent to an evaluation monitoring program, based on site-specific conditions.	DOI has determined that the specific regulations under this ARAR do not currently apply to the RCRA corrective action that is being conducted at the site (see RTC #393). Therefore, no further action is required.

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95	California Action-Specific	Discharges of Waste to Land - Title 23 CCR, Div 3, Ch 15	ARAR Relevant and Appropriate	The regulations in this chapter pertain to water quality aspects of hazardous waste discharge to land, establishing waste and site classifications and waste management requirements for waste treatment, storage, or disposal in landfills, surface impoundments, waste piles, and land treatment facilities. Requirements in this chapter are minimum standards for proper management of each waste category. Pursuant to Section 2511 (Exemptions), because this remediation constitutes actions taken by public agencies to cleanup unauthorized releases of waste, these regulations will only apply if the proposed remedial activities include (1) removal of waste from the immediate place of release, or (2) keeping some contamination in place.	Activities involve (1) removal of waste from the immediate place of release, or (2) keeping some contamination in place.	PG&E	N/A. No further action required unless post-design approval change triggers.	No further action is required. The remedy design does not involve removal of waste from the immediate place of release and is not designed to keep some contamination in place.	No further action is required. The remedy design does not involve removal of waste from the immediate place of release and is not designed to keep some contamination in place.	No further action is required. The remedy design does not involve removal of waste from the immediate place of release and is not designed to keep some contamination in place.	No further action is required. The remedy design does not involve removal of waste from the immediate place of release and is not designed to keep some contamination in place.
96	California Action-Specific	Consolidated Regulations for Storage, Treatment, Processing, or Disposal of Solid Waste - Title 27 CCR, Div 2, Subdivision 1	ARAR Relevant and Appropriate	The regulations in this subdivision (promulgated by the State Water Resources Control Board (SWRCB)) pertain to water quality aspects of discharges of solid waste to land for treatment, storage, or disposal. Pursuant to Section 20090 (Exemptions), because this remediation constitutes actions taken by public agencies to cleanup unauthorized releases of waste, these regulations will only apply if the proposed remedial activities include (1) removal of waste from the immediate place of release, or (2) keeping some contamination in place.	Activities involve (1) removal of waste from the immediate place of release, or (2) keeping some contamination in place.	PG&E	N/A. No further action required unless post-design approval change triggers.	No further action is required. The remedy design does not involve removal of waste from the immediate place of release and is not designed to keep some contamination in place.	No further action is required. The remedy design does not involve removal of waste from the immediate place of release and is not designed to keep some contamination in place.	No further action is required. The remedy design does not involve removal of waste from the immediate place of release and is not designed to keep some contamination in place.	No further action is required. The remedy design does not involve removal of waste from the immediate place of release and is not designed to keep some contamination in place.

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97	California Action-Specific	Requirements for land-use covenants - Cal. Code Regs. Title 22, § 67391.1	ARAR Applicable	This regulation requires appropriate restrictions on use of property in the event that a proposed remedial alternative results in hazardous materials remaining at the property at levels which are not suitable for unrestricted use of the land. This is an ARAR with respect to PG&E-owned land at the Topock site.	A decision document finding that hazardous materials, hazardous wastes or constituents, or hazardous substances will remain at the property at levels which are not suitable for unrestricted use of the land.	DTSC	A land use covenant imposing appropriate limitations on land use shall be executed and recorded when hazardous materials, hazardous wastes or constituents, or hazardous substances will remain at the property at levels which are not suitable for unrestricted use of the land. The land use restrictions must be clearly stated in any response action decision document approved by DTSC. The following information must be specified: (1) the limitations or controls that will be incorporated into an appropriate land use covenant and (2) a description of the implementation and enforcement provisions, including but not limited to frequency of inspections and reporting requirements, necessary to ensure the integrity and long-term protectiveness of the land use covenant.	The final groundwater remedy includes restrictions on use of the groundwater for potable use, based on the conclusions of the groundwater risk assessment. The land use covenants (institutional controls) are described in Section 5.0.	The final groundwater remedy includes restrictions on use of the groundwater for potable use. The land use covenants (institutional controls) are described in Section 5.0 of the 60% BOD Report.	The final groundwater remedy includes restrictions on use of the groundwater for potable use. The land use covenants (institutional controls) are described in Section 5.0 of the 90% BOD Report.	The final groundwater remedy includes restrictions on use of the groundwater for potable use. The land use covenants (institutional controls) are described in Section 5.0 of the Final BOD Report.

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98	California Action-Specific	California Water Code - Section 1380[c], California Well Standards, Bulletin 74-90 (Supplement to Bulletin 74-81)	ARAR Applicable	These standards for water, cathodic, and monitoring wells will be applicable if the remediation requires use of such wells.	Design, construction, decommission of groundwater wells	PG&E	Design submittals, Construction/ Remedial Action Work Plan, Plan for Decommissioning of IM-3 Facility and Site Restoration, Plan for Decommissioning of Remedy Facilities and Restoration.	PG&E will prepare Design submittals, a Construction/Remedial Action Work Plan, Plan for Decommissioning of IM-3 Facility and Site Restoration, and a Decommissioning Plan for Remedy Facility and Site Restoration. The remedy will include water and monitoring wells, and will adhere to the standards specified in this ARAR. Well construction and decommissioning standards will be described in the Construction /Remedial Action Work Plan.	The remedy includes water and monitoring wells, and will adhere to the standards specified in this ARAR. Note that the general approach for well decommissioning is currently being developed by a subgroup that includes PG&E, DTSC, DOI, and Interested Tribes. Protocols for well decommissioning will be based on this general approach and be presented in Appendix B of the O&M Plan (Volume 1 of the O&M Manual), at the 90% design stage. Well construction and decommissioning standards will also be described the Construction/Remedial Action Work Plan.	The remedy includes water and monitoring wells, and will adhere to the standards specified in this ARAR. An approach for well decommissioning has been developed by a subgroup that includes PG&E, DTSC, DOI, and Interested Tribes. Protocols for well decommissioning developed based on this approach, are presented in the O&M Plan (Volume 1 of the O&M Manual). Well construction and decommissioning procedures are also described in the Construction/Remedial Action Work Plan.	The remedy includes water and monitoring wells, and will adhere to the standards specified in this ARAR. An approach for well decommissioning has been developed by a subgroup that includes PG&E, DTSC, DOI, and Interested Tribes. Protocols for well decommissioning developed based on this approach are presented in the O&M Plan (Volume 1 of the O&M Manual). Well construction and decommissioning procedures are also described in the Construction/Remedial Action Work Plan.
99	California Action-Specific	State Water Resources Control Board Resolution No. 88-63 Adoption of Policy Entitled "Sources of Drinking Water"	ARAR Applicable	With certain exceptions, all surface and ground waters of the State of California are to be considered suitable, or potentially suitable, for municipal or domestic water supply. The Regional Water Quality Control Board and State Water Resources Board have designated the beneficial use of the ground and surface waters in the Topock Site area as "municipal and domestic water supply." This designation is set forth in the Basin Plan.	Remedy implementation	PG&E	O&M Plan (sampling and monitoring plan, contingency plan), Progress Reports, Corrective Measure/Remedial Action Completion Report	Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer to a concentration below the federal and state MCLs of 100 µg/L and 50 mg/L respectively which represent the chemical concentrations in drinking water considered safe for human consumption. There are no MCLs or MCLGs for Cr(VI) and the RAO has been established based on the regional background concentration of 32 µg/L Cr(VI) at the conclusion of remedy implementation. The establishment of RAOs (see Section 1.2.1) is based on the conclusions of the groundwater risk assessment which assumed a hypothetical future use of groundwater within the plume as a drinking water supply. The final groundwater remedy includes an institutional control to restrict use of the groundwater for potable use until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that the RAOs	Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer to a concentration below the federal and state MCLs of 100 µg/L and 50 mg/L respectively, which represent the chemical concentrations in drinking water considered safe for human consumption. There are no MCLs or MCLGs for Cr(VI) and the RAO of 32 µg/L (based on the regional background concentration) has been established at the conclusion of remedy implementation. Concentrations of Cr(VI) and in-situ byproducts (e.g., arsenic, manganese) may fluctuate above baseline levels within the treatment area during remedy implementation. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally occurring arsenic concentration in water from the well exceeds the MCL of 10 µg/L, which is typical of water	Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer to a concentration below the federal and state MCLs of 100 µg/L and 50 mg/L respectively, which represent the chemical concentrations in drinking water considered safe for human consumption. The state MCL for Cr(VI) is 10 µg/L. The RAO has been established based on the regional background concentration of 32 µg/L at the conclusion of remedy implementation. Concentrations of Cr(VI) and in-situ byproducts (e.g., arsenic, manganese) may fluctuate above baseline levels within the treatment area during remedy implementation. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally	Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer to a concentration below the federal and state MCLs of 100 µg/L and 50 mg/L respectively, which represent the chemical concentrations in drinking water considered safe for human consumption. The state MCL for Cr(VI) is 10 µg/L but the RAO has been established based on the Alluvial Aquifer regional background concentration of 32 µg/L at the conclusion of remedy implementation. Concentrations of Cr(VI) and in-situ byproducts (e.g., arsenic, manganese) may fluctuate above baseline levels within the treatment area during remedy implementation. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally

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								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
								have been achieved at the conclusion of remedy implementation and prior to removing the institutional control.	quality in the vicinity of Topock, Arizona**,** will be pre-treated to below MCL prior to injection. Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation are localized, will attenuate under site conditions, and will return to pre-remedy baseline levels after the end of active remediation. Modeling also indicates that manganese generated from in-situ remediation does not exceed the upper tolerance level of background manganese concentration at the site. The final groundwater remedy includes an institutional control to restrict use of the groundwater for potable use until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that the RAOs have been achieved at the conclusion of remedy implementation and prior to removing the institutional control.	occurring arsenic concentration in water from the well exceeds the MCL of 10 µg/L, which is typical of water quality in the vicinity of Topock, Arizona. Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation and freshwater injection are localized, will attenuate under site conditions, and will return to pre-remedy baseline levels after the end of active remediation and the cessation of freshwater injection, respectively. Modeling also indicates that manganese generated from in-situ remediation does not exceed the upper tolerance level of background manganese concentration at the site. The final groundwater remedy includes an institutional control to restrict use of the groundwater for potable use until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that the RAOs have been achieved at the conclusion of remedy implementation and prior to removing the institutional control.	occurring arsenic concentration in water from the well exceeds the MCL of 10 µg/L, which is typical of water quality in the vicinity of Topock, Arizona. Modeling indicates that elevated arsenic concentrations generated from in-situ remediation and freshwater injection are localized, will attenuate under site conditions, and will return to pre-remedy baseline levels approximately 10 years after the end of active remediation and the cessation of freshwater injection, respectively. Modeling also indicates that manganese generated from in-situ remediation does not exceed the upper tolerance level of background manganese concentration at the site. The final groundwater remedy includes an institutional control to restrict use of the groundwater for potable use until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that the RAOs have been achieved at the conclusion of remedy implementation and prior to removing the institutional control.

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100	California Action-Specific	Water Quality Control Plan; Colorado River Basin-Region 7, June 2006 (Basin Plan)	ARAR Applicable	This Basin Plan designates the Colorado River and the Colorado Hydrologic unit as having the beneficial use of "MUN" (or, municipal or domestic water supply). The Basin Plan also prescribes General Surface Water Objectives and Ground Water Objectives, in addition to Specific Surface Water Objectives for the Colorado River, which include a flow-weighted average annual numeric criterion for salinity for the portion of the Colorado River on the Topock Site of 723 mg/L. This TDS value must not be exceeded in any remedial alternative being considered	Remedy implementation	PG&E	O&M Plan (sampling and monitoring plan, contingency plan), Progress Reports, Corrective Measure/Remedial Action Completion Report	Surface water sampling in the Colorado River near the site shows concentrations of Cr(T) less than the federal and state MCLs of 100 µg/L and 50 mg/L (drinking water supply standards). Surface water sampling in the Colorado River also show concentrations of Cr(VI) less than the California Toxics Rule criterion of 11 µg/L (protection of freshwater aquatic life). Reducing Cr(VI) concentrations in groundwater by implementation of the remedy will increase the level of certainty that surface water quality will continue to remain below these levels. PG&E will prepare an O&M Plan, Progress Reports, and a Corrective Measure/Remedial Action Completion Report. The remedy is intended to restore groundwater to the regional background Cr(VI) concentration of 32 µg/L, thereby addressing any contribution by PG&E affecting potential beneficial uses. The operation of the River Bank Extraction Wells will prevent migration of contaminants to the Colorado river that could impact beneficial uses or result in a failure to meet surface water quality objectives.	Surface water sampling in the Colorado River near the site shows concentrations of Cr(T) less than the federal and state MCLs of 100 µg/L and 50 mg/L (drinking water supply standards). Surface water sampling in the Colorado River also show concentrations of Cr(VI) less than the California Toxics Rule criterion of 11 µg/L (protection of freshwater aquatic life). Reducing Cr(VI) concentrations in groundwater by implementation of the remedy will increase the level of certainty that surface water quality will continue to remain below these levels. The remedy is intended to restore groundwater to the regional background Cr(VI) concentration of 32 µg/L, thereby addressing any contribution by PG&E affecting potential beneficial uses. The operation of the River Bank Extraction Wells will prevent migration of contaminants to the Colorado River that could impact beneficial uses or result in a failure to meet surface water quality objectives. The remedy is also designed and will be implemented to control the generation and migration of in-situ by-products (arsenic, manganese). The MCL for arsenic is 10 µg/L and the secondary MCL for manganese is 50 µg/L. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally occurring arsenic concentration in water from the well exceeds the MCL of 10 µg/L (which is typical of water quality in the vicinity of Topock, Arizona) will be pre-treated to below MCL prior to injection**.** Modeling indicates that arsenic concentrations that	Surface water sampling in the Colorado River near the site shows concentrations of Cr(T) less than the federal and state MCLs of 100 µg/L and 50 mg/L (drinking water supply standards). Surface water sampling in the Colorado River also show concentrations of Cr(VI) less than the California Toxics Rule criterion of 11 µg/L (protection of freshwater aquatic life). Surface water data in the Colorado River show concentrations of TDS less than the Surface Water Objectives for the Colorado River of 723 mg/L. Calculations show that remedy operations have insignificant impact on TDS in the river. Reducing Cr(VI) concentrations in groundwater by implementation of the remedy will increase the level of certainty that surface water quality will continue to remain below these levels. The remedy is intended to restore groundwater to the regional background Cr(VI) concentration of 32 µg/L, thereby addressing any contribution by PG&E affecting potential beneficial uses. The operation of the River Bank Extraction Wells will prevent migration of contaminants to the Colorado River that could impact beneficial uses or result in a failure to meet surface water quality objectives. The remedy is also designed and will be implemented to control the generation and migration of in-situ by-products (arsenic, manganese). The MCL for arsenic is 10 µg/L and the secondary MCL for	Surface water sampling in the Colorado River near the site shows concentrations of Cr(T) less than the federal and state MCLs of 100 µg/L and 50 mg/L (drinking water supply standards). Surface water sampling in the Colorado River also show concentrations of Cr(VI) less than the California Toxics Rule criterion of 11 µg/L (protection of freshwater aquatic life). Surface water data in the Colorado River show concentrations of TDS less than the Surface Water Objectives for the Colorado River of 723 mg/L. Calculations show that remedy operations have insignificant impact on TDS in the river. The remedy is intended to restore groundwater to the regional background Cr(VI) concentration of 32 µg/L, thereby addressing any contribution by PG&E affecting potential beneficial uses. The operation of the River Bank Extraction Wells will prevent migration of contaminants to the Colorado River that could impact beneficial uses or result in a failure to meet surface water quality objectives. The remedy is also designed and will be implemented to control the generation and migration of in-situ by-products (arsenic, manganese). The MCL for arsenic is 10 µg/L and the secondary MCL for manganese is 50 µg/L. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally occurring arsenic

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									may temporarily be elevated by the generation from in-situ remediation are localized, will attenuate under site conditions and will return to pre-remedy baseline levels after the end of active remediation. Modeling also indicates that manganese generated from in-situ remediation does not exceed the upper tolerance level of background manganese concentration at the site. The O&M Manual is Appendix L of this BOD Report for the 60% design. PG&E will prepare Progress Reports and a Corrective Measure/Remedial Action Completion Report.	manganese is 50 µg/L. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally occurring arsenic concentration in water from the well exceeds the MCL of 10 µg/L, which is typical of water quality in the vicinity of Topock, Arizona. Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation and freshwater injection are localized, will attenuate under site conditions and will return to pre-remedy baseline levels after the end of active remediation and the cessation of freshwater injection, respectively. Modeling also indicates that manganese generated from in-situ remediation does not exceed the upper tolerance level of background manganese concentration at the site.	concentration in water from the well exceeds the MCL of 10 µg/L, which is typical of water quality in the vicinity of Topock, Arizona. Modeling indicates that elevated arsenic concentrations generated from in-situ remediation and freshwater injection are localized, will attenuate under site conditions and will return to pre-remedy baseline levels approximately 10 years after the end of active remediation and the cessation of freshwater injection, respectively. Modeling also indicates that manganese generated from in-situ remediation does not exceed the upper tolerance level of background manganese concentration at the site.

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101	California Action-Specific	State Water Resources Control Board Resolution No. 68-16 ("Antidegradation Policy") - Statement of Policy with respect to Maintaining High Quality of Waters in California	ARAR Applicable	Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.	Remedy implementation	PG&E	O&M Plan (sampling and monitoring plan, contingency plan), Progress Reports, Corrective Measure/Remedial Action Completion Report	PG&E will prepare an O&M Plan, Progress Reports, and a Corrective Measure/Remedial Action Completion Report. Although constituent concentrations will fluctuate inside the footprint of the remedy during implementation, at the conclusion of the remedy the RAOs will achieve background levels for chromium. Therefore, the remedy will comply with the substantive provisions of the SWRCB Resolution 68-16 that requires maintenance of the highest water quality consistent with maximum benefit to the people of the State, and with the substantive provisions of SWRCB Resolution 92-49 that require restoration of background water quality.	The O&M Manual is Appendix L of the BOD Report for the 60% design. PG&E will prepare Progress Reports and a Corrective Measure/Remedial Action Completion Report. Although constituent concentrations will fluctuate inside the footprint of the remedy during implementation, at the conclusion of the remedy the RAOs will achieve background levels for chromium. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally occurring arsenic concentration in water from the well exceeds the MCL of 10 µg/L, which is typical of water quality in the vicinity of Topock, Arizona**,** will be pre-treated to below MCL prior to injection. Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation will attenuate under site conditions, are localized, and will return to pre-remedy baseline levels after the end of active remediation. Modeling also indicates that manganese generated from in-situ remediation does not exceed the upper tolerance level of background manganese concentration at the site. Therefore, the remedy will comply with the substantive provisions of the SWRCB Resolution 68-16 that requires maintenance of the highest water quality consistent with maximum benefit to the people of the State, and with the substantive provisions of SWRCB Resolution 92-49 that require	The O&M Manual is Appendix L of the BOD Report for the 90% design. PG&E will prepare Progress Reports and a Corrective Measure/Remedial Action Completion Report. Although constituent concentrations will fluctuate inside the footprint of the remedy during implementation, at the conclusion of the remedy the RAOs will achieve background levels for chromium. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally occurring arsenic concentration in water from the well exceeds the MCL of 10 µg/L, which is typical of water quality in the vicinity of Topock, Arizona. Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation and freshwater injection will attenuate under site conditions, are localized, and will return to pre-remedy baseline levels after the end of active remediation and the cessation of freshwater injection, respectively. Modeling also indicates that manganese generated from in-situ remediation does not exceed the upper tolerance level of background manganese concentration at the site. Therefore, the remedy will comply with the substantive provisions of the SWRCB Resolution 68-16 that requires maintenance of the highest	The O&M Manual is Appendix L of the Final BOD Report. PG&E will prepare Progress Reports and a Corrective Measure/Remedial Action Completion Report. Although constituent concentrations will fluctuate inside the footprint of the remedy during implementation, at the conclusion of the remedy the RAOs will achieve background levels for chromium. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally occurring arsenic concentration in water from the well exceeds the MCL of 10 µg/L, which is typical of water quality in the vicinity of Topock, Arizona. Modeling indicates that elevated arsenic concentrations generated from in-situ remediation and freshwater injection will attenuate under site conditions, are localized, and will return to pre-remedy baseline levels approximately 10 years after the end of active remediation and the cessation of freshwater injection, respectively. Modeling also indicates that manganese generated from in-situ remediation does not exceed the upper tolerance level of background manganese concentration at the site. Therefore, the remedy will comply with the substantive provisions of the SWRCB Resolution 68-16 that requires maintenance of the highest

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									restoration of background water quality.	water quality consistent with maximum benefit to the people of the State, and with the substantive provisions of SWRCB Resolution 92-49 that require restoration of background water quality.	water quality consistent with maximum benefit to the people of the State, and with the substantive provisions of SWRCB Resolution 92-49 that require restoration of background water quality.
102	California Action-Specific	State Water Resources Control Board Resolution No. 92-49 -- Policies and Procedures for investigation and Cleanup and Abatement of Discharges under Water Code Section 13304	ARAR Relevant and Appropriate	Section III.A of this Resolution states that the Regional Water Board shall "concur with any investigative and abatement proposal which the discharger demonstrates and the Regional Water Board finds to have a substantial likelihood to achieve compliance within a reasonable time frame…"	Remedy implementation	PG&E	Corrective Measure/ Remedial Action Completion Report	PG&E will prepare a Corrective Measure/Remedial Action Completion Report. Because RAOs will achieve background levels for chromium, the remedy will comply with the substantive provisions of the SWRCB Resolution 92-49 that require restoration of background water quality.	PG&E will prepare a Corrective Measure/Remedial Action Completion Report. Because RAOs will achieve background levels for chromium, the remedy will comply with the substantive provisions of the SWRCB Resolution 92-49 that require restoration of background water quality.	PG&E will prepare a Corrective Measure/Remedial Action Completion Report. Because RAOs will achieve background levels for chromium, the remedy will comply with the substantive provisions of the SWRCB Resolution 92-49 that require restoration of background water quality.	PG&E will prepare and submit a Corrective Measure/ Remedial Action Completion Report. Because RAOs will achieve background levels for chromium, the remedy will comply with the substantive provisions of the SWRCB Resolution 92-49 that require restoration of background water quality.
Location-Specific											
5	Federal Location-Specific	Federal Land Policy and Management Act - (FLPMA);43 USC § 1701, et seq.; 43 CFR 2800	ARAR Applicable	In managing public lands, BLM is directed to take any action necessary to prevent unnecessary or undue degradation of the lands. Actions[3] taken on the public land (i.e. BLM-managed land) portions of the Topock site should provide the "optimal balance between authorized resource use and the protection and long-term sustainability of sensitive resources."	Activities on public lands	BLM	Design submittals, Construction/ Remedial Action Work Plan, O&M Plan, Progress Reports, Plan for Decommissioning of Remedy Facilities and Restoration	The preliminary (30%) design was submitted by PG&E to DOI on November 18, 2011, and includes proposed facilities on BLM land. PG&E will prepare future design submittals, a Construction/Remedial Action Work Plan, an O&M Plan, Progress Reports, and a Decommissioning Plan for review by DOI. PG&E understands that DOI will coordinate its review of these submittals with BLM.	The 60% design was submitted to DOI on April 5, 2013, and includes proposed facilities on BLM land. Engineering drawings are included as Appendix D to this 60% design report and an O&M Manual is included as Appendix L. PG&E will submit a Construction/Remedial Action Work Plan as part of the 90% design, a Decommissioning Plan prior to decommissioning, and progress reports for review by DOI. PG&E understands that DOI will coordinate its review of these submittals with BLM.	The 90% design was submitted to DOI on September 8, 2014, and includes proposed facilities on BLM land. Engineering drawings are included as Appendix D to the 90% design report and an O&M Manual is included as Appendix L. The Construction/Remedial Action Work Plan was also submitted concurrently with the 90% design as part of the 90% design. Progress reports will be submitted during the construction and operation and maintenance of the remedy. PG&E understands that DOI will coordinate its review of these submittals with BLM. In compliance with the CD (Appendix C Scope of Work, Article 9), PG&E will prepare a site-specific Plan for Decommissioning and Restoration of remedy facilities within 120 days of DOI's certification of remedial action	The final design was submitted to DOI on November 18, 2015, and includes proposed facilities on BLM land. Engineering drawings are included as Appendix D to this final design report and an O&M Manual is included as Appendix L. The Construction/Remedial Action Work Plan was also submitted concurrently with the final design. Progress reports will be submitted during the construction and operation and maintenance of the remedy. PG&E understands that DOI will coordinate its review of these submittals with BLM. In compliance with the CD (Appendix C Scope of Work, Article 9), PG&E will prepare a site-specific Plan for Decommissioning and Restoration of remedy facilities within 120 days of DOI's certification of remedial action completion and a

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										completion and a determination by DOI that removal of such facilities is protective of human health and the environment.	determination by DOI that removal of such facilities is protective of human health and the environment.
7	Federal Location-Specific	National Wildlife Refuge System Administration Act, as amended - 16 USC §§ 668dd-ee; 50 CFR Part 27	ARAR Applicable	This Act governs the use and management of National Wildlife Refuges. The Act requires that USFWS evaluate ongoing and proposed activities and uses to ensure that such activities are appropriate and compatible with both the mission of the overall National Wildlife Refuge System, as well as the specific purposes for which the Havasu National Wildlife Refuge (HNWR) was established. The Topock site includes portions of the HNWR. Prior to selection of a remedial action[3] by DOI/USFWS, that remedial action must be found by the Refuge Manager to be both an appropriate use of the HNWR and compatible with the mission of the HNWR and the Refuge System as a whole. [2]	Activities on the HNWR	USFWS/DOI	Design submittals, Construction/ Remedial Action Work Plan, O&M Plan, Progress Reports, Plan for Decommissioning of Remedy Facilities and Restoration	The preliminary (30%) design was submitted by PG&E to agencies on November 18. 2011 and includes proposed facilities on HNWR land. PG&E will prepare future design submittals, a Construction/Remedial Action Work Plan, an O&M Plan, Progress Reports, and a Decommissioning Plan for review by DOI. PG&E understands that DOI will coordinate its review of these submittals with USFWS.	The 60% design was submitted to DOI on April 5, 2013, and includes proposed facilities on HNWR land. Engineering drawings are included as Appendix D to this 60% design report and an O&M Manual is included as Appendix L. PG&E will submit a Construction/Remedial Action Work Plan as part of the 90% design, a Decommissioning Plan prior to decommissioning, and progress reports for review by DOI. PG&E understands that DOI will coordinate its review of these submittals with USFWS.	See Table 6.2-1A, Information for the Havasu National Wildlife Refuge's Appropriate Use Analysis and Compatibility Determination (AUA/CD).	See Table 6.2-1A, Information for the Havasu National Wildlife Refuge's Appropriate Use Analysis and Compatibility Determination (AUA/CD).

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13	Federal Location-Specific	Fish and Wildlife Coordination Act - 16 USC §§ 661-667e	ARAR Applicable	This Act requires that any federally-funded or authorized modification of a stream or other water body must provide adequate provisions for conservation, maintenance, and management of wildlife resources and their habitat. Necessary measures should be taken to mitigate, prevent, and compensate for project-related losses of wildlife resources. Any remedial action selected for the Topock site that includes any modification of a water body will be subject to these requirements.	Any modification of a water body	PG&E	N/A. No further action required unless design change triggers; reconfirm in design submittals.	No further action is required. The preliminary (30%) design does not include modification of a water body.	Figure 2.4-5 in the 60% BOD Report document shows the overlaps between remedy infrastructure and the USACE and CDFW jurisdictional waters/wetlands. As shown in Figure 2.4-5, PG&E determined in the 60% Design that complete avoidance of washes is not feasible due to the need to install remediation and monitoring wells and associated pipes and components in washes (e.g., a wash in the Upland, Bat Cave Wash). For activities to be conducted in CDFW jurisdictional washes, PG&E will comply with the avoidance and minimization measures specified in the CDFW letter dated March 6, 2013 (CDFW 2013), and any additional measures PG&E's biologist determines to be necessary. PG&E will work with USACE and USFWS to determine and comply with the substantive requirements, per CERCLA 121(e), of Section 404 and the Fish and Wildlife Coordination Act, respectively.	Figure 2.4-5 in the 90% BOD Report document shows the overlaps between remedy infrastructure and the USACE and CDFW jurisdictional waters/wetlands. As shown in Figure 2.4-5, PG&E determined in the 90% Design that complete avoidance of washes is not feasible due to the need to install remediation and monitoring wells and associated pipes and components in washes (e.g., a wash in the Upland, Bat Cave Wash). For activities to be conducted in CDFW jurisdictional washes, PG&E will comply with the avoidance and minimization measures specified in the CDFW letter dated March 6, 2013 (CDFW 2013), and any additional measures PG&E's biologist determines to be necessary. PG&E will also comply with avoidance, minimization and mitigation measures specified in the Section 404 protocol (see Exhibit 6.1-1 at the end of Table 6.1-1) and the requirements of the Programmatic Biological Assessment. USFWS will be consulted on the 90% BOD Report.	Figure 2.4-5 in this Final BOD Report document shows the overlaps between remedy infrastructure and the USACE and CDFW jurisdictional waters/wetlands. As shown in Figure 2.4-5, PG&E determined in the final design that complete avoidance of washes is not feasible due to the need to install remediation and monitoring wells and associated pipes and components in washes (e.g., a wash in the Upland, Bat Cave Wash). For activities to be conducted in CDFW jurisdictional washes, PG&E will comply with the avoidance and minimization measures specified in the CDFW letter dated March 6, 2013 (CDFW 2013), and any additional measures PG&E's biologist determines to be necessary. PG&E will also comply with avoidance, minimization and mitigation measures specified in the Section 404 protocol (see Exhibit 6.1-1 at the end of Table 6.1-1) and the requirements of the Programmatic Biological Assessment. USFWS was consulted on the 90% BOD Report and during the 90% RTC process.

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14	Federal Location-Specific	National Historic Preservation Act - 16 USC § 470, et seq.;36 CFR 800.1, et seq.	ARAR Applicable	This statute and the implementing regulations direct federal agencies to consider the effects of their undertakings on historic properties included in or eligible for inclusion in the National Register of Historic Places and to consult with certain parties before moving forward with the undertaking. The agency must determine, based on consultation, if an undertaking's effects would be adverse and consider feasible and prudent alternatives that could avoid, mitigate, or minimize such adverse effects on a National Register or eligible property. The agency must then specify how adverse effects will be avoided or mitigated or acknowledge that such effects cannot be avoided or mitigated. The Topock site includes historic properties in or eligible for inclusion in the National Register and remedial action selected for the Topock site qualifies as an undertaking pursuant to the NHPA. Measures to avoid or mitigate adverse effects of any selected remedial action that are adopted by the agency through consultation must be implemented by the remedial action to comply with the NHPA.	Remedial action selected for the Topock site qualifies as an undertaking under NHPA	BLM, Advisory Council on Historic Preservation, California and Arizona State Historic Preservation Offices, USFWS and PG&E are parties to the PA	PA, CHPMP, Design Submittals, Construction/Remedial Action Work Plan, Plan for decommissioning, removal, and restoration of IM-3 facility, Plan for Decommissioning of Remedy Facilities and Restoration, Documents related to ongoing consultation, Brochure, Annual Report, Tribal Access Plan	Documents led by BLM include the PA, the CHPMP, the Brochure, the Annual Report, and the Tribal Access Plan. The PA has been completed. The Brochure to notify other state and federal agencies of the Signatories and Invited Signatories with the actions to be taken within the vicinity of the Topock Remediation Project, and the Topock Maze, is completed. The CHPMP, which is a requirement of the PA, is under preparation and the goal is to have a plan in place by January 20, 2012. BLM distributed a draft CHPMP on November 1, 2011. Comments on the draft CHPMP are due December 5, 2011. The Tribal Access Plan is also under preparation and the goal is to complete the Plan by November 26, 2011 (note that the PA-required Tribal Access Plan will be coordinated with the EIR-required Access Plan).Annual reports of cultural resources activities will be prepared and submitted to all Signatories, Tribes, and Invited Signatories as directed in the PA. Documents led by PG&E include design submittals, a Construction/Remedial Action Work Plan, a Plan for decommissioning, removal, and restoration of IM-3 facility, and a Decommissioning Plan for Remedy Facilities and Restoration. The preliminary (30%) design was submitted on November 18, 2011. The other documents will be prepared and submitted.	Documents led by BLM include the PA, the CHPMP, the Brochure, the Annual Report, and the Tribal Access Plan. The PA has been completed. The Brochure to notify other state and federal agencies of the Signatories and Invited Signatories with the actions to be taken within the vicinity of the Topock Remediation Project, and the Topock Maze, is completed. The CHPMP, which is a requirement of the PA, was issued on January 20, 2012. The CHPMP can be modified and updated, as needed, to address new information and ongoing activities related to the project. Therefore, subsequent to the issuance of the CHPMP, BLM continues to hold periodic working meetings on the CHPMP. It should be noted that treatment measures are included in the CHPMP and a treatment plan will continue to be developed throughout the design to address mitigation measures. The Tribal Access Plan for lands under federal management was completed on November 26, 2011 (note that the PA-required Tribal Access Plan will be coordinated with the EIR-required Access Plan). Annual reports of cultural resources activities will be prepared and submitted to all Signatories, Tribes, and Invited Signatories as directed in the PA. BLM published the first Annual Report on November 25, 2011, and the second Annual Report on January 29, 2013. The PA requires that such reports will be prepared and submitted by December 1 each year for the first five years after execution of the PA and every two years thereafter. Documents led by PG&E include design submittals; a	Documents led by BLM include the PA, the CHPMP, the Brochure, the Annual Report, and the Tribal Access Plan. The PA is completed. The Brochure to notify other state and federal agencies of the Signatories and Invited Signatories with the actions to be taken within the vicinity of the Topock Remediation Project, and the Topock Maze, is also completed. The CHPMP, which is a requirement of the PA, was issued on January 20, 2012. The CHPMP can be modified and updated, as needed, to address new information and ongoing activities related to the project. Therefore, subsequent to the issuance of the CHPMP, BLM continues to hold periodic working meetings on the CHPMP. It should be noted that treatment measures are included in the CHPMP and a treatment plan will be prepared and submitted to DTSC shortly after the submission of the 90% design. The Tribal Access Plan for lands under federal management was completed on November 26, 2011. On October 21, 2013, PG&E provided the Tribes a draft of the Access Plan for lands not under federal management for review and comment. Tribal comments were received on November 22, 2013. PG&E has updated the plan and included the plan in an appendix of the Construction/Remedial Action Work Plan. (Note that the PA-required Tribal Access Plan was	Documents led by BLM include the PA, the CHPMP, the Brochure, the Annual Report, and the Tribal Access Plan. The PA is completed. The Brochure to notify other state and federal agencies of the Signatories and Invited Signatories with the actions to be taken within the vicinity of the Topock Remediation Project, and the Topock Maze, is also completed. The CHPMP, which is a requirement of the PA, was issued on January 20, 2012. The CHPMP can be modified and updated, as needed, to address new information and ongoing activities related to the project. Therefore, subsequent to the issuance of the CHPMP, BLM continues to hold periodic working meetings on the CHPMP. It should be noted that treatment measures are included in the CHPMP, and a Cultural and Historic Property Treatment Plan was submitted to DTSC, DOI, and BLM shortly after the 90% design submittal. The Tribal Access Plan for lands under federal management was completed on November 26, 2011. PG&E has prepared an Access Plan in coordination with Tribes for the lands not under federal management, taking into consideration the information in the BLM Access Plan. The Access Plan is included in an appendix of the Construction/Remedial Action Work Plan submitted on November 18, 2015. Annual reports of cultural resources activities will be prepared and submitted to all

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									Construction/Remedial Action Work Plan; a Plan for decommissioning, removal, and restoration of the IM-3 facility; and a Decommissioning Plan for Remedy Facilities and Restoration. The intermediate (60%) design submittal was submitted on April 5, 2013. The other documents will be prepared and submitted.	coordinated with the EIR-required Access Plan). Annual reports of cultural resources activities will be prepared and submitted to all Signatories, Tribes, and Invited Signatories as directed in the PA. BLM published the first Annual Report on November 25, 2011, and the second Annual Report on January 29, 2013. The Third Annual Report was provided by BLM to the Signatories, Tribes, and Invited Signatories for comment on June 18, 2014. The PA requires that such reports will be prepared and submitted by December 1 each year for the first five years after execution of the PA and every two years thereafter. Documents led by PG&E include design submittals; a Construction/Remedial Action Work Plan; a Plan for decommissioning, removal, and restoration of the IM-3 facility; and a Decommissioning Plan for Remedy Facilities and Restoration. The 90% design, the Construction/Remedial Action Work Plan, and the IM-3 decommissioning, removal, and restoration work plan were submitted on September 8, 2014. In compliance with the CD (Appendix C Scope of Work, Article 9), PG&E will prepare a site-specific Plan for Decommissioning and Restoration of remedy facilities within 120 days of DOI's certification of remedial action completion and a determination by DOI that removal of such facilities is	Signatories, Tribes, and Invited Signatories as directed in the PA. BLM published the first Annual Report on November 25, 2011, and the second Annual Report on January 29, 2013. The Third Annual Report was provided by BLM to the Signatories, Tribes, and Invited Signatories for comment on June 18, 2014. The PA requires that such reports will be prepared and submitted by December 1 each year for the first five years after execution of the PA and every two years thereafter. Documents led by PG&E include design submittals; a Construction/Remedial Action Work Plan; a Plan for decommissioning, removal, and restoration of the IM-3 facility; and a Decommissioning Plan for Remedy Facilities and Restoration. The final design, the Construction/Remedial Action Work Plan, and the IM-3 decommissioning, removal, and restoration work plan were submitted on November 18, 2015. In compliance with the CD (Appendix C Scope of Work, Article 9), PG&E will prepare a site-specific Plan for Decommissioning and Restoration of remedy facilities within 120 days of DOI's certification of remedial action completion and a determination by DOI that removal of such facilities is protective of human health and the environment.

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								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
										protective of human health and the environment.	
17	Federal Location-Specific	National Archaeological and Historic Preservation Act – 16 USC § 469, et seq.; 36 CFR 65	ARAR Applicable	This statute requires the evaluation and preservation of historical and archaeological data which might otherwise be irreparably lost or destroyed through any alteration of terrain as a result of federal construction projects or a federally-licensed activity. The Topock site includes historical and archaeological data. Any remedial action selected for the Topock site must include measures for the evaluation and preservation of historical and archaeological data that might be lost or destroyed as a result of the remedial action.	Alteration of terrain that threatens significant scientific, historical or archaeological data.	Federal Agencies, PG&E	PA, CHPMP, Design Submittals, Construction/ Remedial Action Work Plan	Requirements in the PA and the forthcoming CHPMP will be adhered to. Documents led by PG&E include design submittals, a Construction/Remedial Action Work Plan, a Plan for decommissioning, removal, and restoration of IM-3 facility, and a Decommissioning Plan for Remedy Facilities and Restoration. The preliminary (30%) design was submitted on November 18, 2011. The other documents will be prepared and submitted.	Requirements in the PA and the CHPMP will be adhered to. Documents led by PG&E include design submittals; a Construction/Remedial Action Work Plan; a Plan for decommissioning, removal, and restoration of the IM-3 facility; and a Decommissioning Plan for Remedy Facilities and Restoration. The intermediate (60%) design submittal was submitted on April 5, 2013. The other documents will be prepared and submitted.	Requirements in the PA and the CHPMP will be adhered to. These requirements include implementation of mitigation measures identified in the PA and the CHPMP and through ongoing consultation activities with the Tribes that will avoid, mitigate, or otherwise minimize adverse effects from the undertaking. Tables 6.2-2 and 6.2-3 summarize actions by PG&E to implement the applicable provisions under the PA and the CHPMP. Documents led by PG&E include design submittals; a Construction/Remedial Action Work Plan; a Plan for decommissioning, removal, and restoration of the IM-3 facility; and a Decommissioning Plan for Remedy Facilities and Restoration. The 90% design, the Construction/Remedial Action Work Plan, and the IM-3 decommissioning, removal, and restoration work plan were submitted on September 8, 2014. In compliance with the CD (Appendix C Scope of Work, Article 9), PG&E will prepare a Plan for Decommissioning and Restoration of the remedy facilities within 120 days of DOI's certification of remedial action completion and a determination by DOI that removal of such facilities is protective of human health and the environment.	Requirements in the PA and the CHPMP will be adhered to. These requirements include implementation of mitigation measures identified in the PA and the CHPMP and through ongoing consultation activities with the Tribes that will avoid, mitigate, or otherwise minimize adverse effects from the undertaking. Tables 6.2-2 and 6.2-3 summarize actions by PG&E to implement the applicable provisions under the PA and the CHPMP. Additionally, treatment measures are included in a Cultural and Historic Property Treatment Plan that was submitted to DTSC, DOI, and BLM shortly after the 90% design submittal, and will be adhered to. Documents led by PG&E include design submittals; a Construction/Remedial Action Work Plan; a Plan for decommissioning, removal, and restoration of the IM-3 facility; and a Decommissioning Plan for Remedy Facilities and Restoration. The final design, the Construction/Remedial Action Work Plan, and the IM-3 decommissioning, removal, and restoration work plan were submitted on November 18, 2015. In compliance with the CD (Appendix C Scope of Work, Article 9), PG&E will prepare a Plan for Decommissioning and Restoration of the remedy facilities within 120 days of DOI's certification of remedial action completion and a

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											determination by DOI that removal of such facilities is protective of human health and the environment.
18	Federal Location-Specific	Archaeological Resources Protection Act - 16 USC § 470aa-ii, et seq.;43 CFR 7.1, et seq.	ARAR Applicable	This statute provides for the protection of archeological resources located on public and Tribal lands. The Act establishes criteria which must be met for the land manager's approval of any excavation or removal of archaeological resources if a proposed activity involves soil disturbances. The Topock site includes archaeological resources on public land. Any remedial action selected for the Topock site must satisfy the criteria applicable to excavation or removal of archaeological resources that might be affected as a result of the remedial action.	Disturbance of archaeological and historical sites	Federal Agencies, PG&E	PA, CHPMP, Design Submittals, Construction/ Remedial Action Work Plan	Requirements in the PA and the forthcoming CHPMP will be adhered to. PG&E will prepare and submit design submittals and the Construction/Remedial Action Work Plan. The preliminary (30%) design was submitted on November 18, 2011.	Requirements in the PA and the CHPMP will be adhered to. PG&E will submit a Construction/ Remedial Action Work Plan as part of the 90% design. The 60% design was submitted on April 5, 2013.	Requirements in the PA and the CHPMP will be adhered to. These requirements include implementation of mitigation measures identified in the PA and the CHPMP and through ongoing consultation activities with the Tribes that will avoid, mitigate, or otherwise minimize adverse effects from the undertaking. Tables 6.2-2 and 6.2-3 summarize actions by PG&E to implement the applicable provisions under the PA and the CHPMP. The 90% design and the Construction/Remedial Action Work Plan were submitted on September 8, 2014.	Requirements in the PA and the CHPMP will be adhered to. These requirements include implementation of mitigation measures identified in the PA and the CHPMP and through ongoing consultation activities with the Tribes that will avoid, mitigate, or otherwise minimize adverse effects from the undertaking. Tables 6.2-2 and 6.2-3 summarize actions by PG&E to implement the applicable provisions under the PA and the CHPMP. Additionally, treatment measures are included in a Cultural and Historic Property Treatment Plan that was submitted to DTSC, BLM, and DOI shortly after the 90% design submittal, and will be adhered to. The final design and the Construction/Remedial Action Work Plan were submitted on November 18, 2015.
19	Federal Location-Specific	Historic Sites Act - 16 USC 461-467	ARAR Applicable	Pursuant to this Act, federal agencies are to consider the existence and location of historic sites, buildings, and objects of national significance using information provided by the National Park Service to avoid undesirable impacts upon such landmarks. There are no designated historic landmarks within the APE, although 16 USC 461, through Public Law 106-45, provides for a cooperative program "for the preservation of the Route 66 corridor" through grants and	Existence of a historic landmark	Federal Agencies	Reevaluate in design documents if designated historic landmark exist	There are no historic landmarks in the APE. No further action is required.	There are no historic landmarks in the APE. No further action is required.	There are no historic landmarks in the APE. No further action is required.	There are no historic landmarks in the APE. No further action is required.

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				other measures. Undesirable impacts on this site that might result from any remedial action selected for the Topock site will be evaluated and mitigated to the maximum extent practicable.							
21	Federal Location-Specific	Native American Graves Protection and Repatriation Act (NAGPRA) - 25 USC § 3001, et seq.; 43 CFR 10.1, et seq.	ARAR Applicable	NAGPRA establishes requirements regulating the removal and trafficking of human remains and cultural items, including funerary and sacred objects. The Topock site may contain human remains. If remediation activities result in the discovery of Indian human remains or related objects, NAGPRA requirements must be met.	Federal Lands only - Discovery of human remains	PG&E	PA, CHPMP	Requirements of the PA and the forthcoming CHPMP (led by BLM) will be adhered to during the implementation of the remedy.	Requirements of the PA and the CHPMP (led by BLM) will be adhered to during the implementation of the remedy.	Requirements in the PA and the CHPMP will be adhered to. These requirements include implementation of mitigation measures identified in the PA and the CHPMP and through ongoing consultation activities with the Tribes that will avoid, mitigate, or otherwise minimize adverse effects from the undertaking. Tables 6.2-2 and 6.2-3 summarize actions by PG&E to implement the applicable provisions under the PA and the CHPMP.	Requirements in the PA and the CHPMP will be adhered to. These requirements include implementation of mitigation measures identified in the PA and the CHPMP and through ongoing consultation activities with the Tribes that will avoid, mitigate, or otherwise minimize adverse effects from the undertaking. Tables 6.2-2 and 6.2-3 summarize actions by PG&E to implement the applicable provisions under the PA and the CHPMP. Additionally, treatment measures are included in a Cultural and Historic Property Treatment Plan that was submitted to DTSC, BLM, and DOI shortly after the 90% design submittal, and will be adhered to.
22	Federal Location-Specific	American Indian Religious Freedom Act - 42 USC § 1996, et seq.	ARAR Relevant and Appropriate	The United States must "protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise [their] traditional religions..." Any remedial action selected for the Topock site must satisfy this requirement.	Remedy selection	Federal Agencies (BLM Lead), PG&E	Tribal Access Plan	BLM leads the preparation of the Tribal Access Plan. Goal is to complete the plan by November 26, 2011. Note that the EIR-required Access Plan will be coordinated with the PA-required Access Plan.	BLM led the preparation of the Tribal Access Plan for lands under federal management, and the Plan was completed on November 26, 2011. Note that the EIR-required Access Plan is under preparation.	BLM led the preparation of the Tribal Access Plan for lands under federal management, and the Plan was completed on November 26, 2011. The EIR-required Access Plan was prepared and is included in an appendix of the Construction/ Remedial Action Work Plan.	BLM led the preparation of the Tribal Access Plan for lands under federal management, and the Plan was completed on November 26, 2011. The EIR-required Access Plan was prepared and is included in an appendix of the Construction/ Remedial Action Work Plan.

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27	Federal Location-Specific	Resource Conservation and Recovery Act - 42 USC § 6901, et.seq.; 40 CFR 264.18	ARAR Applicable	These regulations promulgated under RCRA establish Seismic and Floodplain considerations which must be followed for treatment, storage, or disposal facilities constructed, operated, or maintained within certain distances of fault lines and floodplains. Portions of the Topock site are located on or near a 100-year floodplain.	Infrastructure in 100-year floodplain/ regulatory floodway	PG&E	Design submittals	The groundwater remedial facilities are not a permitted RCRA treatment, storage or disposal facility. Seismic load design criteria and geotechnical design criteria are described in Appendix C. The 100-year floodplain is defined in the Flood Insurance Rate Map (FIRM), Panel 5705 of 9400 for San Bernardino County, California and Unincorporated Areas, Revised August 28, 2008. The base flood elevation shown on the current FIRM is 464 at River Mile (RM) 234 of the Colorado River. The effective Flood Insurance Study (FIS) for San Bernardino County lists a regulatory base flood elevation of 463.90. This design uses the more conservative elevation of 464 as the base flood elevation. Wells and pipelines are included in the preliminary (30%) design in areas of the Colorado River floodplain necessary for capture and treatment of the chromium plume. The infrastructure in this preliminary (30%) design (wells, pipes) is mostly outside the 100-year floodplain, see Sheet C-2, well FP-EX-5.	The groundwater remedial facilities are not a permitted RCRA treatment, storage or disposal facility. Seismic load design criteria and geotechnical design criteria are described in Appendix C of this BOD Report for the 60% design. The 100-year floodplain is defined in the Flood Insurance Rate Map (FIRM), Panel 5705 of 9400 for San Bernardino County, California and Unincorporated Areas, Revised August 28, 2008, and Panel 5675 of 6700 for Mohave County, Arizona and Unincorporated Areas, Revised November 18, 2009 (Map Number 04015C5675G). The base flood elevation shown on the current FIRM is 464 at River Mile (RM) 234 of the Colorado River. A review of the Mohave County Flood Insurance Study (FIS) shows that this elevation is specific to the California side of the River only, and is different from information found in the newer FIS for Mohave County, AZ. The effective FIS for San Bernardino County lists a regulatory base flood elevation of 463.90 feet. This design uses the more conservative elevation of 464 feet as the base flood elevation for the project on the California side of the Colorado River. The vertical datum for all flood elevations shown on the San Bernardino County FIRM is NAVD88. The effective FIS for Mohave County lists a regulatory base flood elevation of 465.3 feet NAVD. This is used as the base flood elevation for the project on the Arizona side of the Colorado River. The vertical datum for all flood elevations shown on the Mohave County FIRM is NAVD88.	The groundwater remedial facilities are not a permitted RCRA treatment, storage or disposal facility. Seismic load design criteria and geotechnical design criteria are described in Appendix C of this BOD Report for the 90% design. The 100-year floodplain is defined in the Flood Insurance Rate Map (FIRM), Panel 5705 of 9400 for San Bernardino County, California and Unincorporated Areas, Revised August 28, 2008, and Panel 5675 of 6700 for Mohave County, Arizona and Unincorporated Areas, Revised November 18, 2009 (Map Number 04015C5675G). The base flood elevation shown on the current FIRM is 464 feet at River Mile (RM) 234 of the Colorado River. A review of the Mohave County Flood Insurance Study (FIS) shows that this elevation is specific to the California side of the River only, and is different from information found in the newer FIS for Mohave County, AZ. The effective FIS for San Bernardino County lists a regulatory base flood elevation of 463.90 feet. This design uses the more conservative elevation of 464 feet as the base flood elevation for the project on the California side of the Colorado River. The vertical datum for all flood elevations shown on the San Bernardino County FIRM is NAVD88. The effective FIS for Mohave County lists a regulatory base flood elevation of 465.3 feet NAVD. This is used as the base	The groundwater remedial facilities are not a permitted RCRA treatment, storage or disposal facility. Seismic load design criteria and geotechnical design criteria are described in Appendix C of this BOD Report for the final design. The 100-year floodplain is defined in the Flood Insurance Rate Map (FIRM), Panel 5705 of 9400 for San Bernardino County, California and Unincorporated Areas, Revised August 28, 2008, and Panel 5675 of 6700 for Mohave County, Arizona and Unincorporated Areas, Revised November 18, 2009 (Map Number 04015C5675G). The base flood elevation shown on the current FIRM is 464 feet at River Mile (RM) 234 of the Colorado River. A review of the Mohave County Flood Insurance Study (FIS) shows that this elevation is specific to the California side of the River only, and is different from information found in the newer FIS for Mohave County, AZ. The effective FIS for San Bernardino County lists a regulatory base flood elevation of 463.90 feet. This design uses the more conservative elevation of 464 feet as the base flood elevation for the project on the California side of the Colorado River. The vertical datum for all flood elevations shown on the San Bernardino County FIRM is NAVD88. The effective FIS for Mohave County lists a regulatory base flood elevation of 465.3 feet NAVD. This is used as the base

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								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
									In this 60% design, certain infrastructure (piping) cannot be located outside of the 100-year floodplain as defined by the above baseline flood elevation. PG&E will work with San Bernardino County and the Mohave County Flood Administrator to ensure compliance with the county requirements for construction in the floodplain.	flood elevation for the project on the Arizona side of the Colorado River. The vertical datum for all flood elevations shown on the Mohave County FIRM is NAVD88. In the 90% design, certain infrastructure (piping) cannot be located outside of the 100-year floodplain as defined by the above baseline flood elevation. PG&E has worked with the Mohave County Flood Administrator to ensure compliance with the county requirements for construction in the floodplain.	flood elevation for the project on the Arizona side of the Colorado River. The vertical datum for all flood elevations shown on the Mohave County FIRM is NAVD88. In the final design, certain infrastructure (piping) cannot be located outside of the 100-year floodplain as defined by the above baseline flood elevation. PG&E has worked with the Mohave County Flood Administrator to ensure compliance with the county requirements for construction in the floodplain.
43	Arizona Location-Specific	Archeological Discoveries - A.R.S. § 41-841 through 847	ARAR	This Act prohibits any person from knowingly excavating on Arizona State or State agency owned land which is a historic or prehistoric ruin, burial ground, archaeological or paleontological site. These requirements will apply if the selected remedy involves excavation in Arizona.	Only if remedy in Arizona - Discovery of any archaeological, paleontological or historical site or object (including human remains) that is at least fifty years old	PG&E	PA, CHPMP, Construction/ Remedial Action Work Plan	Requirements from the PA and the forthcoming CHPMP (led by BLM) will be adhered to during implementation of the remedy. PG&E will prepare and submit the Construction/Remedial Action Work Plan.	Requirements from the PA and the CHPMP (led by BLM) will be adhered to during implementation of the remedy. PG&E will prepare and submit the Construction/Remedial Action Work Plan as part of the 90% design.	Requirements in the PA and the CHPMP will be adhered to. These requirements include implementation of mitigation measures identified in the PA and the CHPMP and through ongoing consultation activities with the Tribes that will avoid, mitigate, or otherwise minimize adverse effects from the undertaking. Tables 6.2-2 and 6.2-3 summarize actions by PG&E to implement the applicable provisions under the PA and the CHPMP. The Construction/Remedial Action Work Plan was prepared and submitted concurrently with the 90% design on September 8, 2014.	Requirements in the PA and the CHPMP will be adhered to. These requirements include implementation of mitigation measures identified in the PA and the CHPMP and through ongoing consultation activities with the Tribes that will avoid, mitigate, or otherwise minimize adverse effects from the undertaking. Tables 6.2-2 and 6.2-3 summarize actions by PG&E to implement the applicable provisions under the PA and the CHPMP. Additionally, treatment measures are included in a Cultural and Historic Property Treatment Plan that was submitted to DTSC, BLM, and DOI shortly after the 90% design submittal, and will be adhered to. The Construction/Remedial Action Work Plan was prepared and submitted concurrently with the final design on November 18, 2015.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Item No.[1]	Category[1]	Citation[1,2]	Determination[1,2]	Description in DOI's ARARs Table[1,2]	Triggering Event	Compliance Responsibility	Which existing/ future document(s) will document continued compliance with this ARAR?[4]	Action (Compliance Status)			
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
44	Arizona Location-Specific	Historic Preservation - A.R.S. § 41-865	ARAR	This Act restricts any person from disturbing human remains or funerary objects on lands other than lands[2]owned or controlled by the State. These requirements will apply if the selected remedy involves excavation in Arizona.	Only if remedy in Arizona on private lands - Discovery of human remains/funerary objects	PG&E	PA	Requirements from the PA and the forthcoming CHPMP will be adhered to during implementation of the remedy.	Requirements from the PA and the CHPMP will be adhered to during implementation of the remedy.	Requirements in the PA and the CHPMP will be adhered to. These requirements include implementation of mitigation measures identified in the PA and the CHPMP and through ongoing consultation activities with the Tribes that will avoid, mitigate, or otherwise minimize adverse effects from the undertaking. Tables 6.2-2 and 6.2-3 summarize actions by PG&E to implement the applicable provisions under the PA and the CHPMP.	Requirements in the PA and the CHPMP will be adhered to. These requirements include implementation of mitigation measures identified in the PA and the CHPMP and through ongoing consultation activities with the Tribes that will avoid, mitigate, or otherwise minimize adverse effects from the undertaking. Tables 6.2-2 and 6.2-3 summarize actions by PG&E to implement the applicable provisions under the PA and the CHPMP. Additionally, treatment measures are included in a Cultural and Historic Property Treatment Plan that was submitted to DTSC, BLM, and DOI shortly after the 90% design submittal, and will be adhered to.
63	California Location-Specific	Seismic and Floodplain standards -Title 22, CCR, Div 4.5, Ch 14, Article 2, §66264.18	ARAR Relevant and Appropriate	These standards are relevant and appropriate for TSD facilities constructed, operated, or maintained within certain distances of fault lines, floodplains, or the maximum high tide.	Infrastructure in 100-year floodplain/ regulatory floodway	PG&E	Design submittals, Construction/ Remedial Action Work Plan	The groundwater remedial facilities are not a permitted RCRA treatment, storage or disposal facility. Seismic load design criteria and geotechnical design criteria are described in Appendix C. The 100-year floodplain is defined in the Flood Insurance Rate Map (FIRM), Panel 5705 of 9400 for San Bernardino County, California and Unincorporated Areas, Revised August 28, 2008. The base flood elevation shown on the current FIRM is 464 at River Mile (RM) 234 of the Colorado River. The effective Flood Insurance Study (FIS) for San Bernardino County lists a regulatory base flood elevation of 463.90. This design uses the more conservative elevation of 464 as the base flood elevation. Wells and pipelines are included in the preliminary (30%) design in areas of the Colorado River floodplain necessary for capture and treatment of the chromium plume. The infrastructure in this preliminary	The groundwater remedial facilities are not a permitted RCRA treatment, storage or disposal facility. Seismic load design criteria and geotechnical design criteria are described in Appendix C of the BOD report for the 60% design. The 100-year floodplain is defined in the FIRM, Panel 5705 of 9400 for San Bernardino County, California and Unincorporated Areas, Revised August 28, 2008. The base flood elevation shown on the current FIRM is 464 at RM 234 of the Colorado River. The effective FIS for San Bernardino County lists a regulatory base flood elevation of 463.90 feet. The vertical datum for all flood elevations shown on the San Bernardino County FIRM is NAVD88.This design uses the more conservative elevation of 464 feet as the base flood elevation.	The groundwater remedial facilities are not a permitted RCRA treatment, storage or disposal facility. Seismic load design criteria and geotechnical design criteria are described in Appendix C of the BOD report for the 90% design. The 100-year floodplain is defined in the FIRM, Panel 5705 of 9400 for San Bernardino County, California and Unincorporated Areas, Revised August 28, 2008. The base flood elevation shown on the current FIRM is 464 feet at RM 234 of the Colorado River. The effective FIS for San Bernardino County lists a regulatory base flood elevation of 463.90 feet. The vertical datum for all flood elevations shown on the San Bernardino County FIRM is NAVD88.This design uses the more conservative elevation of 464	The groundwater remedial facilities are not a permitted RCRA treatment, storage or disposal facility. Seismic load design criteria and geotechnical design criteria are described in Appendix C of the BOD report for the final design. The 100-year floodplain is defined in the FIRM, Panel 5705 of 9400 for San Bernardino County, California and Unincorporated Areas, Revised August 28, 2008. The base flood elevation shown on the current FIRM is 464 feet at RM 234 of the Colorado River. The effective FIS for San Bernardino County lists a regulatory base flood elevation of 463.90 feet. The vertical datum for all flood elevations shown on the San Bernardino County FIRM is NAVD88.This design uses the more conservative elevation of 464

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Item No.[1]	Category[1]	Citation[1,2]	Determination[1,2]	Description in DOI's ARARs Table[1,2]	Triggering Event	Compliance Responsibility	Which existing/ future document(s) will document continued compliance with this ARAR?[4]	Action (Compliance Status)			
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
								(30%) design (wells, pipes) is mostly outside the 100-year floodplain, see Sheet C-2, well FP-EX-5.	In this 60% design, certain infrastructure (piping) cannot be located outside of 100-year floodplain as defined by the above baseline flood elevation. PG&E will work with San Bernardino County and Mohave County Flood Administrator to ensure compliance with the county requirements for construction in the floodplain.	feet as the base flood elevation. In the 90% design, certain infrastructure (piping) cannot be located outside of the 100-year floodplain as defined by the above baseline flood elevation. PG&E has worked with the Mohave County Flood Administrator to ensure compliance with the county requirements for construction in the floodplain.	feet as the base flood elevation. In the final design, certain infrastructure (piping) cannot be located outside of the 100-year floodplain as defined by the above baseline flood elevation. PG&E has worked with the Mohave County Flood Administrator to ensure compliance with the county requirements for construction in the floodplain.

Notes:
[1] Source: Table 2 of the Groundwater Record of Decision, Pacific Gas and Electric Company Topock Compressor Station, Needles, San Bernardino County, California, December 2010 (DOI 2010).
[2] As corrected by the Department of the Interior.
[3] The "action" notation in Location-specific ARARs #5 and 7 refers to the DOI Record of Decision (DOI 2010), surnamed by the Bureaus (BLM, BOR, USFWS) and Bureau of Indian Affairs.
[4] The intent of this column is to identify what current or future document(s) are intended to satisfy this measure and be transparent on future forthcoming documentation. This column is not intended to document compliance with the ARARs.

TABLE 6.2-1A
Information for the Havasu National Wildlife Refuge's Appropriate Use Analysis and Compatibility Determination (AUA/CD)
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Items listed in DOI's October 23, 2008 letter *"PG&E Topock Compressor Station Remediation Site – Evaluation of Attainment of Fish and Wildlife Service Location-Specific ARARs for the Proposed Remedial Alternatives"*	**Action (Compliance Status)**	
	90%/Supplemental 90% Design	**Final (100%) Design**
What the proposed actions/facilities are – including specifics (such as how many wells, the spacing of wells, detailed sizes/lengths of facilities, etc.)	The 90% and Supplemental 90% design were submitted to DOI on September 8, 2014 and February 5, 2015, respectively. Section ES. 3 and Table ES-1 (Summary of Engineering Design Parameters and Key features) of the 90% BOD report provide an executive summary and high level description of the remedy features (wells, pipelines, supporting systems and utilities, structures/buildings, access roads, etc.) including references to specific report figures that show the locations of these features. Detailed descriptions of the remedy features are provided throughout the BOD report, specifically: • Section 3.2 describes the in-situ remediation system and its configuration including the IRZ wells, the River Bank Extraction Wells, the Inner Recirculation Loop wells, the TCS Recirculation Loop wells, the Freshwater Injection Wells, and the associated pipeline alignment. • Section 3.3 describes the freshwater source, the contingent arsenic treatment system, and freshwater piping conveyance including storage. • Section 3.4 describes the remedy-produced water management system. • Section 3.5 describes the utilities and other supporting facilities including power supply, SCADA, and structures/buildings to support the remedy. • Section 3.6 describes the monitoring network/wells. • Section 5 describes the ICs which are also required components of the remedy. Additional details were provided for select remedy components in the Supplemental 90% submittal.	The final design was submitted to DOI on November 18, 2015. Section ES. 3 and Table ES-1 (Summary of Engineering Design Parameters and Key Features) of this Final BOD report provide an executive summary and high level description of the remedy features (wells, pipelines, supporting systems and utilities, structures/buildings, access roads, etc.) including references to specific report figures that show the locations of these features. Detailed descriptions of the remedy features are provided throughout the BOD report, specifically: • Section 3.2 describes the in-situ remediation system and its configuration including the IRZ wells, the River Bank Extraction Wells, the Inner Recirculation Loop wells, the TCS Recirculation Loop wells, the Freshwater Injection Wells, and the associated pipeline alignment. • Section 3.3 describes the freshwater source, the contingent arsenic treatment system, and freshwater piping conveyance including storage. • Section 3.4 describes the remedy-produced water management system. • Section 3.5 describes the utilities and other supporting facilities including power supply, SCADA, and structures/buildings to support the remedy. • Section 3.6 describes the monitoring network/wells. • Section 5 describes the ICs which are also required components of the remedy.
Where the use would be conducted – including specific areas of use, habitat types and acres, key wildlife species that occur there, proportion of refuge or habitat type involved, and other areas affected incidental to use – provide in site maps	Section 2.4 (Other Site Conditions Affecting Design) of the 90% BOD report describes the baseline site conditions that affect remedy design. Among the documented conditions related to ecological resources at the site are surface water quality, USACE/CDFW jurisdictional waters and wetlands, vegetation communities, special status plants, and special status wildlife, avian, and aquatic species. Select maps were provided in Section 2.4 that overlays the remedy features on surveyed ecological resources.	Section 2.4 (Other Site Conditions Affecting Design) of this Final BOD report describes the baseline site conditions that affect remedy design. Among the documented conditions related to ecological resources at the site are surface water quality, USACE/CDFW jurisdictional waters and wetlands, vegetation communities, special status plants, and special status wildlife, avian, and aquatic species. Select maps were provided in Section 2.4 that overlay the remedy features on surveyed ecological resources.
When the use would be conducted—including time of day and year; duration of use; and a timeline of implementing, performing/ maintaining, and closing out the actions/facilities	An estimated project schedule is included in Exhibit 7.5-1 in Section 7.5. Exhibit 7.5-1 provides an estimated timeline for implementing the remedial action through remedy start-up and start of full remedy operations (anticipated June 2019). Consistent with the CMS/FS and Agencies Decision Documents (ROD, Statement of Basis), it is anticipated that this remedy could require 30 years of operations on refuge lands. Per the November 20, 2013 State Water Resources Control Board letter, monitoring on refuge land will be required in order to demonstrate that the water quality objective for arsenic in the receiving groundwater is met "within the earlier of (i) 20 years after achieving the remedial action objective for chromium or (ii) 20 years after ceasing injection of the water containing naturally occurring arsenic at concentrations above the water quality objective." After the remedial action is complete, the remedy facilities will be decommissioned.	An estimated project schedule is included in Exhibit 7.5-1 in Section 7.5. Exhibit 7.5-1 provides an estimated timeline for implementing the remedial action through remedy start-up and start of full remedy operations (anticipated June 2019). Consistent with the CMS/FS and Agencies Decision Documents (ROD, Statement of Basis), it is anticipated that this remedy could require 30 years of operations on refuge lands. Per the November 20, 2013 State Water Resources Control Board letter, monitoring on refuge land will be required in order to demonstrate that the water quality objective for arsenic in the receiving groundwater is met "within the earlier of (i) 20 years after achieving the remedial action objective for chromium or (ii) 20 years after ceasing injection of the water containing naturally occurring arsenic at concentrations above the water quality objective." After the remedial action is complete, the remedy facilities will be decommissioned.
How the use would be conducted—including techniques and equipment used, the number of people involved, routine operation and maintenance procedures	O&M procedures are described in Volume 1 of the Draft O&M Manual (Appendix L of the 90% BOD Report). Details related to construction of the remedy are included in the Construction/Remedial Action Work Plan, submitted concurrently with the 90% design.	O&M procedures are described in Volume 1 of the O&M Manual (Appendix L of this Final BOD Report). Details related to construction of the remedy are included in the Construction/Remedial Action Work Plan, submitted concurrently with the final design.

TABLE 6.2-1A
Information for the Havasu National Wildlife Refuge's Appropriate Use Analysis and Compatibility Determination (AUA/CD)
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Items listed in DOI's October 23, 2008 letter *"PG&E Topock Compressor Station Remediation Site – Evaluation of Attainment of Fish and Wildlife Service Location-Specific ARARs for the Proposed Remedial Alternatives"*	**Action (Compliance Status)**	
	90%/Supplemental 90% Design	**Final (100%) Design**
What would be the anticipated impacts—identifying and describing the impacts; citing available sources of information (plans, environmental assessments, narratives, research, state plans, field experience, consultation with others); distinguishing between long-term and short-term impacts; documenting direct, indirect, and cumulative impacts on refuge resources	Section 2.4 (Other Site Conditions Affecting Design) of the 90% BOD report describes the baseline site conditions that affect remedy design. Among the documented conditions related to ecological resources at the site are surface water and wetlands, vegetation communities, special status plants, and special status wildlife, avian, and aquatic species. PG&E, USFWS, and DOI coordinated on the Programmatic Biological Assessment (PBA) for the final groundwater remedy. The Final Groundwater Remedy PBA (CH2M HILL 2014k) was prepared to support informal consultations for actions to be conducted under the remedial action, including activities located on BLM and U.S. Fish and Wildlife Service administered lands. This ESA Section 7 consultation was concluded with receipt of USFWS's concurrence letter on July 7, 2014 which preceded the approval of the Construction/Remedial Action Work Plan. Measures outlined in the PBA and associated USFWS determination will be implemented before and during construction activities. Biological completion reports will be submitted to USFWS documenting areas of impacts and monitoring of construction activities. Impact analyses for proposed construction and operation activities are described in the Final Groundwater Remedy PBA (CH2M HILL 2014k) for the action area, and also in the Habitat Restoration Plans for the HNWR lands (CH2M HILL 2014n) and for Riparian Vegetation and Other Sensitive Habitats (CH2M HILL 2014o) (these plans are included as appendices to the Construction/Remedial Action Work Plan). Impacts analysis are also described in the EIR Section 4.3.3.3 and include: BIO-1 – Potential Fill of Wetlands and Other Waters of the U.S. or removal of Riparian Habitat; BIO-2 – Direct Disturbance of and Loss of Habitat for Special-Status Birds and Desert Tortoise; and BIO-3 – Fish Mortality, Interference with Spawning Habitat, and Other Adverse Effects. Of these, only BIO-1 and BIO-2 are related to the proposed activities. The certified EIR summarizes results from site-specific surveys that were conducted for Southwestern willow flycatcher, Mojave desert tortoise, Yuma clapper rail, and other avian species which were also identified during these surveys. Implementation of the EIR mitigation measures would reduce all of these impacts to a less-than-significant level. Subsequent studies have been conducted to document the type and extent of jurisdictional wetlands and waters of the U.S. (Wetland Delineation Report, Aug 2013); as well as the type and location of rare and protected plants (Floristic Survey Report, Aug 2013) and culturally significant plants (Ethnobotany Survey Report, Aug 2013). Additional surveys for lycium and arrowweed were conducted in response to comment #311 DOI-140. Potential impacts to sensitive resources during remedy implementation will be documented as required by the EIR. Additionally, applicable cultural resource mitigation measures included in the Programmatic Agreement (PA) (BLM 2010), Cultural and Historic Properties Management Plan (CHPMP), Cultural Impact Mitigation Program (CIMP), and the EIR Section 4.4 are being and will continue to be implemented to avoid, minimize, or mitigate adverse effects to cultural and historic properties on refuge land.	Section 2.4 (Other Site Conditions Affecting Design) of this Final BOD report describes the baseline site conditions that affect remedy design. Among the documented conditions related to ecological resources at the site are surface water and wetlands, vegetation communities, special status plants, and special status wildlife, avian, and aquatic species. PG&E, USFWS, and DOI coordinated on the Programmatic Biological Assessment (PBA) for the final groundwater remedy. The Final Groundwater Remedy PBA (CH2M HILL 2014k) was prepared to support informal consultations for actions to be conducted under the remedial action, including activities located on BLM and U.S. Fish and Wildlife Service administered lands. This ESA Section 7 consultation was concluded with receipt of USFWS's concurrence letter on July 7, 2014 which preceded the approval of the Construction/Remedial Action Work Plan. Measures outlined in the PBA and associated USFWS determination will be implemented before and during construction activities. Biological completion reports will be submitted to USFWS documenting areas of impacts and monitoring of construction activities. Impact analyses for proposed construction and operation activities are described in the Final Groundwater Remedy PBA (CH2M HILL 2014k) for the action area, and also in the Habitat Restoration Plans for the HNWR lands (CH2M HILL 2015g) and for Riparian Vegetation and Other Sensitive Habitats (CH2M HILL 2014o) (these plans are included as appendices to the Construction/Remedial Action Work Plan). Impacts analysis are also described in the EIR Section 4.3.3.3 and include: BIO-1 – Potential Fill of Wetlands and Other Waters of the U.S. or removal of Riparian Habitat; BIO-2 – Direct Disturbance of and Loss of Habitat for Special-Status Birds and Desert Tortoise; and BIO-3 – Fish Mortality, Interference with Spawning Habitat, and Other Adverse Effects. Of these, only BIO-1 and BIO-2 are related to the proposed activities. The certified EIR summarizes results from site-specific surveys that were conducted for southwestern willow flycatcher, Mojave desert tortoise, Yuma clapper rail, and other avian species which were also identified during these surveys. Implementation of the EIR mitigation measures would reduce all of these impacts to a less-than-significant level. Subsequent studies have been conducted to document the type and extent of jurisdictional wetlands and waters of the U.S. (Wetland Delineation Report, Aug 2013); as well as the type and location of rare and protected plants (Floristic Survey Report, Aug 2013) and culturally significant plants (Ethnobotany Survey Report, Aug 2013). Additional surveys for lycium and arrowweed were conducted in response to comment #311 DOI-140. Potential impacts to sensitive resources during remedy implementation will be documented as required by the EIR. Additionally, applicable cultural resource mitigation measures included in the Programmatic Agreement (PA) (BLM 2010), Cultural and Historic Properties Management Plan (CHPMP), Cultural Impact Mitigation Program (CIMP), and the EIR Section 4.4 are being and will continue to be implemented to avoid, minimize, or mitigate adverse effects to cultural and historic properties on refuge land.
What mitigation is planned for loss of functional value of refuge while use is in operation	The Construction/Remedial Action Work Plan includes a Habitat Restoration Plan in compliance with the CD, Appendix C (Scope of Work), Article 3. This plan has been prepared to provide information requested by the HNWR for its Appropriate Use Analysis and Compatibility Determination (AUA/CD) regarding planned mitigation for potential loss of functional value of refuge while use is in operation.	The Construction/Remedial Action Work Plan includes a Habitat Restoration Plan in compliance with the CD, Appendix C (Scope of Work), Article 3. This plan has been prepared to provide information requested by the HNWR for its Appropriate Use Analysis and Compatibility Determination (AUA/CD) regarding planned mitigation for potential loss of functional value of refuge while use is in operation.

TABLE 6.2-1A
Information for the Havasu National Wildlife Refuge's Appropriate Use Analysis and Compatibility Determination (AUA/CD)
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Items listed in DOI's October 23, 2008 letter *"PG&E Topock Compressor Station Remediation Site – Evaluation of Attainment of Fish and Wildlife Service Location-Specific ARARs for the Proposed Remedial Alternatives"*	**Action (Compliance Status)**	
	90%/Supplemental 90% Design	**Final (100%) Design**
How and when the actions/facilities would be closed out—including restoration plans	In addition to the Habitat Restoration Plan described above, a Plan for Decommissioning of Remedy Facilities and Restoration will include procedures for the removal and decommissioning of the groundwater remedy. The Plan will also incorporate planning/approaches for post-remedy restoration (including, but not limited to, a series of photo points). This future Plan will be submitted to DOI within 120 days of DOI's certification of completion of the remedial action and a determination by DOI that removal of such facilities is protective of human health and the environment. In addition to the plans mentioned above, three other restoration plans also pertain to HNWR lands including the Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (CH2M HILL 2014o), the Aesthetics and Visual Resources Protection and Revegetation Plan (CH2M HILL 2014l), and the Mitigation and Monitoring Plan for Culturally Significant Plants (CH2M HILL 2014p).	In addition to the Habitat Restoration Plan described above, a Plan for Decommissioning of Remedy Facilities and Restoration will include procedures for the removal and decommissioning of the groundwater remedy. The Plan will also incorporate planning/approaches for post-remedy restoration (including, but not limited to, a series of photo points). This future Plan will be submitted to DOI within 120 days of DOI's certification of completion of the remedial action and a determination by DOI that removal of such facilities is protective of human health and the environment. In addition to the plans mentioned above, three other restoration plans also pertain to HNWR lands including the Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (CH2M HILL 2014o), the Aesthetics and Visual Resources Protection and Revegetation Plan (CH2M HILL 2014l), and the Mitigation and Monitoring Plan for Culturally Significant Plants (CH2M HILL 2014p). Further, Section ES.6 of this Final BOD (Executive Summary) describes the decommissioning process envisioned for the proposed remedy even though it is understood that the detailed decommissioning plan will be prepared much later in the remedial process. In compliance with the Agencies' April 4, 2014 directive letter (DTSC and DOI 2014), PG&E has and will continue to reiterate its commitment to remove all underground utilities and infrastructures to the extent practicable at the time of remedy decommissioning. Section ES.6 includes a conceptual list of remedy components that PG&E believes cannot or should not be removed at the end of the remedy (note that this list is based on current information and may be subject to change): • Freshwater pipeline (and casing) under I-40; • Piping/conduits located in (e.g., direct buried or in trenches) or under (e.g., jack and bore) paved, public roadways; and • Subsurface infrastructure that property owner(s) or land manager(s) request not to be removed, and such request is approved by DTSC and DOI. In addition, as directed by DTSC and DOI in the final design directives (DTSC and DOI 2015), PG&E will work with the landowners to incorporate their preference at the time of decommissioning for removal of infrastructures or abandonment in place. It is noted that the Agencies' preference is to remove infrastructure.
What contingency plans will be in place—identifying actions that will be taken should an accident, unintended discharge, etc. occur.	Contingency Plans are described in Volume 3 of the O&M Manual of the 90% BOD report. Additional details on Contingency Plans for the Remedy Construction are included in the Construction/Remedial Action Work Plan.	Contingency Plans are described in Volume 3 of the O&M Manual of this Final BOD report. Additional details on Contingency Plans for the Remedy Construction are included in the Construction/Remedial Action Work Plan.

Summary of Compliance with Applicable PA Stipulations, CHPMP
(On CD-ROM only)

TABLE 6.2-2
Summary of Compliance with Applicable Programmatic Agreement (PA) Stipulations
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in PA Document	Relevant Excerpt from Document	Triggering Event	Action (Compliance Status)		
				Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
1	Stipulation I(A)	The Federal Agencies, in consultation with the Tribes, SHPOs, ACHP, PG&E, and other interested parties, agree to select and implement, or cause to be implemented, an alternative or combination of alternatives to remediate the groundwater and soil contamination in a manner that fulfills the requirements of CERCLA and the CERCLA Records of Decision (RODs) and protects the Colorado River, human populations, and the natural environment to the maximum extent practicable.	Implementation of Selected Groundwater Remedy	PG&E is implementing the groundwater remedy selected by DOI and DTSC.	PG&E is implementing the groundwater remedy selected by DOI and DTSC.	PG&E is implementing the groundwater remedy selected by DOI and DTSC.
2	Stipulation I(B)	The Federal Agencies, in consultation with the Tribes, SHPOs, ACHP, PG&E, and other interested parties, agree to Subject to I(A) above, carry out, and require others under their jurisdiction to carry out, all investigative, testing and remediation activities, including all supporting operations and maintenance activities, in ways that avoid, minimize, or mitigate adverse effects to cultural and historic properties within the APE, to the maximum extent practicable.	Implementation of Selected Groundwater Remedy	PG&E remediation resources specialist (Glenn Caruso) participated in field reviews of planned remedial facilities with the design team on April 23-24 and June 20, 2012. The purpose of these field reviews along with the ongoing in office reviews is to ensure that the footprints of planned facilities are designed in ways to avoid, minimize, or mitigate impacts on historical and archaeological resources to the maximum extent feasible.	PG&E Cultural Resources Expert (Glenn Caruso) participated in field reviews of planned remedial facilities with the design team on April 7-10, 2014. The purpose of these field reviews along with the ongoing in office reviews is to ensure that the footprints of planned facilities are designed in ways to avoid, minimize, or mitigate impacts on historical and archaeological resources to the maximum extent feasible.	PG&E Cultural Resources Expert Glenn Caruso participated in field review of planned remedial facilities and temporary construction footprints at Moabi Regional Park in late 2014 and early 2015. Glenn Caruso also led in-office review of planned facilities and temporary construction-related footprints in September 2015. The purpose of the field review along with in-office reviews is to ensure that project footprints are designed in ways to avoid and minimize impacts on historical and archaeological resources to the maximum extent feasible.
3	Stipulation I(C)	The BLM, USFWS, USBR and PG&E shall consult with the Tribes that attach cultural significance to the TCP within the APE to develop a plan to ensure Tribal access to areas within the APE for religious, cultural, or spiritual purposes. Access shall be consistent with applicable laws, regulations and agreements governing property within the APE and may not impede the Topock Remediation Project, may not create health and safety concerns, and shall exclude the Topock Compressor Station and related facilities.	Development of Access Plan (Tribal Access)	The Tribal Access Plan for lands under federal management was completed on November 26, 2011. PG&E has initiated work on an Access Plan for the lands not under federal management, taking into consideration the information in the BLM Access Plan, for submittal with the final design (target 2013).	The Tribal Access Plan for lands under federal management was completed on November 26, 2011. PG&E has prepared an Access Plan in coordination with Tribes, for the lands not under federal management, taking into consideration the information in the BLM Access Plan. The Access Plan is included in an appendix of the Construction/Remedial Action Work Plan and submitted on September 8, 2014.	The Tribal Access Plan for lands under federal management was completed on November 26, 2011. PG&E has prepared an Access Plan in coordination with Tribes, for the lands not under federal management, taking into consideration the information in the BLM Access Plan. The Access Plan is included in an appendix of the Construction/Remedial Action Work Plan and submitted on November 18, 2015.
4	Stipulation I(D)	The Federal Agencies, in consultation with the Tribes, SHPOs, ACHP, PG&E, and other interested parties, agree to ensure that PG&E shall to the extent practicable restore the areas affected by the Topock Remediation Project within the APE, including, but not limited to, the site of the existing treatment plant and related facilities but excluding the Topock Compressor Station and related facilities, to the conditions existing prior to the construction of the PG&E investigation and remediation related appurtenances and facilities.	Planning for Restoration	The plan for the decommissioning and removal of the IM-3 Facility and Site Restoration will be included as an appendix to the CIMP, which will be submitted with the 90% Design.	The plan for the decommissioning and removal of the IM-3 Facility and Site Restoration was prepared and submitted as Appendix B of the CIMP and also as an appendix of the Construction/Remedial Action Work Plan. Section 8 of the Plan includes restoration guidelines (steps to be followed during restoration), elements of the restoration of habitat and revegetation and demobilization, and a draft annotated outline of a future more detailed, site specific IM-3 Restoration Plan. In coordination with the FMIT and other Tribes, PG&E has developed a schedule for developing the more detailed Restoration Plan. PG&E anticipates that some details of the restoration plan, in particular the amount of earthwork and earth movement involved in the restoration, will be deferred to the completion of decommissioning, so that PG&E and the Tribes can evaluate which approach may minimize further disturbance (and may minimize the amount of earth movement) while achieving the required restoration.	The plan for the decommissioning and removal of the IM-3 Facility and Site Restoration was prepared and submitted as Appendix B of the CIMP and also as an appendix of the Construction/Remedial Action Work Plan. Section 8 of the Plan includes restoration guidelines (steps to be followed during restoration), elements of the restoration of habitat and revegetation and demobilization, and a draft annotated outline of a future more detailed, site specific IM-3 Restoration Plan. In coordination with the FMIT and other Tribes, PG&E has developed a schedule for developing the more detailed Restoration Plan. PG&E anticipates that some details of the restoration plan, in particular the amount of earthwork and earth movement involved in the restoration, will be deferred to the completion of decommissioning, so that PG&E and the Tribes can evaluate which approach may minimize further disturbance (and may minimize the amount of earth movement) while achieving the required restoration.

TABLE 6.2-2
Summary of Compliance with Applicable Programmatic Agreement (PA) Stipulations
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in PA Document	Relevant Excerpt from Document	Triggering Event	Action (Compliance Status)		
				Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
4	Stipulation I(E)	The Federal Agencies, in consultation with the Tribes, SHPOs, ACHP, PG&E, and other interested parties, agree to consult with other Signatories, Tribes and Invited Signatories, following the guidelines in Appendix B of this PA, regarding actions proposed in this Undertaking, including establishment of any rights of way, time critical or emergency actions.	Groundwater Remedy Design and Implementation	BLM has consulted and is continuing to consult with the Tribes regarding the design under the PA's Consultation Protocol.	BLM has consulted and is continuing to consult with the Tribes regarding the design under the PA's Consultation Protocol.	BLM has consulted and is continuing to consult with the Tribes regarding the design under the PA's Consultation Protocol.
5	Stipulation II(B)	At each phase (work plan or design document) of implementation of the Undertaking, an evaluation will occur to determine if the APE should be amended. This evaluation will coincide with the development of the work plan or design document for the specific phase of the Undertaking. Where alternatives under consideration consist of corridors or large land areas, or where access to properties is restricted, the agency official may use a phased process to conduct identification and evaluation efforts (36 CFR §800.4(b)(2)). Prior to implementation of each phase (work plan or design document) of the Undertaking, BLM will determine, in consultation with the AZ SHPO, CA SHPO, Tribes, and PG&E, what, if any, changes are required in the APE. If BLM determines that the APE must be revised, BLM will redefine the APE taking the input from those parties into account. Should such revision to the APE be needed, BLM will amend the CHPMP to include any changes to the APE.	Groundwater Remedy Design and Implementation	BLM has consulted and is continuing to consult with the Tribes regarding the design under the PA's Consultation Protocol, including on the APE.	BLM has consulted and is continuing to consult with the Tribes regarding the design under the PA's Consultation Protocol, including on the APE.	BLM has consulted and is continuing to consult with the Tribes regarding the design under the PA's Consultation Protocol, including on the APE.
6	Stipulation III(B)(1), III(B)(2)(a) - Remediation of GW contamination	Should Alt E be selected, the Federal Agencies will ensure that, consistent with the general principals in Stipulation I, existing monitoring wells and related facilities shall be used to the maximum extent practicable.	Implementation of Selected Groundwater Remedy	In the intermediate (60%) design, all existing monitoring wells have been incorporated into the monitoring well network for the remedy, thereby reducing the need for drilling new monitoring wells.	In the pre-final (90%) design, existing monitoring wells have been incorporated into the monitoring well network for the remedy, thereby reducing the need for drilling new monitoring wells.	In the final design, existing monitoring wells have been incorporated into the monitoring well network for the remedy, thereby reducing the need for drilling new monitoring wells.
7	Stipulation III(B)(2)(b) - Remediation of GW contamination	Should Alt E be selected, the Federal Agencies will ensure that, consistent with the general principals in Stipulation I, the need for and placement of any new facilities or activities will be determined in consultation with the Tribes and the Consulting Parties following the guidelines in Appendix B.	Implementation of Selected Groundwater Remedy	The 60% design presented planned facilities and activities for the implementation of the groundwater remedy. BLM has consulted and is continuing to consult with the Tribes regarding the design under the PA's Consultation Protocol.	The 90% design presents planned facilities and activities for the implementation of the groundwater remedy. The Construction/Remedial Action Work Plan includes procedures and protocols to be implemented and contingencies during remedy construction and start-up. The O&M Manual includes procedures for implementation and contingencies during operation and maintenance of the remedy. BLM has consulted and is continuing to consult with the Tribes regarding the design under the PA's Consultation Protocol, and will consult the Tribes on the Construction/Remedial Action Work Plan and O&M Manual.	The final design presents planned facilities and activities for the implementation of the groundwater remedy. The Construction/ Remedial Action Work Plan includes procedures and protocols to be implemented and contingencies during remedy construction and start-up. The O&M Manual includes procedures for implementation and contingencies during operation and maintenance of the remedy. BLM has consulted and is continuing to consult with the Tribes regarding the design and the Construction/Remedial Action Work Plan as well as the O&M Manual under the PA's Consultation Protocol.

TABLE 6.2-2
Summary of Compliance with Applicable Programmatic Agreement (PA) Stipulations
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in PA Document	Relevant Excerpt from Document	Triggering Event	Action (Compliance Status)		
				Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
8	Stipulation III(B)(2)(c) - Remediation of GW contamination	Should Alt E be selected, the Federal Agencies will ensure that, consistent with the general principals in Stipulation I, that new facilities or activities be placed in areas already disturbed by previous grading or other mechanized activities to the maximum extent practicable, consistent with protecting human health and the environment and achieving cleanup in a timely manner.	Implementation of Selected Groundwater Remedy	The design has been and is carried out in a manner that gives: (1) priority to previously disturbed areas for the placement of new physical improvements; and (2) priority to re-use of existing physical improvements, such as but not limited to wells and pipelines, but not including IM-3 facilities. A disturbed area map was prepared in compliance with an EIR mitigation measure (CUL-1a-9), to facilitate placement of infrastructure; a current version of the map is included in Appendix A2 of the 60% Basis of Design (BOD) Report. In addition, in compliance with the directive to give priority to re-use of existing physical improvements and to previously disturbed areas for new physical improvements, the intermediate (60%) design proposes the following: • All existing monitoring wells have been incorporated into the monitoring well network for the remedy, thereby reducing the need for drilling new monitoring wells. • The freshwater supply for the remedy will be the existing HNWR-1 well. • The freshwater supply storage will be the existing water storage tanks at the Compressor Station. • The remedy-produced water treatment plant and freshwater pre-injection treatment system will be located entirely within the footprint of Compressor Station. • The central maintenance facility for the remedy will be located entirely on PG&E property, at the Transwestern Bench. By centralizing maintenance functions into one location, this reduces the footprint of remedy structure outside of PG&E property.	The design has been and is carried out in a manner that gives: (1) priority to previously disturbed areas for the placement of new physical improvements; and (2) priority to re-use of existing physical improvements, such as but not limited to wells and pipelines, but not including IM-3 facilities. A disturbed area map was prepared in compliance with an EIR mitigation measure (CUL-1a-9), to facilitate placement of infrastructure; an updated version of the map is included in Appendix A2 of the 90% Basis of Design (BOD) Report. In addition, in compliance with the directive to give priority to re-use of existing physical improvements and to previously disturbed areas for new physical improvements, the pre-final (90%) design proposes the following: • All existing monitoring wells have been incorporated into the monitoring well network for the remedy, thereby reducing the need for drilling new monitoring wells. • The piping corridor is located almost entirely in existing roadways, right of ways and previously disturbed areas. • Most of the existing access roads have been incorporated into the 90% design. • The remedy-produced water conditioning plant and the contingent systems (arsenic treatment and dissolved metals removal) are located entirely within the footprint of the Compressor Station. • The operation building and carbon storage/amendment facilities are located on the existing Transwestern Bench and MW-20 Bench. • All of the proposed soil storage and construction staging areas are located on previously disturbed areas. • The main construction headquarters and staging area is located on previously disturbed areas at Moabi Regional Park.	The design has been and is carried out in a manner that gives: (1) priority to previously disturbed areas for the placement of new physical improvements; and (2) priority to re-use of existing physical improvements, such as but not limited to wells and pipelines, but not including IM-3 facilities (with the exception of certain IM-3 facilities located at the MW-20 bench, which are being reused for the final remedy). A disturbed area map was prepared in compliance with an EIR mitigation measure (CUL-1a-9), to facilitate placement of infrastructure; an updated version of the map is included in Appendix A2 of this Final BOD Report. In addition, in compliance with the directive to give priority to re-use of existing physical improvements and to previously disturbed areas for new physical improvements, the final design proposes the following: • All existing monitoring wells have been incorporated into the monitoring well network for the remedy, thereby reducing the need for drilling new monitoring wells. • The piping corridor is located almost entirely in existing roadways, right of ways and previously disturbed areas. • Most of the existing access roads have been incorporated into the final design. • The remedy-produced water conditioning plant and the contingent systems (arsenic treatment and dissolved metals removal) are located entirely within the footprint of the Compressor Station. • The operation building is located on the existing Transwestern Bench. • The combined carbon storage/amendment facilities are located on the existing MW-20 Bench. • All of the proposed soil processing and construction staging areas are located on previously disturbed areas. • The main construction headquarters and staging area is located on previously disturbed areas at Moabi Regional Park.

TABLE 6.2-2
Summary of Compliance with Applicable Programmatic Agreement (PA) Stipulations
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in PA Document	Relevant Excerpt from Document	Triggering Event	Action (Compliance Status)		
				Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
9	Stipulation III(B)(2)(e) - Remediation of GW contamination	Should Alt E be selected, the Federal Agencies will ensure that, consistent with the general principals in Stipulation I, the performance of all field activities in support of the remedy shall be executed in such a way as to avoid and/or minimize adverse effects to cultural and historic properties to the maximum extent practicable.	Implementation of Field Activities in Support of the Groundwater Remedy	The planning of field activities is executed under the guidance of PG&E's remediation resources specialist (Glenn Caruso). The implementation of field activities is performed in accordance with approved work plans and under the monitoring of Archaeological Monitor(s). Tribal Monitors are invited to observe ground-disturbing field activities.	The planning of field activities is executed under the guidance of PG&E's Cultural Resources Expert (Glenn Caruso). The implementation of field activities is performed in accordance with approved work plans and under the monitoring of Archaeological Monitor(s). Tribal Monitors are invited to observe ground-disturbing field activities.	The planning of field activities is executed under the guidance of PG&E's Cultural Resources Expert (Glenn Caruso). The implementation of field activities is performed in accordance with approved work plans and under the monitoring of Archaeological Monitor(s). Tribal Monitors are invited to observe ground-disturbing field activities.
10	Stipulation III(B)(2)(f) - Remediation of GW contamination	Should Alt E be selected, the Federal Agencies will ensure that, consistent with the general principals in Stipulation I, subject to Stipulation I(A), direct, indirect and cumulative adverse effects shall be considered and mitigated.	Implementation of Selected Groundwater Remedy	Adverse effects are being considered and mitigated through the implementation of the measures included in the PA, the CHPMP and the EIR.	Adverse effects are being considered and mitigated through the implementation of the measures included in the PA, the CHPMP and the EIR.	Adverse effects are being considered and mitigated through the implementation of the measures included in the PA, the CHPMP, the Cultural and Historic Property Treatment Plan and the EIR.
11	Stipulation III(B)(3)(a) - Remediation of GW contamination – Final Design	Consultation between the Signatories, Tribes and Invited Signatories shall be initiated prior to final design and implementation of that alternative.	Design and Implementation of Selected Groundwater Remedy	BLM has consulted and is continuing to consult with the Tribes regarding the design under the PA's Consultation Protocol.	BLM has consulted and is continuing to consult with the Tribes regarding the design under the PA's Consultation Protocol.	BLM has consulted and is continuing to consult with the Tribes regarding the design and implementation under the PA's Consultation Protocol.
12	Stipulation III(B)(3)(b) - Remediation of GW contamination – Final Design	Every effort should be made to avoid and minimize adverse effects in accordance with the general principles set forth in Stipulation I.	Implementation of Selected Groundwater Remedy	PG&E remediation resources specialist (Glenn Caruso) participated in field reviews of planned remedial facilities with the design team on April 23-24 and June 20, 2012. The purpose of these field reviews along with the ongoing in office reviews is to ensure that the footprints of planned facilities are designed in ways to avoid, minimize, or mitigate impacts on historical and archaeological resources to the maximum extent feasible.	PG&E Cultural Resources Expert (Glenn Caruso) participated in field reviews of planned remedial facilities with the design team on April 7-10, 2014. The purpose of these field reviews along with the ongoing in office reviews is to ensure that the footprints of planned facilities are designed in ways to avoid, minimize, or mitigate impacts on historical and archaeological resources to the maximum extent feasible.	PG&E Cultural Resources Expert Glenn Caruso participated in field review of planned remedial facilities and temporary construction footprints at Moabi Regional Park in late 2014 and early 2015. Glenn Caruso also led in-office review of planned facilities and temporary construction-related footprints in September 2015. The purpose of the field review along with in-office reviews is to ensure that project footprints are designed in ways to avoid and minimize impacts on historical and archaeological resources to the maximum extent feasible.
13	Stipulation III(B)(3)(c) - Remediation of GW contamination	Whatever the selected alternative, the Federal Agencies will consult with all Signatories, Tribes, and Invited Signatories during the design, implementation, and monitoring activities to determine how best to restore the areas affected by the Topock Remediation Project. These areas will include, but not be limited to, the site of the existing treatment plant and related facilities but will exclude the Topock Compressor Station and related facilities. The Federal Agencies will ensure that environmental restoration to the conditions existing prior to the construction of the Project, is planned and conducted to the extent practicable.	Implementation of Selected Groundwater Remedy	The plan for the decommissioning and removal of the IM-3 Facility and Site Restoration will be included as an appendix to the CIMP, which will be submitted with the 90% Design. Additionally, a Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning, and BLM will consult the Tribes on this Plan.	The plan for the decommissioning and removal of the IM-3 Facility and Site Restoration was prepared and submitted in Appendix B of the CIMP and also as an appendix of the Construction/Remedial Action Work Plan. A site-specific Plan for Decommissioning and Restoration of remedy facilities will be submitted in the future (within 120 days of DOI's certification of remedial action completion and a determination by DOI that removal of such facilities is protective of human health and the environment), prior to decommissioning, and BLM will consult the Tribes on this Plan.	The plan for the decommissioning and removal of the IM-3 Facility and Site Restoration was prepared and submitted in Appendix B of the CIMP and also as an appendix of the Construction/Remedial Action Work Plan. A site-specific Plan for Decommissioning and Restoration of remedy facilities will be submitted in the future (within 120 days of DOI's certification of remedial action completion and a determination by DOI that removal of such facilities is protective of human health and the environment), prior to decommissioning, and BLM will consult the Tribes on this Plan.

TABLE 6.2-2
Summary of Compliance with Applicable Programmatic Agreement (PA) Stipulations
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

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				Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
14	Stipulation V(A)	All facilities and appurtenances related to the Topock Remediation Project are to be removed as soon as practicable upon attainment of cleanup standards and a determination by DOI that removal of such facilities is protective of human health and the environment. All such removal will be planned in consultation with the Signatories, Tribes, and Invited Signatories, following the guidelines in Appendix B [Consultation Protocol).	Planning for decommissioning	This stipulation will be adhered to in planning for the decommissioning of remedy facilities. Additionally, a Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning, and BLM will consult the Tribes on this Plan.	This stipulation will be adhered to in planning for the decommissioning of remedy facilities. A site-specific Plan for Decommissioning and Restoration of remedy facilities will be submitted in the future (within 120 days of DOI's certification of remedial action completion and a determination by DOI that removal of such facilities is protective of human health and the environment), prior to decommissioning, and BLM will consult the Tribes on this Plan.	This stipulation will be adhered to in planning for the decommissioning of remedy facilities. Section ES.6 of this Final BOD (Executive Summary) describes the decommissioning process envisioned for the proposed remedy even though it is understood that the detailed decommissioning plan will be prepared much later in the remedial process. In compliance with the Agencies' April 4, 2014 directive letter (DTSC and DOI 2014), PG&E has and will continue to reiterate its commitment to remove all underground utilities and infrastructures to the extent practicable at the time of remedy decommissioning. Section ES.6 includes a conceptual list of remedy components that PG&E believes cannot or should not be removed at the end of the remedy (note that this list is based on current information and may be subject to change): • Freshwater pipeline (and casing) under I-40; • Piping/conduits located in (e.g., direct buried or in trenches) or under (e.g., jack and bore) paved, public roadways; and • Subsurface infrastructure that property owner(s) or land manager(s) request not to be removed, and such request is approved by DTSC and DOI. Further, in compliance with the Agencies' November 19, 2015 final directives (DTSC and DOI 2015), PG&E will work with the landowners to incorporate their preference at the time of decommissioning for removal of infrastructures or abandonment in place. It is noted that the Agencies' preference is to remove infrastructure. The site-specific Plan for Decommissioning and Restoration of remedy facilities will be submitted in the future (within 120 days of DOI's certification of remedial action completion and a determination by DOI that removal of such facilities is protective of human health and the environment), prior to decommissioning, and BLM will consult the Tribes on this Plan.
15	Stipulation V(B)	The removal of such facilities shall be monitored following the monitoring guidelines in Appendix C.	Planning for decommissioning	This stipulation will be adhered to in planning for the decommissioning of remedy facilities.	This stipulation will be adhered to in planning for the decommissioning of remedy facilities.	This stipulation will be adhered to in planning for the decommissioning of remedy facilities.
16	Stipulation V(C)	The removal of such facilities shall take place along existing graded roads to the maximum extent practicable.	Planning for decommissioning	This stipulation will be adhered to in planning for the decommissioning of remedy facilities.	This stipulation will be adhered to in planning for the decommissioning of remedy facilities.	This stipulation will be adhered to in planning for the decommissioning of remedy facilities.

TABLE 6.2-2
Summary of Compliance with Applicable Programmatic Agreement (PA) Stipulations
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in PA Document	Relevant Excerpt from Document	Triggering Event	Action (Compliance Status)		
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17	Stipulation V(D)	Prior to decommissioning of any remediation facility, the Federal Agencies will consult with all Signatories, Tribes, and Invited Signatories during the development of the closure plan to determine how to best restore the areas affected by the Topock Remediation Project, including but not limited to, the site of the existing treatment plant and related facilities, but excluding the Topock Compressor Station and related facilities, to ensure that environmental restoration of conditions existing prior to the construction of the Project, is achieved to the extent practicable.	Planning for decommissioning	This stipulation will be adhered to in planning for the decommissioning of remedy facilities. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning, and BLM will consult the Tribes on this Plan.	This stipulation will be adhered to in planning for the decommissioning of remedy facilities. A site-specific Plan for Decommissioning and Restoration of remedy facilities will be submitted in the future (within 120 days of DOI's certification of remedial action completion and a determination by DOI that removal of such facilities is protective of human health and the environment), prior to decommissioning, and BLM will consult the Tribes on this Plan.	This stipulation will be adhered to in planning for the decommissioning of remedy facilities. A site-specific Plan for Decommissioning and Restoration of remedy facilities will be submitted in the future (within 120 days of DOI's certification of remedial action completion and a determination by DOI that removal of such facilities is protective of human health and the environment), prior to decommissioning, and BLM will consult the Tribes on this Plan.
18	Stipulation V(E)	PG&E will draft a plan for decommissioning, removal and restoration of the IM-3 facility prior to implementation of the groundwater remedy, in consultation with all Signatories, Tribes and Invited Signatories.	Groundwater Remedy Design	This stipulation will be adhered to during design. The plan for the decommissioning and removal of the IM-3 Facility and Site Restoration will be included as an appendix to the CIMP, which will be submitted with the 90% Design. The Plan will be drafted in consultation with all Signatories, Tribes and Invited Signatories.	PG&E has developed the plan for the decommissioning and removal of the IM-3 Facility and Site Restoration, in consultation with the Tribes. The Plan was submitted in Appendix B of the CIMP and also as an appendix of the Construction/Remedial Action Work Plan.	PG&E has developed the plan for the decommissioning and removal of the IM-3 Facility and Site Restoration, in consultation with the Tribes. The Plan was submitted in Appendix B of the CIMP and also as an appendix of the Construction/Remedial Action Work Plan.
19	Stipulation IX(A)-(D)	A. If the Undertaking affects a previously unidentified cultural and/or historic resource, including human remains and/or associated funerary objects or graves, or affect such resources in a way not previously anticipated, or have greater adverse effect than previously anticipated, all work in the vicinity of the discovery shall cease. No further action will be taken until the BLM, in consultation with Tribal and Archaeological Monitors and PG&E in the field, has determined the nature of the discovery and delineated an area not to exceed 50 meters from the approximate center point of the discovery (or a smaller or larger areas if warranted by specific circumstances) in which no further work is to take place until treatment of the discovery is resolved. At such point BLM will notify all Signatories, Tribes, and Invited Signatories of the nature and general location of the discovery. The BLM will implement appropriate measures, including stabilization or covering, to protect any discovery (human remains, funerary objects, sacred objects, or objects of cultural patrimony) from further disturbance in accordance with the principles set forth in Stipulation I. Ongoing work not within 50 meters (or a smaller area if determined appropriate by parties in the field) of the discovery may continue. If human remains and/or associated funerary objects compose all or part of the discovery, then BLM shall ensure the stipulations of the POA included in the CHPMP, as described in Stipulation VII (H) hereof, will be completed. Also, if human remains and/or funerary objects are encountered, all activities shall follow the procedures	Field Implementation of Selected Groundwater Remedy	This stipulation will be adhered to during the field implementation of the Construction/Remedial Action Plan. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project. Applied Earthworks, a professional cultural resources consulting firm, was retained by PG&E with DTSC approval. Applied Earthworks will observe ground-disturbing activities and will have the authority to temporarily divert or halt any activities in the event that previously unidentified potentially significant cultural resources are discovered.	This stipulation will be adhered to during the field implementation of the Construction/Remedial Action Plan and during the operation and maintenance of the remedy. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project. Applied Earthworks, a professional cultural resources consulting firm, was retained by PG&E with DTSC approval. Applied Earthworks will observe ground-disturbing activities and will have the authority to temporarily divert or halt any activities in the event that previously unidentified potentially significant cultural resources are discovered.	This stipulation will be adhered to during the field implementation of the Construction/ Remedial Action Plan and during the operation and maintenance of the remedy. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project. Applied Earthworks, a professional cultural resources consulting firm, was retained by PG&E with DTSC approval. Applied Earthworks will observe ground-disturbing activities and will have the authority to temporarily divert or halt any activities in the event that previously unidentified potentially significant cultural resources are discovered.

TABLE 6.2-2
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		and direction provided in NAGPRA and California Public Resources Code sections 5097.98 and 5097.991. For Arizona, such activities shall follow the procedures and direction provided in NAGPRA and applicable state laws, including the Arizona Antiquities Act of 1927 (ARS § 41-841 to 41-846), Burial Protection Law of 1990 (ARS §41-865), and ARS §41-844 of 1990.				
20	Stipulation IX(A)-(D) (continued)	B. If the Tribes, PG&E, and BLM can resolve treatment of the discovery in a manner that does not cause adverse effects to significant cultural and historic properties, BLM shall document the resolution, the activities within the work area may proceed and the AZ SHPO and the CA SHPO shall be notified of the discovery and resolution. The Tribes, PG&E, and BLM will use their best efforts to resolve treatment as quickly as possible. C. If there is failure to resolve treatment of the discovery in consultation with the Tribes and PG&E, BLM shall then consult with the AZ SHPO or the CA SHPO to develop a treatment plan that takes into account the effects of the Undertaking on the discovery. Within fifteen (15) days of notification of discovery, BLM shall provide the consulted SHPO(s), via email, a recommendation for resolving the discovery situation that takes into account the potential effects of the Undertaking on the discovery. D. If the CA SHPO or AZ SHPO (as appropriate, depending on the location of the discovery) does not object to BLM's recommendation(s) within fifteen (15) days, BLM will implement the recommendation(s). If the consulted SHPO objects to the recommendation, BLM will utilize the dispute resolution process in Stipulation XV of this PA to resolve any objection.	Field Implementation of Selected Groundwater Remedy	This stipulation will be adhered to during the field implementation of the selected groundwater remedy.	This stipulation will be adhered to during the field implementation of the selected groundwater remedy.	This stipulation will be adhered to during the field implementation of the selected groundwater remedy.

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Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in PA Document	Relevant Excerpt from Document	Triggering Event	Action (Compliance Status)		
				Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
21	Appendix C Monitoring Protocol	Cultural sensitivity training will be required of all staff, workers and contractors engaged in activities in the Topock Remediation Project APE to familiarize them with the sacred nature of the areas so that they will perform their job in a respectful manner. This training will also be given to new personnel before they are allowed to do fieldwork within the APE. This training will be conducted by PG&E with participation by Tribes and Tribal Monitors, Archaeological Monitors, Federal Agency staff, and PG&E supervising staff, as appropriate. Consistent with PG&E's stated policy, PG&E will not tolerate any disrespectful behavior in the field and will remove any staff, workers or contractors who do not comply with this section.	Implementation of Selected Groundwater Remedy	Site orientation and the training on cultural/historical resources sensitivity will be provided at the project initiation meeting, to be held at the Topock Compressor Station. Site orientation will stress that all site activities will be conducted in a respectful manner. Sensitivity training will be provided by PG&E Site Operations Manager, PG&E Remediation Resources Specialist, and PG&E will invite participation from the Tribes, archaeological monitors, and agency staff, as appropriate. In addition, PG&E and Tribes are collaborating on a similar measure under the CIMP, and to produce a training/education manual to educate workers. This CIMP measure was discussed with interested Tribes at the monthly meeting on April 26, 2012, August 23, 2012 and September 19, 2012.	Site orientation and the training on cultural/ historical resources sensitivity will be provided at the project initiation meeting, to be held at the Topock Compressor Station. Site orientation will stress that all site activities will be conducted in a respectful manner. Sensitivity training will be provided by PG&E's Site Operations Manager, and PG&E Cultural Resources Expert. PG&E will invite participation from the Tribes, archaeological monitors, and agency staff, as appropriate.	Site orientation and the training on cultural/ historical resources sensitivity will be provided at the project initiation meeting, to be held at the Topock Compressor Station. Site orientation will stress that all site activities will be conducted in a respectful manner. Sensitivity training will be provided by PG&E's Site Operations Manager, and PG&E Cultural Resources Expert. PG&E will invite participation from the Tribes, archaeological monitors, and agency staff, as appropriate.
22	Appendix C Monitoring Protocol	Prior to execution of the PA for the Undertaking, PG&E sometimes invited the Tribes to be present on site during construction to monitor and observe non-maintenance grading, trenching, or other excavation for any facilities, new roads, or other project components related to the Undertaking which may have had the potential to adversely impact cultural and historic resources. The Tribal and Archaeological Monitors shall both be invited to monitor such field work.	Implementation of Field Activities	This stipulation will be adhered to during field implementation. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project.	This stipulation will be adhered to during field implementation. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project. In addition, a similar measure under the CIMP (CUL-1a-8l) will also be adhered to during field implementation. The CIMP is included in an appendix of the Construction/Remedial Action Work Plan.	This stipulation will be adhered to during field implementation. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project. In addition, a similar measure under the CIMP (CUL-1a-8l) will also be adhered to during field implementation. The CIMP is included in an appendix of the Construction/Remedial Action Work Plan.
23	Appendix C Monitoring Protocol	This Protocol specifies ways in which the Tribes, BLM, and PG&E may ensure that: 1. Tribes, BLM, and PG&E, each are kept well informed of Undertaking activities and outcomes; 2. Tribal and Archaeological Monitors have the opportunity to alert PG&E's site supervisor (or designee) to potentially sensitive areas or issues that Monitors may be aware of or may become aware of while fieldwork is in progress; 3. PG&E's site supervisor (or designee) notifies BLM of potentially complicated situations. These situations may include discovery of a new cultural or historical resource, damage to a previously recorded cultural or historical resource, or unanticipated effects identified; 4. Tribal concerns regarding work activities are addressed while fieldwork is in progress.	Implementation of Field Activities	This stipulation will be adhered to during field implementation. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project. Applied Earthworks, a professional cultural resources consulting firm, was retained by PG&E with DTSC approval. Applied Earthworks will observe ground-disturbing activities and will have the authority to temporarily divert or halt any activities in the event that previously unidentified potentially significant cultural resources are discovered.	This stipulation will be adhered to during field implementation. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project. Applied Earthworks, a professional cultural resources consulting firm, was retained by PG&E with DTSC approval. Applied Earthworks will observe ground-disturbing activities and will have the authority to temporarily divert or halt any activities in the event that previously unidentified potentially significant cultural resources are discovered. In addition, a similar measure under the CIMP (CUL-1a-8l) will also be adhered to during field implementation. The CIMP is included in an appendix of the Construction/Remedial Action Work Plan.	This stipulation will be adhered to during field implementation. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project. Applied Earthworks, a professional cultural resources consulting firm, was retained by PG&E with DTSC approval. Applied Earthworks will observe ground-disturbing activities and will have the authority to temporarily divert or halt any activities in the event that previously unidentified potentially significant cultural resources are discovered. In addition, a similar measure under the CIMP (CUL-1a-8l) will also be adhered to during field implementation. The CIMP is included in an appendix of the Construction/Remedial Action Work Plan.

TABLE 6.2-2
Summary of Compliance with Applicable Programmatic Agreement (PA) Stipulations
Groundwater Remedy Basis of Design Report/Final (100%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in PA Document	Relevant Excerpt from Document	Triggering Event	Action (Compliance Status)		
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24	Appendix C Monitoring Protocol (Work Schedule)	Tribal and Archaeological Monitors will be provided with anticipated schedules for Topock Remediation Project work that requires monitoring as early as possible but at least three (3) business days in advance of the initiation of the identified project work, whenever possible. Recognizing that changes to the work schedule may be inevitable, any change in the work schedule will be provided to the Tribal and Archaeological Monitors as soon as possible after the change becomes part of the work schedule. If there is a question regarding need for a monitor, the questioning party shall consult the BLM Project or Field Manager who will make the final determination of need.	Implementation of Field Activities	This stipulation will be adhered to during field implementation. The PG&E Site Operations Manager or his designee will provide the work schedule and inform the monitors of schedule changes as soon as practicable.	This stipulation will be adhered to during field implementation. The PG&E Site Operations Manager or his designee will provide the work schedule and inform the monitors of schedule changes as soon as practicable. In addition, a similar measure under the CIMP (CUL-1a-8j) will also be adhered to during field implementation. The CIMP is included in an appendix of the Construction/Remedial Action Work Plan.	This stipulation will be adhered to during field implementation. The PG&E Site Operations Manager or his designee will provide the work schedule and inform the monitors of schedule changes as soon as practicable. In addition, a similar measure under the CIMP (CUL-1a-8j) will also be adhered to during field implementation. The CIMP is included in an appendix of the Construction/Remedial Action Work Plan.
25	Appendix C Monitoring Protocol (Discoveries)	If the Undertaking will affect previously unidentified resources, or affect a previously recorded cultural or historical resource in a way not previously anticipated, or have greater or different effects than previously anticipated, all work having potential for adverse affect shall cease within a fifty (50)-meter radius (or a smaller or larger area if determined appropriate by the BLM, the Monitors, and PG&E in the field) of the point of discovery. The Archaeological and Tribal Monitors will work with BLM and PG&E to ensure that the PA requirements of Stipulation VII (CHPMP) and Stipulation IX (Discoveries) are met.	Implementation of Field Activities	This stipulation will be adhered to during field implementation. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project. Applied Earthworks, a professional cultural resources consulting firm, was retained by PG&E with DTSC approval. Applied Earthworks will observe ground-disturbing activities and will have the authority to temporarily divert or halt any activities in the event that previously unidentified potentially significant cultural resources are discovered.	This stipulation will be adhered to during field implementation. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project. Applied Earthworks, a professional cultural resources consulting firm, was retained by PG&E with DTSC approval. Applied Earthworks will observe ground-disturbing activities and will have the authority to temporarily divert or halt any activities in the event that previously unidentified potentially significant cultural resources are discovered.	This stipulation will be adhered to during field implementation. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project. Applied Earthworks, a professional cultural resources consulting firm, was retained by PG&E with DTSC approval. Applied Earthworks will observe ground-disturbing activities and will have the authority to temporarily divert or halt any activities in the event that previously unidentified potentially significant cultural resources are discovered.
26	Appendix C Monitoring Protocol (Human Remains)	If the Undertaking affects previously unidentified human remains and/or associated funerary objects or graves, or affects such resources in a way not previously anticipated, or has greater adverse effect than previously anticipated, all work in the vicinity of the discovery shall cease. No further action will be taken until the BLM, in consultation with Tribal and Archeological Monitors and PG&E in the field, has determined the nature of the discovery and delineated an area not to exceed 50 meters from the approximate center point of the discovery (or a smaller or larger area if warranted) in which no further work is to take place until treatment of the discovery is resolved.	Implementation of Field Activities	This stipulation will be adhered to during field implementation. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project. Applied Earthworks, a professional cultural resources consulting firm, was retained by PG&E with DTSC approval. Applied Earthworks will observe ground-disturbing activities and will have the authority to temporarily divert or halt any activities in the event that previously unidentified potentially significant cultural resources are discovered.	This stipulation will be adhered to during field implementation. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project. Applied Earthworks, a professional cultural resources consulting firm, was retained by PG&E with DTSC approval. Applied Earthworks will observe ground-disturbing activities and will have the authority to temporarily divert or halt any activities in the event that previously unidentified potentially significant cultural resources are discovered.	This stipulation will be adhered to during field implementation. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project. Applied Earthworks, a professional cultural resources consulting firm, was retained by PG&E with DTSC approval. Applied Earthworks will observe ground-disturbing activities and will have the authority to temporarily divert or halt any activities in the event that previously unidentified potentially significant cultural resources are discovered.

TABLE 6.2-2
Summary of Compliance with Applicable Programmatic Agreement (PA) Stipulations
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27	Appendix C Monitoring Protocol (Safety)	Tribal and Archeological Monitors will be required to meet with PG&E's site supervisor prior to initiating monitoring activity and will be required to obtain any applicable training required under 29 CFR 1910.120 and 40 CFR 300.150. The PG&E site supervisor will identify the safety and logistical guidelines that are appropriate for the monitoring activity. Tribal and Archaeological Monitors are invited to attend the safety meetings at the start of each workday or new work task. If the Monitors do not attend this meeting, they will be instructed about the safety concerns of the day by a PG&E representative. Tribal and Archaeological Monitors will be expected to wear all personal protective equipment specified by PG&E's site supervisor and required of other similarly situated field workers. Tribal and Archaeological Monitors will be expected to actively participate to enhance the safety of themselves and the other workers onsite by communicating with PG&E's site supervisor if any safety concerns are identified. Due to safety considerations at the Project site, Tribal and Archaeological Monitors will also be prohibited from conducting any monitoring within designated construction exclusion zones, unless otherwise authorized by PG&E. Such zones are to be clearly delineated to the Tribal and Archaeological Monitors by PG&E's site supervisor. In these situations, other efforts to provide alternative methods for accommodating Monitors including, but not limited to, high-powered binoculars, spotting scopes, or other vision enhancement tools or alternative viewing platforms will occur.	Implementation of Field Activities	During the project initiation meeting or at similar venues (as appropriate), the PG&E Site Operations Manager or his designee will identify the safety and logistical guidelines that are appropriate for the monitoring activity. Tribal and Archaeological Monitors will be invited to attend the safety meetings at the start of each work day or new work task. If they do not attend, they will be instructed of the safety concerns of the day by PG&E.	During the project initiation meeting or at similar venues (as appropriate), the PG&E Site Operations Manager or his designee will identify the safety and logistical guidelines that are appropriate for the monitoring activity. Tribal and Archaeological Monitors will be invited to attend the safety meetings at the start of each work day or new work task. If they do not attend, they will be instructed of the safety concerns of the day by PG&E.	During the project initiation meeting or at similar venues (as appropriate), the PG&E Site Operations Manager or his designee will identify the safety and logistical guidelines that are appropriate for the monitoring activity. Tribal and Archaeological Monitors will be invited to attend the safety meetings at the start of each work day or new work task. If they do not attend, they will be instructed of the safety concerns of the day by PG&E.

TABLE 6.2-3
Summary of Compliance with Applicable Cultural and Historic Property Management Plan (CHPMP) Provisions
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PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in CHPMP Document	Relevant Excerpt from Document	Action (Compliance Status)		
			Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
1	Section 6.2	Measures and principles to avoid, minimize, or resolve adverse effects include the following: • Existing monitoring wells and related facilities shall be used to the maximum extent practicable. • The need for and placement of any new facilities or activities will be determined in consultation with the Tribes and the Consulting Parties following the Guidelines in Appendix B. • New facilities or activities will be placed in areas already disturbed by previous grading and other mechanized activities to the extent practicable, consistent with human health and the environment and achieving cleanup in a timely manner. • The performance of all field activities in support of the remedy shall be executed in such a way as to avoid and/or minimize adverse effects to cultural and historic properties to the maximum extent practicable. • Subject to Stipulation I(A) above, direct, indirect and cumulative impacts shall be considered and mitigated.	See responses to PA Stipulations I(B), III(B)(1), III(B)(2)(a)-(c), (e) and (f) in Table 6.2-2.	See responses to PA Stipulations I(B), III(B)(1), III(B)(2)(a)-(c), (e) and (f) in Table 6.2-2	See responses to PA Stipulations I(B), III(B)(1), III(B)(2)(a)-(c), (e) and (f) in Table 6.2-2
2	Section 6.2.3	Refers to the requirement in the PA Stipulation V(E) and PG&E's 2006 Settlement Agreement with the Fort Mojave Indian Tribe that a plan will be prepared for the decommissioning, removal and restoration of the IM-3 facility prior to implementation of the groundwater remedy, in consultation with all Signatories, Tribes and Invited Signatories. Additionally, PG&E will remove all other remediation facilities and appurtenances related to the Topock Remediation Project as soon as practicable following the attainment of cleanup standards and a determination by DOI that the removal of these facilities is protective of human health and the environment.	See responses to PA Stipulations V(A)-(E) in Table 6.2-2.	See responses to PA Stipulations V(A)-(E) in Table 6.2-2.	See responses to PA Stipulations V(A)-(E) in Table 6.2-2.
3	Section 6.3	"Environmental Restoration" refers to the restoration obligations in the Programmatic Agreement and the Consent Decree, including that PG&E draft a plan for decommissioning, removal, and restoration of the IM-3 facility and a Remedy Decommissioning Plan that will address post-remedy restoration of the site.	See responses to PA Stipulations I(D), III(B)(3)(c), and V(D)-(E) in Table 6.2-2.	See responses to PA Stipulations I(D), III(B)(3)(c), and V(D)-(E) in Table 6.2-2.	See responses to PA Stipulations I(D), III(B)(3)(c), and V(D)-(E) in Table 6.2-2.
4	Section 6.6.3	"Avoidance Measures/Management Thresholds" provides that: "The primary means for achieving avoidance will be through careful planning and placement of project facilities and installation of temporary barrier fences around significant cultural and historic properties. Metal fence posts and orange mesh all-weather fabric will be used, unless other appropriate materials are identified as preferable, for temporary fencing and will be regularly inspected and maintained. Permanent post-and double cable fencing may be required in high traffic areas. An archaeologist and/or Tribal representative(s) will clearly delineate the sensitive areas to be avoided by construction and supervise fence installation. Project personnel will be notified that fenced locations are to be completely avoided."	See responses EIR MMRP CUL-1a in Table 6.1-1. PG&E remediation resources specialist (Glenn Caruso) participated in field reviews of planned remedial facilities with the design team on April 23-24 and June 20, 2012. The purpose of these field reviews along with in office reviews is to ensure that the footprints of planned facilities are designed, in ways that avoid, minimize, and mitigate significant adverse effects to historically significant cultural and historic resources.	See responses to EIR MMRP CUL-1a in Table 6.1-1. PG&E's steps to prevent and reduce inadvertent damage are outlined in the CIMP Protocol for CUL-1a-8n: Protocols for protective measures for archaeological/historical sites during construction (Section 2.14 of the CIMP). In this protocol, PG&E outlines pre-construction measures to be taken to identify sites requiring protection, pre-construction identification of protective measures, and procedures for installation and removal of the protective measures, and restoration of the area to pre-construction conditions. Further, under the CHPMP requirements at Section 6.6.5 Periodic Site Monitoring, PG&E has proposed a monitoring and condition assessment program in the 2013 monitoring report (AE 2014a) and submitted for DTSC review.	See responses to EIR MMRP CUL-1a in Table 6.1-1. PG&E's steps to prevent and reduce inadvertent damage are outlined in the CIMP Protocol for CUL-1a-8n: Protocols for protective measures for archaeological/historical sites during construction (Section 2.14 of the CIMP). In this protocol, PG&E outlines pre-construction measures to be taken to identify sites requiring protection, pre-construction identification of protective measures, procedures for installation and removal of the protective measures, and restoration of the area to pre-construction conditions. Further, under the CHPMP requirements at Section 6.6.5 Periodic Site Monitoring, PG&E has proposed and initiated a monitoring and condition assessment program in the 2013 monitoring report (AE 2014a) and submitted for DTSC review.

TABLE 6.2-3
Summary of Compliance with Applicable Cultural and Historic Property Management Plan (CHPMP) Provisions
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5	Section 6.6.4	Construction Monitoring Monitoring of all earth-disturbing Project activities will be in accordance with Appendix C of the PA (Tribal and Archaeological Monitoring Protocol). Qualified archaeological and Tribal monitors will be notified in advance and invited to be on site during earth-disturbing construction activities (grading, trenching, boring, drilling, or other excavation) for new injection, extraction or monitoring wells, new pipelines, new treatment facilities, new access roads, new staging areas, other new transportation facilities, or other new Project components. Due to safety considerations at the Project site, Tribal and archaeological monitors will comply with all safety requirements.	See responses to PA Appendix C, Monitoring Protocol in Table 6.2-2. See also EIR MMRP CUL-1a-8(I).	See responses to PA Appendix C, Monitoring Protocol in Table 6.2-2. See also EIR MMRP CUL-1a-8(I).	See responses to PA Appendix C, Monitoring Protocol in Table 6.2-2. See also EIR MMRP CUL-1a-8(I).
6	Section 6.6.5	Periodic Site Monitoring Sound management of the archaeological and historical properties requires that any progressive degradation of sites be identified. Additionally, it is recognized that a mechanism is needed to identify any accidental damage that may occur. To accomplish these goals, PG&E will develop a proposal describing a program of periodic site monitoring and condition assessment. BLM, following consultation with the Tribes and other appropriate parties, will approve any monitoring program before implementation by PG&E. The program will include all historic properties within the APE. Any previously unknown properties that may be encountered during the Project also will be included in the monitoring program unless such properties are evaluated as ineligible. During its initial phase, periodic monitoring and condition assessment will consist of annual field visits to monitor site conditions and disturbances	As part of the 2004 Cultural Resources Management Plan, Applied Earthworks conducted quarterly monitoring the first year and since then (2005 – 2012) annual monitoring and condition assessment.	PG&E has proposed a monitoring and condition assessment program in the 2013 monitoring report (AE 2014a) and submitted for DTSC review.	PG&E has proposed and initiated a monitoring and condition assessment program in the 2013 monitoring report (AE 2014a) and submitted for DTSC review.
7	Section 6.8	"Protocols for Tribal and Archaeological Monitoring" states that monitoring for the Project will be performed in accordance with the PA's Appendix C (Tribal and Archaeological Monitoring Protocol).	See responses to PA Appendix C, Monitoring Protocol in Table 6.2-2. See also EIR MMRP CUL-1a-8(I).	See responses to PA Appendix C, Monitoring Protocol in Table 6.2-2. See also EIR MMRP CUL-1a-8(I).	See responses to PA Appendix C, Monitoring Protocol in Table 6.2-2. See also EIR MMRP CUL-1a-8(I).
8	Section 6.9	If the Undertaking extends beyond the APE, BLM will determine, in consultation with the PA Signatories, Tribes, and Invited Signatories, what (if any) changes are required in the APE. If BLM determines that the APE must be revised, BLM will redefine the APE, taking into account the advice of the other Consulting Parties. Should such revision to the APE be needed, BLM will amend the CHPMP to include any changes to the APE (BLM et al. 2010:8).	See response to PA Stipulation II(B) in Table 6.2-2.	See response to PA Stipulation II(B) in Table 6.2-2.	See response to PA Stipulation II(B) in Table 6.2-2.

TABLE 6.2-3
Summary of Compliance with Applicable Cultural and Historic Property Management Plan (CHPMP) Provisions
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9	Section 7.1	1. Physical avoidance of the Topock Maze and associated prehistoric sites. 2. To the maximum extent practicable, PG&E will avoid all archaeological sites within the APE and protect all historic properties regardless of their NRHP status. The primary means for accomplishing avoidance will be through careful planning and placement of proposed access routes and drilling sites and by the installation of barrier fences around significant historic properties. A pre-project archaeological survey field verification will be conducted prior to any ground-disturbing activities. Consistent with other phases of work conducted at the Topock Remediation Project site, agency representatives and other stakeholders (including representatives of Native American Indian Tribes involved with the Project) will be invited to the site for a project initiation meeting to discuss various cultural sensitivities associated with the Project. 3. Ensure that PG&E shall, to the extent practicable, restore the areas affected by the Topock Remediation Project within the APE, including but not limited to the site of the existing treatment plant and related facilities but excluding the Topock Compressor Station and related facilities, to the conditions existing prior to the construction of the PG&E investigation and remediation related appurtenances and facilities per PA Stipulation I.D. 4. Remediation activities that propose the removal or introduction of vegetation on public lands shall be undertaken after coordination with Tribes to assess if culturally significant native plant species are being impacted and if there could be potential visual impacts to the Topock TCP. 5. Existing monitoring wells and related facilities shall be used to the extent practicable per PA Stipulation III.B.2(a). 6. The need for and placement of any new facilities or activities will be determined in consultation with the Tribes and the Consulting Parties following the Guidelines in Appendix B and per PA Stipulation III.B.2(b). 7. New facilities or activities will be placed in areas already disturbed by previous grading and other mechanized activities to the extent practicable, consistent with human health and the environment and achieving cleanup in a timely manner per PA Stipulation III.B.2(c). 8. Clay deposits are an important resource identified by the Hualapai in their creation, and may be important as well to other Tribes. Accordingly, BLM, PG&E, and those Tribes that ascribe importance to clay deposits shall meet to identify the clay deposits that are considered a resource and develop a protocol to be followed if such clay deposits are encountered.	See responses to PA Stipulations I(B), I(D), III(B)(1), III(B)(2)(a)-(c) and (e), III(B)(3)(c), and V(D) in Table 6.2-2. See also EIR MMRPs CUL-1a-8(i), AES-1, and AES-2. Regarding Item 4, PG&E does not plan to remove or introduce vegetation on public lands in connection with the remedy; instead, only some trimming of vegetation may be required which will be focused on non-native species (e.g., tamarisk). The trimming of native species (e.g., palo verde and mesquite) will be avoided or minimized to the extent practicable. Regarding Item 8, BLM met with the Hualapai Tribe and PG&E in late 2012 and discussed the Clay Monitoring Protocol. The Hualapai representative indicated that the Hualapai would make the initial draft of this protocol and then send it out for BLM and PG&E to review.	See responses to PA Stipulations I(B), I(D), III(B)(1), III(B)(2)(a)-(c) and (e), III(B)(3)(c), and V(D) in Table 6.2-2. See also EIR MMRPs CUL-1a-8(i), AES-1, and AES-2. Regarding Item 4, PG&E will introduce only native plants grown from local seed sources. These plants will be of the same species as those removed. At this 90% design stage, removal of tamarisk and arrow weed will occur during pipeline construction on the historical floodplain. The remedy design has avoided native trees in this area where they have been observed; however, it is possible that individual palo verde or mesquite trees could occur within the tamarisk thickets that will be affected. Where possible during construction, native trees will be avoided even if this requires additional impacts (i.e., removal or trimming) on tamarisk and arrow weed. There will be locations where impacts to native trees cannot be avoided and those losses will be mitigated according to the nature of the impact and the approaches in the appropriate restoration plan for the HNWR refuge, riparian areas, mature plants, or culturally-significant plants. Mitigation for impacts could include transplantation of likely candidate (younger) trees or replacement planting in a designated restoration area. The northern aerial bridge crossing of Bat Cave Wash is one location where it is currently known that 3 palo verde trees will require removal in order to install the aerial pipe bridge. Regarding Item 8, BLM met with the Hualapai Tribe and PG&E in late 2012 and discussed the Clay Monitoring Protocol. The Hualapai representative indicated that the Hualapai would make the initial draft of this protocol and then send it out for BLM and PG&E to review.	See responses to PA Stipulations I(B), I(D), III(B)(1), III(B)(2)(a)-(c) and (e), III(B)(3)(c), and V(D) in Table 6.2-2. See also EIR MMRPs CUL-1a-8(i), AES-1, and AES-2. Regarding Item 4, PG&E will introduce only native plants grown from local seed sources. These plants will be of the same species as those removed. At this final design stage, removal of tamarisk and arrow weed will occur during pipeline construction on the historical floodplain. The remedy design has avoided native trees in this area where they have been observed; however, it is possible that individual palo verde or mesquite trees could occur within the tamarisk thickets that will be affected. Where possible during construction, native trees will be avoided even if this requires additional impacts (i.e., removal or trimming) on tamarisk and arrow weed. There will be locations where impacts to native trees cannot be avoided and those losses will be mitigated according to the nature of the impact and the approaches in the appropriate restoration plan for the HNWR refuge, riparian areas, mature plants, or culturally-significant plants. Mitigation for impacts could include transplantation of likely candidate (younger) trees or replacement planting in a designated restoration area. Regarding Item 8, BLM met with the Hualapai Tribe and PG&E in late 2012 and discussed the Clay Monitoring Protocol. The Hualapai representative indicated that the Hualapai would make the initial draft of this protocol and then send it out for BLM and PG&E to review.
10	Section 7.2	Accommodation of Tribal Activities and Ceremonies Involving the Topock Maze/TCP The BLM will continue to work with the Tribes to identify Tribal activities and ceremonies that are associated with the Topock TCP. When such activities and ceremonies are identified, BLM will consult with the Tribes and PG&E to develop treatment measures to accommodate them. Treatment measures may address scheduling of Undertaking work to accommodate ceremonial activities and to mitigate audible and visual impacts.	See response to EIR MMRP CUL-1a-8k in Table 6.1-1.	See response to EIR MMRP CUL-1a-8k in Table 6.1-1.	See response to EIR MMRP CUL-1a-8k in Table 6.1-1.
11	Section 7.3	Treatment of other cultural, historical, and archaeological properties within the APE "The only properties identified within the APE that are not contributing properties to the Topock TCP are the properties from the historic period (i.e., Route 66, the AT&SF Railroad Grade, and National Old Trails Road). None of these properties has been impacted, to date, by this Undertaking. These properties shall be avoided, to the extent practicable, in the implementation of the Undertaking. These properties are periodically monitored for condition assessment to assure that they are being protected."	See responses to PA Stipulations I(B), III(B)(1), III(B)(2)(a)-(c) and (e) in Table 6.2-2.	See responses to PA Stipulations I(B), III(B)(1), III(B)(2)(a)-(c) and (e) in Table 6.2-2.	See responses to PA Stipulations I(B), III(B)(1), III(B)(2)(a)-(c) and (e) in Table 6.2-2.

TABLE 6.2-3
Summary of Compliance with Applicable Cultural and Historic Property Management Plan (CHPMP) Provisions
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Item No.	Reference Location in CHPMP Document	Relevant Excerpt from Document	Action (Compliance Status)		
			Intermediate (60%) Design	Pre-Final (90%)/Supplemental 90% Design	Final (100%) Design
12	Section 8.1	Discoveries - Steps to be taken if previously unrecorded properties are found	PG&E will follow the procedures specified in Appendix C of the CHPMP (Discovery Plan). See also response to PA Stipulation IX(A)-(D) in Table 6.2-2, and to EIR MMRP CUL-1a-8(b) and -8(o) in Table 6.1-1.	PG&E will follow the procedures specified in Appendix C of the CHPMP (Discovery Plan). See also responses to PA Stipulation IX(A)-(D) in Table 6.2-2, and to EIR MMRP CUL-1a-8(b) and -8(o) in Table 6.1-1.	PG&E will follow the procedures specified in Appendix C of the CHPMP (Discovery Plan). See also responses to PA Stipulation IX(A)-(D) in Table 6.2-2, and to EIR MMRP CUL-1a-8(b) and -8(o) in Table 6.1-1.
13	Section 8.2	Discoveries - Treatment of any human remains, funerary objections, ceremonial objects and items of cultural patrimony	PG&E will follow the procedures specified in Appendix D of the CHPMP (Plan of Action). See also response to PA Stipulation IX(A)-(D) in Table 6.2-2, and to EIR MMRP CUL-1a-8(b) and -8(o) in Table 6.1-1.	PG&E will follow the procedures specified in Appendix D of the CHPMP (Plan of Action). See also responses to PA Stipulation IX(A)-(D) in Table 6.2-2, and to EIR MMRP CUL-1a-8(b) and -8(o) in Table 6.1-1.	PG&E will follow the procedures specified in Appendix D of the CHPMP (Plan of Action). See also responses to PA Stipulation IX(A)-(D) in Table 6.2-2, and to EIR MMRP CUL-1a-8(b) and -8(o) in Table 6.1-1.
14	Section 8.3	Consultation Procedures Related to Unanticipated Discoveries • The BLM will notify all Signatories of the PA, Tribes and Invited Signatories of the nature and general location of any discovery. If the Tribes, PG&E and BLM can resolve treatment of the discovery in a manner that does not cause adverse effects to significant cultural and historic properties, BLM shall document the resolution, the activities within the work area may proceed and the AZ SHPO and the CA SHPO shall be notified of the discovery and resolution. The Tribes, PG&E and BLM will use their best efforts to resolve treatment as quickly as possible. • If there is failure to resolve treatment of the discovery in consultation with the Tribes and PG&E, BLM shall then consult with the AZ SHPO or the CA SHPO to develop a treatment plan that takes into account the effects of the Undertaking on the discovery. Within fifteen (15) days of notification of discovery, BLM shall provide the consulted SHPO(s), via email, a recommendation for resolving the discovery situation that takes into account the potential effects of the Undertaking on the discovery. • If the CA SHPO or AZ SHPO (as appropriate, depending on the location of the discovery) does not object to BLM's recommendation(s) within fifteen (15) days, BLM will implement the recommendation(s). If the consulted SHPO objects to the recommendation, BLM will utilize the dispute resolution process in Stipulation XV of the PA to resolve any objection.	See response to PA Stipulation IX(A)-(D) in Table 6.2-2. See also EIR MMRP CUL-1a-8(b) and -8(o) in Table 6.1-1.	See responses to PA Stipulation IX(A)-(D) in Table 6.2-2 and to EIR MMRP CUL-1a-8(b) and -8(o) in Table 6.1-1.	See responses to PA Stipulation IX(A)-(D) in Table 6.2-2 and to EIR MMRP CUL-1a-8(b) and -8(o) in Table 6.1-1.

Appendix M
Best Management Practices Plan

Appendix M

Best Management Practices Plan for Groundwater Remedy Construction

PG&E Topock Compressor Station Needles, California

Prepared for

Pacific Gas & Electric Company

November 2015

CH2MHILL®
155 Grand Avenue
Suite 800
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Attachment

1 Inspection and Corrective Action Report Form

Acronyms and Abbreviations

ARAR	applicable or relevant and appropriate requirement
BMP	best management practice
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DTSC	California Department of Toxic Substances Control
EIR	Environmental Impact Report
NPDES	National Pollutant Discharge Elimination System
PG&E	Pacific Gas and Electric Company
QSD	Qualified SWPPP Developer
QSP	Qualified SWPPP Practitioner
SMART	Storm Water Multiple Application and Report Tracking System
SOP	Standard Operating Procedure
SWPPP	Storm Water Pollution Prevention Plan
TCS	Topock Compressor Station

SECTION 1

Introduction

This Best Management Practices (BMPs) Plan for the construction of the groundwater remedy at the Pacific Gas and Electric Company (PG&E) Topock Compressor Station (TCS) in Needles, California has been prepared as required by the California Department of Toxic Substances Control's (DTSC's) 2011 *Final Environmental Impact Report for the Topock Compressor Station Groundwater Remediation Project* (EIR) mitigation measures as listed in the adopted Mitigation Monitoring and Reporting Program and applicable or relevant and appropriate requirements (ARARs):

- **Mitigation Measure HYDRO-1** requires the implementation of BMPs to meet the substantive criteria of the National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities, Order No. No. 2009-0009-DWQ NPDES No. CAS000002 (the California General Permit), as well as other applicable federal, state, and local permit and regulatory requirements, even if a permit is not required pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), for purposes of ensuring the protection of receiving water quality. Mitigation measure HYDRO-1 also requires the preparation of a Stormwater Pollution Prevention Plan (SWPPP) that will contain BMPs related to industrial activities (industrial SWPPP).
- **Mitigation Measure GEO-1a** requires the preparation of a grading and erosion control plan, including measures for controlling erosion or loss of topsoil during construction, operation and maintenance, and decommissioning.
- **Mitigation Measure AIR-1** requires the implementation of fugitive dust control measures during construction activities.
- **ARAR #34** requires the implementation of BMPs for stormwater runoff that comes in contact with construction activities (>1 acre of ground disturbance).

This BMPs Plan has been prepared to meet the above requirements and has been prepared in accordance with: (1) the substantive criteria of the California General Permit for construction activities in San Bernardino County, California, and (2) the substantive criteria of the Arizona Pollutant Discharge Elimination System General Permit AZG2013-001 for Stormwater Discharges associated with Construction Activity to Waters of the United States (Arizona General Permit) for construction activities in Mohave County, Arizona.

Because the groundwater remedy is part of a CERCLA response action, remedial construction activities conducted onsite are covered under the permit exemption codified in CERCLA Section 121(e)(1). While the permit exemption applies to the administrative or procedural elements (preparing and submitting permit applications and obtaining permits), the substantive requirements of applicable laws remain. The BMPs identified are consistent with the Arizona Department of Transportation 2012 *Erosion and Pollution Control Manual* and the 2009 *California Stormwater Quality Association Construction BMP Handbook*.

This BMPs Plan has been prepared by a Qualified SWPPP Developer (QSD) and registered civil engineer and will be implemented under the direction of a Qualified SWPPP Practitioner (QSP). A summary of key BMPs identified for the groundwater remedy construction is presented in Section 2.0; inspection, monitoring, corrective actions, reporting, and recordkeeping information for the BMPs Plan is presented in Section 3.0; and workers' training and education is presented in Section 4.0.

The PG&E Construction Manager and appropriate construction team members will have control over day-to-day activities and will implement this BMPs Plan under the direction of the QSP (Section 3.7 of this plan contains additional details on the BMPs project team).

SECTION 2

Best Management Practices for Groundwater Remedy Construction

This section provides a summary of the BMPs for construction of the groundwater remedy. The specific EIR mitigation measures that are addressed other than HYDRO-1 or project Standard Operating Procedures (SOPs), are referenced for each BMP category where appropriate.

Figure 2-1 (located at the end of this section) shows typical erosion control for construction activities. Figures 2-2 through 2-5 show the site topography and inferred surface water flow, as well as the proposed erosion control BMPs for each major work area at the site (TCS, Interim Measure No. 3 Area, Topock Marina Area, and Moabi Regional Park Area).

2.1 Erosion Control BMPs

2.1.1 Preservation of Existing Vegetation

Existing vegetation will be preserved to the maximum extent practicable to facilitate protection of surfaces from erosion and help control sediments. Throughout the design process, efforts have been made to locate remedy facilities along previously disturbed areas to avoid impacts to vegetation. Existing vegetation will be preserved whenever feasible during clearing and grubbing or other soil-disturbing activities. In the event that existing vegetation needs to be disturbed, areas that need to be preserved will be identified by a qualified biologist consistent with Section 4.2.3 of the C/RAWP and marked with temporary fencing. Employees and subcontractors will be informed of the limits of disturbance within the construction site and will be instructed to keep clear of delineated areas.

2.1.2 Geotextiles and Mats

A natural (excelsior, straw, coconut, etc.) or synthetic (usually polyethylene) material will be used to reduce soil erosion by wind or water.

2.1.3 Road Preparation and Maintenance

During road preparation activities, loose sediment will be uniformly compacted, consistent with the substantive San Bernardino County Building and Land Use Services Department requirements, to aid in reducing wind erosion. Ongoing road maintenance—(1) visual inspections to identify areas of erosion, (2) localized road repair and regrading, installation, and maintenance of erosion control features such as berms, silt fences, or straw wattles, (3) grading for road smoothness, and (4) measures to reduce water erosion such as clearing ditches and culverts of debris—will be performed as needed to reduce potential for erosion.

2.2 Sediment Control BMPs

2.2.1 Silt Fence

Silt fences are perimeter controls, typically used in combination with sediment basins and sediment traps, as well as erosion controls, which are designed to retain sediment in place where soil is being disturbed by construction processes. They are also placed down slope of areas where sheet flows discharge from the site. They could also be used as interior controls down slope of disturbed areas where runoff may occur in the form of sheet and rill erosion and around inlets within disturbed areas. Silt fences are most effective when used in combination with erosion controls along the perimeter of a project, below the toe or down slope of exposed and erodible slopes, along streams and channels, around temporary spoil areas and stockpiles, and below other small cleared areas, including spoils that have been treated by soil stabilization polymer products.

2.2.2 Fiber Rolls/Sediment Wattles

These consist of aspen wood excelsior, straw, flax, or other similar materials rolled and bound into tight tubular rolls and placed on the face of slopes at regular intervals, depending on steepness of slopes, to intercept runoff and reduce flow velocity. Rolls/wattles will be installed prior to start of construction activities to form a barrier around work areas and stockpiles and will be anchored down with stakes. If the stockpiles are on paved areas, gravel or sand bags are preferred; however, fiber rolls can be used and secured with gravel or sand bags. The fiber rolls/sediment wattles will be inspected prior to a forecasted rain event and after rain events to ensure the fiber rolls are working properly. Sediment accumulated by the fiber rolls will be removed to maintain the effectiveness of the fiber rolls.

2.2.3 Gravel Bag Berm

Gravel bag berms can be used as an alternative to fiber rolls and sediment wattles. If used, they will be installed prior to rain events to form a barrier to intercept runoff or reduce its velocity. The QSP will determine whether gravel bags will be placed along the upgradient side of equipment not in use. Gravel bags will also be used, if necessary, during trenching activities when stockpiles are onsite. In the event that gravel bag berms are used as perimeter erosion control, bags will be stacked, one on top of the other (two high). When used to anchor stockpiles, the bags will be placed one high.

2.2.4 Sandbag Berm

Sandbag berms can also be used as an alternative to fiber rolls and sediment wattles. If used, they will be installed prior to rain events to form a barrier to intercept runoff or reduce its velocity. The purpose is to allow sediment to settle from runoff before water leaves the construction site. Sandbags will also be used, if necessary, during trenching activities when stockpiles are left overnight. In the event that sandbag berms are needed, they will be placed around the staging area and trenching area.

2.2.5 Straw-bale Barrier

Straw-bale barriers can also be used as an alternative to fiber rolls, gravel bag berms, and sandbag berms. Straw-bale barriers intercept and slow down sheet-flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions, allowing sediment to settle. Straw-bale barriers also interrupt the slope length, thereby reducing erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills and ultimately gullies, into disturbed, sloped soils.

2.3 Waste and Materials Management Control BMPs

2.3.1 Material Delivery and Storage

Proper delivery and storage of materials will be implemented to ensure minimal discharge or elimination of discharge of these materials to the storm drain systems or waterways. Construction materials and equipment will be parked and stored in the staging area. The storage area will be covered during nonworking days and prior to and during rain events. Storage and transfer of toxic or hazardous materials will be on impervious surfaces. Employees and subcontractors will be trained on proper material delivery and storage practices. Safety Data Sheets will be supplied for materials stored or used onsite. Instructions on proper storage of materials will be posted in a conspicuous location. An inventory of materials delivered and stored will be maintained onsite.

2.3.2 Material Use

Proper use of materials will be implemented to ensure minimal or complete elimination of discharge to the storm drain systems or waterways. Material Safety Data Sheets will be supplied for materials used. Spill cleanup materials will be kept near the construction and staging areas. Leaks and spills will be cleaned up immediately using proper absorbent materials, which will then be disposed of as hazardous waste, unless determined to be non-hazardous waste. Employees and subcontractors will be informed on the practices and procedures and must implement these procedures throughout the project.

2.3.3 Stockpile Management

Stockpile management procedures and practices are implemented to reduce or eliminate pollution to the air and stormwater from materials that are stockpiled. Stockpile protection is required year-round. Stockpiles will be stored in the primary work zone or staging area and outside of the roadway right of way. Stockpiles will be located a minimum of 50 feet away from any concentrated flow of stormwater, drainage courses, and inlets. During the rainy season, stockpiles will be covered and anchored down with fiber rolls/sediment wattles, silt fences, gravel bags, sandbags, straw bales, and/or polymer soil stabilizer products.

Additional stockpile management BMPs for categories of soil generated during the groundwater remedy construction consistent with the Soil Management Plan are presented below.

2.3.3.1 RCRA and non-RCRA Hazardous Soil

Stockpiling of Resource Conservation and Recovery Act (RCRA) and non-RCRA hazardous waste/soil is not planned. It is anticipated that non-RCRA hazardous soil will be placed in roll-off bins or similar containers. If it is necessary to temporarily stockpile non-RCRA hazardous soil the following BMPs will be followed:

- Stockpiles will be constructed with liners and perimeter berms to prevent release or infiltration of liquids. Minimum 20-mil polyethylene sheeting or equivalent will be used for liners if the stockpile is on a foundation, or minimum 60-mil polyethylene sheeting or equivalent will be used if the stockpile is not on a foundation.
- Wind erosion will be prevented by use of a cover, applying Soiltac® or a similar soil stabilization product, or other suitable means. If a cover is employed it will be minimum 6-mil polyethylene sheeting or equivalent.
- The perimeter berm will be constructed of clean materials (such as hay bales or straw wattle under the liner).
- If a cover is employed, it shall extend over the outer edges of the perimeter berm and liner so that rainfall is prevented from entering the stockpile.
- Covers and perimeter berms will be secured in place when not in use and at the end of each workday and as necessary to prevent wind dispersion or runoff from precipitation events.
- Only soil that does not contain free liquids will be stockpiled.
- Liquids that accumulate inside the berm will be pumped from the stockpile to a container or tank for characterization and disposal.
- If the stockpile is outside of a secured area, the stockpile will be demarcated with barricades, orange cones, and/or caution tape until it is removed from the site.
- Erosion control measures will be employed to prevent stockpiled soil from contributing to surface runoff and wind-generated particulate matter.
- The stockpile will be inspected weekly and after storms to verify that controls for windblown dispersion and prevention of runoff and run-on are functioning properly.
- After the stockpile has been removed, the area will be inspected and all residual material shall be removed from the underlying and surrounding areas.

The stockpile location will be certified by a California-registered professional engineer for compliance with these requirements, consistent with California Health and Safety Code Section 25123.3 (b)(4)(B),

2.3.3.2 Nonhazardous Soil above Interim Screening Levels or Project-Specific Cleanup Goals (once established)

It is anticipated that soil above soil screening levels or project-specific cleanup goals will not be stockpiled and will be placed in roll-off bins or similar containers. If it is necessary to stockpile displaced soil that is non-

hazardous, but unsuitable for final disposition onsite because contaminants are present above the interim screening levels or project-specific cleanup goals, the following BMPs will be followed:

- Stockpiles will be constructed with liners and perimeter berms to prevent release or infiltration of liquids. Minimum 20-mil polyethylene sheeting or equivalent will be used for liners.
- Wind erosion will be prevented by use of a cover, applying Soiltac, a similar soil stabilization product, or other suitable means. If a cover is employed, it will be minimum 6-mil polyethylene sheeting or equivalent.
- The perimeter berm will be constructed of clean materials (such as hay bales or straw wattle under the liner).
- If a cover is employed, it will extend over the outer edges of the perimeter berm and liner so that rainfall is prevented from entering the bermed area.
- Covers and perimeter berms will be secured in place when not in use, at the end of each workday, and as necessary to prevent wind dispersion or runoff from precipitation events.
- Liquids that accumulate inside the berm will be pumped from the stockpile to a container or tank for characterization and disposal.
- If the stockpile is outside of a secured area, the stockpile will be demarcated with barricades, orange cones, and/or caution tape until the stockpiles are removed from the site.
- Erosion control measures will be employed to prevent stockpiled soil from contributing to surface runoff and wind-generated particulate matter.
- After the final volume of stockpiled soil has been removed, the area will be inspected for visual contamination due to stockpiling activities, and any remaining residual contaminated material will be removed.

2.3.3.3 Clean Soil

Stockpiles of displaced soil outside of soil RFI/RI investigation areas that are non-hazardous, clean, and suitable for immediate reuse will be stored following these BMPs:

- Stockpiles will be constructed with liner and perimeter berm to prevent release or infiltration of liquids. Minimum 20-mil polyethylene sheeting or equivalent will be used for liners.
- Wind erosion will be prevented by use of a cover, applying Soiltac, a similar soil stabilization product, or other suitable means. If a cover is employed, it will be minimum 6-mil polyethylene sheeting or equivalent.
- The perimeter berm will be constructed of clean materials (such as hay bales or straw wattle under the liner).
- If a cover is employed, it will extend over the outer edges of the perimeter berm and liner so that rainfall is prevented from entering the stockpile.
- Covers and perimeter berms will be secured in place when not in use, at the end of each workday, and as necessary to prevent wind dispersion or run off from precipitation events.
- If the stockpile is outside of a secured area, the stockpile will be demarcated with barricades, orange cones, and/or caution tape until the stockpiles are removed from the site.
- Erosion control measures will be employed to prevent stockpiled soil from contributing to surface runoff and wind-generated particulate matter.

- After the stockpile has been removed, residual material will be removed from the underlying and surrounding areas.

2.3.4 Spill Prevention and Control

Spill prevention and control procedures and practices will be implemented in conjunction with the Waste Management Plan to prevent and control spills anytime chemicals and/or hazardous materials are stored on the construction site. Implementation of these procedures will minimize or prevent the discharge of spilled material into the drainage system or watercourses. Leaks and spills will be immediately cleaned up to the extent possible using absorbent materials, which will then be disposed of properly. Leaks and spills shall not be covered and/or buried or washed with water. Kits with appropriate spill response equipment will be kept near the construction and staging areas. The materials used for cleaning will not be allowed to enter storm drains or watercourses and will be collected and disposed of in accordance with BMPs. In particular, absorbents used to clean up spills of hazardous materials or waste must be managed as hazardous waste unless characterized as non-hazardous.

2.3.5 Solid Waste Management

Solid waste management procedures and practices will be implemented at the beginning and throughout the Project. Solid waste, consisting primarily of asphalt concrete waste, shall be loaded directly onto trucks for offsite disposal. Loose debris will be picked up daily. A sufficient number of conveniently located trash and scrap receptacles will be provided to promote proper disposal of solid wastes. Receptacles shall be provided with lids or covers to prevent windblown litter. Additionally, a sufficient number of proper receptacles will be provided to promote proper disposal of hazardous wastes. Employees and subcontractors will be informed of these practices and will be required to follow solid waste handling and storage procedures.

2.3.6 Concrete Waste Management

Concrete waste management procedures will be implemented where concrete is used as a construction material or where concrete dust and debris result from demolition activities. The concrete waste containers will be placed a minimum 50 feet from any drainage ways. Washouts will include secondary containment so that there is no discharge into the underlying soil and onto the surrounding areas. Watertight containers with lids and secondary containment, manufactured for the expressed purpose of containing waste concrete and its liquid residue, may be used. Containers will be emptied or removed from the project site when 75 percent of the full capacity has been reached.

2.3.7 Sanitary/Septic Waste Management

Sanitary/septic waste management procedures and practices are implemented at construction sites when a temporary or portable sanitary/septic waste system exists. Sanitary facilities will be located away from drainage facilities, waterways, and from traffic circulation. In the event of high winds or a risk of high winds, temporary sanitary facilities will be secured with spikes or weighed down to prevent overturning. The sanitation subcontractor will monitor onsite sanitary/septic waste storage and disposal procedures on a weekly basis in accordance with the sanitary/septic waste management BMPs. Wastewater will not be discharged or buried. Waste will be removed and disposed offsite. Regular waste collection should be arranged before facilities overflow. The sanitary facility will be located a minimum of 50 feet away from drainage facilities and away from waterways and traffic circulation.

2.3.8 Liquid Waste Management

Liquid waste management procedures will be employed to prevent the discharge of pollutants from liquid waste to the storm drain systems or watercourses. Liquid waste management will be applied if non-hazardous residuals or wastes are generated by construction activities. Employees and subcontractors will be informed that it is unacceptable for liquid wastes to enter storm drain systems or watercourses. Employees and subcontractors will be educated on the proper practices of disposing liquid waste.

2.4 Wind Erosion Control BMPs

To comply with EIR Mitigation Measures AIR-1a, AIR-1b, AIR-1c, and AIR-1e, wind erosion control will be applied as necessary to prevent nuisance dust and to minimize the movement of sediment disturbed during construction. The project site will be watered periodically with a water truck for short-term stabilization of disturbed surface areas, including haul roads, to minimize visible fugitive dust emissions during dust episodes. A water truck also will be used to control dust on disturbed surfaces during visible dusting episodes. Water application rates will be optimized to the greatest practical extent while still maintaining dust control but controlling runoff from affected material. Water may be applied as a pre-wetting step or may be used during construction activities. Loaded haul vehicles will be covered on publicly maintained roads. Graded sites will be stabilized using soil binders, as necessary, upon completion of grading when subsequent development is delayed or is expected to be delayed more than 30 days, except when such delay is caused by precipitation that dampens the disturbed surface area to eliminate visible fugitive dust emissions. Commercial dust control and soil stabilization products are typically polymer-or plant-based slurries, such as Soiltac or similar products. Nonessential earthmoving activities will also be curtailed or reduced under high wind conditions (sustained winds greater than 25 miles per hour).

2.5 Tracking Control BMPs

A temporary construction entrance is defined as a stabilized point of entrance/exit to a construction site to reduce the tracking of mud and dirt onto private or public paved roads by construction vehicles. A temporary construction entrance will be established at applicable paved intersections and entry points to prevent sediment tracking. The temporary construction entrance will be inspected routinely. To comply with EIR Mitigation Measure AIR-1d, project-related track-out or spills on publicly maintained paved surfaces will be cleaned up within 24 hours.

2.6 Non-stormwater BMPs

2.6.1 Water Conservation Practices

Water conservation practices will be implemented during the construction to avoid causing erosion and transporting pollutants offsite. Regular inspections will be conducted on high priority areas. If necessary, washing of vehicles and equipment will be washed in designated wash areas. Washwater will be collected, stored, characterized and properly disposed according to the protocols described in the Waste Management Plan. Used oil, used antifreeze, and hazardous chemical recycling programs shall also be implemented as necessary. Employees and subcontractors will be informed on the requirements of water conservation practices and will be required to implement the practices.

2.6.2 Dewatering Operations

Dewatering operations are practices that manage the discharge of pollutants when non-stormwater and accumulated precipitation must be removed from a work location so that construction work may be accomplished. No water from dewatering will be discharged offsite without prior approval of the appropriate construction management team member.

2.6.3 Paving and Grinding Operations

Paving and grinding operations are practices to prevent or reduce the discharge of pollutants from paving operations using measures to prevent runon and runoff pollution, properly disposing of wastes, and training employees and subcontractors. Many types of construction materials associated with paving and grinding operations, including mortar, concrete, and cement and their associated wastes, have basic chemical properties than can raise pH levels outside of the permitted range. Paving and grinding activities will prevent or minimize materials from entering drainage systems by covering inlet structures and manholes with filter fabric. Residue from paving and grinding operations will be collected and disposed of properly. Sandbags may be used to contain materials in the disturbed area. Nuisance water will removed with excavation spoils.

Excess saw-cut water can be removed with a vacuum truck. Paving and grinding operations will not be conducted if rainfall is predicted. Additional care will be taken when managing these materials to prevent contact with stormwater flows.

2.6.4 Illicit Connection/Illegal Discharge Detention Reporting

Illicit connections are connections that could convey anything not composed entirely of surface and storm water directly to the storm drainage system or a water body or are illegally dumped. Illicit connection and illegal discharge detection and reporting will be implemented. Illicit connections or illegally dumped or discharged materials on the construction site will be reported to the Site Operations Manager at the time of discovery. The site will be inspected regularly for evidence of illicit connections or illegal dumping or discharges. The construction contractor's Onsite Supervisor will report instances to the Site Operations Manager immediately after he or she learns of them. Employees and subcontractors will be informed on the practices and will be required to implement the practices throughout the project.

2.6.5 Vehicle and Equipment Fueling

Vehicle and equipment fueling policy/procedures will be implemented to minimize or eliminate discharge of pollutants associated with fueling to storm drain systems or watercourses (see Remedy-SOP-02 for "Safe Fueling and Fueling Handling Policy"). Onsite refueling will be used where it is impractical to send vehicles and equipment offsite for fueling. Fueling will only occur onsite over proper secondary containment. Fuel areas will be kept clean using dry cleanup methods, such as sweeping or using rags and absorbents for leaks and spills, and will be covered to prevent contact with stormwater. Employees and subcontractors will be informed of the vehicle and equipment fueling practices, trained, and required to implement them. Spill kits and absorbent spill cleanup materials will be available in fueling areas and on fueling trucks.

2.6.6 Vehicle and Equipment Maintenance

Vehicle and equipment maintenance procedures will be used to minimize or eliminate the discharge of pollutants to storm drain systems or watercourses when onsite vehicle and equipment maintenance is necessary. For open road vehicles, offsite maintenance facilities will be used whenever possible. Onsite vehicle maintenance, as needed, will occur with proper spill control and containment. The designated maintenance area will be located at least 50 feet from downstream drainage facilities and waterways and will be protected from stormwater runoff and onsite flooding. Employees and subcontractors will be informed of the procedures and practices and will be required to implement these practices.

2.6.7 Concrete Curing

Concrete is used in the construction of structures such as roadways, curbs, gutters, sidewalks, and structured foundations. Concrete is cured using both chemical and water methods. Proper handling, storage, application, and cleanup of curing compounds are required to minimize discharge of concrete-laden curing compounds with stormwater.

2.6.8 Concrete Finishing

Concrete finishing methods are used for paint removal, curing compound removal, and final surface finish appearances. Methods may include sandblasting, shotblasting, grinding, or high-pressure water blasting. Stormwater and non-stormwater exposed to concrete finishing byproducts may have a high pH and may contain chemicals, metals, and fines. Proper procedures and implementation of appropriate BMPs (such as directing water from blasting operations away from inlets and watercourses and collecting contaminated water from infiltration) can minimize the impact that concrete-finishing methods may have on stormwater and non-stormwater discharges.

2.7 Good Housekeeping BMPs

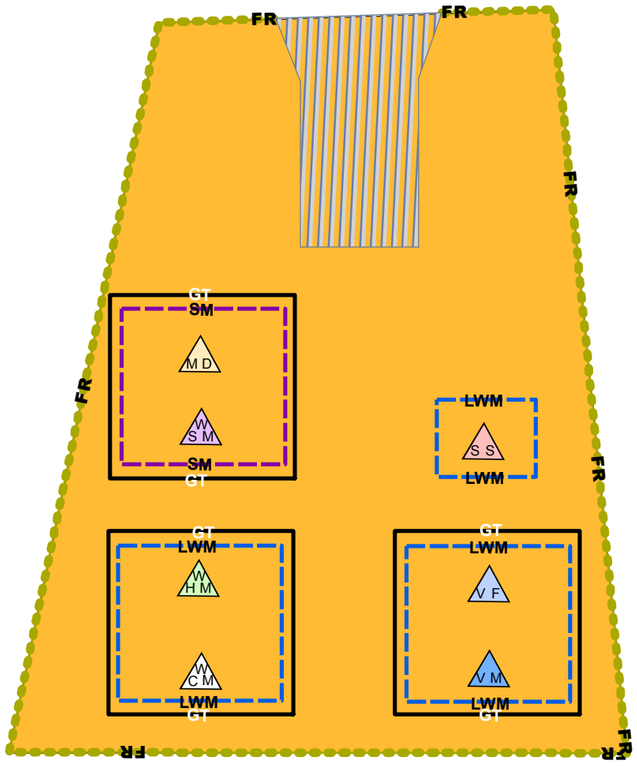
Good housekeeping measures will be implemented onsite for the duration of the project and include the following:

- Store chemicals in watertight containers (with appropriate secondary containment) in a completely enclosed storage cabinet, trailer, or sealed drums shed to prevent spillage and leakage.
- Minimize exposure of construction materials to precipitation.
- Cover waste disposal containers at the end of every business day and during rain events.
- Prevent discharges from waste disposal containers to the stormwater drainage system or receiving water.
- Prevent oil, grease, or fuel from leaking into the ground, storm drains, or surface waters.
- Immediately clean up leaked material and dispose of properly.
- Establish and maintain effective perimeter controls and stabilize construction entrances and exits to control erosion and sediment discharges from the site.
- Conduct regular stormwater tailgate meetings with the workforce when the project is staffed and work is underway.

Notes:

1. This figure shows typical BMPs in typical locations. The actual type, number, and location of the BMPs will be determined in the field by the construction contractor and may vary from what's currently depicted.

2. BPMs not drawn to scale.



LEGEND

- Proposed Staging Area
- Stabilized Construction Entrance/Exit
- Liquid Waste Management (LWM)
- Geotextile, Mats, Plastic Covers, and Erosion Control Blankets (GT)
- Stockpile Management (SM)

Erosion Control Measures

- Fiber rolls/sediment wattles straw bales/silt fence (FR)

- W C M — Concrete Waste Management (CWM)
- W H M — Harzardous Waste Management (HWM)
- M D — Material Delivery (MD)
- S S — Sanitary/Septic Waste Management (SS)
- W S M — Solid Waste Management
- V F — Vehicle and Equipment Fueling
- V M — Vehicle and Equipment Maintenance

0 25 50 100 Feet

FIGURE 2-1
EROSION CONTROL, TYPICAL
GROUNDWATER REMEDY CONSTRUCTION/
REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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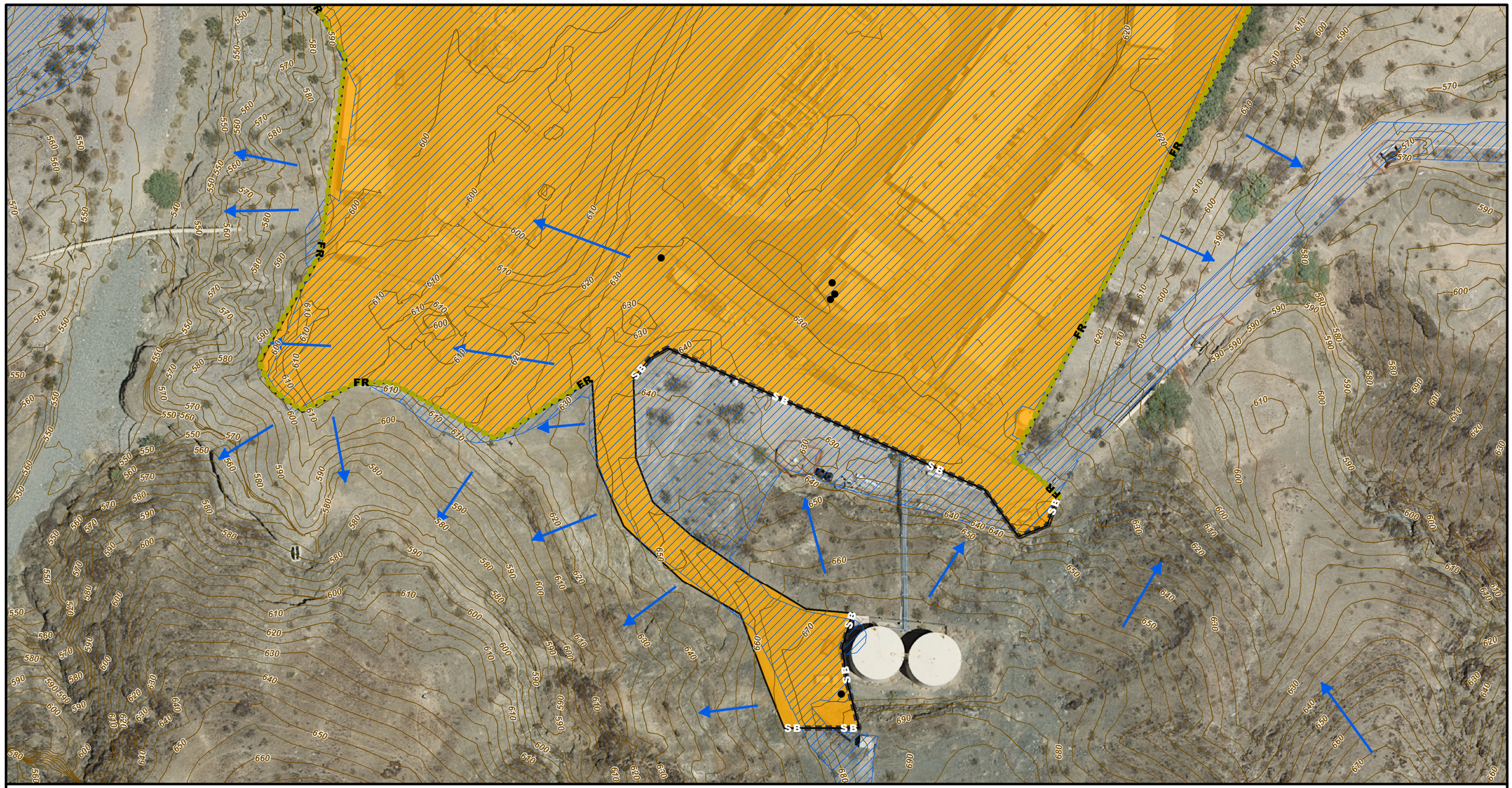

LEGEND

- Existing Well
- Proposed Staging Area
- Construction Footprint Including:
  - Remediation Wells
  - Monitoring Wells
  - Pipelines

Erosion Control Measures

- Approximate Flow Direction of Run-off
- Sand Bags (SB)
- Fiber rolls/sediment wattles/ straw bales/silt fence (FR)

0 37.5 75 150 Feet

N

FIGURE 2-2
EROSION CONTROL, TOPOCK COMPRESSOR STATION
GROUNDWATER REMEDY CONSTRUCTION/ REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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LEGEND

- New Well
- Existing Well
- Proposed Staging Area
- Construction Footprint Including:
  - Remediation Wells
  - Monitoring Wells
  - Pipelines

Erosion Control Measures

- Approximate Flow Direction of Run-off
- Sand Bags (SB)
- Fiber rolls/sediment wattles/ straw bales/silt fence (FR)

Note:

1. BMPs not drawn to scale.

0 30 60 120 Feet

N

FIGURE 2-3
EROSION CONTROL, IM-3 AREA
GROUNDWATER REMEDY CONSTRUCTION/
REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

Document Path: R:\PGEAlliance\Topock\MapFiles\2015\ErosionControl\Figure2_3_IM3Area.mxd

LEGEND

- Existing Well
- Proposed Staging Area

Erosion Control Measures

- Approximate Flow Direction of Run-off
- Sand Bags (SB)
- Fiber rolls/sediment wattles/ straw bales/silt fence (FR)

Notes:

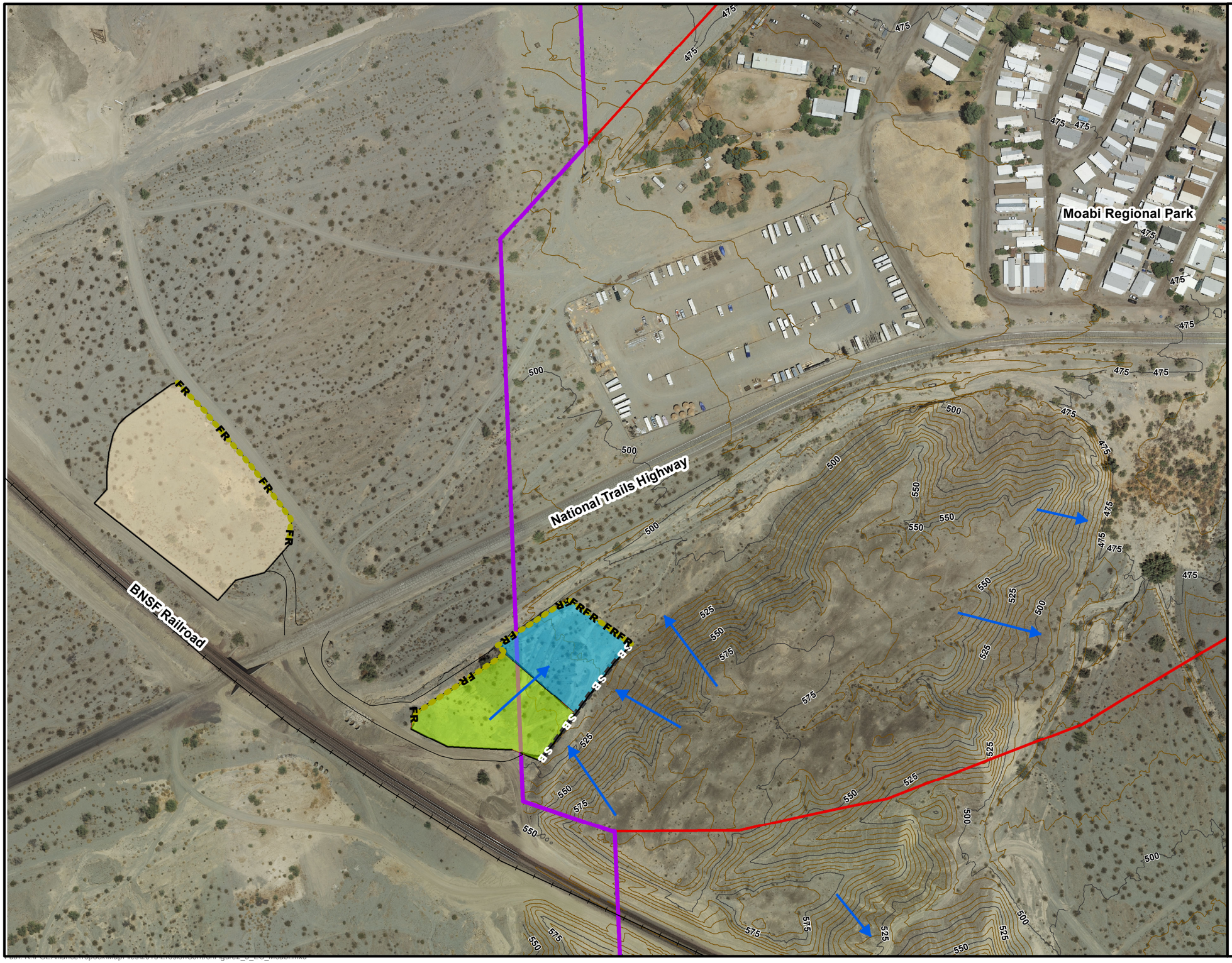
1. BMPs not drawn to scale.
2. Stabilized construction Entrances/Exits shall be used at all transitions from unpaved to paved roads, per TC-1.

0 45 90 180 Feet

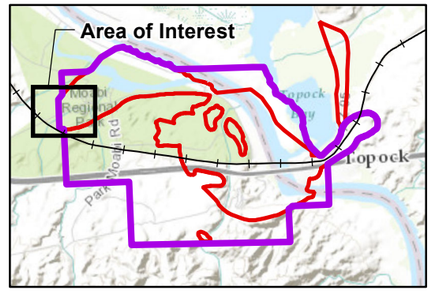
N

FIGURE 2-4
EROSION CONTROL,
TOPOCK MARINA AREA
GROUNDWATER REMEDY CONSTRUCTION/
REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

Document Path: R:\PGEAlliance\Topock\MapFiles\2015\ErosionControl\Figure2_4_EC_MarinaArea.mxd



VICINITY MAP



LEGEND

- Long-term Remedy Support Area (0.8 Acres Approximate)
- Soil Processing Area (2.56 Acres Approximate)
- Temporary Construction Laydown Area (1.05 Acres Approximate)
- Area of Potential Effects (APE)
- EIR Project Area
- Sand Bags (SB)
- Fiber rolls/sediment wattles/ straw bales/silt fence (FR)

Notes:
1. See Figure 2-1 for Construction Laydown BMP Typical.
2. This is a conceptual layout. Locations are approximate.
3. Descriptions of activities/functions anticipated for the construction support areas are included in the Construction/Remedial Action Work Plan.
4. Descriptions of activities/functions anticipated for the long-term remedy support areas are included in Section 3.5 of the BOD, and the O&M Manual.

N

0 90 180 360 Feet

FIGURE 2-5
EROSION CONTROL,
MOABI REGIONAL PARK AREA
GROUNDWATER REMEDY CONSTRUCTION/
REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

SECTION 3

Visual Inspection, Monitoring for Nonvisual Pollutants, Reporting, Training, and Recordkeeping

This section discusses visual inspections, monitoring for nonvisual pollutants, reporting, workers training and education, and recordkeeping.

3.1 Visual Inspection after Qualifying Rain Event

In conformance with the substantive requirements of the Arizona General Permit (Order No. AZG2013-001) and California General Permit (Order No. 2009-0009-DWQ), visual inspections will be implemented to assess the effectiveness of BMPs and to modify those BMPs, if necessary, to continue to reduce pollutants and impacts on receiving waters. Anticipated activities associated with the inspections include the following:

- Visually inspect BMPs and stormwater discharges at discharge locations within 2 business days (48 hours) after each qualifying rain event (producing precipitation of 0.5 inch or more). The objectives are to (1) identify whether BMPs were adequately designed, implemented, and effective and (2) identify additional BMPs accordingly.
- Visually inspect the discharge of stored or contained stormwater derived from and discharged subsequent to a qualifying rain event producing precipitation of 0.5 inch or more at the time of discharge. Stored or contained stormwater that will likely discharge after operating hours due to anticipated precipitation will be discharged during operating hours as necessary.
- Record the time, date, and rain gauge reading of qualifying rain events.
- Implement corrective actions, as appropriate.

Rain event inspections shall occur during working hours when it is safe to do so by the Construction Health and Safety Manager or designee. In the event of rain over a weekend or during a long holiday the inspection can occur prior to or after the weekend. If the inspection day falls on a Sunday, the inspection may be conducted on the following Monday.

Inspections are not required under adverse conditions. The QSP is not required to inspect areas that, at the time of inspection, are considered unsafe for inspection personnel. Inspections may be postponed when conditions exist such as local flooding, high winds, electrical storms, or situations that otherwise make inspections unsafe. The inspection must resume as soon as conditions are safe. Results of the inspection and any corrective action performed will be documented and kept onsite. An example Inspection and Corrective Action Report Form is included in Attachment 1.

3.2 Visual Inspection for Non-stormwater Discharge

In addition, quarterly visual inspections will be conducted for non-stormwater discharge. The objective is to inspect for the presence of (or indications of prior) unauthorized and authorized non-stormwater discharges and their sources. Inspection records will include the personnel performing the visual observation (inspections), the dates and approximate time of the inspection, and the response taken to eliminate unauthorized non-stormwater discharges and to reduce or prevent pollutants from contacting non-stormwater discharges, if any.

3.3 Monitoring for Nonvisual Pollutants

Monitoring for nonvisual pollutants will be conducted to determine whether pollutants known to occur within the construction area and that cannot be visually observed or detected in stormwater discharges are being conveyed from the site by stormwater.

The QSP will develop and implement the sampling and analysis requirements prior to the start of construction to monitor for nonvisual pollutants associated with construction activities. These requirements may be modified as needed to meet the monitoring objectives. Sampling and analysis is only required where the QSP believes pollutants associated with construction activities have the potential to be discharged with stormwater runoff due to a spill or in the event there was a breach, malfunction, failure, and/or leak of a BMP. If sampling is required as determined by the QSP, samples will be collected downgradient from potential discharge locations in areas that can be safely accessed. In addition, a sample of stormwater that has not come into contact with disturbed soil or materials stored or used onsite (uncontaminated sample) will be collected for comparison with the discharge sample. These samples will be collected during the first 2 hours of discharge from rain events occurring during business and daylight hours and generating runoff.

Samples will be analyzed for parameters indicating the presence of pollutants identified in the pollutant source assessment required by the Construction General Permit which states:

> *Identify the products used and/or expected to be used and the end products that are produced and/or expected to be produced. This does not include materials and equipment that are designed to be outdoors and exposed to environmental conditions (i.e., poles, equipment pads, cabinets, conductors, insulators, bricks, etc.).*

3.4 Reporting

Annual reports include a summary and evaluation of sampling and analysis results, original laboratory reports, chain-of-custody forms, a summary of corrective actions taken during the compliance year, and compliance activities or corrective actions that were not implemented. Annual reporting is a requirement of permitted SWPPP documents, and reports are submitted electronically through the Storm Water Multiple Application and Report Tracking System (SMARTs). Because this is not a permitted SWPPP, the annual reports will not be submitted through SMARTs. The annual reports will be submitted to DTSC (in compliance with HYDRO-1) and the U.S. Department of the Interior.

3.5 Workers Training and Education

Prior to the beginning of construction, construction workers will be trained on the overall stormwater management program and, more specifically, on proper implementation of this BMPs Plan and the SOPs for the operation and maintenance of facility components. Refresher training will be performed periodically for unique definable phases of work, and at least annually. Persons directly responsible for compliance with the plan, such as inspectors, workers installing and maintaining the erosion control devices, and workers collecting stormwater samples, will receive additional training. New personnel requiring stormwater management training after the start of construction will be provided training. Documentation of the training will be kept onsite.

3.6 Recordkeeping

The following records will be maintained onsite:

- This BMPs Plan and updates necessary to reflect current conditions and to maintain accuracy.
- Copies of relevant documents affecting the provisions or implementation of the BMPs Plan.
- Descriptions and dates of incidences of significant spills, leaks, or other releases pertaining to construction resulting in discharges of pollutants in stormwater to a regulated municipal separate

stormwater systems or to waters of the U.S., the circumstances leading to the release, and actions taken in response to the release and measures taken to prevent the recurrence of such releases.

- Documentation of maintenance, including repairs of structural control measures, including the date(s) of discovery of areas in need of repair/replacement, date(s) that the structural control measure(s) returned to full function, and the justification for any extended repair schedules. The maintenance records shall include the date(s) of regular maintenance.
- BMP inspection reports and corrective action report forms (Attachment 1).
- Annual reports.
- Training documentation.

3.7 Project Team

The project team members include:

- PG&E Site Operations Manager, Curt Russell – Responsible for overall onsite operations, and primary point of contact for field activities at the site
- PG&E Construction Manager, Danielle Starring – Overall management of activities related to the groundwater remedy construction program
- Construction Manager, Shakeel Jogia – Operational control over construction plans and specifications, management of construction contractors
- QSD, Gino Nguyen (CH2M) – Overall development and Implementation of this BMPs Plan
- QSP, to be appointed – Implementation of BMPs in this plan, non-storm water and storm water visual observations, and sampling and analysis.
- Construction Contractor(s), to be appointed – Responsible for day-to-day activities

The project team as defined above represents the current project organization. PG&E may reorganize and/or assign other parties to these roles over the course of the construction project to ensure project success.

Attachment 1
Inspection and Corrective Action Report Form

2013 Construction General Permit
Inspection & Corrective Action Report Form

ADEQ Arizona Department of Environmental Quality

Section I. General Information (see instructions)

Name of Project		CGP Tracking No.	AZCON – _____	Inspection Date	___ / ___ / _____

☐ **Check box when using this form to inspect an inactive/ unstaffed construction site (this option applies to an entire site only).** See Part 4.2(4) of the permit. Inspect the site immediately before becoming inactive/ unstaffed and every 6 months thereafter and within 24 hours of each storm event of 0.5 inch or greater in 24 hours.

Inspector Name, Title & Contact Information	**Name:** _____ **Title:** _____ **Contact information:** _____
Present Phase of Construction	

Inspection Schedule (all days are calendar days) *(Note: you may be subject to different inspection frequencies in different areas of the site. Check all that apply.)*

Routine Schedule: ☐ Every 7 days ☐ Every 14 days and within 24 hours of a 0.5" storm event

☐ Once per month, but not within 14 days of the previous inspection and within 24 hours of a 0.25" storm event

Reduced Schedule: once per month (but not within 14 days of the previous inspection) and before an anticipated storm event and within 24 hours of the end of each storm event of 0.5 inch or greater in 24 hours.

☐ Once per month (in stabilized areas)

☐ Once per month (where discharges are unlikely based on seasonal rainfall patterns)

☐ Once per month (where winter conditions exist and earth-disturbing activities are being conducted)

Discharge points within 1/4 mile of an impaired water or outstanding Arizona water (OAW): ☐ Every 7 days and within 24 hours of a 0.5" storm event

Was this inspection triggered by either a 0.25" or 0.5" storm event? ☐ Yes ☐ No

If yes, duration of storm event: ☐ < 1 hour ☐ < 6 hrs ☐ > 6 hrs

If yes, how was the storm event determined (either 0.25" or 0.5")?

☐ Rain gauge on site ☐ Weather station representative of site. Specify weather station source: _____

Total rainfall amount that triggered the inspection (in inches)**:** _____

Identify all sources of non-stormwater discharges occurring at the site and the associated control measures in place

sources of non-stormwater discharges:	control measures associated with the non-stormwater discharges:
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____
5. _____	5. _____

Adverse or Unsafe Conditions for Inspection

Did you determine that any portion of the site was unsafe for inspection per CGP Part 4.2(6)? ☐ Yes ☐ No

If "yes", complete the following:

- Describe the conditions that prevented you from conducting the inspection in this location:

- Location(s) where conditions were found:

Note: *Inspections may be postponed when adverse or unsafe conditions exist such as local flooding, high winds, or electrical storms, or situations that otherwise make inspections unsafe. However, the inspection must resume as soon as conditions are safe.*

Section II. Description of Discharges and Condition of the Discharge Locations (CGP Part 4.3(11)) (see instructions)

Discharge Point	Observations *(Note: discharges may not occur at every discharge point on the site after a storm event. Check all that apply.)*
1.	Describe the discharge: ☐ Stormwater ☐ Non-stormwater ☐ None Since the last inspection, do you see any evidence of erosion, sediment accumulation and/ or other pollutants that can be attributed to your discharge? ☐ Yes ☐ No
If yes, describe the characteristics of the discharge (color, odor, clarity, etc.) specify the location(s) of these conditions, and indicate whether modification, maintenance, or corrective action is needed to correct the problem. Also, describe any visible signs of erosion or sediment accumulation.	
2.	Describe the discharge: ☐ Stormwater ☐ Non-stormwater ☐ None Since the last inspection, do you see any evidence of erosion, sediment accumulation and/ or other pollutants that can be attributed to your discharge? ☐ Yes ☐ No
If yes, describe the characteristics of the discharge (color, odor, clarity, etc.) specify the location(s) of these conditions, and indicate whether modification, maintenance, or corrective action is needed to correct the problem. Also, describe any visible signs of erosion or sediment accumulation.	
3.	Describe the discharge: ☐ Stormwater ☐ Non-stormwater ☐ None Since the last inspection, do you see any evidence of erosion, sediment accumulation and/ or other pollutants that can be attributed to your discharge? ☐ Yes ☐ No
If yes, describe the characteristics of the discharge (color, odor, clarity, etc.) specify the location(s) of these conditions, and indicate whether modification, maintenance, or corrective action is needed to correct the problem. Also, describe any visible signs of erosion or sediment accumulation.	

Section II. CONTINUATION SHEET FOR: Description of Discharges and Condition of the Discharge Locations [Print additional sheets as necessary]

Discharge Point	Observations *(Note: discharges may not occur at every discharge point on the site after a storm event. Check all that apply.)*
#___.	Describe the discharge: ☐ Stormwater ☐ Non-stormwater ☐ None Since the last inspection, do you see any evidence of erosion, sediment accumulation and/ or other pollutants that can be attributed to your discharge? ☐ Yes ☐ No
If yes, describe the characteristics of the discharge (color, odor, clarity, etc.) specify the location(s) of these conditions, and indicate whether modification, maintenance, or corrective action is needed to correct the problem. Also, describe any visible signs of erosion or sediment accumulation.	
#___.	Describe the discharge: ☐ Stormwater ☐ Non-stormwater ☐ None Since the last inspection, do you see any evidence of erosion, sediment accumulation and/ or other pollutants that can be attributed to your discharge? ☐ Yes ☐ No
If yes, describe the characteristics of the discharge (color, odor, clarity, etc.) specify the location(s) of these conditions, and indicate whether modification, maintenance, or corrective action is needed to correct the problem. Also, describe any visible signs of erosion or sediment accumulation.	
#___.	Describe the discharge: ☐ Stormwater ☐ Non-stormwater ☐ None Since the last inspection, do you see any evidence of erosion, sediment accumulation and/ or other pollutants that can be attributed to your discharge? ☐ Yes ☐ No
If yes, describe the characteristics of the discharge (color, odor, clarity, etc.) specify the location(s) of these conditions, and indicate whether modification, maintenance, or corrective action is needed to correct the problem. Also, describe any visible signs of erosion or sediment accumulation.	
#___.	Describe the discharge: ☐ Stormwater ☐ Non-stormwater ☐ None Since the last inspection, do you see any evidence of erosion, sediment accumulation and/ or other pollutants that can be attributed to your discharge? ☐ Yes ☐ No
If yes, describe the characteristics of the discharge (color, odor, clarity, etc.) specify the location(s) of these conditions, and indicate whether modification, maintenance, or corrective action is needed to correct the problem. Also, describe any visible signs of erosion or sediment accumulation.	

Section III. Condition and Effectiveness of All On-site Control Measures (Erosion and Sediment (E&S)), Stabilization and Pollution Prevention (P2) Practices (CGP Part 3.1.1 through 3.1.3) (see instructions)					
Description of Control Measures	**Type of Control Measure:** ▪ **Erosion and Sediment (E&S)** ▪ **Stabilization** ▪ **Pollution Prevention (P2)**	**Additional controls required?**	**Repairs or other maintenance needed?[1]**	**Corrective action required?[1, 2]** Date of discovery	**Specify stabilization method** (mulch, rock, planted vegetation, etc.)
1.	☐ E&S ☐ Stabilization ☐ P2	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No ___ / ___ / _____	
Notes (e.g., provide details about needed additional control measures, maintenance performed, etc.)					
Description of Control Measures	**Type of Control Measure:** ▪ **Erosion and Sediment (E&S)** ▪ **Stabilization** ▪ **Pollution Prevention (P2)**	**Additional controls required?**	**Repairs or other maintenance needed?[1]**	**Corrective action required?[1, 2]** Date of discovery	**Specify stabilization method** (mulch, rock, planted vegetation, etc.)
2.	☐ E&S ☐ Stabilization ☐ P2	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No ___ / ___ / _____	
Notes (e.g., provide details about needed additional control measures, maintenance performed, etc.)					

Note 1: The permit differentiates between conditions requiring repairs and maintenance, and those requiring corrective action. The permit requires maintenance in order to keep controls in effective operating condition and requires repairs if controls are not operating as intended. Corrective actions are triggered only for specific, more serious conditions, which include: 1) A necessary stormwater control was never installed, was installed incorrectly, or not in accordance with the requirements in Part 3.1 and/or Part 3.2; 2) One of the prohibited discharges in Part 1.4 is occurring or has occurred; or 3) ADEQ or USEPA determines that modifications to the control measures are necessary to meet the requirements of Part 3.

Note 2: If answering "Yes" (i.e., a site condition that meets one or more of the three criteria in Note 1 above requires a corrective action), you must complete Section IV (Corrective Action Report) below. See Part 5 of the permit for more information.

Section III. CONTINUATION SHEET FOR: Control Measure Condition and Effectiveness [Print additional sheets as necessary]

Description of Control Measures	Type of Control Measure: ▪ Erosion and Sediment (E&S) ▪ Stabilization ▪ Pollution Prevention (P2)	Additional controls required?	Repairs or other maintenance needed?[1]	Corrective action required?[1, 2] Date of discovery	Specify stabilization method (mulch, rock, planted vegetation, etc.)
#___.	☐ E&S ☐ Stabilization ☐ P2	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No ___ / ___ / _____	
Notes (e.g., provide details about needed additional control measures, maintenance performed, etc.)					

Description of Control Measures	Type of Control Measure: ▪ Erosion and Sediment (E&S) ▪ Stabilization ▪ Pollution Prevention (P2)	Additional controls required?	Repairs or other maintenance needed?[1]	Corrective action required?[1, 2] Date of discovery	Specify stabilization method (mulch, rock, planted vegetation, etc.)
#___.	☐ E&S ☐ Stabilization ☐ P2	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No ___ / ___ / _____	
Notes (e.g., provide details about needed additional control measures, maintenance performed, etc.)					

Note 1: The permit differentiates between conditions requiring repairs and maintenance, and those requiring corrective action. The permit requires maintenance in order to keep controls in effective operating condition and requires repairs if controls are not operating as intended. Corrective actions are triggered only for specific, more serious conditions, which include: 1) A necessary stormwater control was never installed, was installed incorrectly, or not in accordance with the requirements in Part 3.1 and/or Part 3.2; 2) One of the prohibited discharges in Part 1.4 is occurring or has occurred; or 3) ADEQ or USEPA determines that modifications to the control measures are necessary to meet the requirements of Part 3.

Note 2: If answering "Yes" (i.e., a site condition that meets one or more of the three criteria in Note 1 above requires a corrective action), you must complete Section IV (Corrective Action Report) below. See Part 5 of the permit for more information.

ADEQ Arizona Department of Environmental Quality

Section IV. Corrective Action Report Form

Section IV.A. – General Information

(Complete this section within 24 hours of discovering the condition that triggered corrective action)

Date/ Time Problem First Discovered	Date: ___ / ___ / _____ Time: _____ ___AM ___PM	Today's Date	___ / ___ / _____

Name and Contact Information of Individual Completing this Form

Name: _____

Contact information: _____

What site conditions triggered the requirement to conduct corrective action? *(Check the box that applies)*

- ☐ A necessary stormwater control was never installed, was installed incorrectly, or not in accordance with the requirements in Part 2 and/or 3
- ☐ A prohibited discharge described in Part 1.4 has occurred or is occurring
- ☐ ADEQ or USEPA has determined that modifications to the control measures are necessary to meet the requirements of Part 3.

Provide a description of the problem: (Provide description of the specific problem that triggered the need for corrective action, and the specific location where it was found. If you have already provided this explanation in an inspection report, you can refer to that report.)

Deadline for completing corrective action:

- ☐ Work will be completed no more than 7 calendar days after the date the problem was discovered (enter date): ____ / ____ / _____
- ☐ It is infeasible to complete work within the first 7 days, therefore, the work will be completed as soon as practicable following the 7th day (enter date): ____ / ____ / _____

If the estimated date of completion falls after the 7-day deadline, document the following: (1) The reason it is infeasible to complete work within 7 days, and (2) The schedule for installing and making the new or modified stormwater control operational in the soonest practicable timeframe.

NOTE: *Any corrective actions that result in changes to any of the stormwater controls or procedures shall be documented in the SWPPP within 7 calendar days of completing the corrective action work.*

Section IV.B. – Stormwater Control Modifications to be Implemented in Response to a Corrective Action Trigger [Print additional sheets as necessary]			
List of stormwater control(s) to be modified or replaced to correct the condition that required the Corrective Action	**Actual or Planned Completion Date**	**SWPPP Update Necessary?** **If yes, specify date SWPPP modified**	**Notes and observations**
1.	___ / ___ / _____	☐ Yes ☐ No ___ / ___ / _____	
2.	___ / ___ / _____	☐ Yes ☐ No ___ / ___ / _____	
3.	___ / ___ / _____	☐ Yes ☐ No ___ / ___ / _____	
4.	___ / ___ / _____	☐ Yes ☐ No ___ / ___ / _____	
5.	___ / ___ / _____	☐ Yes ☐ No ___ / ___ / _____	
6.	___ / ___ / _____	☐ Yes ☐ No ___ / ___ / _____	
7.	___ / ___ / _____	☐ Yes ☐ No ___ / ___ / _____	

Section V. CONTINUATION SHEET for Miscellaneous Items (see instructions) [Print additional sheets as necessary]

Use this space for miscellaneous information or as continuation of items found elsewhere in this report.

Section VI. Certification and Signature (CGP Appendix B. 9.)

Section VI.A. – Certification and Signature by Contractor or Subcontractor performing the inspections (if applicable)

Check one of the following:

- ☐ No instances of non-compliance were discovered during this inspection and the project was in full compliance with the SWPPP and permit.
- ☐ Inspection follow-up is required, in accordance with Parts 4.5(1) and 4.5(2) of the permit.

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Signature of Contractor or Subcontractor: _____ Title: _____

Printed name : _____ Date: _____

Business / Agency: _____ Phone number: _____

Section VI.B. – Certification and Signature by Permittee (permittee / operator or a duly authorized representative is required to sign)

Check one of the following:

- ☐ No instances of non-compliance were discovered during this inspection and the project was in full compliance with the SWPPP and permit.
- ☐ Inspection follow-up is required, in accordance with Parts 4.5(1) and 4.5(2) of the permit.

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Signature of Permittee or
"Duly Authorized Representative": _____ Title: _____

Printed Name: _____ Date: _____

Business / Agency: _____ Phone number: _____

Appendix N
Aesthetics and Visual Resources Protection and Revegetation Plan
(On CD-ROM Only)

Final

Topock Compressor Station Groundwater Remediation Project Aesthetics and Visual Resources Protection and Revegetation Plan

Prepared for

Pacific Gas and Electric Company

September 2014

Prepared by

CH2M HILL, Inc., and E2 Consulting Engineers, Inc.

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Acronyms and Abbreviations

BLM	Bureau of Land Management
BNSF	Burlington Northern Santa Fe
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
compressor station	Topock Compressor Station
DOI	Department of the Interior
DTSC	Department of Toxic Substances Control
ER	East Ravine
GANDA	Garcia and Associates
GPS	global positioning system
I-40	Interstate 40
IRL	inner recirculation loop
IRZ	in situ reactive zone
PG&E	Pacific Gas and Electric Company
PPD	preconstruction photo documentation
Project	implementation of the groundwater remedy
RB	riverbank
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RPD	revegetation photo documentation
TCS	Topock Compressor Station
TWB	Transwestern Bench
U.S.	United States
USBR	United States Bureau of Reclamation

SECTION 1

Introduction

In December 1951, Pacific Gas and Electric Company (PG&E) began operations near Topock, Arizona, to compress natural gas supplied from the southwestern United States (U.S.) for transport through pipelines to PG&E's service territory in central and northern California. The Topock Compressor Station (TCS or compressor station) is approximately 15 miles southeast of Needles in San Bernardino County, California (Figure 1). The station is still active and is anticipated to remain active into the foreseeable future. Operations at the compressor station consist of six major activities: water conditioning, compressing natural gas, cooling compressed natural gas and compressor lubricating oil, wastewater treatment, facility and equipment maintenance, and miscellaneous operations.

Historical wastewater discharge from TCS operations to Bat Cave Wash and the East Ravine have resulted in chromium contamination in groundwater. In 1996, PG&E entered into a Corrective Action Consent Agreement with the California Department of Toxic Substances Control (DTSC) to oversee the investigation and remediation of the TCS site under California state law. DTSC is the California state lead agency charged with directing investigative activities in the action area in accordance with the Resource Conservation and Recovery Act (RCRA). The U.S. Department of the Interior (DOI) is the lead federal agency overseeing response actions for land under its jurisdiction, custody, or control near the TCS pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

In January 2011, the DOI issued a Record of Decision (ROD) selecting the groundwater remedy for the site, and at the same time, DTSC adopted the final remedy for groundwater contamination at the site. DTSC also issued the Final Environmental Impact Report (FEIR) for the final remedy (DTSC 2011). Section 4.1 of the FEIR specifically addressed the aesthetics of the groundwater remedy project (the project), including a description of the existing visual quality of the landscape and an analysis of potential visual impacts resulting from the project.

Figures 2a through 2c show the planned final groundwater remedy system layout in California, Moabi Regional Park, and Arizona, respectively. The project is expected to operate for several decades (estimated duration between 30 and 50 years).

Generally, the project will include the following key features:

- An in situ reactive zone (IRZ) along the National Trails Highway that will use a line of wells that may be used as both injection and extraction wells to circulate groundwater and distribute an organic carbon source that will promote reduction of the hexavalent chromium to trivalent chromium.
- An inner recirculation loop (IRL) that comprises:
  - Extraction wells near the Colorado River (referred to as the riverbank [RB] extraction wells) to provide hydraulic capture of the deep hexavalent chromium groundwater concentrations, accelerate cleanup of the floodplain, enhance the flow of contaminated groundwater through the IRZ line, and control migration of IRZ-generated byproducts toward the Colorado River.
  - Injection wells to re-inject groundwater extracted from the RB extraction wells, which may be amended with an organic carbon source, in the upgradient portion of the hexavalent chromium plume to flush the plume through the IRZ.
- A TCS recirculation loop, which includes:
  - East Ravine (ER) extraction wells near the eastern end of the East Ravine to capture contaminated groundwater in the shallow bedrock.

  - Transwestern Bench (TWB) extraction wells near the eastern portion of the TCS parcel to capture contaminated groundwater downgradient of the compressor station.
  - TCS injection wells located within the compressor station for the re-injection of groundwater extracted from the ER and TWB extraction wells. The extracted water will be amended with an organic carbon source to promote reduction of hexavalent chromium to trivalent chromium and reduce elevated hexavalent chromium groundwater concentrations from the alluvial aquifer in the vicinity of the compressor station.
- The freshwater supply system will convey water from supply well(s) in Arizona to assist with flushing the chromium plume through the National Trails Highway IRZ and constrain the westward spread of carbon-amended water and in situ byproducts from the IRL.

Figure 3 provide a close-up of the currently proposed project features in the areas near the Colorado River between the Burlington Northern Santa Fe (BNSF) Railroad and the Bat Cave Wash outlet. This is an important area for this current revegetation plan because it comprises the area that is most sensitive from a visual quality impact analysis standpoint, as described in the following subsection.

1.1 Visual Quality Impact Analysis from the FEIR

The analysis included in the FEIR (DTSC 2011) evaluated potential impacts on aesthetics and visual quality from 14 key viewpoints (Exhibit 4.1-7 in Appendix A). The analysis determined that no project impacts would occur at four of the key viewpoints (7, 8, 12, and 13), and impacts would be less than significant at eight of the key viewpoints (Table 1). Only two key views (5 and 11) were identified to have potentially significant impacts on the visual quality of the landscape.

Key View 5 represents the views experienced by pedestrian visitors to the Topock Maze area located immediately west of the National Trails Highway overlooking the sandy terrace along the western side of the Colorado River (Exhibit 4.1-7 included in Appendix A). The analysis determined that temporary changes to the visual quality of this area during construction would be less than significant; however, the installation of wells, access roads, and removal of vegetation would result in a strong degree of contrast to the existing visual character of the sandy terrace, and the impacts to visual quality in this area were considered potentially significant (DTSC, 2011).

Key View 11 considers views of recreational boaters on the Colorado River looking southwest toward the sandy terrace on the eastern side if the National Trails Highway (Exhibit 4.1-7 included in Appendix A). The FEIR analysis was based on the potential introduction of up to 170 wells in this area that would result in the extensive removal of vegetation, as well as the potential alteration of riparian vegetation along the riverbank. This was considered to represent a potentially significant impact to the visual quality in this area.

TABLE 1
Summary of Key View Analysis
(Copy of Table 4.1-3 from FEIR [DTSC, 2011])

Key View	Viewer Group	Scenic Resource Representation	Proposed Project Visible?	Degree of Contrast (BLM)	Determination of Impact (CEQA)
1	Vehicular	Views from 1-40; an eligible scenic highway	Yes	Weak	Less than significant
2	Vehicular	Views from 1-40; an eligible scenic highway	Yes	Moderate	Less than significant
3	Vehicular	Views from 1-40; an eligible scenic highway	Yes	Weak	Less than significant
4	Vehicular	Views to "Needles" rock; a scenic vista	Yes	Moderate	Less than significant
5	Pedestrian	Views from Topock Maze; a scenic vista	Yes	Strong	Potentially Significant

TABLE 1
Summary of Key View Analysis
(Copy of Table 4.1-3 from FEIR [DTSC, 2011])

Key View	Viewer Group	Scenic Resource Representation	Proposed Project Visible?	Degree of Contrast (BLM)	Determination of Impact (CEQA)
6	Pedestrian	Views from Topock Maze; a scenic vista	Yes	Low	Less than significant
7	Pedestrian	Views to Topock Maze; a scenic vista	No	N/A	N/A
8	Pedestrian	None	No	N/A	N/A
9	Pedestrian	Views from Topock Maze; a scenic vista	Yes	Moderate	Less than significant
10	Recreational	Views from Chemehuevi Mountain; a scenic vista	Yes	Weak	Less than significant
11	Recreational	Views from Colorado River; a scenic resources corridor	Yes	Strong	Potentially significant
12	Recreational	None	No	N/A	N/A
13	Recreational	Views from Colorado River; a scenic resources corridor	Yes	Moderate	Less than significant
14	Recreational	None	No	N/A	N/A

Notes:
BLM = U.S. Bureau of Land Management
I-40 = Interstate 40
Boldface denotes that project features are visible from that key view and that the key view was selected for analysis.
Source: Data compiled by AECOM in 2009

1.2 FEIR Aesthetic Mitigation Measures

The following mitigation measures were included in the FEIR (DTSC, 2011) and are intended to reduce impacts resulting from implementation of the project on aesthetics and visual quality from Key Views 5 and 11. This report specifically addresses mitigation for impacts to mature plants and riparian vegetation in areas to be disturbed in relation to these two key views. Identification of mature plant specimens and impacts to culturally sensitive plant species have been addressed in other documents prepared for the project (Garcia and Associates [GANDA] and CH2M HILL, 2012; GANDA and E2 Consulting Engineers, 2013; E2 Consulting Engineers, 2014).

1.2.1 Mitigation Measure AES-1: Impacts on Views from Topock Maze Locus B, A Scenic Vista (Key View 5)

The proposed project shall be designed and implemented to adhere to the design criteria presented below.

- Existing mature plant specimens shall be protected in place during construction, operation, and decommissioning phases. The identification of plant specimens that are determined to be mature and retained shall occur as part of the design phase and mapped/identified by a qualified plant ecologist or biologist and integrated into the final design and project implementation consistent with CUL-1a-5.[1]

[1] Mitigation Measure CUL-1a-5 states, "Should any indigenous plants of traditional cultural significance and listed in Appendix PLA of this FEIR be identified within the project area, PG&E shall avoid, protect, and encourage the natural regeneration of the identified plants when developing the remediation design, final restoration plan, and IM-3 decommission plan. In the event that impacts on the identified plants cannot be avoided and such plants will be displaced, PG&E shall retain a qualified botanist who shall prepare a plant transplantation/monitoring plan which can be included as part of the Cultural Impact Mitigation Program (CIMP) referenced in CUL-1a-8 either by (1) transplanting such indigenous plants to an onsite location, or (2) providing a 2:1 ratio replacement to another location decided upon between PG&E and members of the Interested Tribes. Plans to transplant or replace such plants shall be approved by DTSC. In coordination with the qualified botanist, PG&E shall monitor all replanted and replacement plants for at least 5 years, and shall ensure at least a 75 percent survivorship during that time. This mitigation measure is not meant to

- Revegetation of disturbed areas within the riparian vegetation along the Colorado River shall occur concurrently with construction operations. Plans and specifications for revegetation shall be developed by a qualified plant ecologist or biologist before any riparian vegetation is disturbed. The revegetation plan shall include specification of maintenance and monitoring requirements, which shall be implemented for a period of 5 years after project construction or after the vegetation has successfully established, as determined by a qualified plant ecologist or biologist.
- Plant material shall be consistent with surrounding native vegetation.
- The color of the wells, pipelines, reagent storage tanks, control structures, and utilities shall consist of muted, earth-tone colors that are consistent with the surrounding natural color palette. Matte finishes shall be used to prevent reflectivity along the view corridor. Integral color concrete shall be used in place of standard gray concrete.
- The final revegetation plans and specifications shall be reviewed and approved by an architect, landscape architect, or allied design professional licensed in California to ensure the design objectives and criteria are being met. Planting associated with biological mitigation may contribute to, but may not fully satisfy, visual mitigation.

1.2.2 Mitigation Measure AES-2: Impacts on Views from Colorado River, A Scenic Resources Corridor (Key View 11)

The proposed project shall be designed and implemented to adhere to the design criteria presented below.

- A minimum setback requirement of 20 feet from the water (ordinary high water mark) shall be enforced, except with regard to any required river intake facilities, to prevent substantial vegetation removal along the riverbank.
- Existing mature plant specimens shall be protected in place during construction, operation, and decommissioning phases. The identification of plant specimens that are determined to be mature and retained shall occur as part of the design phase and mapped/identified by a qualified plant ecologist or biologist and integrated into the final design and project implementation.
- Revegetation of disturbed areas within the riparian vegetation along the Colorado River shall occur concurrently with construction operations. Plans and specifications for revegetation shall be developed by a qualified plant ecologist or biologist before any riparian vegetation is disturbed. The revegetation plan shall include specification of maintenance and monitoring requirements, which shall be implemented for a period of 5 years after project construction or after the vegetation has successfully established, as determined by a qualified plant ecologist or biologist.
- Plant material shall be consistent with surrounding native vegetation.
- The color of the wells, pipelines, and utilities shall consist of muted, earth-tone colors that are consistent with the surrounding natural color palette. Matte finishes shall be used to prevent reflectivity along the view corridor. Integral color concrete should be used in place of standard gray concrete.
- The final revegetation plans and specifications shall be reviewed and approved by an architect, landscape architect, or allied design professional licensed in California to ensure the design objectives and criteria are being met. Planting associated with biological mitigation may contribute to, but may not fully satisfy, visual mitigation.

replace or subsume any actions required by state or federal entities with regard to the protection of species listed as rare, threatened, or endangered."

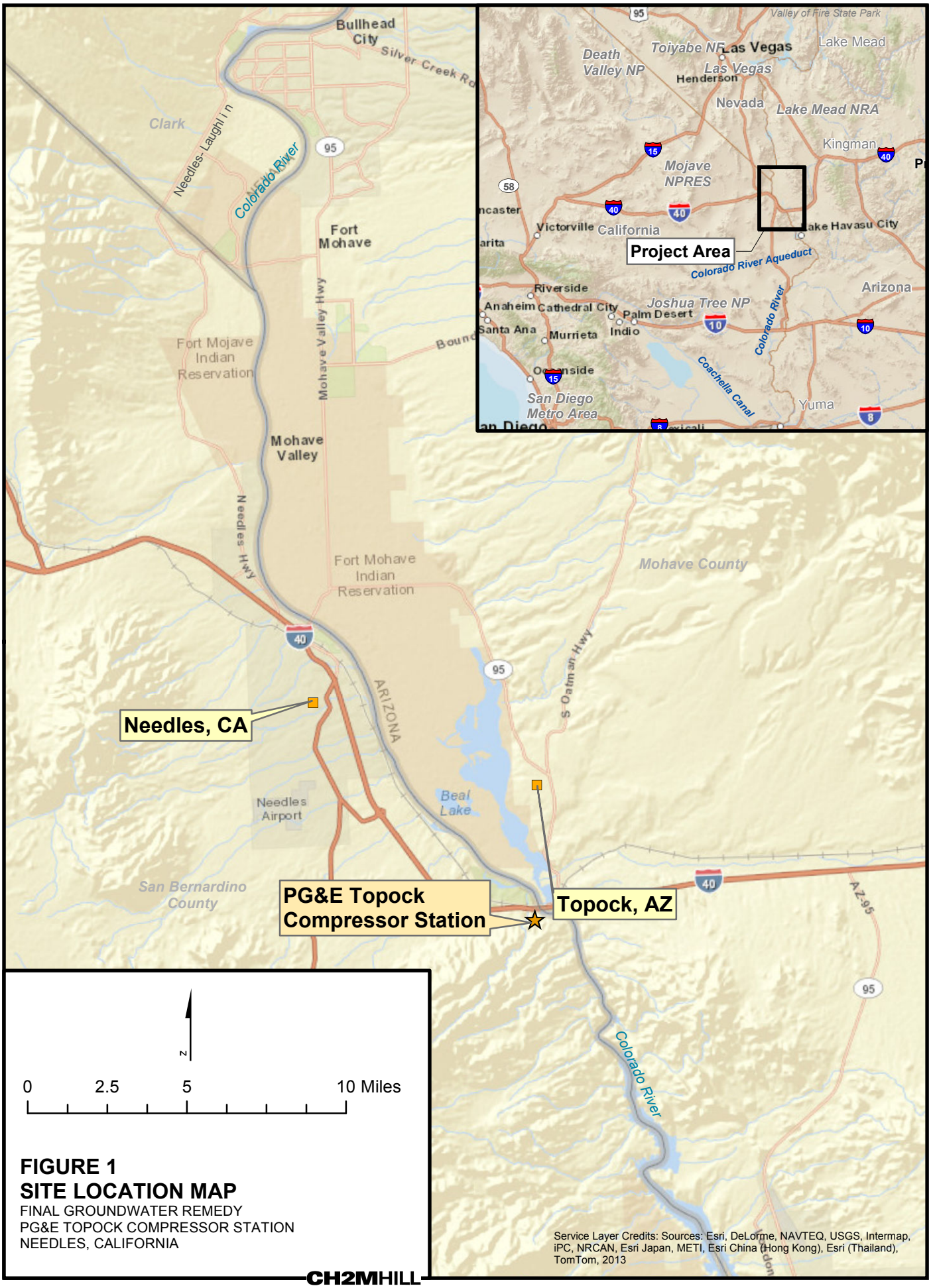
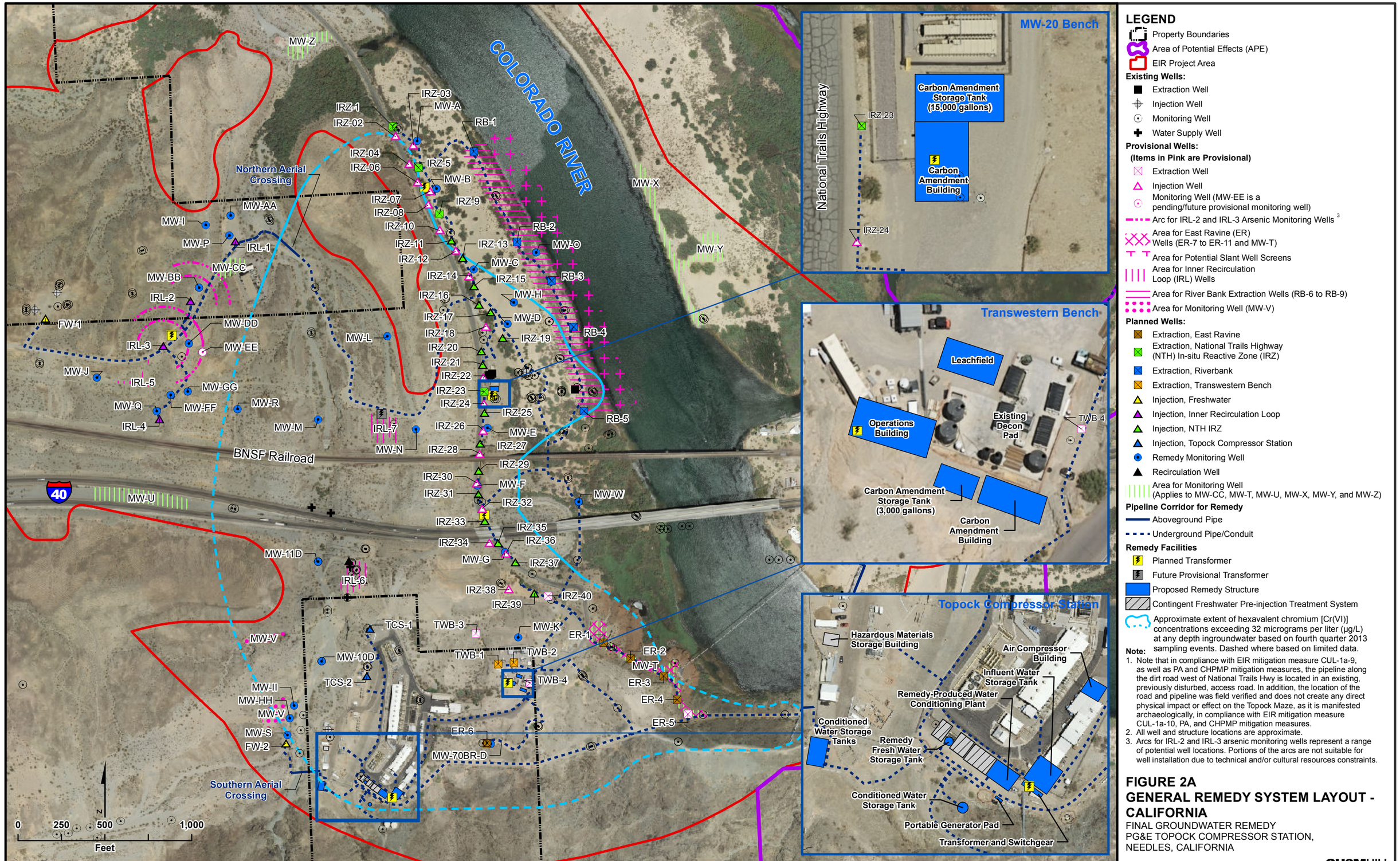


FIGURE 1
SITE LOCATION MAP
FINAL GROUNDWATER REMEDY
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\HNWR\FIG1_SiteLocationHNWR.mxd Date Saved: 6/19/2014 10:15:09 AM



LEGEND

- Property Boundaries
- Area of Potential Effects (APE)
- EIR Project Area

Existing Wells:

- Extraction Well
- Injection Well
- Monitoring Well
- Water Supply Well

Provisional Wells:

(Items in Pink are Provisional)

- Extraction Well
- Injection Well
- Monitoring Well (MW-EE is a pending/future provisional monitoring well)
- Arc for IRL-2 and IRL-3 Arsenic Monitoring Wells [3]
- Area for East Ravine (ER) Wells (ER-7 to ER-11 and MW-T)
- Area for Potential Slant Well Screens
- Area for Inner Recirculation Loop (IRL) Wells
- Area for River Bank Extraction Wells (RB-6 to RB-9)
- Area for Monitoring Well (MW-V)

Planned Wells:

- Extraction, East Ravine
- Extraction, National Trails Highway (NTH) In-situ Reactive Zone (IRZ)
- Extraction, Riverbank
- Extraction, Transwestern Bench
- Injection, Freshwater
- Injection, Inner Recirculation Loop
- Injection, NTH IRZ
- Injection, Topock Compressor Station
- Remedy Monitoring Well
- Recirculation Well
- Area for Monitoring Well (Applies to MW-CC, MW-T, MW-U, MW-X, MW-Y, and MW-Z)

Pipeline Corridor for Remedy

- Aboveground Pipe
- Underground Pipe/Conduit

Remedy Facilities

- Planned Transformer
- Future Provisional Transformer
- Proposed Remedy Structure
- Contingent Freshwater Pre-injection Treatment System
- Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

Note:

1. Note that in compliance with EIR mitigation measure CUL-1a-9, as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Hwy is located in an existing, previously disturbed, access road. In addition, the location of the road and pipeline was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10, PA, and CHPMP mitigation measures.
2. All well and structure locations are approximate.
3. Arcs for IRL-2 and IRL-3 arsenic monitoring wells represent a range of potential well locations. Portions of the arcs are not suitable for well installation due to technical and/or cultural resources constraints.

FIGURE 2A
GENERAL REMEDY SYSTEM LAYOUT - CALIFORNIA

FINAL GROUNDWATER REMEDY
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

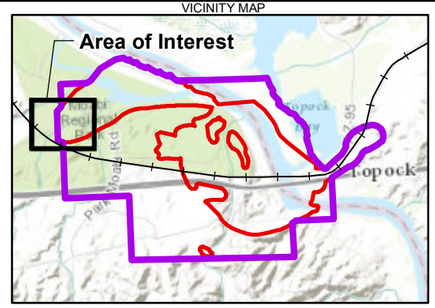
Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\Vegetation\FIG2A_90pct_CAdetails.mxd

Moabi Regional Park

National Trails Highway

BNSF Railroad

VICINITY MAP



LEGEND

- Long Term Remedy Support Area (1.2 acres approx.)
- Soil Storage Area (Each 1.5 acres approx.)
- Temporary Construction Laydown Area (1.3 acres approx.)
- Area of Potential Effects (APE)
- EIR Project Area

Notes:
1. This is a conceptual layout. Locations are approximate.
2. Descriptions of activities/functions anticipated for the construction support areas are included in the Construction/Remedial Action Work Plan.
3. Descriptions of activities/functions anticipated for the long-term remedy support areas are included in Section 3.5 of this BOD, and the O&M Manual.

N

0 95 190 380 Feet

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

FIGURE 2B
GENERAL REMEDY SYSTEM LAYOUT - MOABI REGIONAL PARK
FINAL GROUNDWATER REMEDY
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\Vegetation\FIG2B_PM_StagingRemedy_11x17.mxd

Site B

County Highway 10

HNWR-1A

HNWR-1

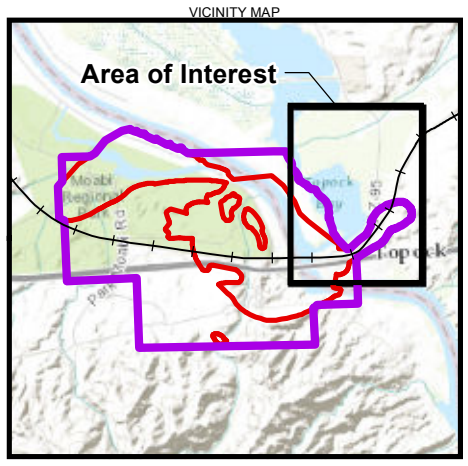
MW-X

MW-Y

BNSF Railroad

40

VICINITY MAP



LEGEND

Existing Wells:

- Monitoring Well
- Water Supply Well

Planned Wells:

- Area for Monitoring Well (Applies to MW-X and MW-Y)

Provisional Wells:

- Area for Potential Slant Well Screens

Pipeline Corridor for Remedy

- Aboveground Freshwater Pipe
- Underground Freshwater Pipe
- Future Provisional/Contingent Fresh Water Pipe

- Area of Potential Effects (APE)
- EIR Project Area

Note:
All wells and remedy structure locations are approximate.

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

N

0 200 400 800 Feet

FIGURE 2C
GENERAL REMEDY SYSTEM LAYOUT - ARIZONA
FINAL GROUNDWATER REMEDY
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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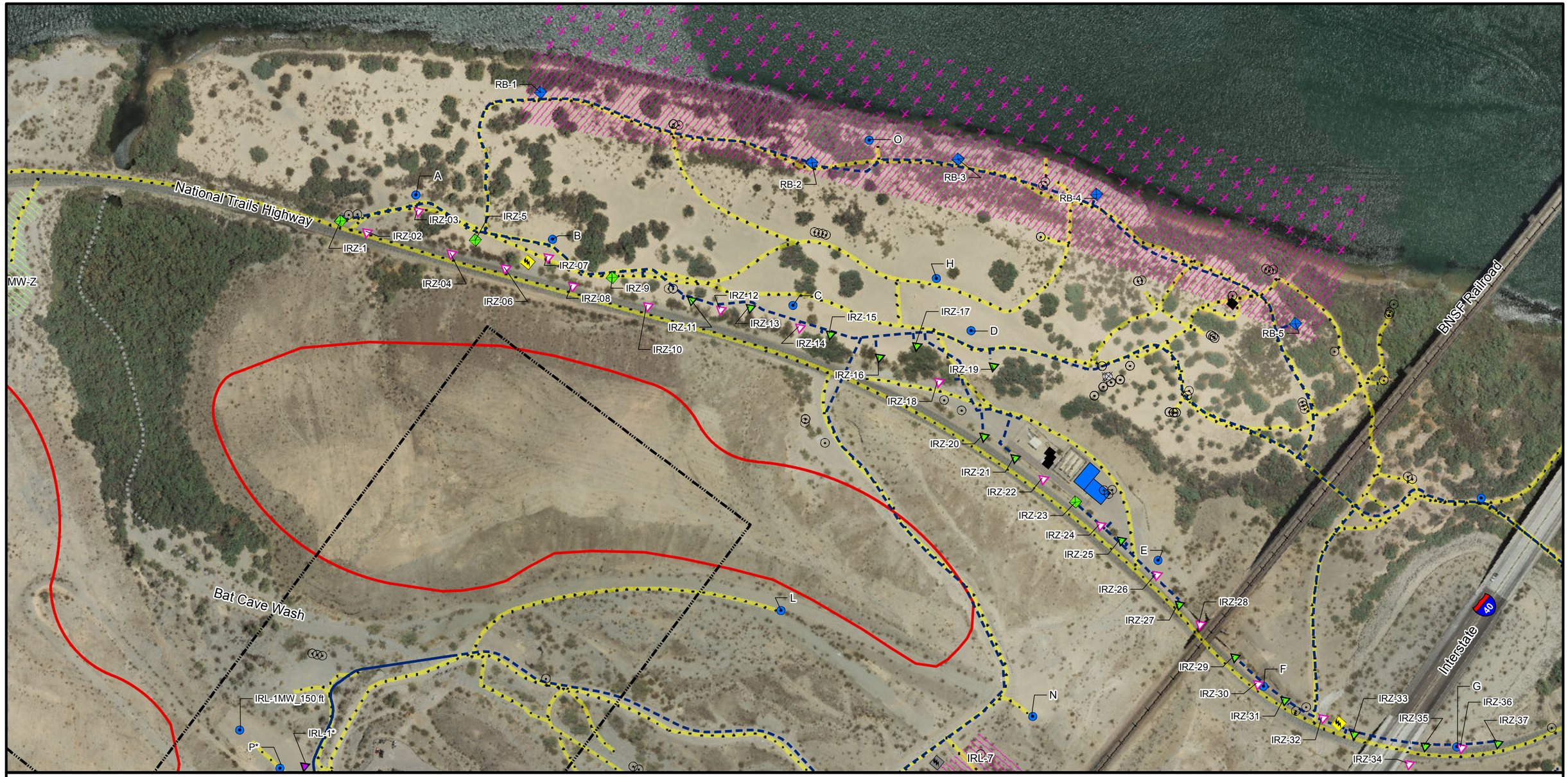

LEGEND

Existing Wells:
- Extraction Well
- Injection Well
- Monitoring Well

Provisional Wells:
- Injection Well
- Area for Potential Slant Well Screens
- Area for Inner Recirculation Loop (IRL) Wells
- Area for River Bank Extraction Wells (RB-6 to RB-9)

Planned Wells:
- Extraction, NTH IRZ
- Extraction, Riverbank
- Injection, Inner Recirculation Loop
- Injection, NTH IRZ
- Remedy Monitoring Well
- Area for Monitoring Well (Applies to MW-CC, MW-T, MW-U, MW-X, MW-Y, and MW-Z)

- Planned Transformer
- Future Provisional Transformer
- Proposed Access Routes

Pipeline Corridor for Remedy
- Aboveground Pipe
- Underground Pipe/Conduit
- Future Provisional/ Contingent Fresh Water Pipe
- Property Boundaries
- Area of Potential Effects (APE)
- EIR Project Area *EIR Project Area*

Remedy Facilities
- Proposed Remedy Structure
- Contingent Freshwater Pre-injection Treatment System
- Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

N

0 90 180 360 Feet

FIGURE 3
AESTHETICS AND VISUAL RESOURCES REVEGETATION PLAN

FINAL GROUNDWATER REMEDY
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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SECTION 2

Description of Vegetation Related to Visual Quality of Key Views 5 and 11

The following subsections include a discussion of the vegetation resources associated with Key Views 5 and 11 that may be affected by the project. Although the FEIR evaluated views from the Colorado River specifically from Key View 11, this section provides a general description of all riparian habitats along the Colorado River in the project area.

2.1 Mature Vegetation

Mature plant surveys were completed in August 2011 by senior botanist Kim Steiner, PhD, and biologist, Morgan King. For the survey, a mature plant was defined as a living mature tree, large or prominent shrub, or tall predominately herbaceous plant that could add to the aesthetic value of the project area. Trees, shrubs, and herbaceous plants that would not currently add to the aesthetic value because of their small stature were not considered to be mature plants (for example, seedlings, immature plants, small perennials, and annuals). The results were summarized in the Mature Plants Survey Report was issued by GANDA and CH2M HILL (2012). The most abundant mature plants associated with the sandy terrace west of the Colorado River (the primary area included in Key Views 5 and 11) are arrow weed (*Pluchea sericea*) and the exotic and invasive salt cedar (*Tamarix ramosissima*). Arrow weed is widespread in many areas of the sandy terrace west of the Colorado River where it often forms dense, shrubby thickets (Photo 1). Salt cedar also is common on the sandy terraces adjacent to the Colorado River, especially to the south near the Interstate 40 (I-40) and the BNSF Railroad bridges that span the river. In many areas, salt cedar and arrow weed are intermixed (Photo 2), while in other locations, salt cedar occurs as scattered individuals (Photo 3) or forms dense thickets.

Salt cedar is an invasive exotic that has been used for erosion control on the banks of the Colorado River since the early 1900s (Barranco, 2001). Since that time, it has spread dramatically throughout the western states and is considered to be highly invasive in California because of its severe ecological impacts on local plant and animal communities, high reproductive output (a mature salt cedar tree can produce 600,000 seeds annually), and high dispersal capabilities (Barranco, 2001; DiTomaso, 1998).



PHOTO 1
Dense stand of arrow weed on the sandy terrace west of the Colorado River



PHOTO 2
Salt cedar and arrow weed on the sandy terrace west of the Colorado River



PHOTO 3
Scattered salt cedar on the sandy terrace west of the Colorado River

Other mature vegetation identified on the sandy terrace west of the river includes blue palo verde (*Parkinsonia florida*), honey mesquite (*Prosopis glandulosa*), creosote bush (*Larrea tridentata*), smoke tree (*Psorothamnus spinosus*), and catclaw acacia (*Senegalia greggii*). Blue palo verde is considered to be an important mature plant because it is a large, aesthetically pleasing native tree that is common to the area that is part of the Lower Colorado River Valley Subdivision of the Sonoran Desert scrub (Turner and Brown, 1994). Blue palo verde occurs in a few locations along the eastern side of the National Trails Highway (Photo 4). Honey mesquite is another large native tree growing in large clumps along the eastern side of the National Trails Highway (Photos 5 and 6), as well as in scattered locations along the upper banks of the Colorado River. Creosote bush is most common along the eastern side of the National Trails Highway, but it also occurs in a few scattered locations on the sandy terrace west of the Colorado River and is often intermixed with arrow weed and salt cedar (Photos 4 and 6). Smoke tree and catclaw acacia are associated primarily with the desert washes.



PHOTO 4
Large blue palo verde tree on east side of the National Trails Highway, scattered creosote bushes also present along the roadway in this area in background, vegetation to the left side includes creosote bush and salt cedar



PHOTO 5
Large clump of honey mesquite on east side of the National Trails Highway



PHOTO 6
Scattered creosote bush along the east side of the National Trails Highway, with honey mesquite on far right side of the photograph

2.2 Riparian Vegetation

It is commonly accepted that riparian vegetation occurs along the edges of streams, rivers and lakes where the plants grow in association with some type of persistent aquatic feature. However, such broad definition is oversimplified and fails to distinguish riparian vegetation from upland communities that may also occur in proximity to water (Fischer et al., 2001). The FEIR identifies riparian areas as a sensitive habitat, but provides no definition of such areas.

To adequately address impacts to riparian vegetation, it is critical to have a scientifically-based definition of riparian habitat. One such definition is provided by Johnson et al. (1984), that defines riparian as “pertaining to the banks and other adjacent terrestrial (as opposed to aquatic) environs of freshwater bodies, water courses, estuaries, and surface emergent aquifers (springs, seeps, oases), whose transported freshwaters provide soil moisture sufficiently in excess of that otherwise available through local precipitation to potentially support the growth of mesic vegetation.”

Another, more complete definition, was developed by the National Research Council (2002): “Riparian areas are transitional between terrestrial and aquatic ecosystems and are distinguished by gradients in biophysical conditions, ecological processes, and biota. They are areas through which surface and subsurface hydrology connect water bodies with their adjacent uplands. They include those portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (i.e., a zone of influence). Riparian areas are adjacent to perennial, intermittent and ephemeral streams, lakes and estuarine- marine shorelines.”

Both of these definitions indicate that proximity of vegetation to a water feature alone does not constitute riparian habitat. There must also be some degree of hydrologic influence on the vegetation by the adjacent water feature.

Using the above definitions of riparian habitat, riparian vegetation that is present within the project area includes areas of emergent vegetation along the edges of the Colorado River as well as the trees and shrubs growing immediately adjacent to the Colorado River that have a direct hydrologic connection with the river. Within the project area, there are vegetated areas along the terrace above the Colorado River that is referred to as the historical floodplain. This area is located east of National Trails Highway but outside of the 100-year floodplain and is the area where former dredged sands were historically deposited. The higher elevation and control of flows by upstream dams means that the historical floodplain is not subject to occasional flooding and now lacks a direct hydrologic connection with the river. For this reason, the historical floodplain is not considered riparian habitat.

Vegetation types considered to be riparian habitat using the above definitions include scattered patches of southern cattail (*Typha domingensis*), California bulrush (*Schoenoplectus californicus*), common reed (*Phragmites australis*), and giant reed (*Arundo donax*) growing along the edges of the Colorado River. Most of these riparian areas occur below the ordinary high water line or on the low terraces that are likely subject to regular flooding. Patches of emergent vegetation are found in scattered locations along the banks of the Colorado River and in the vicinity of the Topock Marina. Also included are areas with California bulrush along the outlet of Bat Cave Wash and areas with broad-leaved cattail (*Typha latifolia*) within the outlet of the East Ravine near the southern boundary of the project area. The largest of these wetland areas occurs on the western side of the river just south of the I-40 bridge and is characterized by dense growth of common reed, California bulrush, and patches of giant reed (Photos 7 and 8).



PHOTO 7
Emergent wetland vegetation along the banks of the Colorado River



PHOTO 8
Large wetland area south of Interstate 40 bridge along the western side of the Colorado River

Much of the riparian vegetation associated with the rocky banks adjacent to the water's edge is characterized by salt cedar and arrow weed (Photos 9 and 10) with occasional species such as broom baccharis (*Baccharis sarothroides*), giant reed, and honey mesquite also present in a few scattered locations.



PHOTO 9
Salt cedar and arrow weed along the western banks of the of the Colorado River



PHOTO 10
Salt cedar and arrow weed along the eastern banks of the of the Colorado River

SECTION 3

Assessment of Vegetation Impacts Related to Key Views

Throughout the design phase of the project, efforts have been made to avoid impacts to existing plants and natural habitats. To the extent possible, work activities have been designed to utilize existing roadways and previously disturbed areas. As the final design for the remedial action is developed, efforts will continue to minimize disturbance to natural vegetation. The following impact assessment is based on preconstruction surveys of work areas, staging areas and access routes that have been identified in the 60 percent design, as amended in a field constructability review conducted between April 7 through 10, 2014. For aesthetics and visual resources, this impact assessment focuses on Key Views 5 and 11 as these vantage points have been identified as having potentially significant visual impacts, and this impact assessment includes all riparian habitat along the Colorado River within the project area. Restoration for impacts to vegetation is discussed in the following section.

3.1 Impacts to Mature Vegetation

Mitigation measures included in the FEIR (DTSC, 2011) state that "existing mature plant specimens shall be protected in place during construction, operation, and decommissioning phases." Because of the ambiguity of what constitutes a mature plant, all medium- to large-sized trees, large or prominent shrubs, and tall predominately herbaceous plants were all included as "mature plants" during the 2011 surveys (GANDA and CH2M HILL, 2012). As noted above, the project infrastructure has been designed to minimize impacts to vegetation and allow preservation in place for mature plants. To the extent possible, access roads, well locations, and pipelines have been located in open areas with sparse to no vegetation (Photo 11). However, not all vegetation in this area is avoidable during construction activities that will include well installation and pipeline excavations.

During remedy design, priority will be given to preserving in place and avoiding impacts to mature plants. Where the impacts to mature plants cannot be avoided, design and construction implementation will preferentially seek to avoid impacts to native woody perennial native trees, such as blue palo verde and honey mesquite, because these species are valuable in terms of aesthetics and provide habitat for birds and wildlife species. With the exception of some creosote bushes, the majority of the vegetation impacts will occur to arrow weed and salt cedar on the historical floodplain that lies above the 100-year flood elevation below the National Trails Highway and the MW-20 bench.

Impacts to mature vegetation will include both temporary and permanent impacts. Temporary impacts would occur in areas where some vegetation clearing is needed to provide work space for well installation and construction activities that are associated with the excavation and installation of the pipeline infrastructure. In these areas, plants such as arrow weed, salt cedar and, to a limited extent, creosote bush, will either be trimmed or flattened, but the root systems of the plants will be left intact. Both arrow weed and salt cedar are adapted to frequent disturbance and will readily re-sprout if the root systems remain intact (Horton, 1977). Creosote bush also has a strong ability to naturally recover as long as the root system is not significantly disturbed.

Permanent impacts to mature plants will occur in areas where the root systems of the plants are significantly disturbed as a result of excavations for the pipelines. Permanent impacts may also occur at those locations where vegetation will be removed to create access roadways that will be used throughout the operation phase of the project for routine monitoring, inspection, and maintenance activities. The FEIR performed the impact analysis using the assumption that up to 170 wells could be located on the sandy terrace seen from Key View 5, which would result in the extensive removal of vegetation. As shown on Figure 3, 17 new wells would be located on the sandy terrace to the north and east of the existing water

storage tanks on the MW-20 bench that would potentially have a significant impact on the visual quality of this area (Figure 3). An additional 10 provisional wells could be installed immediately west of the National Trails Highway at a later date, if needed. As noted above, the project has been designed to minimize impacts to mature vegetation with access routes, wells, and pipelines located in areas with minimal vegetation to the extent possible (Photo 11). This also is evident for the visual simulations for Key View 5 included in the FEIR (Exhibit 4.1.9 in Appendix A).



PHOTO 11
To the extent possible groundwater remedy infrastructure such as access routes, wells and pipelines have been located in areas where minimal vegetation disturbance will be required

3.2 Impacts to Riparian Vegetation

The visual simulation for this key view included in the EIR (Figure 45.1-23 in Appendix A) assumed the removal of the tamarisk trees along the upper edge of the riverbanks in this area. The project has been designed to avoid impacts to all riparian and wetland vegetation along the Colorado River. In a few areas, RB wells will be installed in proximity to the Colorado River (Figure 3), but above (that is, outside of) the riparian vegetation zone. In these locations, mature trees, if present, will be left intact to provide a visual barrier between the wells and the river.

SECTION 4

Avoidance, Minimization, and Replanting Measures

This section provides information on avoidance and minimization measures that will be implemented to reduce impacts to vegetation resources and provides information on plant salvage and other replacement methods that will be used where long-term impacts to vegetation are unavoidable. The information included in this section also is intended to provide general guidance on replacement planting that may be used to offset mature plant losses that may occur.

The exact number of mature plants (trees and shrubs) permanently impacted and the specific locations for mitigation plantings will be determined once the final project design is complete and long-term access routes, well locations, and excavation areas have been determined. Given that the purpose of the mitigation plantings will be to minimize the impacts to visual quality, mature plants will be preserved in place to the maximum extent feasible. If mature plants cannot be preserved in place, the replacement planting or transplanting will occur as close to the permanent vegetation impacts as practicable. Access routes for monitoring, inspection and maintenance will be kept clear and no trees or shrubs will be planted directly over or within 10 feet of either side of the pipeline infrastructure to avoid potential pipeline damage from roots and allow for inspection and maintenance access as needed.

4.1 Design and Construction

Throughout the design process for the project, efforts have been made to locate pipelines and wells along roadways, pipeline rights-of-way, and other previously disturbed areas to avoid impacts to vegetation. Construction areas, as well as staging and storage areas, also have been located in previously disturbed and/or developed areas to minimize and avoid impacts to vegetation and other sensitive resources. To further minimize impacts, a biologist will conduct preconstruction surveys and areas of native vegetation and sensitive habitats in the immediate vicinity of the construction areas will be identified and clearly marked with flagging, fencing, and/or signage. Construction workers also will be provided with environmental awareness training regarding biological resources including sensitive species and habitats.

Implementation of the project will not be able to avoid impacts to all plants that are considered as mature. However, the field implementation and approach will be first to avoid mature vegetation wherever feasible. If mature pant impacts cannot be avoided, then the preference during implementation will be to avoid mature, native plants, such as honey mesquite and blue palo verde wherever feasible, even if this approach might preferentially impact tamarisk or arrow weed.

4.2 Habitat Requirements for Mitigation Planting

Native plants in the project area have different habitat requirements and ecological tolerances, which are reflected in the sites that they occupy. Blue palo verde is a relatively large tree associated with sandy areas, is widely distributed on the edges and bottoms of the ephemeral washes that dissect the upland alluvial terraces, and occurs along sandy roadsides. In contrast, the related hillside palo verde is a tree of shorter stature that is restricted to rocky hillsides above the Colorado River in the southern portion of the project area.

Western honey mesquite and screw bean mesquite typically grow in areas with root access to permanent underground water; however, western honey mesquite is more likely to occur in somewhat drier habitats than screwbean mesquite. While both species are salt tolerant, screwbean mesquite has a higher tolerance level than western honey mesquite (Miyamoto et al., 2004), an important consideration when planting mitigation trees. Transplanting or replacement planting of native species will be located in areas where the

species are growing to ensure appropriate environmental conditions are present for the establishment and survival. The exact planting locations will be determined as part of the final design based on the number of transplants and/or mitigation plantings and the locations and extent of the work areas and access routes.

4.3 Replacement Planting Procedures

Replacement plantings will be used to mitigate for permanent impacts to mature trees and shrubs through the use of container grown plant materials. Trees and shrubs including palo verde, western honey mesquite, screwbean mesquite, cattle saltbush, and big saltbush are relatively easy to propagate in a nursery and well adapted to transplanting with a minimal amount of care and maintenance (Bainbridge and Virginia, 1990; Bainbridge, 2007; Romney et al., 1989). Several commercial nurseries grow native plants from the Mojave Desert (Appendix B).

Depending on the number of trees and shrubs that are required for revegetation of disturbed areas, PG&E will consider contracting with a nursery that specializes in desert plant propagation to collect local seed and establish trees, shrubs, and other plants from onsite material before mitigation planting. This would ensure replacement plants are suitable for local environmental conditions. If only a small number of plants are required, appropriate available nursery stock may also be used.

Replacement planting for native trees including blue palo verde, hillside palo verde, western honey mesquite, and screwbean mesquite will consist largely of container-grown plants. Containers shall be long and narrow to encourage deep root growth such as Tall One Tree Pots (Steuewe & Sons, Inc., 4.5 inches wide by 14 inches deep). Seedlings/saplings shall be between 4 to 6 months old when transplanted to prevent the plants from becoming root-bound in the pots. Replacement planting of shrubs such as mesquite, cattle saltbush, big saltbush, and others shall be grown in 4- to 6-inch tube packs and transplanted when 9 to 12 months old.

Based on experimental results from the Mojave Desert, the median survival rate for species such as western honey mesquite is around 50 percent (Edwards et al., 2000; Grantz et al., 1998). Therefore, to achieve the desired density of plant species, the number of container grown plants should be more a higher ratio to account for anticipated mortality.

Transplanting of container-grown trees and shrubs typically is done in the late winter to early spring between February and April (Romney et al., 1989; Edwards et al., 2000). Planting holes shall be excavated using an 8- to 10-inch-diameter power auger to a depth equal or just slightly more than the depth of the container (Grantz et al., 1998). Carefully remove the saplings from the container and place against one side of the planting hole, using excavated soils to backfill around the roots. Do not add additional soil amendments, fertilizer, or mulch to the soil as these have been found to be unnecessary for desert trees and shrubs (Bainbridge et al., 2001; Romney et al., 1989). When backfilling, add water simultaneously to minimize air pockets. Be sure the soil is firmly packed around the roots, but not firmly compacted. Water thoroughly and slowly after the hole is completely filled.

Trees will be spaced to maintain a density similar to the area from which they are removed or in similar spacing based on undisturbed areas near the project, but no closer than 8 feet apart. Shrubs will be spaced in a density similar to the density in the undisturbed surrounding vegetation, but no closer than 3 feet apart. To ensure soil and other environmental factors are most favorable for establishment, replacement plants will be planted in areas where individuals of the same species are healthy and growing well.

Some type of initial herbivore protection (such as wire mesh or tree shelters placed around the seedlings) is necessary to ensure good survival and growth of transplanted trees and shrubs (Romney et al., 1989; Grantz et al., 1998). Plastic tree shelters such as Tree-Pee (Bailey's Inc.) have been found to result in significantly higher survivorship than using wire mesh (Grantz et al., 1998).

Transplanted trees and shrubs should be watered using deep irrigation pipes (Bainbridge, 2006; Bainbridge et al., 2001). Deep pipe irrigation has been shown to produce much better survival rates and to require less

water than other irrigation methods (Bainbridge et al., 2001). Bainbridge et al. (2001) had an establishment success rate of 71 percent for seedlings of western honey mesquite, by using only 5.3 gallons over 3.5 years with deep pipe irrigation when trees were planted with tubular tree protectors to minimize herbivory.

The method for using deep irrigation is described in Bainbridge (2006). For each transplanted tree or shrub, a hole is drilled to a depth of 20 to 30 inches with a soil auger. A polyvinyl chloride pipe (2 inches in diameter and 20 inches long with a series of 1/16-inch holes drilled 2 to 3 inches down one side beginning 7 inches below the top) is inserted to the bottom of the hole such that the side with holes faces the seedling or shrub with about 4 inches protruding above the ground surface for easy filling. The pipe shall be situated about 3 to 4 inches from the seedling. Two or three pipes can be situated around the root ball for transplanting shrubs or small trees.

Water (1 quart) will be directly applied to seedlings once every week for the first 8 weeks. Then irrigation pipes will be filled with 2 quarts every other week for at least 3 months after the initial watering. Watering will be continued at least until the end of August each year and will be done for the first 2 years after planting.

For relatively small areas where a large number of replacement trees may be needed, a gravity feed drip irrigation system from a large 4,000 to 5,000-gallon storage tank shall be used as an alternative watering method. This method will depend on the ability to situate the tank in an area accessible to a water truck for periodic refilling. This method was used successfully for the screwbean mesquite restoration project under the freeway bridge next to the Colorado River from 2006–2009 at TCS (C. Smith, pers. comm., 2013). For that project, newly planted trees were watered three times per week for about 3 to 4 hours per day for the first year and once per week in the subsequent 2 years.

There is generally no evidence that additional mulching enhances long-term survival and plant growth and some indication it may do more harm than good (Bainbridge et al., 2001), so no additional mulching is recommended. If tree seedlings or shrubs are planted from containers, inoculation of soil biota can be done by backfilling with excavated soil. In general, inoculation of soil biota is only required for severely degraded sites where the natural soil biota has been significantly depleted or is absent (Bainbridge and Virginia, 1990).

SECTION 5

Success Criteria, Monitoring, and Adaptive Management

Due to the fact that replacement saplings do not provide the same habitat value as mature trees, a mitigation ratio of 3:1 will be used to offset impacts to riparian trees. Replacement trees will be propagated from locally collected seeds and grown in a nursery for 1 year prior to planting in selected mitigation sites. The success criteria for mitigation plantings will be a final minimum plant replacement ratio of 2.25:1 (75% overall survival rate) of mitigation plantings at the end of a minimum 5-year monitoring period.

Monitoring will continue for a minimum of 5 years following mitigation plantings. In the event that mortality rates or trends in declining vigor of the mitigation plantings result in less than a minimum of a final 2.25:1 mitigation ratio, additional saplings will be planted. Any replacement plantings will be monitored for 5 years from the time of the initial planting to ensure that the mitigation success criteria have been met.

In order to account for anticipated mortality rates, the initial replanting will include twice as many saplings as required by the mitigation ratios. This initial higher planting ratio is intended to compensate for expected sapling mortality over time and ensure that the final mitigation ratios are obtained, while avoiding annual replanting for losses and costly repetitive propagation expenses. For example, if three palo verde trees will be removed during construction they would be replaced at a 3:1 ratio with seedlings grown from locally sourced seeds. The initial mitigation would therefore require nine replacement plantings. The success criteria would be 75% overall survival of these plantings after 5 years, resulting in a final mitigation ratio of 2.25:1 or survival of 6.75 (rounds to 7) out of nine initial plantings.

Taking into account expected mortality rates, the initial mitigation planting would be doubled to include 18 replacement plantings during the first year (see Table 2). It is anticipated that with the higher number of initial plantings and adaptive management at least 7 of the 18 saplings will become successfully established after 5 years. It is possible that even more plants may become established if adaptive management techniques result in increased survival. In the event mortality or trends in declining vigor indicate that success criteria will not be met, additional plantings and monitoring will be required to ensure that the final mitigation ratio is met.

TABLE 2
Example of Replacement Planting Ratios and Success Criteria

Number of Trees Impacted	3:1 Replacement Plantings	Initial Planting to Account for Anticipated Mortality	Final Success Criteria Minimum of 2.25:1 Replacement After 5 Years
3	9	18	7

Assuming 18 initial plantings with a potential 50% mortality rate and a final success criteria of 7 replacement trees

Monitoring	Anticipated Minimum Survivorship (Vigor Class of 2 or Greater)	Number of plantings Remaining*	Mortality Thresholds Triggering Additional Plantings	Number of plantings Remaining*
Year 1	90%	17	60% or less survivorship	11 or less
Year 2	80%	14	60% or less survivorship	11 or less
Year 3	70%	13	50% or less survivorship	9 or less
Year 4	60%	11	40% or less survivorship	7 or less
Year 5	50%	9	Success criteria not met	Less than 7

Note:
*Values are rounded to nearest whole number where required.

5.1 Tree and Shrub Assessment

Assessment of the vigor of trees and shrubs will utilize a modified index initially developed by Bainbridge et al. (2001):

- 0 = dead, stems brown brittle with no green or purple
- 1 = barely alive, stems still flexible with some green or purple
- 2 = some green or purple on stem, a few green leaves
- 3 = green or purple stem and a number of green leaves
- 4 = green or purple stem and green leaves, vigorous

5.2 Maintenance and Adaptive Management

Adaptive management involves learning from experience and modifying subsequent behavior in light of that experience. Data shall be collected and analyzed throughout the monitoring period and the results used to modify (adapt) restoration approaches, as appropriate, to ensure successful establishment of planted trees and shrubs to achieve the desired density and cover of plants in the revegetation areas. Maintenance and adaptive management will focus on the following areas: weed control, irrigation modification, herbivory protection, and mortality rates.

5.2.1 Weed Control

Weedy species, such as Russian thistle (*Salsola tragus*), Sahara mustard *(Brassica tournefortii*), and salt cedar can significantly affect growth and survival of transplants. Transplant and seed sites shall be relatively weed-free and shall be monitored regularly for weed infestations. It is much easier to prevent the establishment of weeds in an area than it is to eradicate weed populations once they have become established. Monitoring for weed seedlings of Russian thistle, Sahara mustard, and salt cedar will be done early in the growing season (March–April) to allow for treatment and removal of weedy species before flowering and seed dispersal. In addition, young weed seedlings can be removed by hand, thereby avoiding the need for more intensive mechanical or chemical treatments.

5.2.2 Irrigation Modification

The objective is to obtain the maximum survival rate of transplanted trees and shrubs; therefore, it may be necessary to modify the irrigation schedule and/or amount of water during the revegetation period. While irrigation will only be used during the initial establishment period, the condition of the plants will be monitored throughout the monitoring period of 5 years. If after the initial watering, plants show a notable decline in vigor, it may be necessary to increase the amount and/or timing of irrigation to prevent mortality and increase vigor. Care shall be taken not to overwater the plants.

5.2.3 Herbivory Protection

Tree and shrub protectors will be maintained until the plants are large enough to withstand herbivory or before the growth of the plant being impacted by the barrier. PG&E will be responsible for removing the tree and shrub protectors.

5.2.4 Mortality Rates

It is expected that the initial plantings will experience some level of mortality. If survivorship drops below target levels of 50 percent, additional plantings will be required. To prevent further mortality, adjustments to the watering regime and/or herbivore protection will be necessary, depending on the most probable cause of the mortality.

5.3 Photo-Monitoring Stations

Photo-monitoring stations will be established by a qualified vegetation ecologist or landscape architect in areas where vegetation impacts will occur as a result of the project in Key Views 5 and 11 to document preconstruction conditions. These photo points also will be used to monitor natural recovery of plant species as well as plant growth in the mitigation areas. The following methods and procedures are adapted from the U.S. Department of Agriculture's Photo Point Monitoring Handbook (Hall, 2002).

5.3.1 Objectives

The objectives of the photo monitoring include the following:

- Document the preconstruction site conditions of the project work areas in areas where vegetation impacts are considered potentially significant in terms of visual quality and aesthetics
- Document the post-construction site conditions before revegetation and mitigation of the project work areas where vegetation impacts are considered potentially significant in terms of visual quality and aesthetics
- Document natural regeneration and recovery of native plant species where the aboveground portion of trees and shrubs was removed but the root systems were left intact in areas where vegetation impacts are considered potentially significant in terms of visual quality and aesthetics
- Document landscape conditions in the construction sites including vegetation changes over time as well as general qualitative documentation of plant cover and vegetation condition in areas where vegetation impacts are considered potentially significant in terms of visual quality and aesthetics

5.3.2 Equipment

The following equipment will be needed for the photo monitoring:

- Digital camera
- Global positioning system (GPS) unit with sub-meter accuracy
- White board and black dry erase pen
- Compass
- Photo monitoring data sheets (Appendix C)

5.3.3 Methods

Before starting construction, multiple photo monitoring locations will be selected throughout the project area that will be used to document the pre- and post-construction conditions. This will be referenced to as preconstruction photo documentation (PPD). PPD will be completed to assist in restoration activities after remedy decommissioning. A subset of the PPD photo points will be located in areas to specifically document areas where existing vegetation and habitats will be impacted by project activities. These photo points will be referred to as revegetation photo documentation (RPD). The exact locations and views of the photo monitoring stations will be determined once the final project design has been completed and the limits of the work areas have been firmly established. Additional photo monitoring stations also will be established at revegetation/restoration sites as well as any reference plant community locations.

Once the photo monitoring sites have been determined, a GPS unit with submeter accuracy will be used to record the location of the camera position. Notes will be taken on the locations including any notable landmarks and other information that will assist in easily relocating the position. Photo point locations will then be mapped on aerial photographs that have roads and other major landmarks clearly labeled.

Once the scene to be captured by the photo point has been determined, record the compass direction of the camera view in both cardinal directions (north, south, southwest, etc.) and degrees. Subsequent photographs taken from the same photo point will be taken in the same direction each time.

On the data sheet, describe the scene including notable items in the view that mat help with reorientation of the camera during subsequent monitoring. Provide a general description of the photo point including plant species, ground cover, disturbance, vegetation condition, etc.

After the first photo monitoring event is completed, maps, directions, and instructions on the orientations and views for each photo location will be prepared that will be used as the basis for subsequent monitoring events at each location.

After photographing the selected scene at each location, it may be useful to include additional site photographs of particular features and plants to provide additional detail on the site. For each additional photo, include a description of the setting or conditions that are being documented and include the photos and additional information with the photo monitoring report.

5.3.4 Frequency

Photo monitoring will occur before starting construction and following construction concurrent with monitoring of the revegetation sites. Photo documentation will be taken for 5 years post-construction and will occur in years 1, 2, 3 and 5. Post-construction and RPD monitoring will occur with each vegetation monitoring event, and photos will be appropriately archived in monitoring reports for use during post-decommissioning restoration.

5.4 Reporting

Following each monitoring event, a monitoring report will be prepared. The first monitoring report will be prepared during the first year following completion of construction activities. The first monitoring report will include specific information on the number, species, and locations of trees and shrubs that were removed or otherwise permanently impacted during construction as well as the number, species, and locations of mitigation plantings. The report also will include information on areas where aboveground trimming of shrubs occurred, but belowground root systems were left intact. The first monitoring report will include pre- and post-construction photographs from the photo monitoring stations, as well as photographs of the revegetation sites. The first report also will include the necessary documentation to relocate the photo monitoring stations in subsequent years.

Additional monitoring reports will be prepared for the following year 2, 3, and 5 monitoring events. These reports will include observations of natural recovery in construction areas, with particular emphasis on those areas where the belowground roots were left intact. Assessment of the revegetation areas including the condition of the revegetation plantings, discussion of any problems, and recommendations for adaptive management actions needed to be taken to address the problems. These reports also will include photographs and information from each of the photo monitoring stations.

Monitoring reports will be submitted to DTSC within 90 days of the completion of each monitoring event.

SECTION 6

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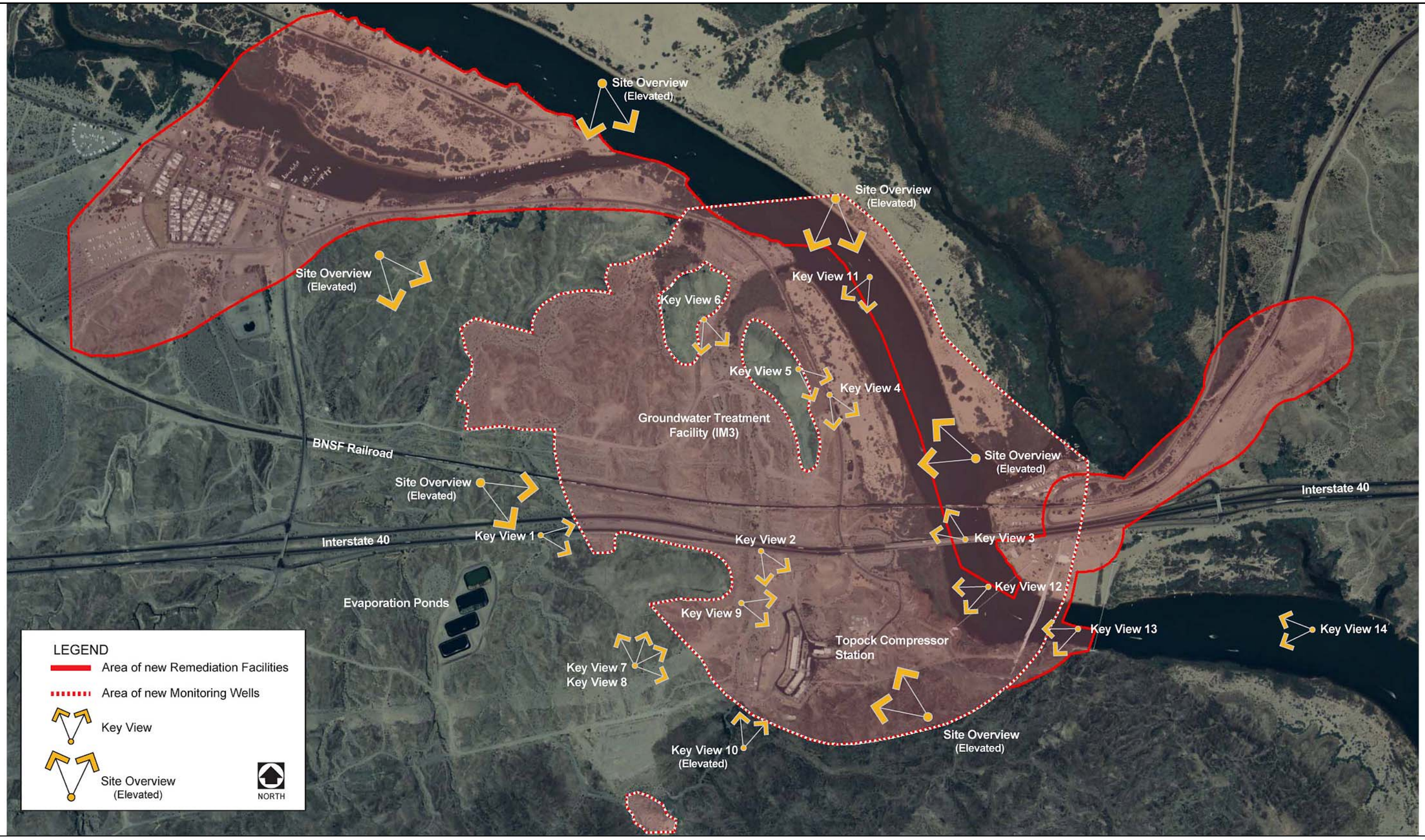
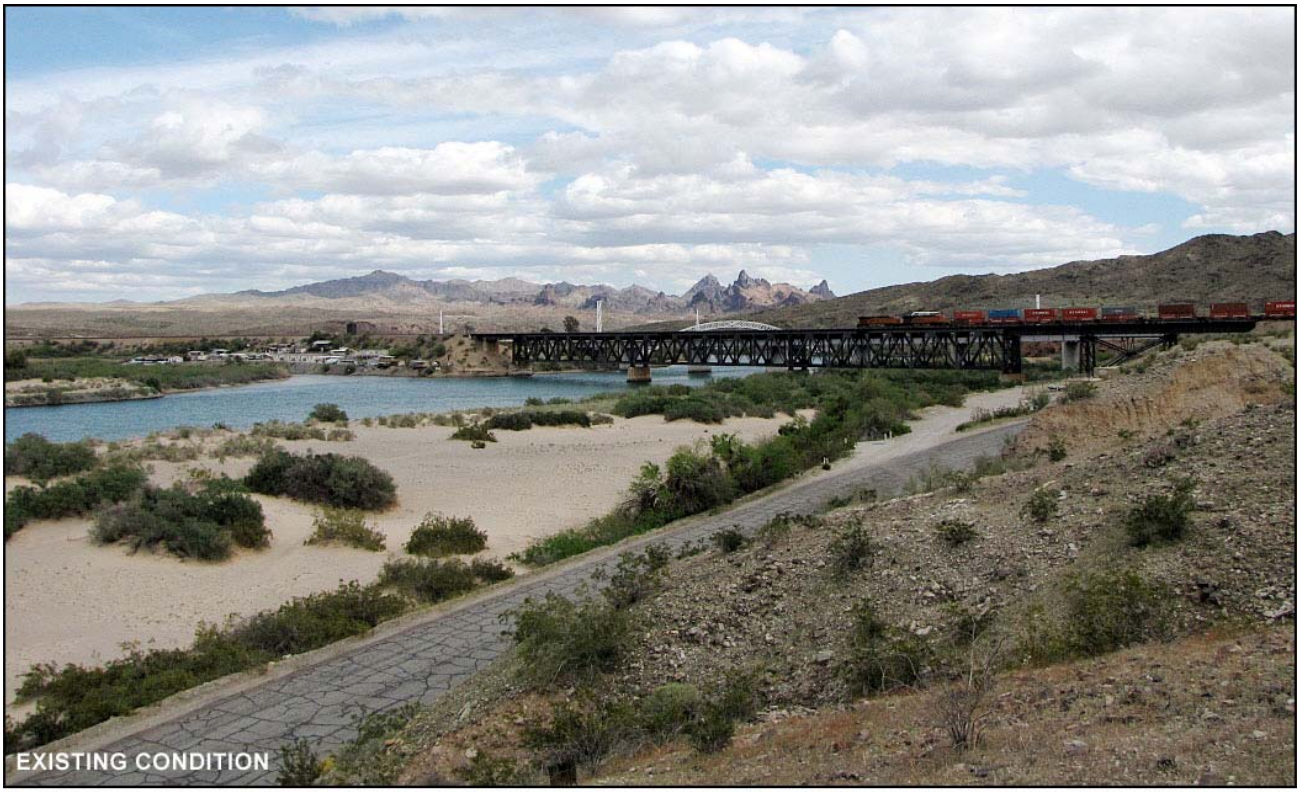
Appendix A
Map of Key Views and Photo Simulation for Key Views 5 and 11

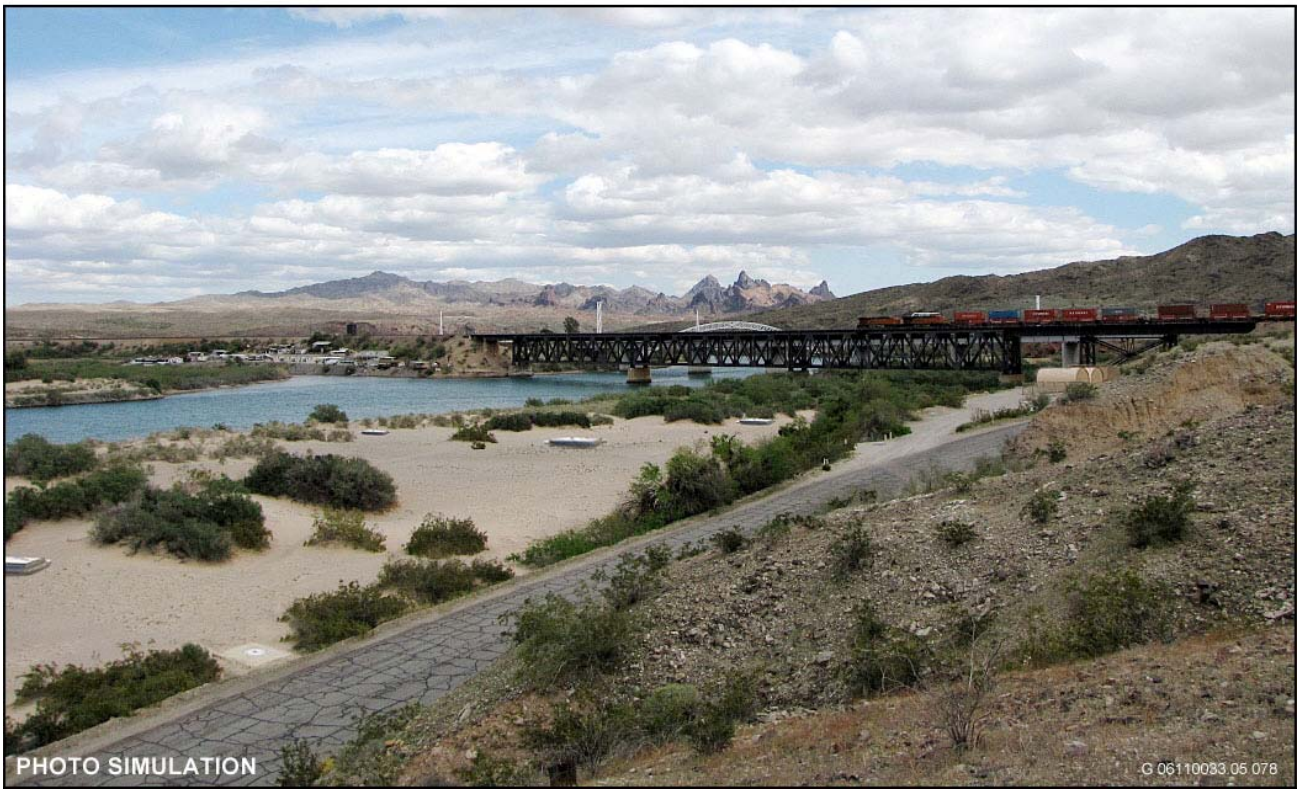


Source: Digital Globe 2009, AECOM 2010

Key View Map

Exhibit 4.1-7





Source: AECOM 2009

Key View 5, Existing Conditions Photo and Visual Simulation of the Proposed Project **Exhibit 4.1-19**

Appendix B
Commercial Nurseries that Grow Native Mojave Desert Plants

Ahakhav Native Plants Nursery
Colorado River Indian Reservation
25401 Rodeo Road
Parker AZ 85344
(928) 669-2664

El Nativo Growers
200 South Peckham Road
Azusa, CA 91702
(626) 969-8449
www.elnativogrowers.com
sales@elnativogrowers.com

High Country Gardens
2902 Rufina Street
Santa Fe, NM 87507
(800) 925-9387
www.highcountrygardens.com

LandscapeMart
8028 West Thunderbird Road
Peoria, AZ 85381-4612
(623) 298-6800
http://www.landscapemart.com/

Larners Seeds
P.O. Box 407
235 Grove Road
Bolinas, CA 94924
(415) 868-9407
info@larnerseeds.com
http://www.larnerseeds.com/_pages/wildflower_annual.html

Las Pilitas Nursery
8331 Nelson Way
Escondido, CA 92026
(760) 749-5930
www.laspilitas.com

Mountain States Wholesale Nursery
Litchfield Park, AZ 85340-2600
Phone: (623) 247-8509
Fax: (623) 247-6354
http://www.mswn.com/

Mountain Valley Growers
38325 Pepperweed Road
Squaw Valley, CA 93675
(559) 338-2775
http://www.mountainvalleygrowers.com

Misty Meadows Nursery
43601 Mesa Street
Banning, CA 92220
(951) 765-7542 or (951) 897-1585
mistymeadows@live.com
http://www.mistymeadowsnursery.com/601.html

Native American Seed
3791 North US Highway 377
Junction, TX 76849
(800) 728-0403
info@seedsource.com
http://www.seedsource.com/catalog/index.asp

Oak Hills Nursery
13874 Ranchero Road
Oak Hills, CA 92345
(760) 947-6261
oakhillsnursery@hotmail.com
http://www.oakhillsnursery.com
http://www.mojavedesertplants.com

Seedland, Inc.
9895 Adams Road
Wellborn, FL 32094
(386) 963-2080
sales@seedland.com
http://www.seedland.com/

S & S Seeds
P.O. Box 1275
Carpenteria, CA 93014
(805) 684-0436

San Marcos Growers
125 South San Marcos Road,
P.O. Box 6827
Santa Barbara, CA 93160
(805) 683-1561
http://www.smgrowers.com

Sheldon Nursery
4999 N. Sabino Canyon Rd.
Tucson, AZ 85750
520-529-0609
http://www.sheldonnursery.com
sheldonnursery1@yahoo.com

White Tank Nursery
P.O. Box 810
Waddell, AZ 85355
(623) 935-4276
info@whitetankpalms.com
http://www.whitetanknursery.com/index.html

Comstock Seed
917 Highway 88
Gardnerville, NV 89460
(777) 265-0090
sales@comstockseed.com
http://www.comstockseed.com

Appendix C
Photo Point Monitoring Datasheet

Pacific Gas and Electric Company
Topock Compressor Station
Photo Point Monitoring Data Sheet

Photo Point Station:_____ Date:_____

Observer:_____

Coordinates:_____ Datum:_____

Location Description:_____

_____

_____

_____

_____

_____

_____

Photo Direction: N NE E SE S SW W NW Compass Bearing:_____ Mag. or True North

Description of Setting (Including any vegetation, substrate and disturbance):

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Appendix O
Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats
(On CD-ROM only)

Final

Topock Compressor Station Groundwater Remediation Project Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats

Prepared for

Pacific Gas and Electric Company

September 2014

Prepared by

CH2M HILL, Inc., and E2 Consulting Engineers, Inc.

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Appendixes

A Vegetation Maps (with photo points) and Preconstruction Photographs
B Commercial Nurseries that Grow Native Mojave Desert Plants
C Photo Point Monitoring Datasheet

Acronyms and Abbreviations

BLM	United States Bureau of Land Management
CD	Consent Decree
CDFG	California Department of Fish and Game (now Department of Fish and Wildlife)
CDFW	California Department of Fish and Wildlife (formerly Department of Fish and Game)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
compressor station	Topock Compressor Station
C/RAWP	Construction/Remedial Action Work Plan
DOI	Department of the Interior
DTSC	California Department of Toxic Substances Control
ER	East Ravine
FEIR	Final Environmental Impact Report (for Topock Groundwater Remediation Project)
GPS	global positioning system
HNWR	Havasu National Wildlife Refuge
IM	Interim Measure
IRL	inner recirculation loop
IRZ	in situ reactive zone
ISA	International Society of Arboriculture
MMRP	Mitigation Monitoring and Reporting Program
msl	mean sea level
NHD	National Hydrographic Dataset
O&M	operation and maintenance
OHWM	ordinary high water mark
PBA	programmatic biological assessment
PG&E	Pacific Gas and Electric Company
PPD	preconstruction photo documentation
Project Area	Topock Groundwater Remediation Project AreaRB riverbank
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RPD	revegetation photo documentation
SWPPP	stormwater pollution prevention plan
TCS	Topock Compressor Station
TWB	Transwestern Bench

USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

SECTION 1

Introduction

In December 1951, the Topock Compressor Station (TCS or compressor station) began operations to compress natural gas supplied from the southwestern U.S. for transport through pipelines to Pacific Gas and Electric Company's (PG&E) service territory in central and northern California. The TCS is approximately 15 miles southeast of Needles in San Bernardino County, California (Figure 1). The compressor station is still active and is anticipated to remain active into the foreseeable future. Operations at the compressor station consist of six major activities: water conditioning, compressing natural gas, cooling compressed natural gas and compressor lubricating oil, wastewater treatment, facility and equipment maintenance, and miscellaneous operations.

Historical wastewater discharge from TCS operations to Bat Cave Wash and the East Ravine have resulted in chromium contamination in groundwater. In 1996, PG&E entered into a Corrective Action Consent Agreement with the California Department of Toxic Substances Control (DTSC) to oversee the investigation and remediation of the TCS under California state law. DTSC is the California state lead agency charged with directing investigative activities in the action area in accordance with the Resource Conservation and Recovery Act (RCRA). The U.S. Department of the Interior (DOI) is the lead federal agency overseeing response actions for land under its jurisdiction, custody, or control near the TCS pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

In July 2005, PG&E and the Federal Agencies (DOI, Bureau of Land Management [BLM], Bureau Reclamation [USBR], and the U.S. Fish and Wildlife Service [USFWS]) entered into an Administrative Consent Agreement. In addition, PG&E and the United States also have entered into a Remedial Design/Remedial Action Consent Decree (CD) under CERCLA governing the groundwater remedy, which was entered by the U.S. District Court for the Central District of California in November 2013.

In January 2011, the DOI issued a Record of Decision (ROD) selecting the groundwater remedy for the site, and at the same time, DTSC also adopted the Final Remedy for the groundwater contamination. The 2013 CD requires the planning, design, construction, operation and maintenance (O&M), post-remediation monitoring, decommissioning, and restoration of the groundwater remedy selected in the ROD.

Implementation of the groundwater remedy (the project) consists of several phases, including construction, O&M, post-remediation monitoring, decommissioning, and restoration. Figures 2a through 2c show the planned final groundwater remedy system layout in California, Moabi Regional Park, and Arizona, respectively. The project is expected to operate for several decades (estimated duration between 30 and 50 years).

Generally, the final groundwater remedy will include the following key features:

- An in situ reactive zone (IRZ) along the National Trails Highway that will use a line of wells that may be used as both injection and extraction wells to circulate groundwater and distribute an organic carbon source that will promote reduction of the hexavalent chromium to trivalent chromium.
- An inner recirculation loop (IRL) that comprises:
  - Extraction wells near the Colorado River (referred to as the riverbank [RB] extraction wells) to provide hydraulic capture of the deep hexavalent chromium groundwater concentrations, accelerate cleanup of the floodplain, enhance the flow of contaminated groundwater through the IRZ line, and control migration of IRZ-generated byproducts toward the Colorado River.
  - Injection wells to reinject groundwater extracted from the RB extraction wells, which may be amended with an organic carbon source, in the upgradient portion of the hexavalent chromium plume to flush the plume through the IRZ.

- A TCS recirculation loop, which includes:
  - East Ravine (ER) extraction wells near the eastern end of the East Ravine to capture contaminated groundwater in the shallow bedrock.
  - Transwestern Bench (TWB) extraction wells near the eastern portion of the TCS parcel to capture contaminated groundwater downgradient of the compressor station.
  - TCS injection wells located within the compressor station for the reinjection of groundwater extracted from the ER and TWB extraction wells. The extracted water will be amended with an organic carbon source to promote reduction of hexavalent chromium to trivalent chromium and reduce elevated hexavalent chromium groundwater concentrations from the alluvial aquifer in the vicinity of the compressor station.
- The freshwater supply system will convey water from supply well(s) in Arizona to assist with flushing the chromium plume through the National Trails Highway IRZ and constrain the westward spread of carbon-amended water and in situ byproducts from the IRL.

1.1 Purpose

DTSC certified the Topock Groundwater Remediation Project Final Environmental Impact Report (FEIR; DTSC, 2011) for the project and adopted the Mitigation Monitoring and Reporting Program (MMRP) in January 2011. Mitigation Measure BIO-1, listed below, is part of the measures intended to protect biological resources in the FEIR and MMRP. This restoration plan has been prepared to address the portions of the MMRP highlighted in the boldface type below.

> ***Mitigation Measure BIO-1:*** *Areas of sensitive habitat in the Project Area have been identified during project surveys. These areas include floodplain and riparian areas, wetlands, and waters of the United States. Habitats designated by California Department of Fish and Game (DFG) as sensitive, including desert washes and desert riparian, are also included. To the extent feasible, elements of the project shall be designed to avoid direct effects on these sensitive areas. During the design process and before ground disturbing activities, a qualified biologist shall coordinate with PG&E to ensure that the footprints of construction zones, drill pads, staging areas, and access routes are designed to avoid disturbance of sensitive habitats to the extent feasible. DTSC shall be responsible for enforcing compliance with design and all preconstruction measures.*
>
> *. . .*
>
> *If during the design process it is shown that complete avoidance of habitats under DFG jurisdiction (such as changes to the natural flow and/or bed and bank of a waterway) is infeasible, a Section 1602 streambed alteration agreement shall be obtained from DFG and affected habitats shall be replaced and/or rehabilitated. If complete avoidance of identified riparian habitat is not feasible, the acreage of riparian habitat that would be removed shall be replaced or rehabilitated on a no-net-loss basis in accordance with DFG regulations and, if applicable, as specified in the streambed alteration agreement, if needed.* ***Habitat restoration, rehabilitation, and/or replacement shall be at a location and by methods agreeable to DFG and consistent with the purpose and intent of applicable county policies and codes, as well as those policies outlined under the respective federal agency guidance documents.*** *Minimization and compensation measures adopted through the permitting process shall also be implemented.*

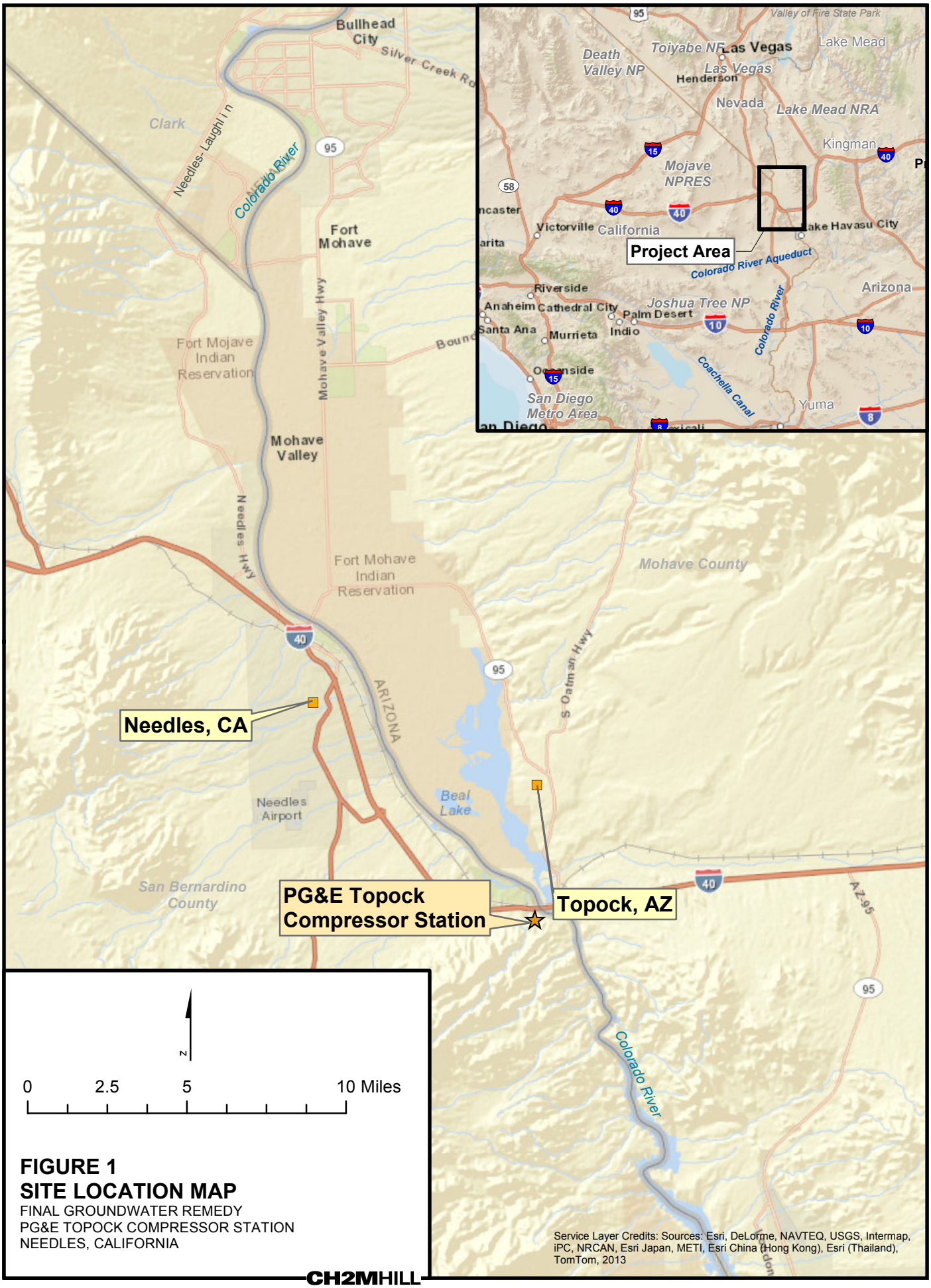
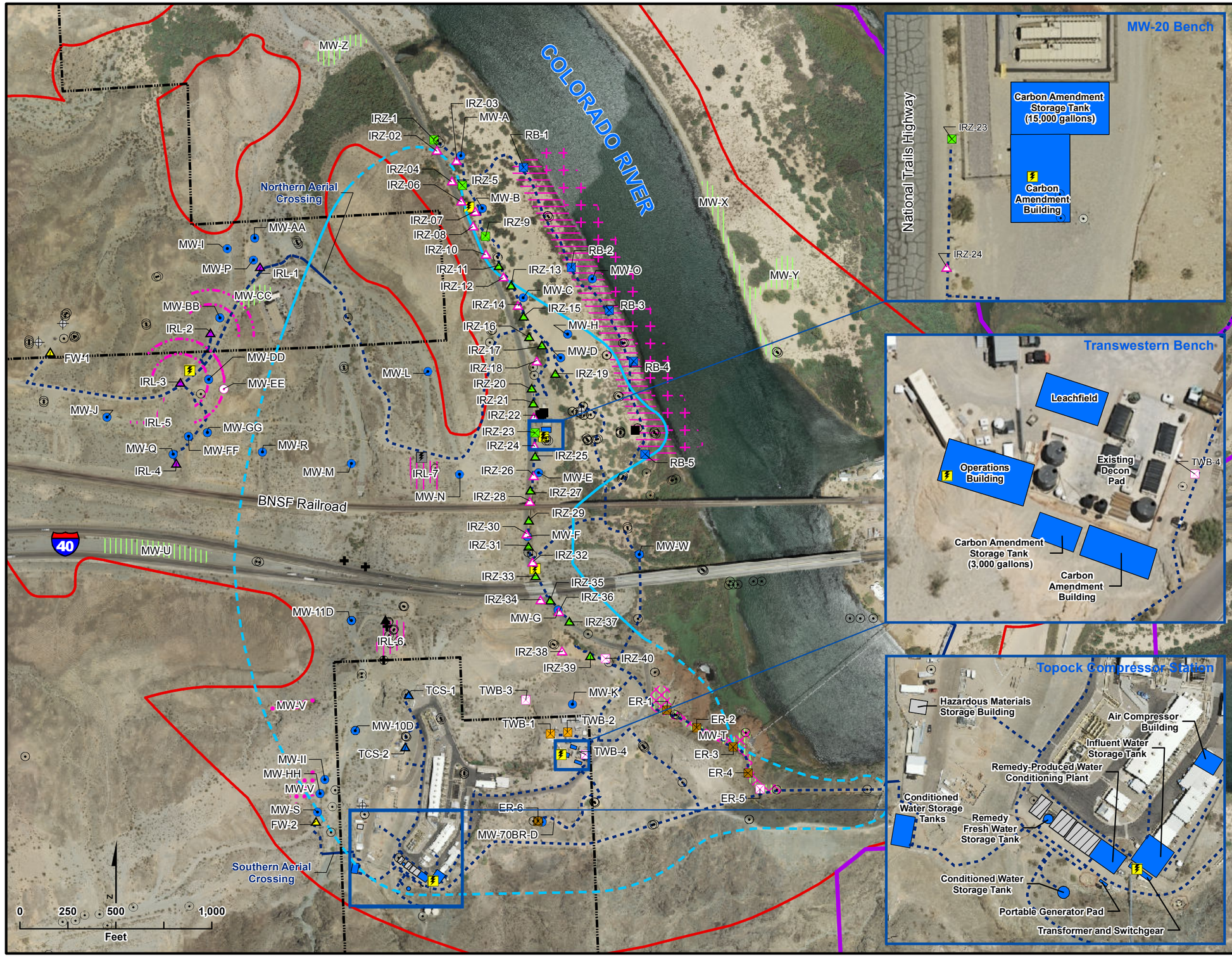


FIGURE 1
SITE LOCATION MAP
FINAL GROUNDWATER REMEDY
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\HNWR\FIG1_SiteLocationHNWR.mxd Date Saved: 6/19/2014 10:15:09 AM



LEGEND

- Property Boundaries
- Area of Potential Effects (APE)
- EIR Project Area

Existing Wells:

- Extraction Well
- Injection Well
- Monitoring Well
- Water Supply Well

Provisional Wells:

(Items in Pink are Provisional)

- Extraction Well
- Injection Well
- Monitoring Well (MW-EE is a pending/future provisional monitoring well)
- Arc for IRL-2 and IRL-3 Arsenic Monitoring Wells [3]
- Area for East Ravine (ER) Wells (ER-7 to ER-11 and MW-T)
- Area for Potential Slant Well Screens
- Area for Inner Recirculation Loop (IRL) Wells
- Area for River Bank Extraction Wells (RB-6 to RB-9)
- Area for Monitoring Well (MW-V)

Planned Wells:

- Extraction, East Ravine
- Extraction, National Trails Highway (NTH) In-situ Reactive Zone (IRZ)
- Extraction, Riverbank
- Extraction, Transwestern Bench
- Injection, Freshwater
- Injection, Inner Recirculation Loop
- Injection, NTH IRZ
- Injection, Topock Compressor Station
- Remedy Monitoring Well
- Recirculation Well
- Area for Monitoring Well (Applies to MW-CC, MW-T, MW-U, MW-X, MW-Y, and MW-Z)

Pipeline Corridor for Remedy

- Aboveground Pipe
- Underground Pipe/Conduit

Remedy Facilities

- Planned Transformer
- Future Provisional Transformer
- Proposed Remedy Structure
- Contingent Freshwater Pre-injection Treatment System
- Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

Note:

1. Note that in compliance with EIR mitigation measure CUL-1a-9, as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Hwy is located in an existing, previously disturbed, access road. In addition, the location of the road and pipeline was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10, PA, and CHPMP mitigation measures.
2. All well and structure locations are approximate.
3. Arcs for IRL-2 and IRL-3 arsenic monitoring wells represent a range of potential well locations. Portions of the arcs are not suitable for well installation due to technical and/or cultural resources constraints.

FIGURE 2A
GENERAL REMEDY SYSTEM LAYOUT - CALIFORNIA

FINAL GROUNDWATER REMEDY
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

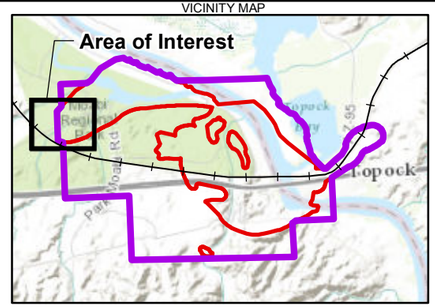
Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\Vegetation\FIG2A_90pct_CAdetails.mxd

Moabi Regional Park

National Trails Highway

BNSF Railroad

VICINITY MAP



LEGEND

- Long Term Remedy Support Area (1.2 acres approx.)
- Soil Storage Area (Each 1.5 acres approx.)
- Temporary Construction Laydown Area (1.3 acres approx.)
- Area of Potential Effects (APE)
- EIR Project Area

Notes:
1. This is a conceptual layout. Locations are approximate.
2. Descriptions of activities/functions anticipated for the construction support areas are included in the Construction/Remedial Action Work Plan.
3. Descriptions of activities/functions anticipated for the long-term remedy support areas are included in Section 3.5 of this BOD, and the O&M Manual.

N

0 95 190 380 Feet

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

FIGURE 2B
GENERAL REMEDY SYSTEM LAYOUT - MOABI REGIONAL PARK
FINAL GROUNDWATER REMEDY
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\Vegetation\FIG2B_PM_StagingRemedy_11x17.mxd

Site B

County Highway 10

HNWR-1A

HNWR-1

MW-X

MW-Y

BNSF Railroad

40

VICINITY MAP

Area of Interest

LEGEND

Existing Wells:

- Monitoring Well
- Water Supply Well

Planned Wells:

- Area for Monitoring Well (Applies to MW-X and MW-Y)

Provisional Wells:

- Area for Potential Slant Well Screens

Pipeline Corridor for Remedy

- Aboveground Freshwater Pipe
- Underground Freshwater Pipe
- Future Provisional/Contingent Fresh Water Pipe

- Area of Potential Effects (APE)
- EIR Project Area

Note:
All wells and remedy structure locations are approximate.

N

0 200 400 800 Feet

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

FIGURE 2C
GENERAL REMEDY SYSTEM LAYOUT - ARIZONA

FINAL GROUNDWATER REMEDY
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\Vegetation\FIG2C_ArizonaFW_11x17.mxd

Restoration of any disturbed areas shall include measures to achieve "no-net-loss" of habitat functions and values existing before project implementation. ***These measures shall be achieved by developing and implementing a habitat restoration plan submitted to DFG, U.S. Bureau of Land Management (BLM), and U.S. Fish and Wildlife Service (USFWS) that is agreeable to these agencies, or, alternately, through the implementation of a habitat restoration plan consistent with the substantive policies of DFG, Bureau of land Management (BLM), and United States Fish and Wildlife Service (USFWS).*** *The plan shall include a revegetation seed mix or plantings design, a site grading concept plan, success criteria for restoration, a monitoring plan for achieving no net loss of habitat values and functions, and an adaptive management plan. Alternately, if DFG declines to assert jurisdiction because it determines that Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121(e)(1) applies, and during the design process it is shown that complete avoidance of habitats under DFG jurisdiction (such as changes to the natural flow and/or bed and bank of a waterway) is infeasible, the substantive mandates of a streambed alteration agreement shall be implemented, and affected habitats shall be replaced and/or rehabilitated. If complete avoidance of identified riparian habitat is not feasible, the acreage of riparian habitat that would be removed shall be replaced or rehabilitated on a "no-net-loss" basis in accordance with DFG regulations and, if applicable. Habitat restoration, rehabilitation, and/or replacement shall be at a location and by methods agreeable to DFG and consistent with the purpose and intent of applicable county policies and codes, as well as those policies outlined under the respective federal agency guidance documents. Minimization and compensation measures adopted through the permitting process shall also be implemented. Restoration of any disturbed areas shall include measures to achieve "no-net-loss" of habitat functions and values existing before project implementation. These measures shall be achieved by developing and implementing a habitat restoration plan developed consistent with the substantive policies of DFG, BLM and USFWS.*

A separate revegetation plan has been developed to specifically address impacts on the Havasu National Wildlife Refuge (HNWR), for mature plants, and culturally significant plants that may be affected by proposed groundwater remediation activities. Furthermore, a programmatic biological assessment (PBA) has been prepared to address potential impacts to federally listed species and was submitted into consultation on April 28, 2014. On March 6, 2013, Chris Hayes, Deputy Regional Manager for California Department of Fish and Wildlife's (CDFW) Inland Desert Region, confirmed in a letter that response actions conducted at the TCS site, specifically soil and groundwater investigations and remediation activities, are exempted from obtaining a Lake and Streambed Alteration Agreement under Section 121(e)(1) of CERCLA. However, to comply with Mitigation Measure BIO-1, PG&E must comply with the substantive elements that would be required in a Streambed Alteration Agreement for the project.

This habitat restoration plan provides detailed information on salvage, relocation and transplantation methods, and replacement planting for plant species in sensitive habitat areas that are within areas under the jurisdiction of CDFW pursuant to Section 1600 of the State of California Fish and Game Code. This report also includes proposed monitoring methods, survival criteria, and a discussion of adaptive management as required by FEIR mitigation measure BIO-1.

1.2 Goals and Objectives

The goal of the restoration plan for riparian vegetation and other sensitive habitats is to satisfy the requirements of Mitigation Measure BIO-1, which is intended is to protect and preserve certain sensitive habitats including rivers, streams, wetlands, and riparian habitat in the Topock Groundwater Remediation Project Area (Project Area). The Project Area includes the area studied in the FEIR (DTSC, 2011), as well as the areas associated with the potential soil stockpiles and the proposed freshwater supply system in Arizona. Note, however, no soil storage areas will occur within riparian areas. The Project Area in terms of this restoration plan includes any jurisdictional wetland or waters where the proposed final groundwater remedy action may occur.

The primary objective during implementation of the final groundwater remedy is to avoid and minimize disturbance of sensitive habitats and, where this is not possible, mitigate for disturbance through salvage or restoration planting. Final groundwater remedy actions that may results in impacts to sensitive habitats include construction, O&M, sampling and monitoring, decommissioning, and restoration.

1.3 Description of Sensitive Habitats in the Project Area

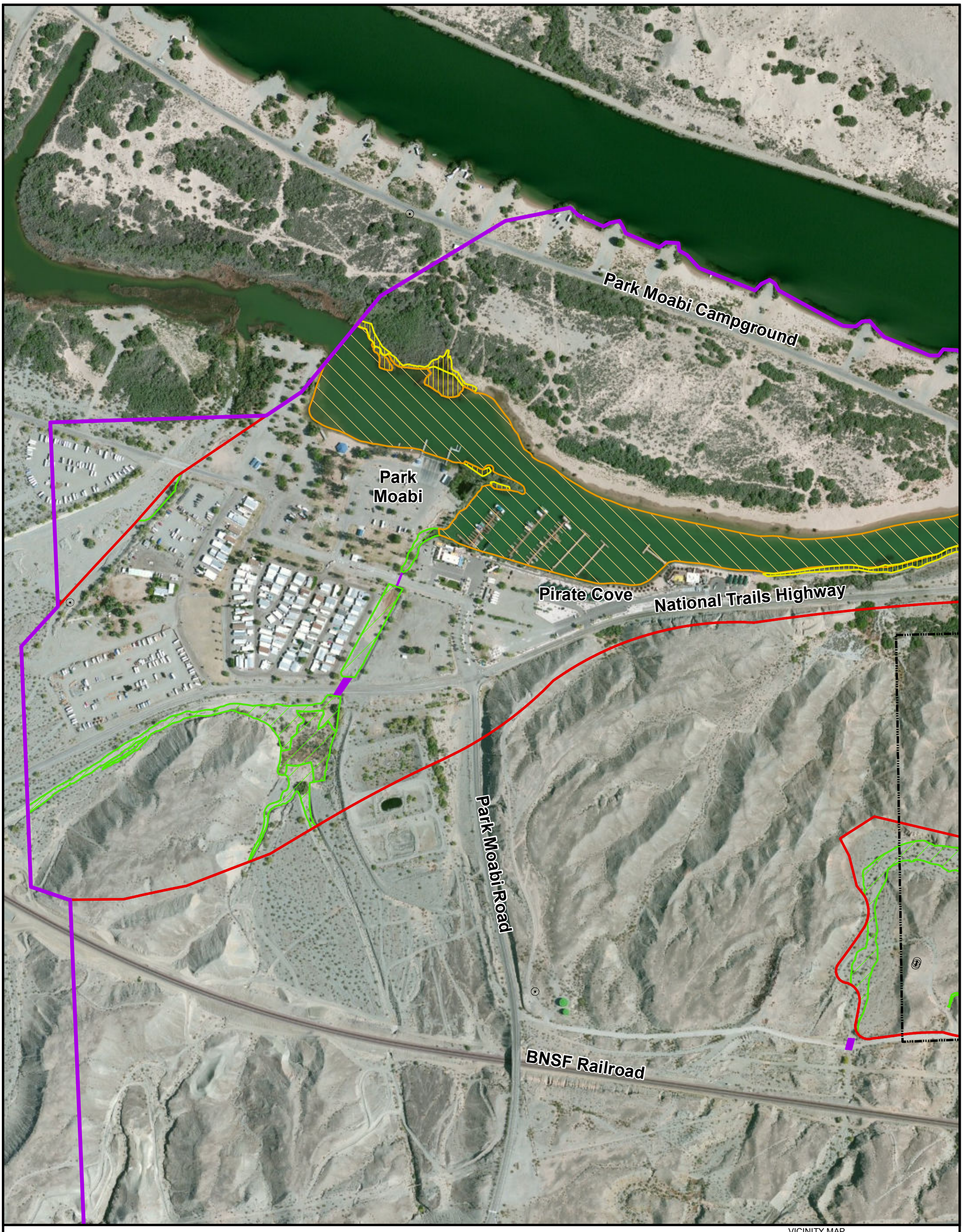
Primary sensitive habitats identified within the Project Area include riparian vegetation as well as rivers, streams (including ephemeral washes), and wetlands. These habitat types were identified and mapped as part of the wetlands delineation survey and CDFW jurisdictional memorandum (CH2M HILL, 2013 and 2014). The following sections provide a description of rivers and streams as well as associated riparian habitat that are considered to be sensitive habitats by CDFW, as directed by the groundwater remediation project FEIR (DTSC 2011). The distribution of these features is shown on Figures 3-1 through 3-6, and representative photographs are provided in Appendix A. A more detailed description of the specific vegetation impacts is provided in Section 1.3.6.

1.3.1 Colorado River

The Colorado River is the primary surface water feature in the Project Area. The river flows approximately 6,400 feet through the central part of the Project Area. Significant changes to the Colorado River hydraulic regime near the Project Area occurred after construction of Hoover Dam and Parker Dam. With the completion of Hoover Dam in 1936, annual spring floods and associated scouring events ended. With the completion of Parker Dam in 1938, and subsequent filling of Lake Havasu, the Colorado River channel between Needles and Topock rapidly aggraded (Metzger and Loeltz, 1973). By 1944, the aggradation of the river channel caused elevated groundwater levels and flooding in low-lying areas. In response to this condition, the USBR conducted extensive dredging of the river channel to maintain channel geometry and reduce flooding. These changes have had a significant impact on the natural floodplain processes and associated riparian vegetation in the Project Area.

The water elevations in the Colorado River fluctuate seasonally and daily due to upstream flow regulation from the Davis Dam, located approximately 41 river miles upstream of the Project Area. Data from the United States Geological Survey (USGS) river gauge at the Topock Marsh inlet shows that average flow rate ranges from a low of 14 cubic feet per second (cfs) in January to a high of 99 cfs in June (Figure 4). Daily surface water elevation data for the Colorado River have been measured near the Interstate-40 bridge since the middle of June 2003 as part of the ongoing monitoring program at the compressor station. The average water level elevation recorded for this period was 454.9 feet above mean sea level (msl), with a minimum of 450.6 feet above msl and a maximum of 458.7 feet above msl. Average monthly flow rates measured at the Topock Marsh inlet between January 1967 and September 2012 show a fluctuating, but controlled, rate of discharge that did not exceed a mean of 193 cfs (Figure 5).

Upstream of the Interstate-40 bridge, the river channel ranges from approximately 600 to 740 feet wide. Downstream of the bridge, the river traverses the exposed bedrock of the Chemehuevi Mountains, and the channel width narrows to approximately 435 feet. Throughout much of the Project Area, the channel banks are primarily characterized by steep slopes that have been armored with large boulders. The elevation at the top of the banks is approximately 466 feet above msl, more than 7 feet above the maximum flow level recorded in this area since 2003. Further south along the Arizona side of the Colorado River, near the inlet to the Topock Marina, the banks are slightly lower and have narrow sandy beaches and eroded sandy banks at elevations ranging from around 460 to 463 feet above msl.



LEGEND

Existing Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- Water Supply Well

Provisional Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- ARC for IRL-2 and IRL-3 Arsenic Monitoring Wells
- Area for East Ravine (ER) Wells (ER-7 to ER-11 and MW-T)
- Area for Potential Slant Well Screens
- Area for Inner Recirculation Loop (IRL) Wells
- Area for River Bank Extraction Wells (RB-6 to RB-9)
- Area for Monitoring Well (MW-V)

Planned Wells:
- Extraction, East Ravine
- Extraction, NTH IRZ
- Extraction, Riverbank
- Extraction, Transwestern Bench
- Injection, Freshwater
- Injection, Inner Recirculation Loop
- Injection, NTH IRZ
- Injection, Topock Compressor Station
- Injection/Extraction, Inner Recirculation Loop
- Remedy Monitoring Well
- Recirculation Well
- Area for Monitoring Well (Applies to MW-CC, MW-T, MW-U, MW-X, MW-Y, and MW-Z)

Transformers
- Planned Transformer
- Future Provisional Transformer

Pipeline Corridor for Remedy
- Aboveground Pipe
- Underground Pipe/Conduit
- Future Provisional/ Contingent Fresh Water Pipe
- Area of Potential Effects (APE)
- Property Boundaries

Remedy Facilities
- Proposed Remedy Structure
- Contingent Freshwater Pre-injection Treatment System
- Wetland Delineation Boundary
- Culvert

CDFW Jurisdiction Areas
- CDFW Ephemeral Stream
- CDFW Riparian
- Colorado River
- Park Moabi Slough

N

0 420 Feet

Note:
CDFW = California Department of Fish and Wildlife

Source:
Wetland Delineation
Completed March 13-17, 2012
R. Huddleston and K. Steiner.
Update Completed July16-17, 2012
R. Huddleston and M. Fowler.
Update Completed December 12-13, 2012 R. Huddleston.

VICINITY MAP

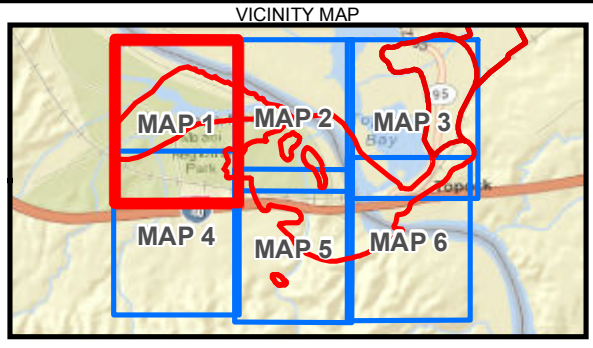


FIGURE 3-1
RIVERS, STREAMS AND RIPARIAN AREAS
Map 1 of 6
Final Groundwater Remedy
PG&E Topock Compressor Station
Needles, California

Park Moabi Campground

National Trails Highway

24" CMP

4 48" Culverts

IM-3

2 48" CMP

36" CMP

36" CMP

48" CMP

MW-20

Nat

LEGEND

Existing Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- Water Supply Well

Provisional Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- ARC for IRL-2 and IRL-3 Arsenic Monitoring Wells
- Area for East Ravine (ER) Wells (ER-7 to ER-11 and MW-T)
- Area for Potential Slant Well Screens
- Area for Inner Recirculation Loop (IRL) Wells
- Area for River Bank Extraction Wells (RB-6 to RB-9)
- Area for Monitoring Well (MW-V)

Planned Wells:
- Extraction, East Ravine
- Extraction, NTH IRZ
- Extraction, Riverbank
- Extraction, Transwestern Bench
- Injection, Freshwater
- Injection, Inner Recirculation Loop
- Injection, NTH IRZ
- Injection, Topock Compressor Station
- Injection/Extraction, Inner Recirculation Loop
- Remedy Monitoring Well
- Recirculation Well
- Area for Monitoring Well (Applies to MW-CC, MW-T, MW-U, MW-X, MW-Y, and MW-Z)

Transformers
- Planned Transformer
- Future Provisional Transformer

Pipeline Corridor for Remedy
- Aboveground Pipe
- Underground Pipe/Conduit
- Future Provisional/ Contingent Fresh Water Pipe
- Area of Potential Effects (APE)
- Property Boundaries

Remedy Facilities
- Proposed Remedy Structure
- Contingent Freshwater Pre-injection Treatment System
- Wetland Delineation Boundary
- Culvert

CDFW Jurisdiction Areas
- CDFW Ephemeral Stream
- CDFW Riparian
- Colorado River
- Park Moabi Slough

N

0 380 Feet

Note:
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Source:
Wetland Delineation Completed March 13-17, 2012 R. Huddleston and K. Steiner. Update Completed July16-17, 2012 R. Huddleston and M. Fowler. Update Completed December 12-13, 2012 R. Huddleston.

VICINITY MAP

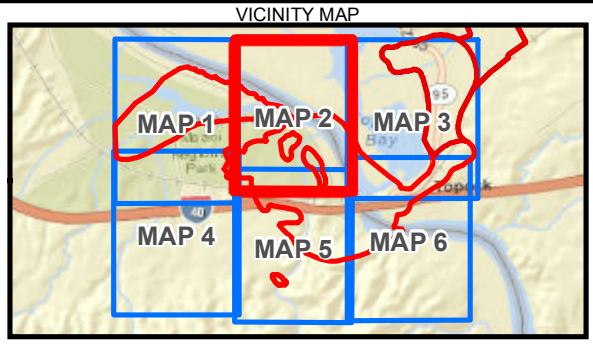

FIGURE 3-2
RIVERS, STREAMS AND RIPARIAN AREAS
Map 2 of 6
Final Groundwater Remedy
PG&E Topock Compressor Station
Needles, California

8' Culvert

5' Culvert

Topock Marsh

State Route 95

Topock Marina

BNSF Railroad

LEGEND

Existing Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- Water Supply Well

Provisional Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- ARC for IRL-2 and IRL-3 Arsenic Monitoring Wells
- Area for East Ravine (ER) Wells (ER-7 to ER-11 and MW-T)
- Area for Potential Slant Well Screens
- Area for Inner Recirculation Loop (IRL) Wells
- Area for River Bank Extraction Wells (RB-6 to RB-9)
- Area for Monitoring Well (MW-V)

Planned Wells:
- Extraction, East Ravine
- Extraction, NTH IRZ
- Extraction, Riverbank
- Extraction, Transwestern Bench
- Injection, Freshwater
- Injection, Inner Recirculation Loop
- Injection, NTH IRZ
- Injection, Topock Compressor Station
- Injection/Extraction, Inner Recirculation Loop
- Remedy Monitoring Well
- Recirculation Well
- Area for Monitoring Well (Applies to MW-CC, MW-T, MW-U, MW-X, MW-Y, and MW-Z)

Transformers
- Planned Transformer
- Future Provisional Transformer

Pipeline Corridor for Remedy
- Aboveground Pipe
- Underground Pipe/Conduit
- Future Provisional/ Contingent Fresh Water Pipe
- Area of Potential Effects (APE)
- Property Boundaries

Remedy Facilities
- Proposed Remedy Structure
- Contingent Freshwater Pre-injection Treatment System
- Wetland Delineation Boundary
- Culvert

CDFW Jurisdiction Areas
- CDFW Ephemeral Stream
- CDFW Riparian
- Colorado River
- Park Moabi Slough

N

0 420 Feet

Note:
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Source:
Wetland Delineation Completed March 13-17, 2012 R. Huddleston and K. Steiner. Update Completed July16-17, 2012 R. Huddleston and M. Fowler. Update Completed December 12-13, 2012 R. Huddleston.

VICINITY MAP

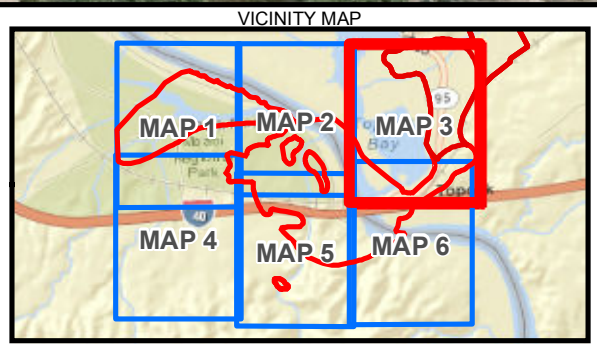
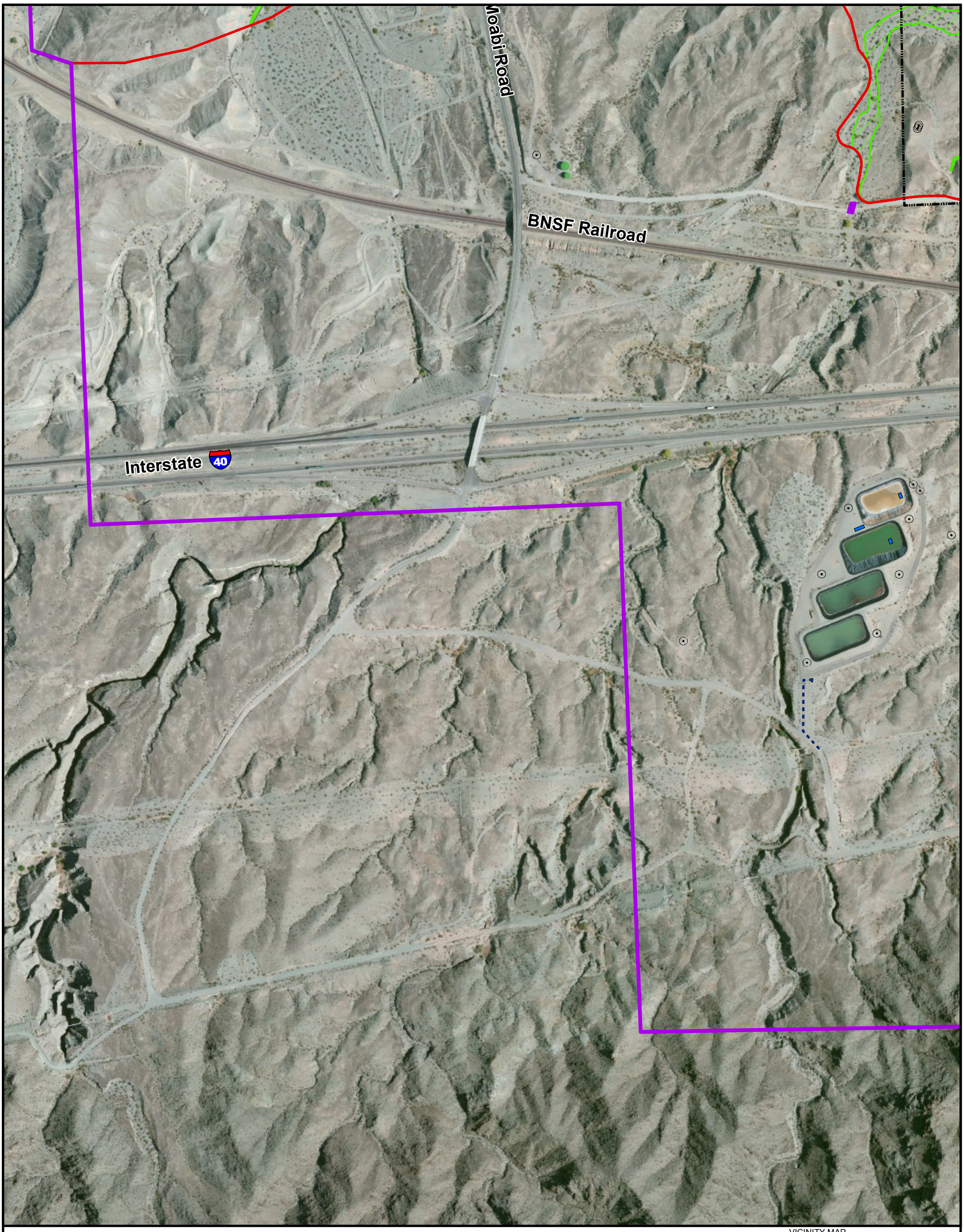


FIGURE 3-3
RIVERS, STREAMS AND RIPARIAN AREAS
Map 3 of 6
Final Groundwater Remedy
PG&E Topock Compressor Station
Needles, California



LEGEND

Existing Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- Water Supply Well

Provisional Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- ARC for IRL-2 and IRL-3 Arsenic Monitoring Wells
- Area for East Ravine (ER) Wells (ER-7 to ER-11 and MW-T)
- Area for Potential Slant Well Screens
- Area for Inner Recirculation Loop (IRL) Wells
- Area for River Bank Extraction Wells (RB-6 to RB-9)
- Area for Monitoring Well (MW-V)

Planned Wells:
- Extraction, East Ravine
- Extraction, NTH IRZ
- Extraction, Riverbank
- Extraction, Transwestern Bench
- Injection, Freshwater
- Injection, Inner Recirculation Loop
- Injection, NTH IRZ
- Injection, Topock Compressor Station
- Injection/Extraction, Inner Recirculation Loop
- Remedy Monitoring Well
- Recirculation Well
- Area for Monitoring Well (Applies to MW-CC, MW-T, MW-U, MW-X, MW-Y, and MW-Z)

Transformers
- Planned Transformer
- Future Provisional Transformer

Pipeline Corridor for Remedy
- Aboveground Pipe
- Underground Pipe/Conduit
- Future Provisional/ Contingent Fresh Water Pipe
- Area of Potential Effects (APE)
- Property Boundaries

Remedy Facilities
- Proposed Remedy Structure
- Contingent Freshwater Pre-injection Treatment System
- Wetland Delineation Boundary
- Culvert

CDFW Jurisdiction Areas
- CDFW Ephemeral Stream
- CDFW Riparian
- Colorado River
- Park Moabi Slough

N

0 420 Feet

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Update Completed July16-17, 2012
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VICINITY MAP

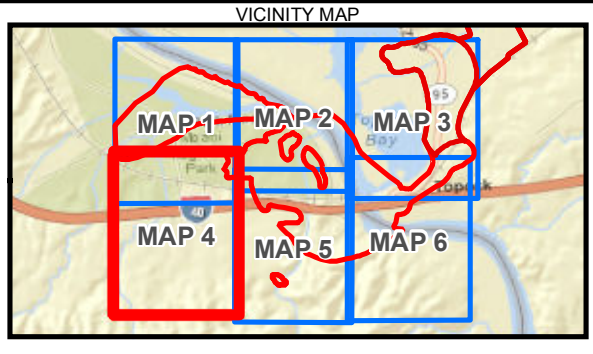

FIGURE 3-4
RIVERS, STREAMS AND RIPARIAN AREAS
Map 4 of 6
Final Groundwater Remedy
PG&E Topock Compressor Station
Needles, California

IM-3
2" 48" CMP
36" CMP
36" CMP
48" CMP
MW-20
National Trails Highway
22' Concrete Underpass
Interstate 40
4 10' Box Culverts
TB-3
PG&E
Topock
Compressor Station
TB-25

LEGEND

Existing Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- Water Supply Well

Provisional Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- ARC for IRL-2 and IRL-3 Arsenic Monitoring Wells
- Area for East Ravine (ER) Wells (ER-7 to ER-11 and MW-T)
- Area for Potential Slant Well Screens
- Area for Inner Recirculation Loop (IRL) Wells
- Area for River Bank Extraction Wells (RB-6 to RB-9)
- Area for Monitoring Well (MW-V)

Planned Wells:
- Extraction, East Ravine
- Extraction, NTH IRZ
- Extraction, Riverbank
- Extraction, Transwestern Bench
- Injection, Freshwater
- Injection, Inner Recirculation Loop
- Injection, NTH IRZ
- Injection, Topock Compressor Station
- Injection/Extraction, Inner Recirculation Loop
- Remedy Monitoring Well
- Recirculation Well
- Area for Monitoring Well (Applies to MW-CC, MW-T, MW-U, MW-X, MW-Y, and MW-Z)

Transformers
- Planned Transformer
- Future Provisional Transformer

Pipeline Corridor for Remedy
- Aboveground Pipe
- Underground Pipe/Conduit
- Future Provisional/ Contingent Fresh Water Pipe
- Area of Potential Effects (APE)
- Property Boundaries

Remedy Facilities
- Proposed Remedy Structure
- Contingent Freshwater Pre-injection Treatment System
- Wetland Delineation Boundary
- Culvert

CDFW Jurisdiction Areas
- CDFW Ephemeral Stream
- CDFW Riparian
- Colorado River
- Park Moabi Slough

N

0 400 Feet

Note:
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Source:
Wetland Delineation Completed March 13-17, 2012 R. Huddleston and K. Steiner. Update Completed July16-17, 2012 R. Huddleston and M. Fowler. Update Completed December 12-13, 2012 R. Huddleston.

VICINITY MAP

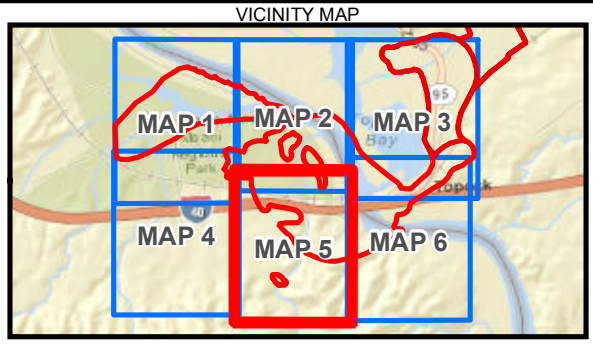
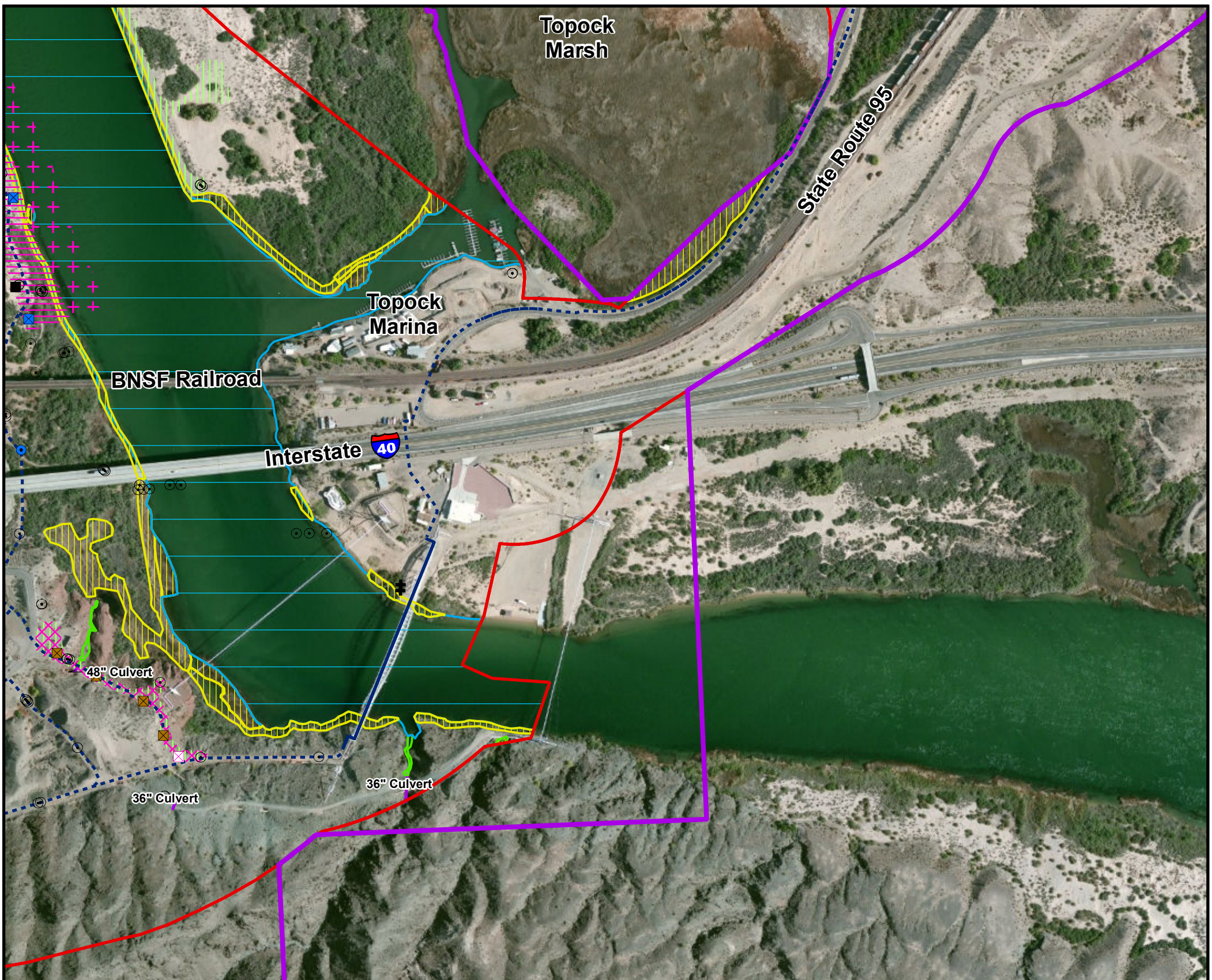


FIGURE 3-5
RIVERS, STREAMS AND RIPARIAN AREAS
Map 5 of 6
Final Groundwater Remedy
PG&E Topock Compressor Station
Needles, California

BAO \\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2014\MPRP\FIG3-X_CDFW_JURIS_WETLAND.MXD ECLARK1 9/4/2014 8:56:25 PM



LEGEND

Existing Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- Water Supply Well

Provisional Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- ARC for IRL-2 and IRL-3 Arsenic Monitoring Wells
- Area for East Ravine (ER) Wells (ER-7 to ER-11 and MW-T)
- Area for Potential Slant Well Screens
- Area for Inner Recirculation Loop (IRL) Wells
- Area for River Bank Extraction Wells (RB-6 to RB-9)
- Area for Monitoring Well (MW-V)

Planned Wells:
- Extraction, East Ravine
- Extraction, NTH IRZ
- Extraction, Riverbank
- Extraction, Transwestern Bench
- Injection, Freshwater
- Injection, Inner Recirculation Loop
- Injection, NTH IRZ
- Injection, Topock Compressor Station
- Injection/Extraction, Inner Recirculation Loop
- Remedy Monitoring Well
- Recirculation Well
- Area for Monitoring Well (Applies to MW-CC, MW-T, MW-U, MW-X, MW-Y, and MW-Z)

Transformers
- Planned Transformer
- Future Provisional Transformer

Pipeline Corridor for Remedy
- Aboveground Pipe
- Underground Pipe/Conduit
- Future Provisional/ Contingent Fresh Water Pipe
- Area of Potential Effects (APE)
- Property Boundaries

Remedy Facilities
- Proposed Remedy Structure
- Contingent Freshwater Pre-injection Treatment System
- Wetland Delineation Boundary
- Culvert

CDFW Jurisdiction Areas
- CDFW Ephemeral Stream
- CDFW Riparian
- Colorado River
- Park Moabi Slough

N

0 420 Feet

Note:
CDFW = California Department of Fish and Wildlife

Source:
Wetland Delineation Completed March 13-17, 2012 R. Huddleston and K. Steiner. Update Completed July16-17, 2012 R. Huddleston and M. Fowler. Update Completed December 12-13, 2012 R. Huddleston.

VICINITY MAP

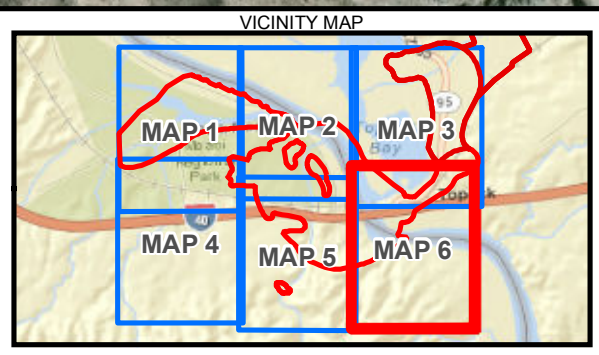
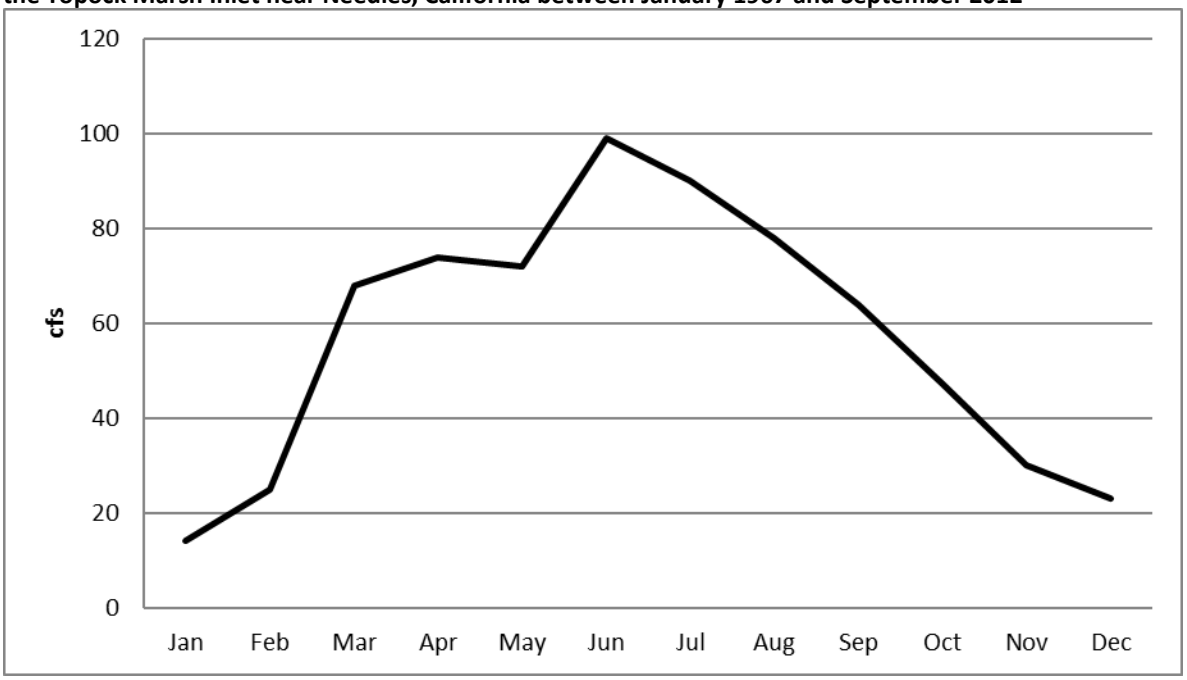


FIGURE 3-6
RIVERS, STREAMS AND RIPARIAN AREAS
Map 6 of 6
Final Groundwater Remedy
PG&E Topock Compressor Station
Needles, California

FIGURE 4
Overall Monthly Average Flow Rate (cfs) for the Colorado River as Measured at the USGS River Gauge (09423550) at the Topock Marsh Inlet near Needles, California between January 1967 and September 2012



Because of controlled discharges regulated by upstream dams as well as past dredging and channelization along this reach of the Colorado River, there is no longer an active floodplain in the Project Area, and as described below, the riparian habitat is limited to a narrow band immediately along the channel banks of the river.

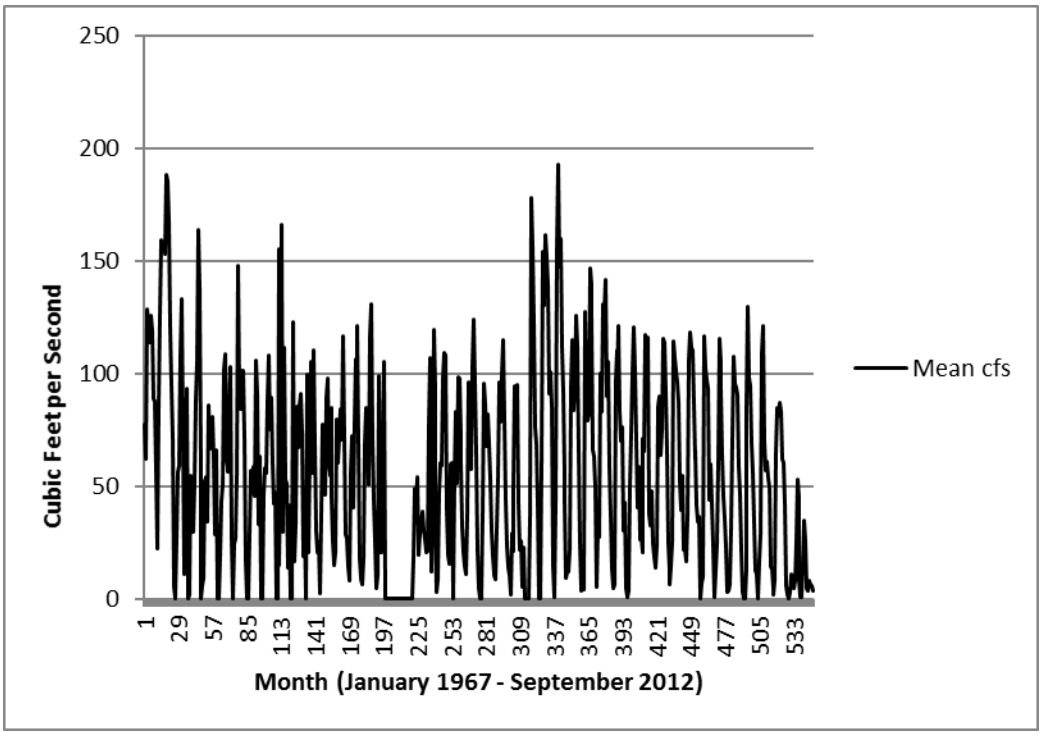
The only project activity in this area is the installation of a section of freshwater supply pipeline that will be installed along the existing natural gas line bridge that spans the Colorado River. The project will not result in impacts to the bank or channel of the Colorado River.

1.3.2 Park Moabi Slough

Park Moabi Slough was created by major dredging activities done by the USBR. Historical photographs indicate that much of the present shoreline, bank stabilization, and sand dune area features in the Park Moabi area were completed during in the mid-1960s. Within the Project Area, most of the areas along the channel are characterized by developed beaches, vacation cabins, boat docks, and boat ramps associated with the Pirate Cove Resort and Park Moabi. East of the developed areas, the southern shore of the slough is characterized by relatively steep sandy and rocky banks with dense vegetation. As with the Colorado River, no active floodplain is associated with the slough, and riparian vegetation, where present, is limited to a narrow band along the edges of the channel.

No project activities are associated with the Park Moabi Slough and, therefore, there will be no impacts to this area.

FIGURE 5
Monthly Average Flow Rate (cfs) for the Colorado River as Measured at the USGS River Gauge (09423550) at the Topock Marsh Inlet near Needles, California between January 1967 and September 2012
The data gap circa 1983-4 (or circa month 200) corresponds to the Colorado River flood after which the Topock gauge was replaced.



1.3.3 Ephemeral Washes West and North of the Compressor Station

Arid region ephemeral washes are a unique type of stream feature, which required the U.S. Army Corps of Engineers (USACE) to publish a number of guidance documents regarding the determination of jurisdictional limits in these areas, including *A Field Guide to Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the* Western United States (Lichvar and McColley, 2008) and the *Updated Datasheet for the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States* (Curtis and Lichvar, 2010). Unlike perennial or seasonal streams in wetter environments where the extent of federal jurisdiction is determined by the ordinary high water flows, the extent of jurisdiction of arid-region ephemeral washes includes all of the hydrogeomorphic floodplain units such as low-flow channels, active floodplain, and low terraces. In these areas, the federal jurisdictional limits are defined by the lateral extent of the active floodplain, which also is generally the extent of desert wash (riparian) vegetation. Therefore, the areas of ephemeral washes included in the wetlands delineation for federal waters of the U.S. were considered representative of area that would be regulated under state regulations by CDFW and are subject to the requirements of Mitigation Measure BIO-1.

The alluvial terraces along the southern side of the Colorado River and north of the Chemehuevi Mountains are characterized by numerous incised drainage channels and ephemeral washes. One of the largest ephemeral washes in the Project Area is Bat Cave Wash, a north-south trending channel that is immediately west of the TCS. Bat Cave Wash is shown as an intermittent blue line stream on the USGS Topock topographic quadrangle map and is included as an intermittent stream in the National Hydrographic Dataset (NHD).

Bat Cave Wash is a tributary of the Colorado River. Large volume surface flows are generally infrequent and occur only briefly in response to high-intensity rainfall events. Stormwater flows are conveyed directly into the river under a bridge along the National Trails Highway. Within the Project Area, the upper part of Bat Cave Wash is confined by steep rocky slopes and has an approximately 30-foot-wide gravel-cobble floodplain. Vegetation in the upper reaches of the wash is sparse, consisting of scattered shrubs such as Anderson's box-thorn (*Lycium andersonii*), catclaw acacia (*Senegalia* greggii), and desert lavender (*Hyptis emoryi*). As the wash continues downslope, the channel broadens to more than 190 feet wide in some areas. In this reach, multiple low-flow channels are present throughout the active floodplain. Vegetation cover also increases downslope with blue palo verde (*Parkinsonia florida*) and salt cedar (*Tamarix ramosissima*) trees scattered throughout the active floodplain. Other common shrubs on, or immediately adjacent to, the active floodplain include brittlebush (*Encelia farinosa*), creosote bush (*Larrea tridentata*), white bur-sage (*Ambrosia dumosa*), sweetbush (*Bebbia juncea*), and white rhatany (*Krameria bicolor*). Total vegetative cover throughout most of the wash is less than 30 percent, with the exception of a dense stand of salt cedar at the northern end of the wash, just south of the National Trails Highway.

Two freshwater supply pipelines will cross Bat Cave Wash. The upstream crossing is west of the TCS and will traverse Bat Cave Wash on an aerial pipe support bridge that will be immediately adjacent to an existing natural gas pipeline that spans the wash in this area. No impacts to riparian vegetation or the bed, bank, or channel would occur at this upstream crossing location. The downstream crossing is near the Interim Measure (IM) 3 water treatment plant and will include an aerial crossing over the channel with a steel support bridge complete with access ladders to allow for pipe inspections. The support footings for the pipe bridge will be located outside the channel on both sides, so no permanent impacts will occur to the bed, bank, or channel. However, there would be minor temporary impacts from placing equipment within the channel, and up to three mature blue palo verde trees that are adjacent to the wash may be removed during construction of the pipe bridge at this location.

A second large ephemeral wash is west of Bat Cave Wash and is referred to as the Western Drainage. There is no blue line stream indicated on the USGS Topock quadrangle map in this area nor is there any mapped feature in the NHD at this location. The active floodplain of this channel ranges from approximately 100 to 240 feet wide and is characterized by a sandy-pebble-cobble substrate with multiple low-flow channels. Scattered perennial vegetation throughout the channel includes blue palo verde, catclaw, Anderson's box-thorn, sweetbush, creosote bush, white rhatany, and cheesebush (*Ambrosia salsola*). Similar to Bat Cave Wash, a dense thicket of salt cedar and honey mesquite (*Prosopis glandulosa*) is at the northern (downslope) end of the wash feature. A large earthen dam has been constructed at the downstream terminus of this feature, and there is no longer a direct hydrologic connection to the Colorado River. A perennial pond is immediately north of the dam that is connected to a small wetland adjacent to the Colorado River via a large culvert that passes under the National Trails Highway. No project activities will occur in or adjacent to this wash.

Within the Project Area, several small, incised tributary drainages flow directly into either Bat Cave Wash or the Western Drainage system. These channels are characterized by a single low-flow channel and generally have sandy-gravel, cobbly, or rocky substrates. Most of the low-flow channels are devoid of vegetation or have only sparse, scattered herbaceous species such as spurge (*Chamaesyce* spp.), Spanish needle (*Palafoxia arida*), ovate plantain (*Plantago ovata*), and needle grama (*Bouteloua aristidoides* var*. aristidoides*). Common trees and shrubs along the lower slopes and channel edges in these areas include blue palo verde, catclaw acacia, Anderson's box-thorn, creosote bush, white bur-sage, white rhatany, and sweetbush. No project activities will occur in these tributary washes.

1.3.4 Park Moabi Drainages

Three ephemeral drainages are in the western part of the Project Area, originating south of the developed portion of Moabi Regional Park. Two of these drainages are shown as unnamed blue line streams of the USGS Whale Mountain Topographic quadrangle map and are included as intermittent streams in the NHD.

These ephemeral channels are characterized by relatively steep vertical side banks and sand-pebble-cobble beds that are largely devoid of vegetation. Scattered blue palo verde trees and occasional shrubs such as cheesebush, brittlebush, and creosote bush are present along the edges and side slopes of the channels. All three channels flow into a broad retention basin on the southern side of the National Trails Highway, west of Park Moabi Road. Six 48-inch-diameter culverts are in the northeastern corner of the retention basin that convey flows under the National Trails Highway into a broad U-shaped, routinely maintained, stormwater channel in the developed area of the park. At the time of the survey, the sandy-gravel substrate of the stormwater channel was devoid of vegetation because of recent maintenance activities.

At the northern end of the U-shaped channel, a 24-inch-diameter culvert is under a paved road that drains into a low topographic swale characterized by upland vegetation. The swale feature continues north where stormwater flows are discharged into Park Moabi Slough near the southwestern corner of the Pirate Cove Marina. No project activities will occur in these drainages.

1.3.5 Riparian Vegetation

Riparian vegetation includes areas of emergent vegetation along the edges of the Colorado River and Park Moabi Slough, trees and shrubs growing immediately adjacent to the Colorado River, and undeveloped areas of Park Moabi Slough and adjacent wetlands that have a direct hydrologic connection with the Colorado River. Vegetated areas along the low terraces above the high water limit of the Colorado River, which are not subject to occasional flooding, were not considered to be riparian habitat.

Riparian habitat associated with the Colorado River and Park Moabi Slough include scattered patches of southern cattail (*Typha domingensis*), California bulrush (*Schoenoplectus californicus*), common reed (*Phragmites australis*), and giant reed (*Arundo donax*) growing along the edges of the Colorado River and Park Moabi Slough. Most of these areas occur below the ordinary high water line or on low terraces that likely are subject to regular flooding. Patches of emergent vegetation are most common along the southern banks of the Park Moabi Slough, but also are found along the northern banks of the slough in the western-most part of the Project Area. Patches of emergent vegetation are less common along the Colorado River and occur in scattered locations along the southwestern bank as well as near the Topock Marina. Also included are areas with California bulrush along the outlet of Bat Cave Wash and areas with broad-leaved cattail (*Typha latifolia*) in the outlet of the East Ravine near the southern boundary of the Project Area.

Much of the riparian vegetation associated with the rocky banks adjacent to the water's edge is characterized by scattered patches of salt cedar and arrow weed (*Pluchea sericea*), with some locally dense areas of honey mesquite. Species such as broom baccharis (*Baccharis sarothroides*) and occasional sand bar willow (*Salix exigua*) are present along some of the sandy banks on the southern side of Park Moabi Slough.

Riparian habitat also includes adjacent wetlands that are immediately adjacent to the Colorado River or Park Moabi Slough. The largest such wetland is on the southern side of the Interstate-40 bridge on the western side of the Colorado River. A dense monoculture of common reed characterize this wetland. At the time of the wetland survey in February 2012, saturated soil and groundwater were present at a depth of 8 inches. Based on the location and elevation of this wetland, surface water is likely present in the summer months (May through July) because of higher flow levels of the Colorado River.

Another adjacent wetland is on the eastern side of the Colorado River, north of the Topock Marina. This wetland is characterized by a strip of emergent wetland immediately above the shoreline and includes a narrow band of low trees and shrubs further inland. Emergent vegetation is characterized by iris-leaved rush (*Juncus xiphioides*), dallis grass (*Paspalum dilatatum*), and marsh pennywort (*Hydrocotyle verticillata*) with scattered common reed and California bulrush. A shallow water table and saturated soils were present at 12 inches below ground surface at the time of the February 2012 survey. This area appears subject to some flooding during higher flows and appears to have saturated conditions in the upper part of the soil for most of the year. Immediately inland, the riparian vegetation is characterized by small salt cedar trees and shrubs, arrow-weed, broom baccharis, and scattered narrow-leaved willow. Herbaceous vegetation in this area is

limited to sparse common reed. A shallow water table was encountered at a depth of 15 inches below the ground surface during the February 2012 survey.

The third adjacent wetland is on the southern bank of the Colorado River at its confluence with the Western Drainage, approximately 600 feet downstream of the confluences of the Park Moabi Slough and the Colorado River. This low, depressional area is filled with dense growth of southern cattail. At the time of the February 2012 survey, shallow groundwater and saturated soil were present at a depth of 10 inches below the ground surface. A culvert connects this area to a pond on the southern side of the National Trails Highway. Given the low topographic position, hydrologic connection to the pond south of the road, and shallow groundwater noted at the time of the survey, this area likely is subject to shallow seasonal flooding for part of the year.

The fourth adjacent wetland occurs on the northern side of Park Moabi Slough northwest of the Moabi Regional Park parking area and boat ramp. This wetland is on the landward side of the shore zone and is characterized by iris-leaved rush, marsh pennywort, and dallisgrass with scattered southern cattail. Shallow groundwater and saturated soils were encountered at 11 inches below ground surface in this area during the February 2012 survey. This wetland area appears to be located in a topographic low area where some flooding likely occurs during periods of higher flows.

A pond is on the southern side of the National Trails Highway approximately 800 feet southeast of the confluence of Park Moabi Slough and the Colorado River. An earthen dam separates the pond from the ephemeral wash system that extends south. The pond is connected to the adjacent emergent wetland described above via a large culvert. The southern half of the pond is characterized by dense growth of southern cattail, while the northern part is open water. Several feet of water was observed in the pond during the February and July 2012 surveys. A beaver lodge was near the center of the pond at the edge of the cattails. It appears that at one time, this was part of the larger wash system that has been cut off by the earthen dam. This area was considered riparian habitat, as it is now functionally a small backwater area of the Colorado River (via culvert connections). The dam likely is associated with railroad construction and maintenance, but may be related to the later development of a “roadhouse” with a building and campground that operated west of this feature when Historic Route 66 and then the National Trails Highway were in use as primary travel routes, before Interstate 40 construction. No project activities will occur in these wetlands or riparian areas.

1.3.6 Vegetation Impact Assessment

The vegetation impact assessment specific to CDFW jurisdictional areas was completed using a geographical information system (GIS) to combine the expected project construction footprint based on the 90 percent design with previously mapped sensitive resources such as desert washes and riparian vegetation.

Focused surveys to identify and map all vegetation in the 90 percent design footprint were conducted between August 6 and 8, 2014. The vegetation assessment and inventory included any identifiable persistent perennials, succulents, and all woody shrubs and trees. Non-persistent perennial and annual plants were not included in the inventory. Most of the plants were individually mapped using a Trimble GEO XT global positioning system (GPS); however, some vegetation including dense stands of arrow weed, salt cedar, or abundant and widespread creosote bushes were mapped on aerial photos and later digitized into GIS. Plants that were just outside of the polygon footprint were generally not mapped unless they represented an important resource to avoid. Dead vegetation within the footprint was also not mapped. This methodology provided a fairly comprehensive inventory of vegetation, including sensitive habitat areas, within the 90 percent design project footprint.

For most species, the vegetative cover associated with individual perennial plants was approximated by buffering the mapped GPS points to approximate the canopy cover evident on the aerial photograph. Vegetation impacts and the associated estimated acreage impacts within the 90 percent design footprint

associated with sensitive habitats are shown in Table 1. Vegetation maps, photo points, and preconstruction photographs are provided in Appendix A.

It should be noted that the plant information depicted on the Appendix A maps shows a mixture of polygons and symbols, not the actual impact areas. The symbols may deviate slightly from the underlying aerial photograph images. These deviations are due to inherent sources of error associated with GIS technology which include: changes in vegetation cover since the aerial photograph base map was taken in 2011, satellite geometry over the course of the mapping, the "canyon effect" near buildings and very steep slopes, geo-referencing changes where measured vertical elevation deviates from actual, and effect of high temperatures on the accuracy of the GPS unit.

TABLE 1
Summary of Vegetation Impacts within the 90% Design Footprint within CDFW Jurisdictional Riparian Areas

Species	Number of Plants*	Estimated Acreage
Anderson's desert thorn (*Lycium andersonii*)	4	0.002
Beaver tail (*Opuntia basilaris*)	2	<0.001
Brittlebush (*Encelia farinosa*)	13	0.009
Catclaw acacia (*Senegalia greggii*)	18	0.032
Cheesebush (*Ambrosia salsola*)	62	0.028
Creosote bush (*Larrea tridentata*)	40	0.018
Desert lavender (*Hyptis emoryi*)	14	0.011
Honey mesquite (*Prosopis glandulosa*)	2	0.001
Blue palo verde (*Parkinsonia florida*)	8	0.019
Rush milkweed (*Asclepias subulata*)	1	<0.001
Smoke tree (*Psorothamnus spinosus*)	3	0.010
Sweetbush (*Bebbia juncea*)	127	0.058
White Rhatany (*Krameria erecta*)	8	0.003
Total Vegetation	**302**	**0.191**

Note:
* Number of plants and estimated cover within the 90 percent design footprint. Actual plant impacts will be less with implementation of avoidance measures in the field.

BOLDFACE species are those that will be transplanted or replaced with new plantings.

SECTION 2

Avoidance, Minimization and Salvage/ Replanting Measures

This section provides information on avoidance and minimization measures that will be implemented to reduce adverse effects on sensitive habitats and provide information on plant salvage and replanting methods that will be used where vegetation impacts are unavoidable. Specifics related to mitigation plantings and precisely how the plantings will take place within a restoration area (e.g., number of species, plant size and container type, locations, and irrigation system design) will be provided to the agencies for review in a separate Planting Plan prior to implementation. Furthermore, a separate Final Restoration Plan will be prepared to address restoration and planting after the final groundwater remedy system has been decommissioned and removed.

2.1 Design and Construction

Throughout the project design process, efforts have been made to locate pipelines and wells along roadways, pipeline rights-of-way, and other previously disturbed areas to avoid impacts to vegetation. Construction areas, as well as staging and storage areas, also have been located in previously disturbed and/or developed areas to minimize and avoid impacts to vegetation and other sensitive resources. To further minimize impacts, a biologist will conduct preconstruction surveys, and areas of native vegetation and sensitive habitats in the immediate vicinity of the construction areas will be identified and clearly marked with flagging, fencing, and/or signage. Construction workers also will be provided with environmental awareness training regarding biological resources including sensitive species and habitats.

The issue of soil stabilization is being addressed separately under a stormwater pollution prevention plan (SWPPP) that will be included in the C/RAWP and O&M Manual. However, the use of herbaceous vegetation covers as a soil stabilization technique is not being proposed for this project because this approach was not considered appropriate for this environment. Soil stabilization techniques will be an integral part of the SWPPP because these measures minimize dust and protect desert topsoil, particularly in areas of contamination or with minimal surface soil. Vegetative covers are not discussed further in this document.

Similarly, grading plans also will be developed and submitted for review as part of the 90 percent design submittal.

2.2 Habitat Requirements for Mitigation Planting

Native plants in the Project Area have different habitat requirements and ecological tolerances, which are reflected in the sites they occupy. Blue palo verde is a relatively large tree associated with sandy areas, is widely distributed on the edges and bottoms of the ephemeral washes that dissect the upland alluvial terraces, and occurs along sandy roadsides. In contrast, the related hillside palo verde is a tree of shorter stature that is restricted to rocky hillsides above the Colorado River in the southern portion of the Project Area.

Western honey mesquite and screwbean mesquite typically grow in areas with root access to permanent underground water; however, western honey mesquite is more likely to occur in somewhat drier habitats than screwbean mesquite. While both species are salt tolerant, screwbean mesquite has a higher tolerance level than western honey mesquite (Miyamoto et al., 2004), an important consideration when planting mitigation trees. To ensure appropriate environmental conditions are present for the establishment and survival, transplanting or replacement planting of native species will be sited in areas where the species are growing. The exact planting locations will be determined as part of the final design based on the number of

transplants and/or mitigation plantings, the locations and extent of the project work areas and the access routes.

2.3 Salvage/Replacement and Transplantation of Trees, Shrubs, and Wetland Plant Species

The following section provides general guidelines for salvage, transplant, and replacement of trees, shrubs, and wetland species.

2.3.1 Salvage and Transplanting Trees

Native trees identified in the project area can exceed 20 feet in height when mature. However, large individuals are unlikely to survive salvage and replanting because of "transplant shock" caused by extensive and unavoidable loss of roots. Therefore, salvage of native trees should be limited to small individuals or saplings whose root systems are small enough to excavate and transport with minimal damage. Such individuals are more likely to recover and survive the physiological stress of transplanting. In general, trees most suitable for transplanting will be less than 4 inches in diameter at the base of the trunk and no more than 6 feet tall. Trees shall be transplanted between November and March, when temperatures are cooler, trees are dormant, and irrigation demands are less. Transplanting will occur before bud break to allow the roots time to recover and proliferate before they are required to withstand excessive transpirational loads caused by higher ambient temperatures. To the extent possible, young trees will be relocated near the project work areas that have similar soil types, exposure, and drainage conditions, but distant enough that they will not be affected by future work activities. If no suitable transplantation areas are near the work area, the trees will be relocated to other sites within the Project Area where the species is known to occur and will not be affected by work activities.

The following transplanting specifications follow general guidelines from the International Society of Arboriculture (ISA) (2013) and the American Standard for Nursery Stock (2004).

To minimize the time the roots of a salvaged tree are exposed and to increase survivability, the transplant location will have been identified and a hole excavated before the tree is removed from the soil. The transplant hole will be large enough to accommodate the root system at the same depth or slightly shallower than the tree being moved. The initial hole shall be at least two to three times the width of the root ball near the surface and taper down to the size of the root ball at the bottom. The depth of the hole shall be no greater than the distance from the trunk flare[1] to the bottom of the root ball.

Where possible, pre-dig the perimeter of the root ball using a sharp spade or shovel to avoid breaking and tearing of the roots. Pre-digging the root ball can stimulate regeneration of roots and increase root density in the final root ball. If a backhoe is used to excavate the root ball, the initial hole shall be larger than the final root ball. The final root ball will be shaped by hand using loppers to cut the roots cleanly. Table 2 provides size guidelines for the minimum size of the root ball for transplanted trees.

Depth of the root ball is variable depending on the size of the tree but generally will be between 24 and 36 inches deep. The root ball shall taper along the sides slanting inwards slightly toward the base. If the soil is hard and compact, it may be necessary to add water before cutting the root ball. The final root ball shall stand on a pedestal before being undercut. Once the root ball has been cut and shaped, wrap the sides and top in burlap to secure the roots and soil. A skirt shall be left hanging to cover the bottom of the root ball. Secure the burlap wrapping with rope or twine before lifting from the hole. If necessary secure any branches with burlap or ropes to prevent damage and breaking. Pruning of branches generally should not be required, but if some branches need to be trimmed, it will be kept to a minimum with no more than 20 percent of the canopy removed in accordance with ANSI 300A Part 1 (American National Standard Institute 2008). Once

[1] The area at the base of the plants stem or trunk where the stem or trunk broadens to form roots

the root ball and branches have been secured, lift the tree straight up from the root ball to remove from the hole; do not lift by the trunk, as this can damage the trunk and roots.

TABLE 2
Size Guidelines for Root Balls when Transplanting Trees

Trees Height or Stem Diameter*	Minimum Root Ball Diameter (Inches)
Trees < 6 feet tall and/or stem < ¾ inch in diameter near the base	16
Trees > ¾ inch diameter and stem < 2 inches in diameter near the base	24
Trees 2-3 inches in diameter near the base	32
Trees 3 -4 inches in diameter near the base	42

Note:
*Stem diameter for trees less than 4 inches is measured at 6 inches above the ground surface

Transport the excavated tree immediately to its new location and lower it (by holding the root ball not the trunk) into the hole. Remove the burlap from around the root ball and backfill around the roots with the soil that was removed from the planting hole. Do not add additional soil amendments, fertilizer, or mulch to the soil, as these have been found to be unnecessary for desert trees and shrubs (Bainbridge et al., 2001). When backfilling, add water to minimize air pockets. Be sure the soil is firmly packed around the bottom of the root ball to ensure the tree is vertical and well supported. The remaining soil shall be tamped down lightly around the roots, but not firmly compacted. Water thoroughly and slowly after the hole is filled.

Staking of the trees shall be avoided, as staking often can result in detrimental effects such as reduced trunk taper, smaller root system development, and greater instability once the stakes are removed (ISA, 2013). If additional support is required, a single stake located upwind of the tree may be sufficient. The stake shall be driven into the ground outside the newly planted root zone. Stabilize the tree as low on the trunk as possible, while still providing support with broad, slightly elastic, material that will not damage the tree. Staking supports shall be removed within 2 years of the initial planting.

2.3.2 Shrubs

There is little available information on transplanting native shrubs. Most desert shrubs have extensive fibrous root systems that likely would be extensively damaged during excavation and transplanting. Some desert shrub species, such as creosote bush and arrow weed, are capable of regeneration as long as the roots remain intact and undamaged. In areas were vegetation clearing is necessary for temporary construction access, cutting or flattening the aboveground stems while leaving the root systems intact generally will facilitate natural regeneration in a relatively short time. Additionally, many desert shrubs are propagated by seed or nursery stock (Abella and Newton, 2009; Clary and Slayback, 1984). In areas where natural regeneration is not possible, seed collection from local material can be used to establish container plants that can be used to establish new shrubs in selected planting areas.

2.3.3 Wetland Plants

Common wetland plants in the Project Area, including cattails and common reed, can be salvaged by taking rhizome cuttings from areas where site disturbance is unavoidable. Rhizomes shall be a minimum of 2 inches long and typically re-establish best if they are removed shortly after bud break, but before extensive shoot elongation. Cuttings will be kept cool and moist until they can be transplanted. Rhizome cuttings shall be planted in soils that are moist to saturated for most or all of the year.

2.4 Seed Collection and Replacement Planting

Several methods for re-establishing vegetation will be implemented at the Project Area. The restoration method will depend on the site conditions as well as duration of remediation activities that affect sensitive habitats.

2.4.1 Seed Collection

Where transplanting of trees, shrubs, and herbaceous plants is not possible, seed can be collected from plants on site for mitigation. Rainfall is variable in the Project Area, and dry years can dramatically affect germination of annual plants as well as flowering and seed production of trees, shrubs, and perennial species. Therefore, seed collection should only occur during "good" years with sufficient rainfall to stimulate germination and abundant flowering of the target species. The specific number, species, and distribution of collection sites will vary according to size, density, continuity of populations, and the desired quantity of seed to be obtained. A general rule is to collect from a minimum of five collection sites at least 0.5 to 1 mile apart, and from no more than 20 percent of an individual plant's seed crop. Collection from multiple populations in the Project Area may not be possible, since the number of known populations is limited for some species. If additional seed is needed, collections should be made from the regional project vicinity (within 10 miles if possible). Seed that is not used immediately should be stored in a cool, dry place until mitigation sites can be prepared or seeds can be sown in containers for propagation in a nursery. Reseeding of small disturbed sites (less than 0.5 acre) may be done by hand sowing in fall or early winter.

2.4.2 Replacement by Container-Grown Plants

Impacts to larger trees (over 4 inches in diameter) and shrub species will likely require replacement plantings using container-grown materials. Trees and shrubs including palo verde, western honey mesquite, screwbean mesquite, cattle saltbush, and big saltbush are relatively easy to propagate in a nursery and well adapted to transplanting with a minimal amount of care and maintenance (Bainbridge and Virginia, 1990; Bainbridge, 2007; Romney et al., 1989). Several commercial nurseries grow native plants from the Mojave Desert (Appendix B).

Depending on the number of trees and shrubs required for revegetation of disturbed areas, PG&E will consider contracting with a nursery that specializes in desert plant propagation to collect local seed and establish trees, shrubs, and other plants from onsite material before mitigation planting. This would ensure replacement plants are suitable for local environmental conditions. If only a small number of plants are required, appropriate available nursery stock may also be used.

Replacement planting for native trees including blue palo verde, hillside palo verde, western honey mesquite, and screwbean mesquite will consist largely of container-grown plants. Containers shall be long and narrow to encourage deep root growth such as Tall One Tree Pots (Steuewe & Sons, Inc., 4.5 inches wide by 14 Inches deep). Seedlings/saplings shall be between 4 to 6 months old when transplanted to prevent the plants from becoming root-bound in the pots. Replacement planting of shrubs such as mesquite, cattle saltbush, big saltbush, and others shall be grown in 4- to 6-inch tube packs and transplanted when 9 to 12 months old.

Based on experimental results from the Mojave Desert, the median survival rate for species such as western honey mesquite is around 50 percent (Edwards et al., 2000; Grantz et al., 1998). Therefore, to achieve the desired density of plant species, the number of container-grown plants should be a higher ratio to account for anticipated mortality.

2.4.3 Timing and Methods of Planting for Container-Grown Trees and Shrubs

Planting of container-grown trees and shrubs typically is done in the late winter to early spring between February and April (Romney et al., 1989; Edwards et al., 2000). Planting holes shall be excavated using an 8- to 10-inch-diameter power auger to a depth equal or just slightly more than the depth of the container

(Grantz et al., 1998). Carefully remove the saplings from the container and place against one side of the planting hole, using excavated soil to backfill around the roots. Do not add additional soil amendments, fertilizer, or mulch to the soil as these have been found to be unnecessary for desert trees and shrubs (Bainbridge et al., 2001; Romney et al., 1989). When backfilling, add water simultaneously to minimize air pockets. Be sure the soil is firmly packed around the roots, but not firmly compacted. Water thoroughly and slowly after the hole is filled.

2.4.4 Spacing and Locations

Trees will be spaced to maintain a density similar to the area from which they were removed or in similar spacing based on undisturbed areas near the project, but no closer than 8 feet apart. Shrubs will be spaced in a density similar to the density in the undisturbed surrounding vegetation, but no closer than 3 feet apart. To ensure soil and other environmental factors are most favorable for establishment, replacement plants will be planted in areas where individuals of the same species are healthy and growing well.

2.4.5 Grazing Protection

Some type of initial herbivore protection (such as wire mesh or tree shelters placed around the seedlings) is necessary to ensure good survival and growth of transplanted trees and shrubs (Romney et al., 1989; Grantz et al., 1998). Plastic tree shelters such as Tree-Pee (Bailey's, Inc.) have been found to result in significantly higher survivorship than using wire mesh (Grantz et al., 1998).

2.4.6 Irrigation for Salvaged and Transplanted Trees and Shrubs

Transplanted trees and shrubs should be watered using deep irrigation pipes (Bainbridge 2006; Bainbridge et al. 2001). Deep pipe irrigation has been shown to produce much better survival rates and require less water than other irrigation methods (Bainbridge et al., 2001). Bainbridge et al. (2001) had an establishment success rate of 71 percent for seedlings of western honey mesquite by using only 5.3 gallons over 3.5 years with deep pipe irrigation when trees were planted with tubular tree protectors to minimize herbivory.

The method for using deep irrigation is described in Bainbridge (2006). For each transplanted tree or shrub, a hole is drilled to a depth of 20 to 30 inches with a soil auger. A polyvinyl chloride pipe (2 inches in diameter and 20 inches long with a series of 1/16-inch holes drilled 2 to 3 inches down one side beginning 7 inches below the top) is inserted to the bottom of the hole such that the side with holes faces the seedling or shrub with about 4 inches protruding above the ground surface for easy filling. The pipe shall be situated approximately 3 to 4 inches from the seedling. Two or three pipes can be situated around the root ball for transplanted shrubs or small trees.

Water (1 quart) will be directly applied to seedlings once every week for the first 8 weeks. After the initial watering, irrigation water will be applied in the pipe(s) (2 quarts) every other week for at least 3 months and continue until the end of August. Watering will be continued at least until the end of August each year and will be done for the first 2 years after planting.

For relatively small areas where a large number of replacement trees may be needed, a gravity feed drip irrigation system from a 4,000 to 5,000-gallon storage tank shall be used as an alternative watering method. This method will depend on the ability to situate the tank in an area accessible to a water truck for periodic refilling. This method was used successfully for the screwbean mesquite restoration project under the freeway bridge next to the Colorado River from 2006–2009 at TCS (C. Smith, pers. comm., 2013). For that project, newly planted trees were watered three times per week for about 3 to 4 hours per day for the first year and once per week in the subsequent 2 years.

2.4.7 Mulch and Inoculation

There is generally no evidence that additional mulching enhances long-term survival and plant growth, and some indication it may do more harm than good (Bainbridge et al., 2001), so no additional mulching is recommended. If tree seedlings or shrubs are planted from containers, inoculation of soil biota can be done

by backfilling with excavated soil. In general, inoculation of soil biota is only required for severely degraded sites where the natural soil biota has been significantly depleted or is absent (Bainbridge and Virginia, 1990).

SECTION 3

Success Criteria, Monitoring, and Adaptive Management

Due to the fact that replacement saplings do not provide the same habitat value as mature trees, a mitigation ratio of 3:1 will be used to offset impacts to riparian trees. Replacement trees will be propagated from locally collected seeds and grown in a nursery for 1 year prior to planting in selected mitigation sites. The success criteria for mitigation plantings will be a final minimum plant replacement ratio of 2.25:1 (75% overall survival rate) of mitigation plantings at the end of a minimum 5-year monitoring period.

In the event that mortality rates or trends in declining vigor of the mitigation plantings result in less than a final 2.25:1 mitigation ratio, additional saplings will be planted. Any replacement plantings will be monitored for 5 years from the time of their initial planting to ensure that the mitigation success criteria have been met.

In order to account for anticipated mortality rates for desert mitigation plantings that may be as high as 50 percent, the initial planting will include twice as many saplings as required by the mitigation ratios. This initial higher planting ratio is intended to compensate for expected sapling mortality over time and increase the probability that the final mitigation ratios are obtained. For example, if three palo verde trees will be removed during construction they would be replaced at a 3:1 ratio with seedlings grown from locally sourced seeds. The initial mitigation would therefore require nine replacement plantings. The success criteria would be 75 percent overall survival of these plantings after 5 years, resulting in a final mitigation ratio of 2.25:1 or survival of 6.75 (rounds to 7) out of nine initial plantings.

Taking into account expected mortality rates, the initial mitigation planting would be doubled to include 18 replacement plantings during the first year (see Table 3). It is anticipated that with the higher number of initial plantings and adaptive management at least 7 of the 18 saplings will become successfully established after 5 years. It is possible that even more plants may become established if adaptive management techniques result in increased survival. In the event mortality or trends in declining vigor indicate that success criteria will not be met, additional plantings and monitoring will be required to ensure that the final mitigation ratio is met.

TABLE 3
Example of Replacement Planting Ratios and Success Criteria

Number of Trees Impacted	3:1 Replacement Plantings	Initial Planting to Account for Anticipated Mortality	Final Success Criteria Minimum of 2.25:1 Replacement After 5 Years
3	9	18	7

Assuming 18 initial plantings with a potential 50% mortality rate and a final success criteria of 7 replacement trees

Monitoring	Anticipated Minimum Survivorship (Vigor Class of 2 or Greater)	Number of Plantings Remaining*	Mortality Thresholds Triggering Additional Plantings	Number of Plantings Remaining*
Year 1	90%	17	60% or less survivorship	11 or less
Year 2	80%	14	60% or less survivorship	11 or less
Year 3	70%	13	50% or less survivorship	9 or less
Year 4	60%	11	40% or less survivorship	7 or less
Year 5	50%	9	Success criteria not met	Less than 7

Note:
*Values are rounded to nearest whole number where required.

3.1 Tree and Shrub Assessment

Assessment of trees and shrubs will use a modified index initially developed by Bainbridge et al. 2001:

- 0 = dead, stems brown brittle with no green or purple
- 1 = barely alive, stems still flexible with some green or purple
- 2 = some green or purple on stem, a few green leaves
- 3 = green or purple stem and a number of green leaves
- 4 = green or purple stem and green leaves, vigorous

3.2 Wetland Plants

Monitoring in areas where rhizomes of wetland plants were relocated will include initial photograph points immediately after transplanting and annual photographs from the same location. During annual monitoring, the cover of wetland plants will be visually estimated to determine if the mitigation ratio of 2:1 has been achieved in the transplant area. In addition, the overall condition of the plants will be evaluated relative to the condition of plants in undisturbed areas.

3.3 Maintenance and Adaptive Management

Adaptive management involves learning from experience and modifying subsequent behavior in light of that experience. Data shall be collected and analyzed throughout the monitoring period and the results used to modify (adapt) restoration approaches, as appropriate, to ensure successful establishment of transplanted species and the desired density and cover of plants. Maintenance and adaptive management will focus on the following areas: weed control, irrigation modification, herbivory protection, and mortality rates.

3.3.1 Weed Control

Weedy species, such as Russian thistle (*Salsola tragus*), Sahara mustard *(Brassica tournefortii*), and salt cedar can significantly affect growth and survival of transplants. Transplant and seeding sites should be relatively weed-free and should be monitored regularly for weed infestations. It is easier to prevent the establishment of weeds in an area than it is to eradicate weed populations once they have become established. Annual monitoring for weed seedlings of Russian thistle, Sahara mustard, and salt cedar early in the growing season (March through April) allows for treatment and removal of weedy species before flowering and seed dispersal. In addition, young seedlings can be removed by hand, avoiding the need for more intensive mechanical or chemical treatment.

3.3.2 Irrigation Modification

Because the objective is to obtain the maximum survival rate of transplanted individuals, it may be necessary to modify the irrigation schedule and/or amount of water during the restoration process. While irrigation will only be used during the initial establishment phase, the condition of the plants will be monitored throughout the monitoring period. If after the initial watering, plants show a notable decline in vigor, it may be necessary to increase the amount or timing of irrigation to prevent mortality and reduced vigor. Care shall be taken not to overwater the plants.

3.3.3 Herbivory Protection

Tree and shrub protectors will be maintained until the plants are large enough to withstand herbivory or before the growth of the plant being impacted by the barrier. The annual monitoring report shall recommend when removal of protectors is appropriate. PG&E will be responsible for removing the tree and shrub protectors.

3.3.4 Mortality Rates

It is expected that the initial plantings will experience some level of mortality. If survivorship drops below target levels listed in Table 3, additional plantings will be required. To prevent further mortality, adjustments to the watering regime and/or herbivore protection will be necessary, depending on the most probable cause of the mortality.

3.4 Photo Monitoring Stations

Photo-monitoring stations will be established at selected locations throughout the Project Area to document preconstruction conditions, natural recovery, and as part of the monitoring of revegetation and restoration areas. The following methods and procedure are adapted from the U.S. Department of Agriculture's Photo Point Monitoring Handbook (Hall, 2002).

3.4.1 Objectives

The objectives of the photo monitoring include:

- Document the preconstruction site conditions of the project work areas on the HNWR for restoration activities after decommissioning
- Document the post-construction site conditions of the project work areas on the HNWR
- Document changes in vegetation over time in the work areas, including natural regeneration and recovery of native plants
- Document revegetation and/or restoration sites, including vegetation changes over time as well as general qualitative documentation of plant cover and vegetation condition

3.4.2 Equipment

The following equipment will be needed for the photo monitoring:

- Digital camera
- GPS unit with sub-meter accuracy
- White board and black dry erase pen
- Compass
- Photo monitoring data sheets (Appendix C)

3.4.3 Methods

Before starting construction, multiple photo-monitoring locations will be selected throughout the Project Area that will be used to document the pre- and post-construction conditions. This will be referenced to as preconstruction photo documentation (PPD). PPD will be completed to assist in restoration activities after remedy decommissioning. A subset of the PPD photo points will be in areas to specifically document where existing vegetation and habitats will be affected by project activities. These photo points will be referred to revegetation photo documentation (RPD). The exact locations and views of the photo-monitoring stations will be determined once the final project design has been completed and the limits of the work areas have been firmly established. All PPD information will be included on the photo. Additional photo-monitoring stations will be established at revegetation and restoration sites as well as any reference plant community locations.

Once the photo-monitoring sites have been determined, a GPS unit with sub-meter accuracy will be used to record the location of the camera position. Notes will be taken on the locations including notable landmarks and other information that will assist in relocating the position. Photo-monitoring locations will then be mapped on aerial photographs that have roads and other major landmarks labeled.

Once the scene to be captured by the photo-monitoring point has been determined, record the compass direction of the camera view in both cardinal directions (north, south, southwest, etc.) and degrees. Subsequent photographs taken from the same photo point will be taken in the same direction each time.

On the data sheet, describe the scene including notable items in the view that may help with reorientation of the camera during subsequent monitoring. Provide a general description of the photo-monitoring point, including plant species, ground cover, disturbance, vegetation condition, etc.

After the first photo-monitoring event is completed, maps, directions, and instructions on the orientations and views for each photo-monitoring location will be prepared and be used as the basis for subsequent photo-monitoring events at each location.

After photographing the selected scene at each location, it may be useful to include additional site photographs of particular features and plants to provide additional detail on the site. For each additional photograph, include a description of the setting or conditions that are being documented and include the photographs and additional information with the photo-monitoring report.

3.4.4 Frequency

Photo monitoring will occur before starting construction and following construction concurrent with monitoring of the revegetation sites. Photo documentation will be taken for 5 years post-construction and will occur in years 1, 2, 3, and 5. Post-construction and RPD monitoring will occur with each vegetation monitoring event, and photographs will be appropriately archived in monitoring reports for use during post-decommissioning restoration.

3.5 Reporting

Following each monitoring event, a monitoring report will be prepared. The first monitoring report will be prepared during the first year following completion of construction activities. The first monitoring report will include specific information on the number, species, and locations of trees and shrubs that were removed or otherwise permanently affected during construction as well as the number, species, and locations of mitigation plantings. The report will include information on areas where aboveground trimming of shrubs occurred, but belowground root systems were left intact. The first monitoring report will include pre- and post-construction photographs from the photo-monitoring stations, as well as photographs of the revegetation sites. The first report will include the necessary documentation to relocate the photo-monitoring stations in subsequent years.

Additional monitoring reports will be prepared for the following year 2, 3, and 5 monitoring events. These reports will include observations of natural recovery in construction areas, with particular emphasis on those areas where the belowground roots were left intact, and assessment of the revegetation areas including the condition of the revegetation plantings, discussion of any problems, and recommendations for adaptive management actions necessary to address the problems. These reports will include photographs and information from each of the photo-monitoring stations.

Monitoring reports will be submitted to CDFW and USFWS within 90 days of completing each monitoring event.

SECTION 4

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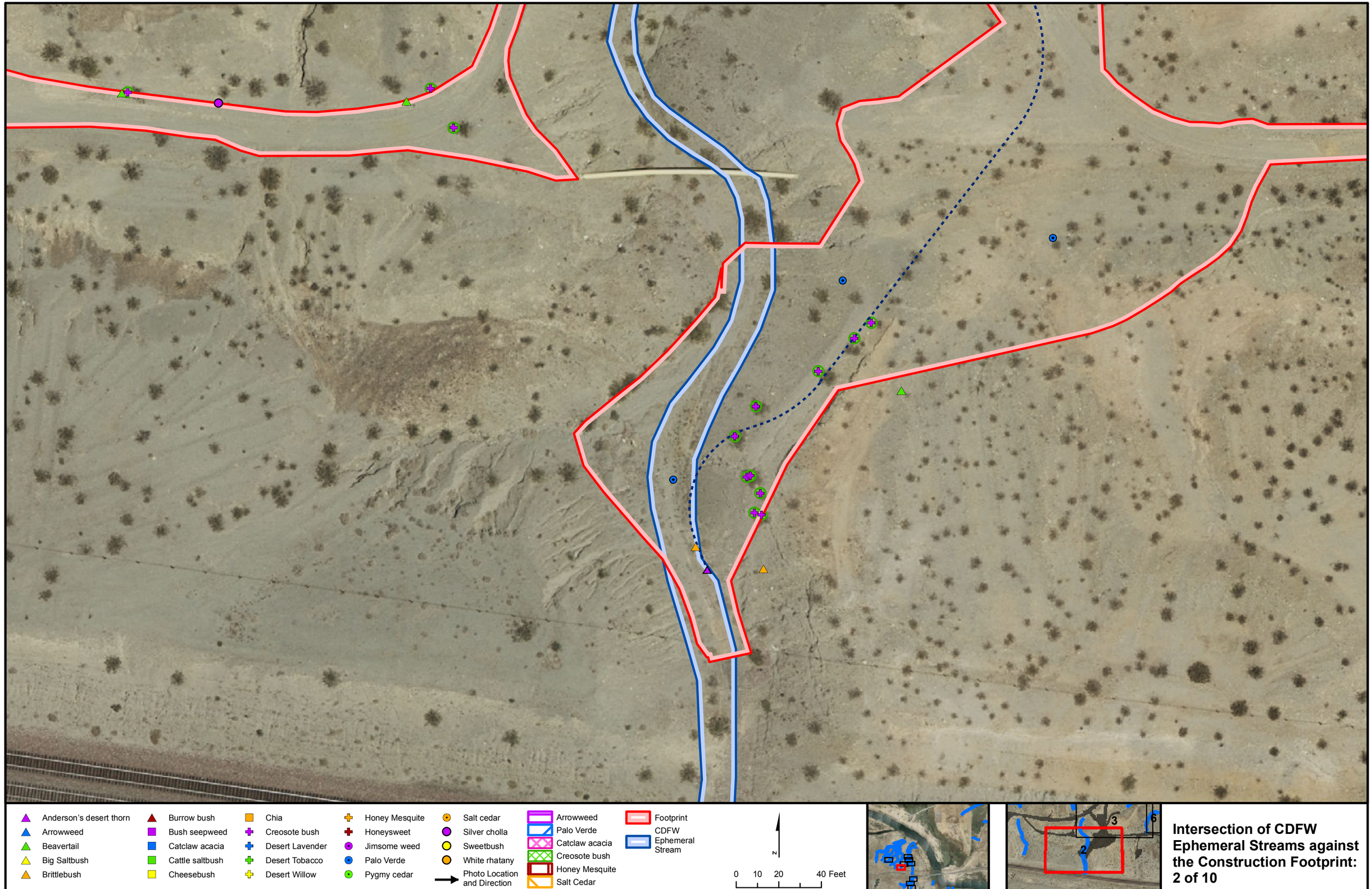
Appendix A
Vegetation Maps (with photo points) and Preconstruction Photographs



Intersection of CDFW Ephemeral Streams against the Construction Footprint: 1 of 10



Intersection of CDFW Ephemeral Streams against the Construction Footprint: 2 of 10

Anderson's desert thorn
Arrowweed
Beavertail
Big Saltbush
Brittlebush
Burrow bush
Bush seepweed
Catclaw acacia
Cattle saltbush
Cheesebush
Chia
Creosote bush
Desert Lavender
Desert Tobacco
Desert Willow
Honey Mesquite
Honeysweet
Jimsome weed
Palo Verde
Pygmy cedar
Salt cedar
Silver cholla
Sweetbush
White rhatany
Photo Location and Direction
Arrowweed
Palo Verde
Catclaw acacia
Creosote bush
Honey Mesquite
Salt Cedar
Footprint
CDFW Ephemeral Stream
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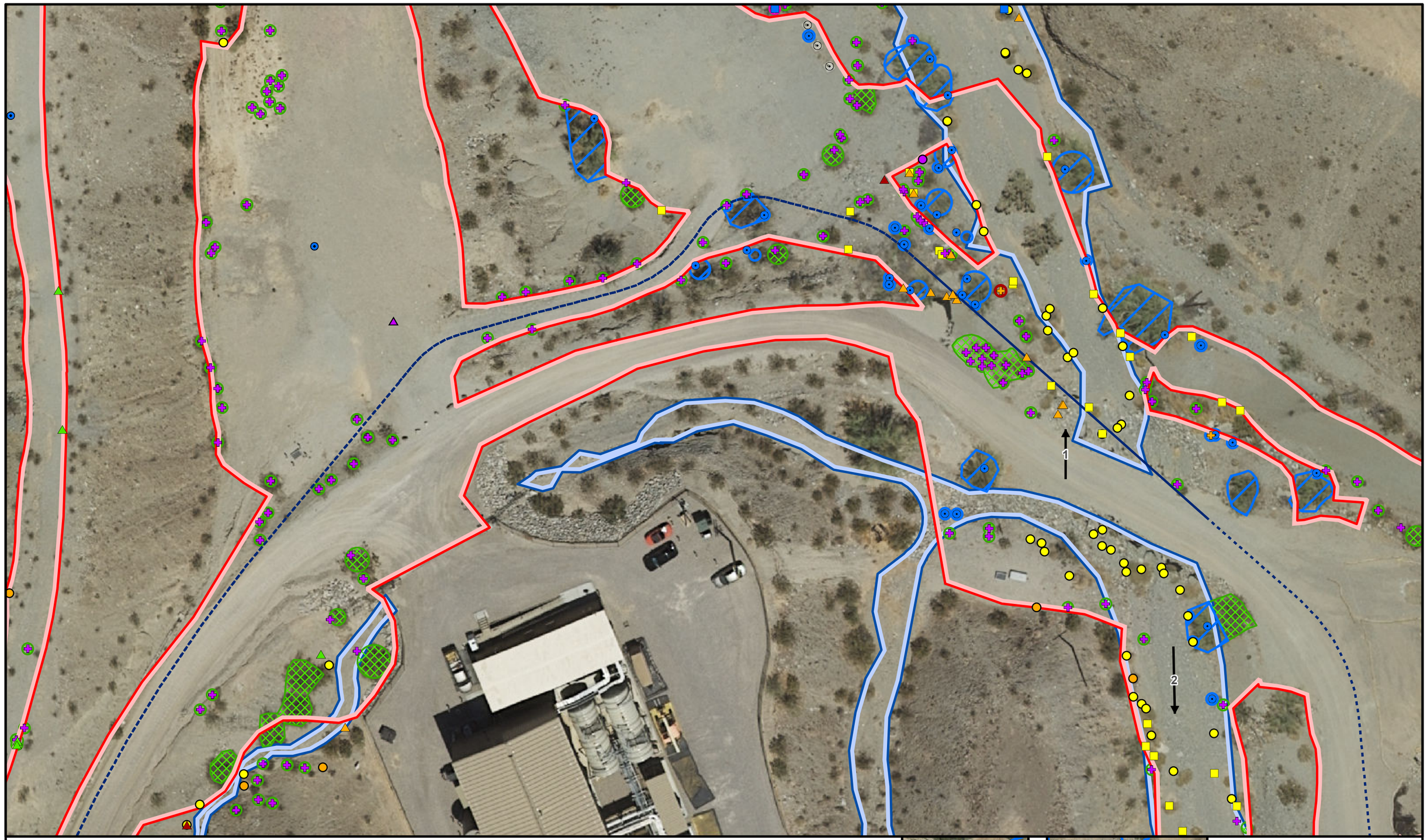
5
3
6
2

Intersection of CDFW Ephemeral Streams against the Construction Footprint: 3 of 10



Anderson's desert thorn
Arrowweed
Beavertail
Big Saltbush
Brittlebush
Burrow bush
Bush seepweed
Catclaw acacia
Cattle saltbush
Cheesebush
Chia
Creosote bush
Desert Lavender
Desert Tobacco
Desert Willow
Honey Mesquite
Honeysweet
Jimsome weed
Palo Verde
Pygmy cedar
Salt cedar
Silver cholla
Sweetbush
White rhatany
Photo Location and Direction
Arrowweed
Palo Verde
Catclaw acacia
Creosote bush
Honey Mesquite
Salt Cedar
Footprint
CDFW Ephemeral Stream

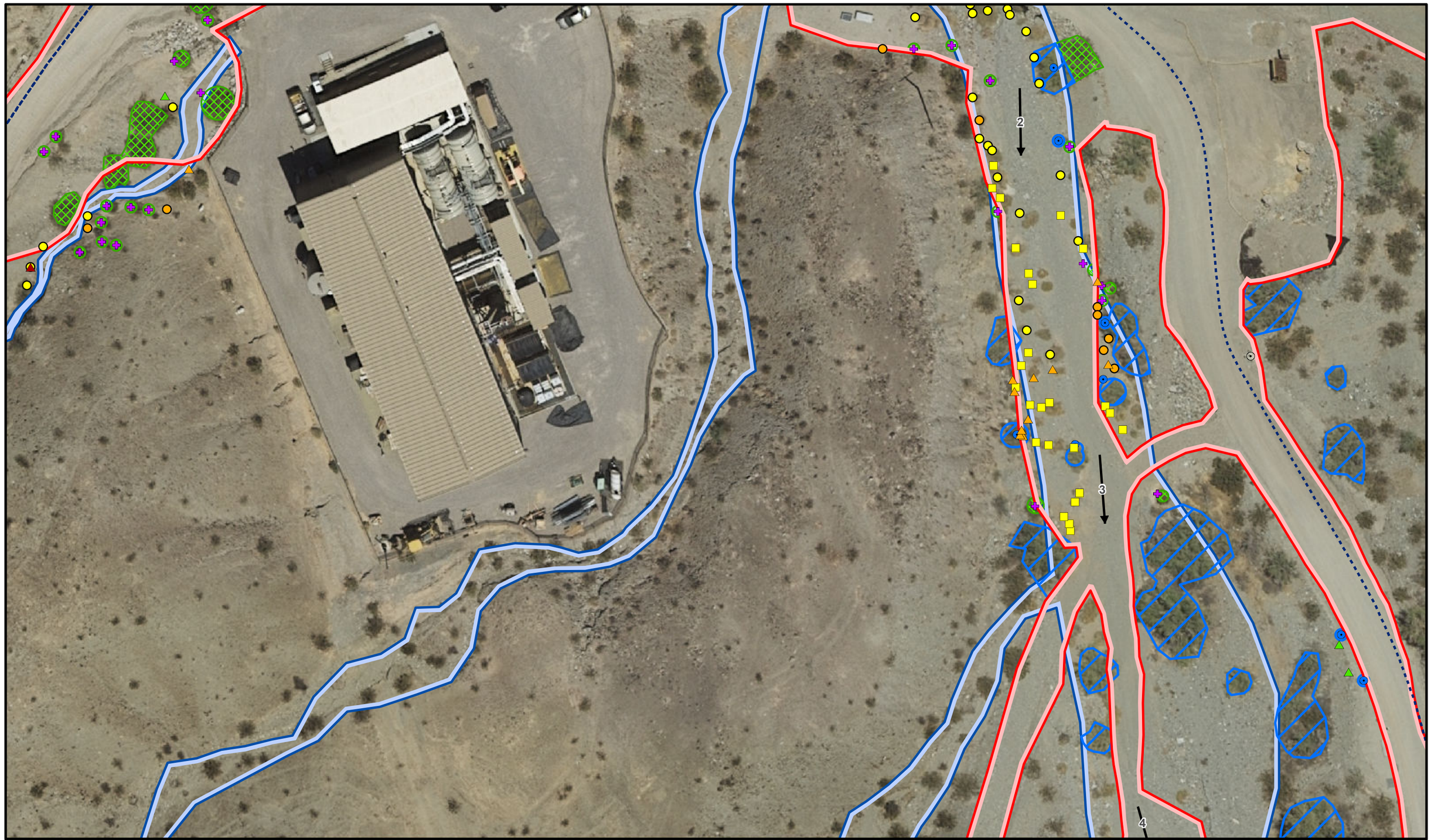
N

0 10 20 40 Feet





Intersection of CDFW Ephemeral Streams against the Construction Footprint: 4 of 10



Anderson's desert thorn
Arrowweed
Beavertail
Big Saltbush
Brittlebush
Burrow bush
Bush seepweed
Catclaw acacia
Cattle saltbush
Cheesebush
Chia
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Desert Tobacco
Desert Willow
Honey Mesquite
Honeysweet
Jimsome weed
Palo Verde
Pygmy cedar
Salt cedar
Silver cholla
Sweetbush
White rhatany
Photo Location and Direction
Arrowweed
Palo Verde
Catclaw acacia
Creosote bush
Honey Mesquite
Salt Cedar
Footprint
CDFW Ephemeral Stream

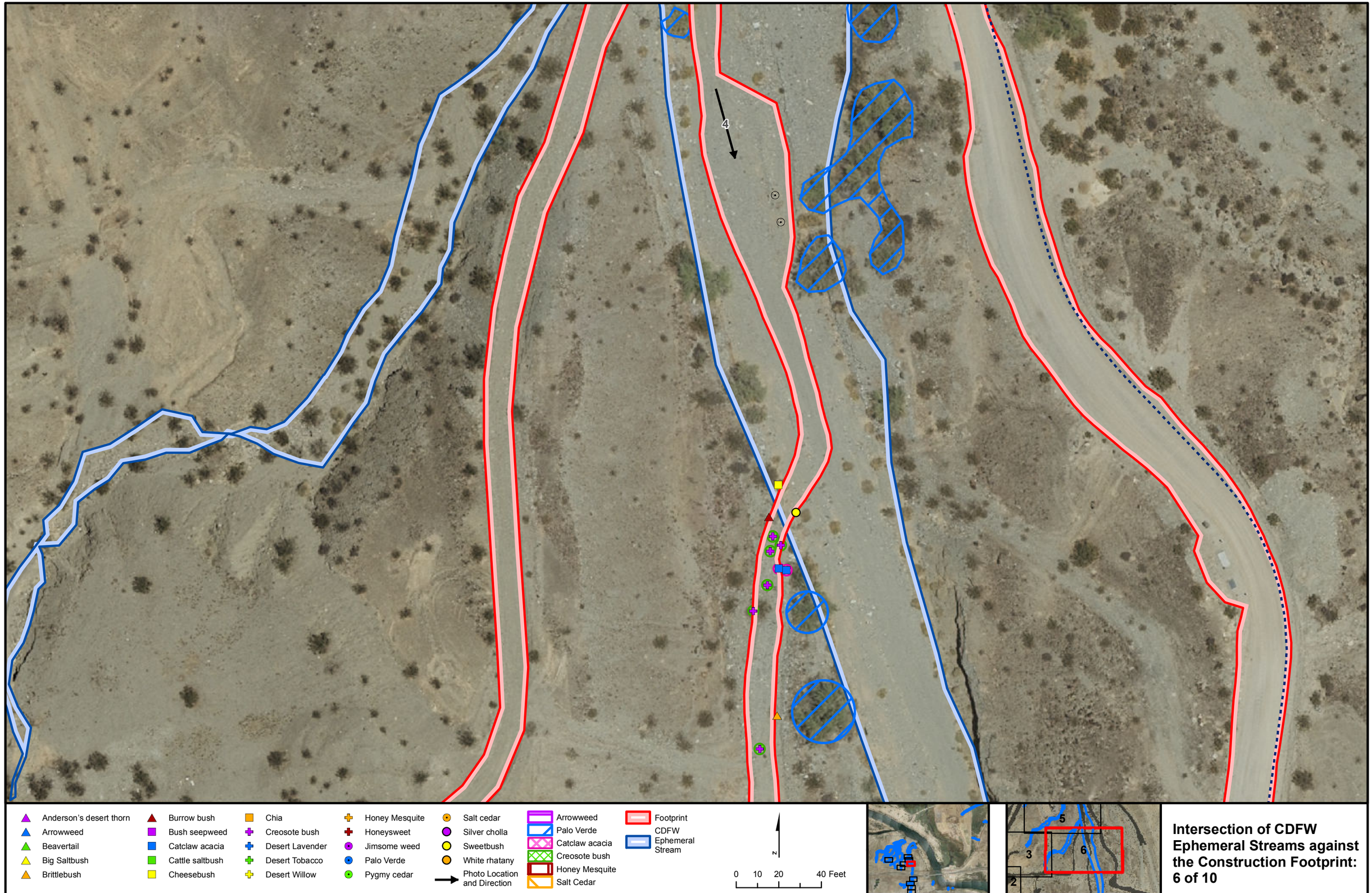
N

0 10 20 40 Feet

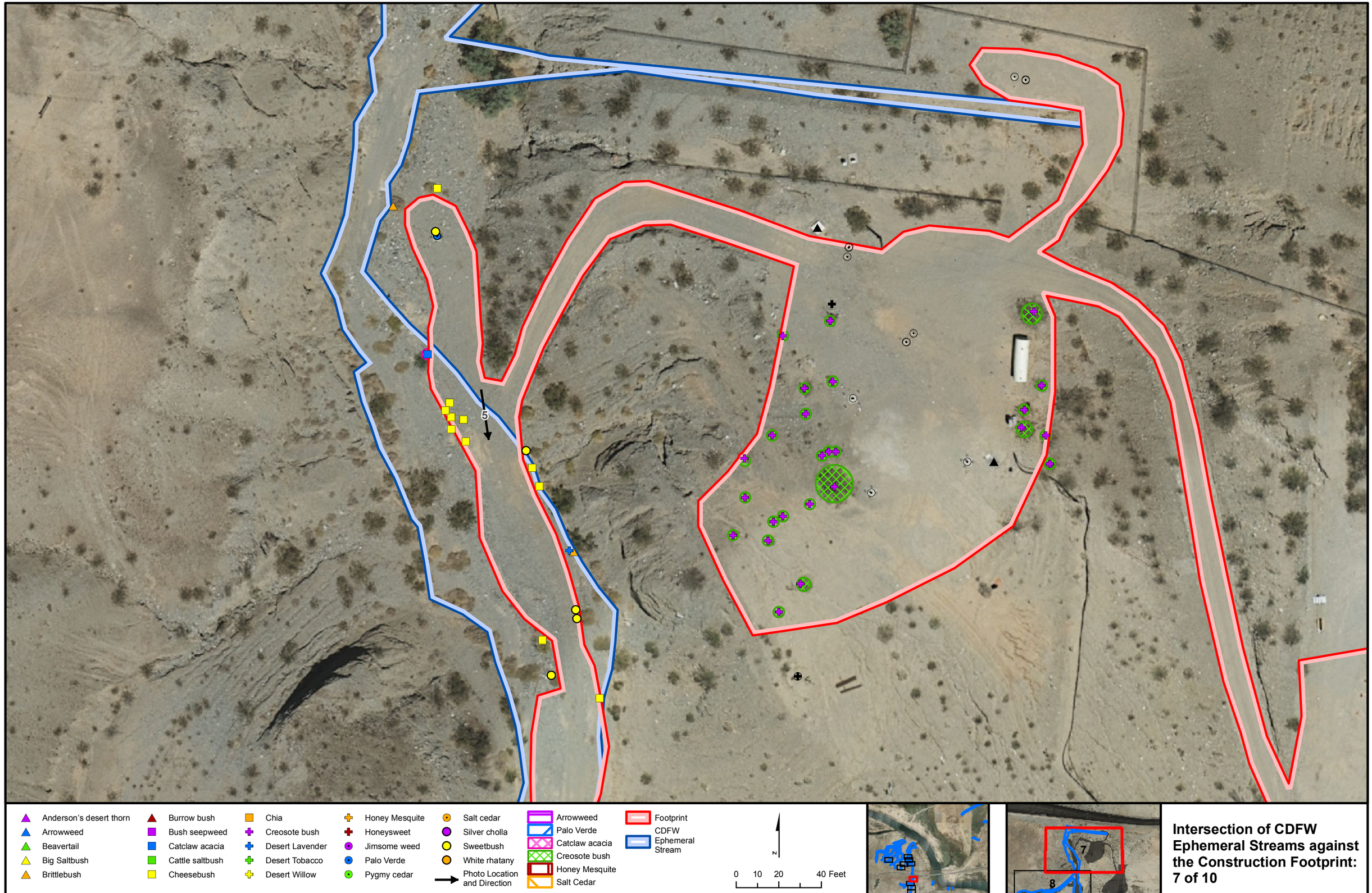




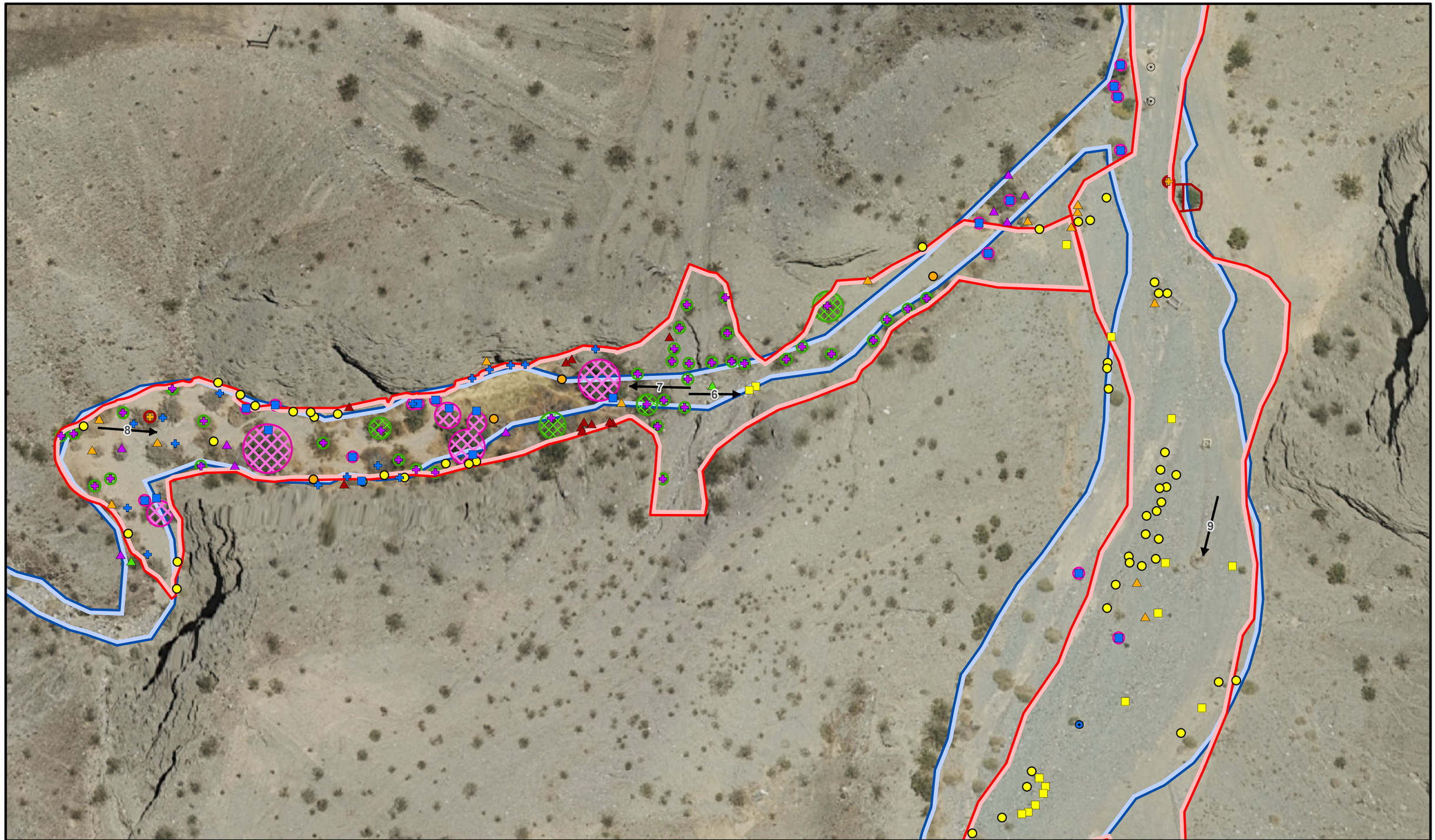
Intersection of CDFW Ephemeral Streams against the Construction Footprint: 5 of 10



Intersection of CDFW Ephemeral Streams against the Construction Footprint: 6 of 10



Intersection of CDFW Ephemeral Streams against the Construction Footprint: 7 of 10



Anderson's desert thorn
Arrowweed
Beavertail
Big Saltbush
Brittlebush
Burrow bush
Bush seepweed
Catclaw acacia
Cattle saltbush
Cheesebush
Chia
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Honey Mesquite
Honeysweet
Jimsome weed
Palo Verde
Pygmy cedar
Salt cedar
Silver cholla
Sweetbush
White rhatany
Photo Location and Direction
Arrowweed
Palo Verde
Catclaw acacia
Creosote bush
Honey Mesquite
Salt Cedar
Footprint
CDFW Ephemeral Stream

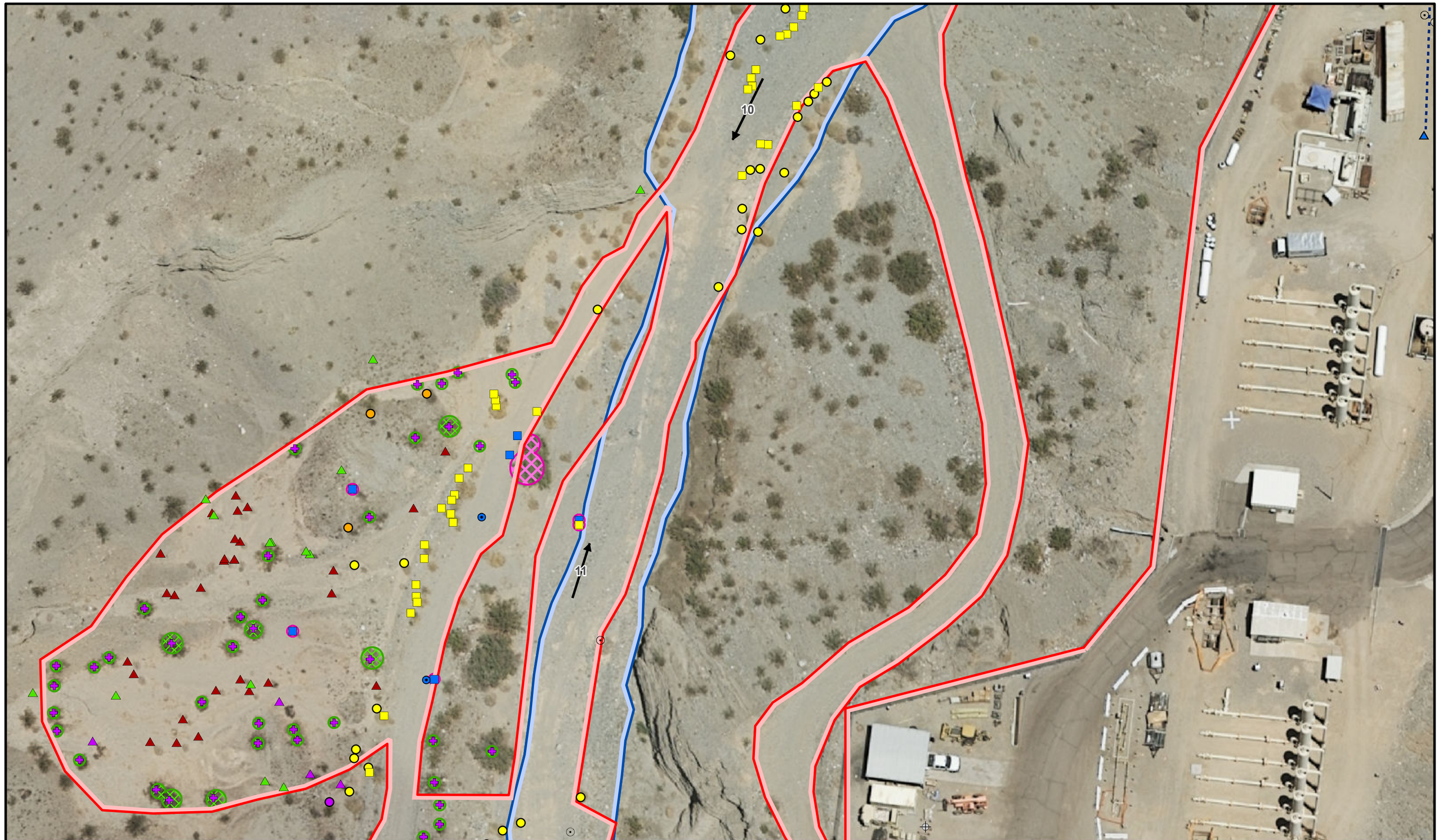
N

0 10 20 40 Feet





Intersection of CDFW Ephemeral Streams against the Construction Footprint: 8 of 10



Anderson's desert thorn
Arrowweed
Beavertail
Big Saltbush
Brittlebush
Burrow bush
Bush seepweed
Catclaw acacia
Cattle saltbush
Cheesebush
Chia
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Desert Lavender
Desert Tobacco
Desert Willow
Honey Mesquite
Honeysweet
Jimsome weed
Palo Verde
Pygmy cedar
Salt cedar
Silver cholla
Sweetbush
White rhatany
Photo Location and Direction
Arrowweed
Palo Verde
Catclaw acacia
Creosote bush
Honey Mesquite
Salt Cedar
Footprint
CDFW Ephemeral Stream

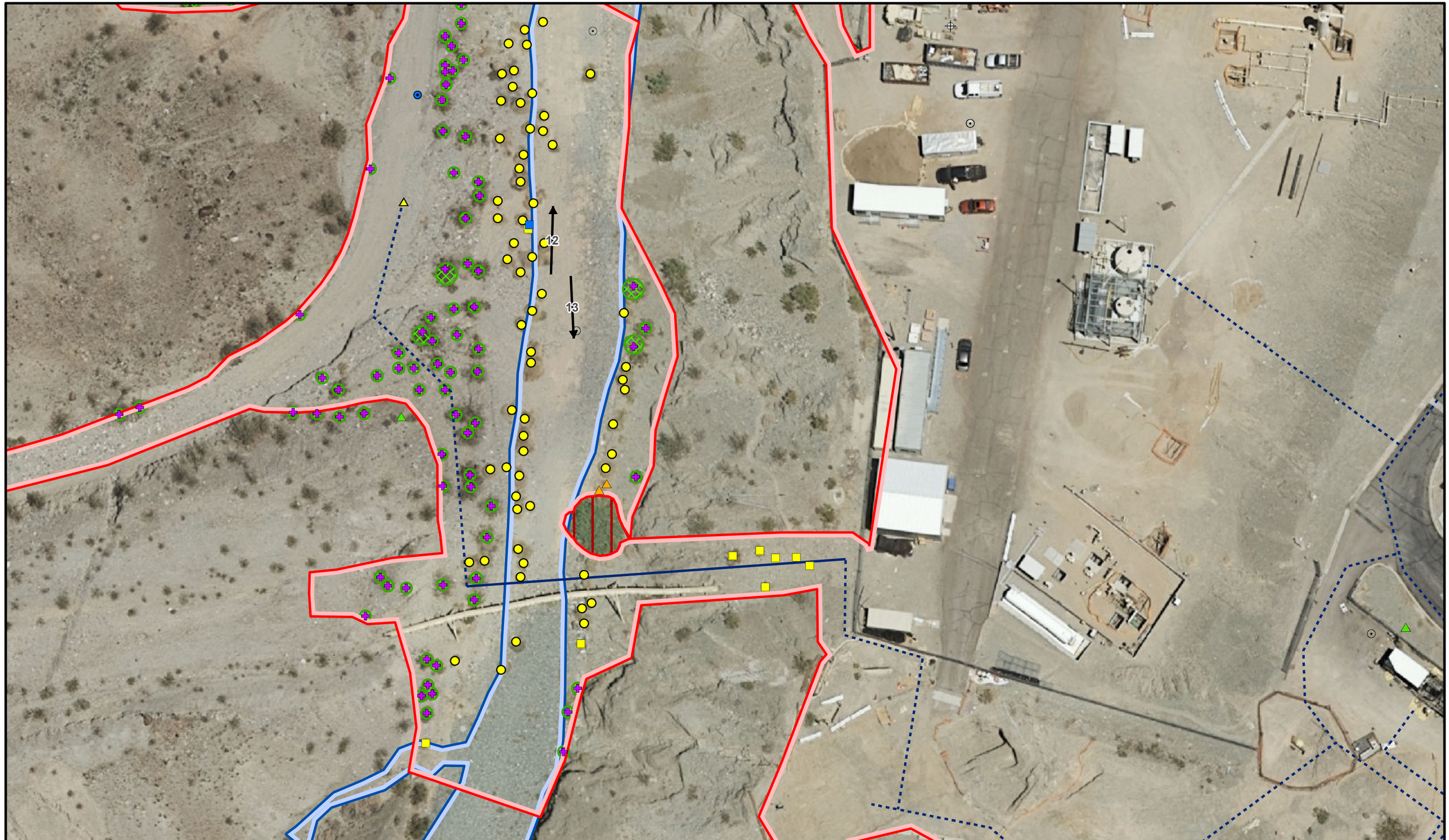
N

0 10 20 40 Feet





Intersection of CDFW Ephemeral Streams against the Construction Footprint: 9 of 10



Intersection of CDFW Ephemeral Streams against the Construction Footprint: 10 of 10



Photo 1 – Bat Cave Wash, August 7, 2014



Photo 2– Bat Cave Wash, August 7, 2014



Photo 3 – Bat Cave Wash, August 7, 2014



Photo 4 – Bat Cave Wash, August 7, 2014



Photo 5 – Bat Cave Wash, August 8, 2014



Photo 6 – Tributary to Bat Cave Wash, August 8, 2014



Photo 7 – Tributary to Bat Cave Wash, August 8, 2014



Photo 8– Tributary to Bat Cave Wash, August 8, 2014



Photo 9 – Bat Cave Wash, August 8, 2014



Photo 10 – Bat Cave Wash, August 8, 2014



Photo 11 – Bat Cave Wash, August 8, 2014



Photo 12 – Bat Cave Wash, August 8, 2014



Photo 13 – Bat Cave Wash, August 8, 2014

Appendix B
Commercial Nurseries that Grow Native Mojave Desert Plants

Ahakhav Native Plants Nursery
Colorado River Indian Reservation
25401 Rodeo Road
Parker AZ 85344
(928) 669-2664

El Nativo Growers
200 South Peckham Road
Azusa, CA 91702
(626) 969-8449
www.elnativogrowers.com
sales@elnativogrowers.com

High Country Gardens
2902 Rufina Street
Santa Fe, NM 87507
(800) 925-9387
www.highcountrygardens.com

LandscapeMart
8028 West Thunderbird Road
Peoria, AZ 85381-4612
(623) 298-6800
http://www.landscapemart.com/

Larners Seeds
P.O. Box 407
235 Grove Road
Bolinas, CA 94924
(415) 868-9407
info@larnerseeds.com
http://www.larnerseeds.com/_pages/wildflower_annual.html

Las Pilitas Nursery
8331 Nelson Way
Escondido, CA 92026
(760) 749-5930
www.laspilitas.com

Mountain States Wholesale Nursery
Litchfield Park, AZ 85340-2600
Phone: (623) 247-8509
Fax: (623) 247-6354
http://www.mswn.com/

Mountain Valley Growers
38325 Pepperweed Road
Squaw Valley, CA 93675
(559) 338-2775
http://www.mountainvalleygrowers.com

Misty Meadows Nursery
43601 Mesa Street
Banning, CA 92220
(951) 765-7542 or (951) 897-1585
mistymeadows@live.com
http://www.mistymeadowsnursery.com/601.html

Native American Seed
3791 North US Highway 377
Junction, TX 76849
(800) 728-0403
info@seedsource.com
http://www.seedsource.com/catalog/index.asp

Oak Hills Nursery
13874 Ranchero Road
Oak Hills, CA 92345
(760) 947-6261
oakhillsnursery@hotmail.com
http://www.oakhillsnursery.com, http://www.mojavedesertplants.com

Seedland, Inc.
9895 Adams Road
Wellborn, FL 32094
(386) 963-2080
sales@seedland.com
http://www.seedland.com/

S & S Seeds
P. O. Box 1275
Carpenteria, CA 93014
(805) 684-0436

San Marcos Growers
125 South San Marcos Road
P.O. Box 6827
Santa Barbara, CA 93160
(805) 683-1561
http://www.smgrowers.com

Sheldon Nursery
4999 N. Sabino Canyon Rd.
Tucson, AZ 85750
(520) 529-0609
http://www.sheldonnursery.com
sheldonnursery1@yahoo.com

White Tank Nursery
P.O. Box 810
Waddell, AZ 85355
(623) 935-4276
info@whitetankpalms.com
http://www.whitetanknursery.com/index.html

Comstock Seed
917 Highway 88
Gardnerville, NV 89460
(777) 265-0090
sales@comstockseed.com
http://www.comstockseed.com

Appendix C
Photo Point Monitoring Datasheet

Pacific Gas and Electric Company
Topock Compressor Station
Photo Point Monitoring Data Sheet

Photo Point Station:_____ Date:_____

Observer:_____

Coordinates:_____ Datum:_____

Location Description:_____

_____

_____

_____

_____

_____

_____

Photo Direction: N NE E SE S SW W NW Compass Bearing:_____ Mag. or True North

Description of Setting (Including any vegetation, substrate and disturbance):

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Appendix P
Cultural Resources Protocols
(On CD-ROM Only)

CUL-1a-2: Protocol to Preserve Tribal Members' Access to, and Use of, the Project Area
CUL-1a-3(c): Outreach to Visitors
CUL-1a-3(d): Post Off-Road Vehicle Use Signage
CUL-1a-7: Protocols for Nighttime Lighting
CUL-1a-13: Development of Cultural Sensitivity Education Program
CUL-4: Discovery of Human Remains

CUL-1a-2: Protocol to Preserve Tribal Members' Access to, and Use of, the Project Area

CUL-1a-2: PROTOCOL TO PRESERVE TRIBAL MEMBERS' ACCESS TO, AND USE OF, THE PROJECT AREA

> As part of the CMI Workplan, PG&E shall develop a written access plan to preserve tribal members' access to, and use of, the project area for religious, spiritual, or other cultural purposes. This plan will allow access to the extent PG&E has the authority to facilitate such access, and be consistent with existing laws, regulations, and agreements governing property within the project area. The access plan may place restrictions on access into certain areas, such as the Compressor Station and the existing evaporation ponds, subject to DTSC review with regard to health and safety concerns and to ensure noninterference with approved remediation activities. This access plan may be developed in coordination with the federal agencies with land management responsibilities in the project area (e.g., BLM and USFWS) in accordance with the related stipulation (General Principle I.C) contained in the Programmatic Agreement (Appendix PA). PG&E shall demonstrate a good faith effort to coordinate with Interested Tribes by including communication logs as part of the CMI Workplan.

This protocol serves as PG&E's access plan to preserve Tribal members' access to, and use of, the project area for religious, spiritual, or other cultural purposes, to the extent that PG&E has the authority to facilitate such access, consistent with the requirements of this EIR mitigation measure (CUL-1a-2).

Land Ownership and Management

Most of the land in the project area is owned by the United States and managed by federal agencies. Portions of these federal lands are also utilized by other entities, such as the California Department of Transportation, San Bernardino County, Mohave County, and various utility companies through leases, easements, and rights-of-way. The rest of the land in the project area is owned by private or governmental parties, including Burlington Northern Santa Fe Railroad (BNSF), the Metropolitan Water District of Southern California, the Fort Mojave Indian Tribe, PG&E, and other owners of smaller parcels in Arizona.

Tribal Access Plan for Federal Properties

The U.S. Department of Interior, Bureau of Land Management issued an access plan on November 26, 2011 entitled "PG&E Topock Remediation Project Tribal Access Plan for Federal Properties" (Federal Tribal Access Plan). The Federal Tribal Access Plan was developed by BLM in collaboration with interested Tribes in accordance with the requirements in the Programmatic Agreement. It covers all aspects of Tribal access to federal properties in the project area and thus addresses the access issues related to federal properties for EIR mitigation measure CUL-1a-2. The Federal Tribal Access Plan is attached to this Plan as Attachment 1.

Tribal Access to Non-PG&E Private Parcels in the Project Area

PG&E does not have authority to unilaterally provide Tribal access to non-PG&E owned private parcels in the project area for religious, spiritual, or other cultural purposes. PG&E will seek Tribal access to non-PG&E owned private parcels to allow tribal monitoring during construction associated with implementing the groundwater remedy.

Tribal Access to PG&E Property

PG&E is committed to cooperate with all Interested Tribes to provide safe access for religious, spiritual, or other cultural purposes to PG&E property within the project area, as depicted on a map attached to this Plan as Attachment 2.

To obtain access to PG&E property the process is:

- The Tribe seeking access must send an email or call the assigned PG&E representative (initially identified as Curt Russell, Topock Site Manager, but subject to change upon written notification to the Interested Tribes) no less than seven (7) days prior to the date(s) of access, and specify: (1) the date(s) and time(s) for which access is sought; (2) the approximate number of individuals seeking access; and (3) the general purpose for the requested access to the property. The email address for Curt Russell is gcr4@pge.com and his telephone number is (760) 791-5884. In addition, PG&E will attempt to accommodate Tribal access requests made with less than seven (7) days prior notice, whenever possible.

- After consideration of the Tribe's request, PG&E shall notify the requesting Tribe via telephone and email, if available, regarding PG&E's determination of whether to grant the Tribe access. PG&E has the discretion to deny such access due to health and safety concerns and to ensure noninterference with approved remediation activities and Topock Compressor Station operations.

For safety and security purposes, Tribal representatives will contact PG&E on the date of access when they arrive at PG&E property. A PG&E escort is required for Tribal access to the Topock Compressor Station and other portions of PG&E's property that have hazards. PG&E will work with the Tribal government to arrange a mutually-agreeable time for PG&E to provide such escorted access. Tribal representatives must follow all PG&E safety and logistics requirements while they are on PG&E property. Any Tribal access to PG&E property for religious, spiritual, or other cultural purposes must not interfere with approved remediation activities or Topock Compressor Station operations. In the event such interference occurs, Tribal members will be required to leave PG&E's property.

Attachment 1
Federal Access Plan

BLM

U.S. Department of the Interior

Bureau of Land Management

PG&E TOPOCK REMEDIATION PROJECT

TRIBAL ACCESS PLAN

FOR FEDERAL PROPERTIES

Prepared by:
Department of the Interior
Bureau of Land Management
Lake Havasu Field Office
2610 Sweetwater Avenue
Lake Havasu City, Arizona 86404

NATIONAL SYSTEM OF PUBLIC LANDS

Date: November 26, 2011

PG&E TOPOCK REMEDIATION PROJECT TRIBAL ACCESS PLAN FOR FEDERAL PROPERTIES

I. Introduction

II. Surrounding Property Owners, Easements, and Right-of-Way Holders within the Topock Remediation Project Area of Potential Effect (APE)

III. Current Public Access Routes within the Topock Remediation Project APE

IV. Federally Managed Lands within the Topock Remediation Project APE closed by Emergency Closure in 2006

V. Management Prescriptions

VI. Privacy Prescriptions

VII. Appendices

1. Map Showing Surrounding Property Owners, Easements, and Rights-of-Way within the Topock Remediation Project APE

2. Topock Remediation Project Area Emergency Road Closure Document

PG&E TOPOCK REMEDIATION PROJECT TRIBAL ACCESS PLAN FOR FEDERAL PROPERTIES

I. Introduction

The Fort Mojave Indian Tribe believes that the entire landscape within which the Topock Remediation Project is being carried out is the significant cultural resource. The Bureau of Land Management (BLM) acknowledges that there is a Traditional Cultural Property (TCP) of religious and cultural significance to the Fort Mojave Indian Tribe and other Lower Colorado River Tribes within the presently identified Area of Potential Effect (APE) for the Topock Remediation Project that is eligible for inclusion on the National Register of Historic Places (NRHP). BLM also recognizes that the boundaries for this TCP may extend beyond the present boundaries of the expanded APE, but BLM believes that the Topock Remediation Project is not the proper forum for a determination of a proposed cultural landscape beyond what is required to complete the project for CERCLA cleanup actions.

The purpose of this Tribal Access Plan is to assure the rights of Tribes to access their places of spiritual and cultural importance located on federal lands contained within the boundary of the APE, including those recognized pursuant to the National Historic Preservation Act of 1966, as amended, the American Religious Freedom Act of 1978 and amendments of 1994, and Executive Order 13007 - Indian Sacred Sites.

This Tribal Access Plan assures that the Lower Colorado River Tribal governments and their members are able to freely exercise their religious rights in their aboriginal territories. Management of those parts of the Topock Remediation Project APE that are on federal land will be done in a manner that respects the cultural, religious, and spiritual importance of that portion of the TCP bounded by the APE. The federal lands within the APE will be managed in a way that minimizes incompatible land and resource uses while recognizing the important cultural, spiritual, and religious values held by the Lower Colorado River Tribes. In no manner will Tribes be subject to more restrictions than are imposed on the general public, as the point of this tribal access plan is to allow the Tribes greater, culturally appropriate access that that afforded to casual visitors without cultural ties to the area.

This Access Plan for Tribes to the Topock Remediation Project APE for traditional, religious, cultural, or spiritual purposes is and shall be interpreted in a manner consistent with the United States Constitution, applicable laws, regulations, and agreements governing property within the APE and in accordance with the stipulations in the Programmatic Agreement for the Topock Remediation Project, signed October 26, 2010. The PA defines the process by which compliance with the National Historic Preservation Act will be accomplished from this point forward. Stipulation I(C) of the Programmatic Agreement provides that access may not impede the Topock Remediation Project, may not create health and safety concerns and shall exclude the Topock Compressor Station and related facilities owned and/or operated by PG&E. Although the majority of the Tribes did not sign the Programmatic Agreement, they will nevertheless be consulted and afforded access in accordance with the Federal Government's responsibility for government-to-government consultation and in the exercise of its trust responsibilities.

II. Surrounding Property Owners, Easements, and Right-of-Way Holders within the Topock Remediation Project APE

Surrounding property owners, easement, and right-of-way holders within the Topock Remediation APE are shown on the map provided as Appendix 1. The parties holding such ownership, easements, and rights-of-way include: the Bureau of Land Management (BLM), the Bureau of Reclamation (BR),

the US Fish and Wildlife Service (USFWS), the Fort Mojave Indian Tribe, San Bernardino County, the Burlington Northern Santa Fe (BNSF) Railroad, Pacific Gas and Electric (PG&E), the Metropolitan Water District of Southern California, the California Department of Transportation (Caltrans), Mohave County, Southern California Gas, Trans-Western Gas Pipeline Company, Mojave Gas Pipeline Company, the City of Needles Electric Company, the Southwest Gas Corporation, Southwest Water Company, Mohave Electric Cooperative, Frontier Communications and various private property landowners within the APE in Arizona.

The Tribes will work with PG&E to obtain access to any fenced-off PG&E facility that is authorized to be on Federal Government land within the APE. PG&E shall grant access on a case by case basis and in coordination with the federal agency having jurisdiction over the lands. Portions of some of these areas may need to be controlled due to health and safety issues. Any restriction by PG&E on tribal access to such areas will be explained in writing to the tribe requesting access and the federal agency with jurisdiction. Any access granted to Tribes must include procedures established to ensure human health and safety, and shall not impede the Topock Remediation Project.

If the Tribes desire to obtain access to fenced-off facilities managed by other property managers (So Cal Gas Company, Trans-Western Gas Company, Caltrans, etc.) on Federal Government land within the APE, the federal agency with jurisdiction over the lands in question will work with the Tribes to obtain such access from the respective property managers.

III. Current Public Access Routes within the Topock Remediation Project APE

For the purposes of the Tribal Access Plan, a public road is any purposely constructed and legally designated right-of-way which is under the jurisdiction of the Federal Highway Administration, the State Highway Department, a county, a municipal government, or identified or maintained by one of the Federal land management agencies. Public roads do not include informal routes of passage created by off-road vehicle traffic. Public roads are open to public travel unless closed by order of the agency or local government having jurisdiction.

Motorized vehicle use, equestrian use, and the use of any other form of conveyance within the Topock APE are restricted to public roads as defined above. Allowable motorized vehicle uses near cultural resource sites and site complexes are restricted to activities that are compatible with the objective of preserving cultural resources.

Neither members of the public nor employees of the agencies or PG&E will be allowed by the agencies or PG&E to disturb Maze remnants, cairns, pottery sherds, the work stations of tribal ancestors, lithic scatters, earth figures, geoglyphs, petroglyphs, pictographs, ruins, rock rings, historic buildings, or any other artifacts that may be present on federally managed lands within the Topock APE.

Tribal members accessing the area may carry out cultural activities appropriate to their spiritual beliefs and practices, including but not limited to the burning of sage and leaving of offerings.

The BLM will review requests from Tribes for vehicular access to road-less sacred areas and consider authorizing such use on a case-by-case basis. Consistent with the Stipulations in the Programmatic Agreement, administrative access will be granted to Tribes so they may access the area(s) requested. Neither emergency nor permanent road closures would inhibit any Tribe's use of the APE for traditional cultural or religious purposes.

IV. Federally Managed Lands within the Topock Remediation Project APE Closed by Emergency Closure in 2006

For purposes of the Tribal Access Plan, *federally managed* lands mean any land managed by the BLM, BR, or USFWS. Such lands are generally open to public recreational use, including hunting

and fishing, subject to the regulations of the managing agency. Within the Topock Remediation Project APE, public entry to a portion of the northern half of the APE in California is closed by order of BLM dated July 31, 2006.

This northern portion of the APE was subject to an Emergency Closure in 2006 to protect both public safety and sensitive cultural and natural resources (refer to Appendix 2). Pursuant to Title 43 Code of Federal Regulations, Subpart 8364.1, the BLM, Lake Havasu Field Office, closed portions of roads on public lands within the Topock Remediation Project APE to motorized and mechanical vehicle use, to protect soils, vegetation and cultural resources that have been adversely impacted, or are at risk of being adversely impacted by off-highway vehicle (OHV) use.

This emergency road closure began August 1, 2006, and will remain in effect until adverse effects giving rise to the closure are eliminated, and measures are implemented to prevent recurrence of these adverse effects. The placement of notices, signs, and rock barriers used to block existing roads will be determined after the Federal Government's consultation with regional tribes has been completed. Comments offered by the Tribes will be taken into consideration before any measures are employed to block and sign roads. Law enforcement patrols and citations are used to enforce road closures. Signage includes the posting of narratives regarding penalties or citation to law.

V. Management Prescriptions

Management prescriptions will respect the traditional cultural practices of the Lower Colorado River Tribes that ascribe religious or other heritage values to properties within the APE. The BLM shall cooperate with the Tribes to allow them to select, access, and utilize harvesting areas (personal or Tribal use) for the collection of: a) medicinal, craft, or ceremonial plants, b) minerals (e.g., quartz, clay) or c) other natural materials, for traditional or ceremonial noncommercial use without specific authorization on federally managed lands.

The Tribes will request BLM's specific permission should they wish to build a fire anywhere within the Topock APE on federal lands. BLM will not unreasonably withhold such permission; however, this prescription is necessary for maintaining obvious health and safety standards within the setting which includes multiple high-pressure natural gas pipelines. BLM will consult with PG&E and other gas companies if fires are proposed in the vicinity of gas facilities.

Individual Tribal members and groups of such members, not to exceed approximately one hundred (100) persons, may utilize unfenced areas of the APE for traditional, religious, cultural, or spiritual purposes consistent with applicable laws, regulations, and agreements governing the federal property within the APE. However, should a Tribe or tribal member wish to camp or hold gatherings of Tribal members for more than a 24 hour period on federal lands, the Tribe or individual will need to inform BLM so that BLM can ensure that appropriate health and safety precautions are in effect. Notification of intent to undertake such an encampment or gathering will be submitted in writing, two weeks in advance to the BLM – Lake Havasu Field Manager.

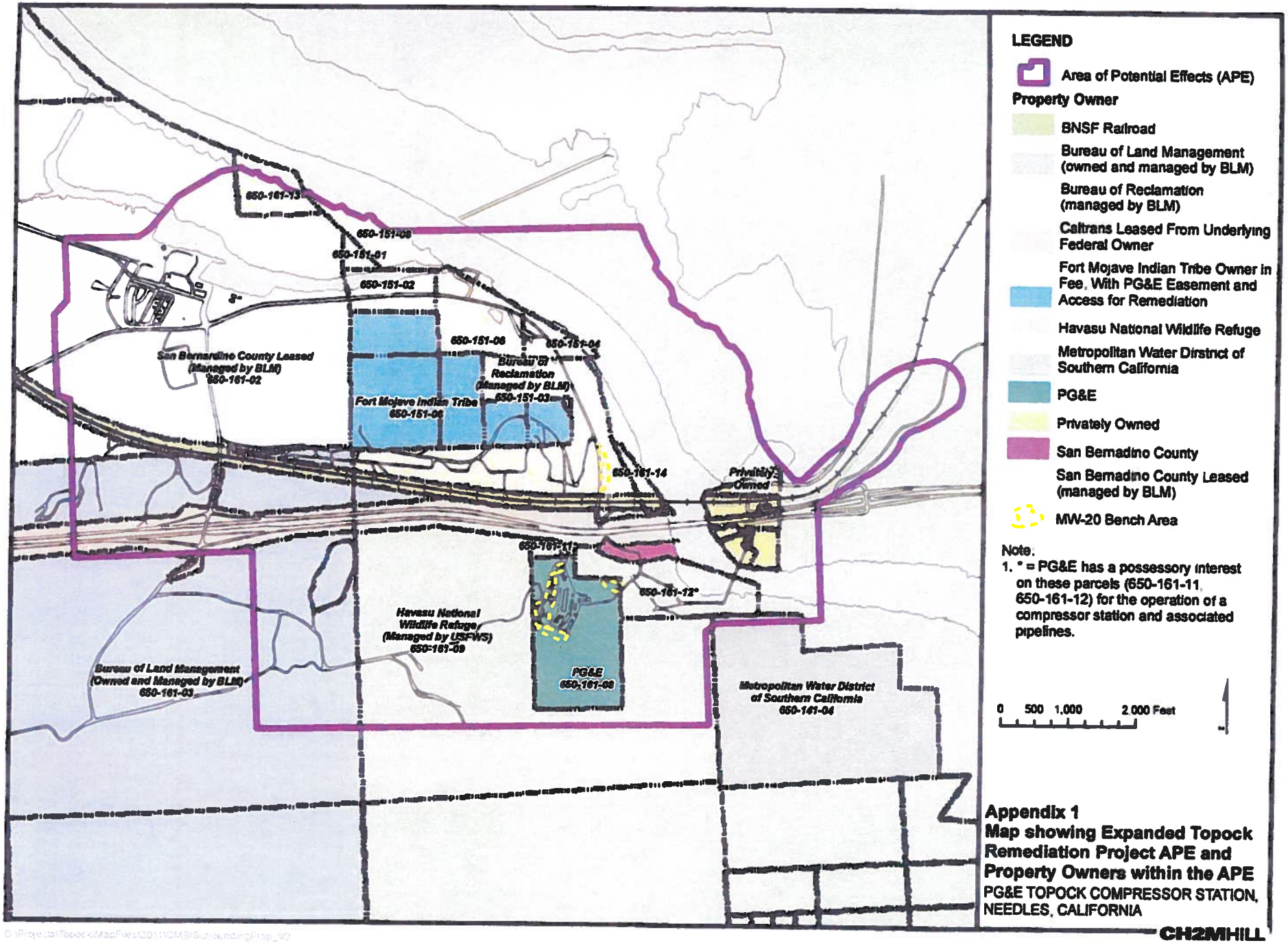
VI. Privacy Prescriptions

No federal agency, PG&E or any other party under the control of a federal agency or PG&E shall videotape, audiotape, photograph or otherwise record or monitor any tribal cultural activities on the land subject to this access plan. The tribes require privacy and maintenance of as natural and safe a setting as modern conditions permit, with appropriate aural and visual conditions, and may regard such monitoring or recording as substantial burdens on their practice of religion.

VII. Appendices

1. Map showing Expanded Topock Remediation Project APE and Property Owners within the APE

2. BLM AZ-330-06-2641-HO-AZZF Topock Project Area Emergency Road Closure Document



Appendix 1
Map showing Expanded Topock Remediation Project APE and Property Owners within the APE
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

APPENDIX 2

UNITED STATES DEPARTMENT OF THE INTERIOR

Bureau of Land Management

AZ-330-06-2641-HO-AZZF

AGENCY: Bureau of Land Management, Lake Havasu Field Office, Arizona

ACTION: Topock Project Area Emergency Road Closure

SUMMARY: Pursuant to Title 43 Code of Federal Regulations, Subpart 8364.1, the Bureau of Land Management, Lake Havasu Field Office, will close portions of roads on public lands to motorized and mechanized vehicle use. The purpose of the emergency closure is to protect soils, vegetation and cultural resources that have been adversely impacted, or are at risk of being adversely impacted, by off-highway vehicle (OHV) use. In addition, this closure is needed to alleviate congestion in the project area during Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) remediation of hexavalent chromium in the groundwater at the Pacific Gas and Electric (PG&E) Topock Compressor Station in Needles, California. Copies of this Emergency Closure Notice and map are available at the BLM Lake Havasu Field Office, 2610 Sweetwater Avenue, Lake Havasu City, AZ 86406, phone (928) 505-1200.

EFFECTIVE DATES: This emergency road closure is in effect beginning August 1, 2006, and will remain in effect until considerable adverse effects giving rise to the closure are eliminated, and measures are implemented to prevent recurrence of these adverse effects.

FOR FURTHER INFORMATION CONTACT: Michael Dodson, Law Enforcement Ranger, Bureau of Land Management Lake Havasu Field Office, 2610 Sweetwater

Avenue, Lake Havasu City, AZ 86406, phone (928) 505-1200.

SUPPLEMENTARY INFORMATION: The BLM Lake Havasu Field Office and other entities have observed and documented considerable adverse effects to soils, vegetation, and cultural resources from motorized or mechanized vehicle use in this area. Based on this information, the BLM authorized officer has determined that motorized or mechanized vehicle use in this area is causing, and will continue to cause, considerable adverse effects. In addition, portions of roads in the emergency road closure area are utilized by Pacific Gas and Electric Company to control and remove hexavalent chromium from the groundwater. The emergency road closure in the area will help protect public safety and remediation efforts during CERCLA operations, by restricting motorized and mechanized use of the area. The public lands affected are closed to travel by motorized and mechanized vehicle use (including trucks, sport utility vehicles, all-terrain vehicles, cars, motorcycles, bicycles), except for authorized access to private lands and rights-of-way (ROW), use by fire and law enforcement vehicles, emergency activities, and other authorized government uses. The authorities for this emergency closure and restriction order are 43 CFR 8364.1 and 9268.3(d). BLM is implementing this action on 269 acres of public land in San Bernardino County, California. OHV use on the remainder of the public lands administered by the BLM Lake Havasu Field Office will continue to be managed according to existing Federal Register orders, and the 1985 Yuma District Resource Management Plan.

DESCRIPTION OF CLOSED AREA:

This emergency closure affects 269 acres of public lands and roads, subject to the exceptions below, located within the Topock Project area. Public lands in the following described tracts are hereby closed to motorized and mechanized vehicles:

T. 7 N., R. 24 E, portions of sections 5, 6, 7 and 8.

Private lands within the closure boundary are not under the jurisdiction of the BLM, and not affected by this emergency closure.

Exceptions to the Emergency Closure and Restriction Orders

Exceptions to this closure include emergency personnel (law enforcement, fire, medical), authorized BLM personnel, and persons authorized access to private lands and Rights of Way within the closure boundary

Penalties

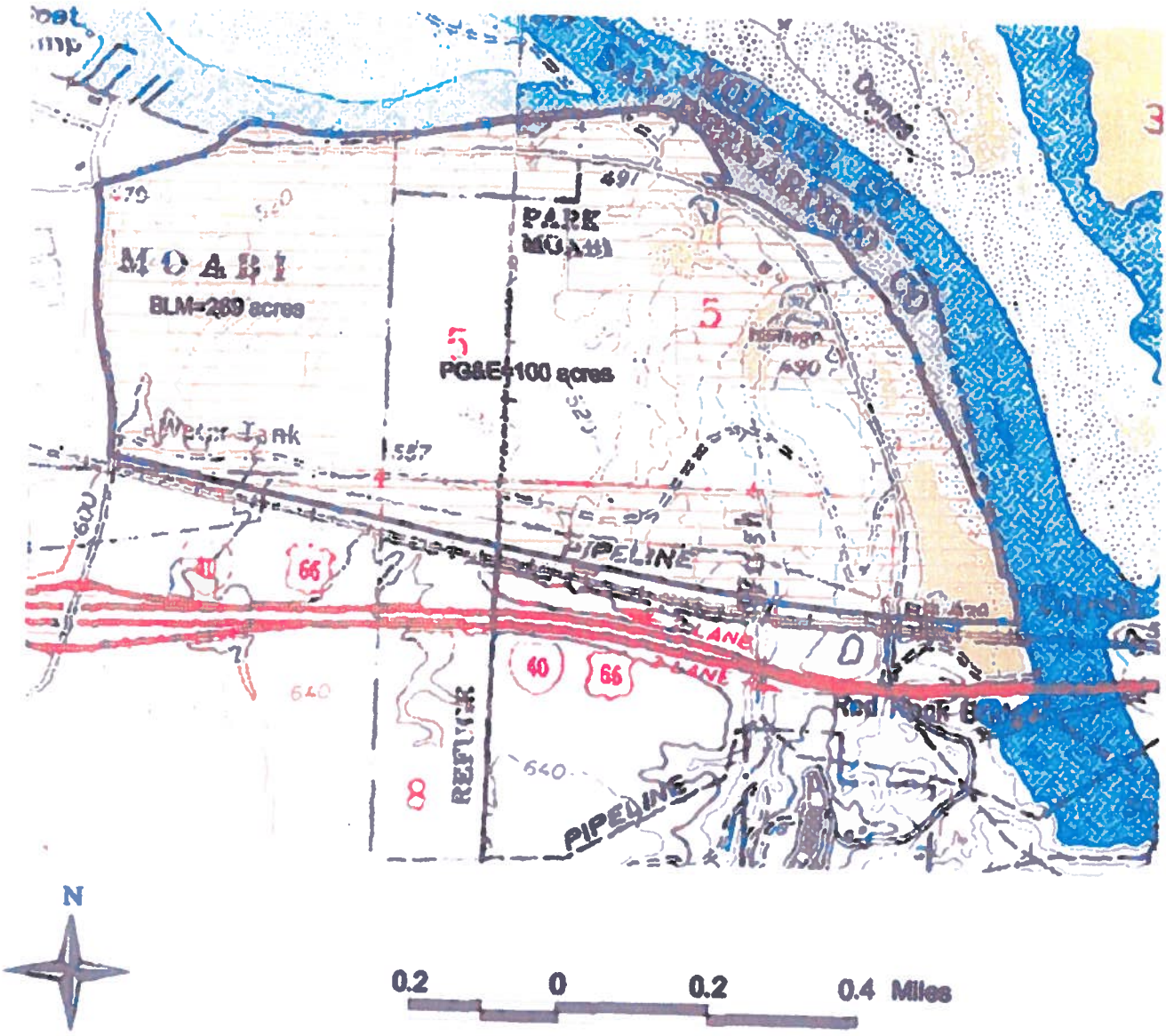
Under section 303(a) of the Federal Land Policy and Management Act (FLPMA) of 1976, (43 U.S.C 1733(a), and 43 CFR 8360-7, if you violate these closures or restrictions on public lands within the boundaries established, you may be tried before a United States Magistrate and fined no more than $100,000 or, imprisoned for no more than 12 months, or both Such violations may also be subject to the enhanced fines provided for by 18 U S C 3571

Date: July 31, 2008

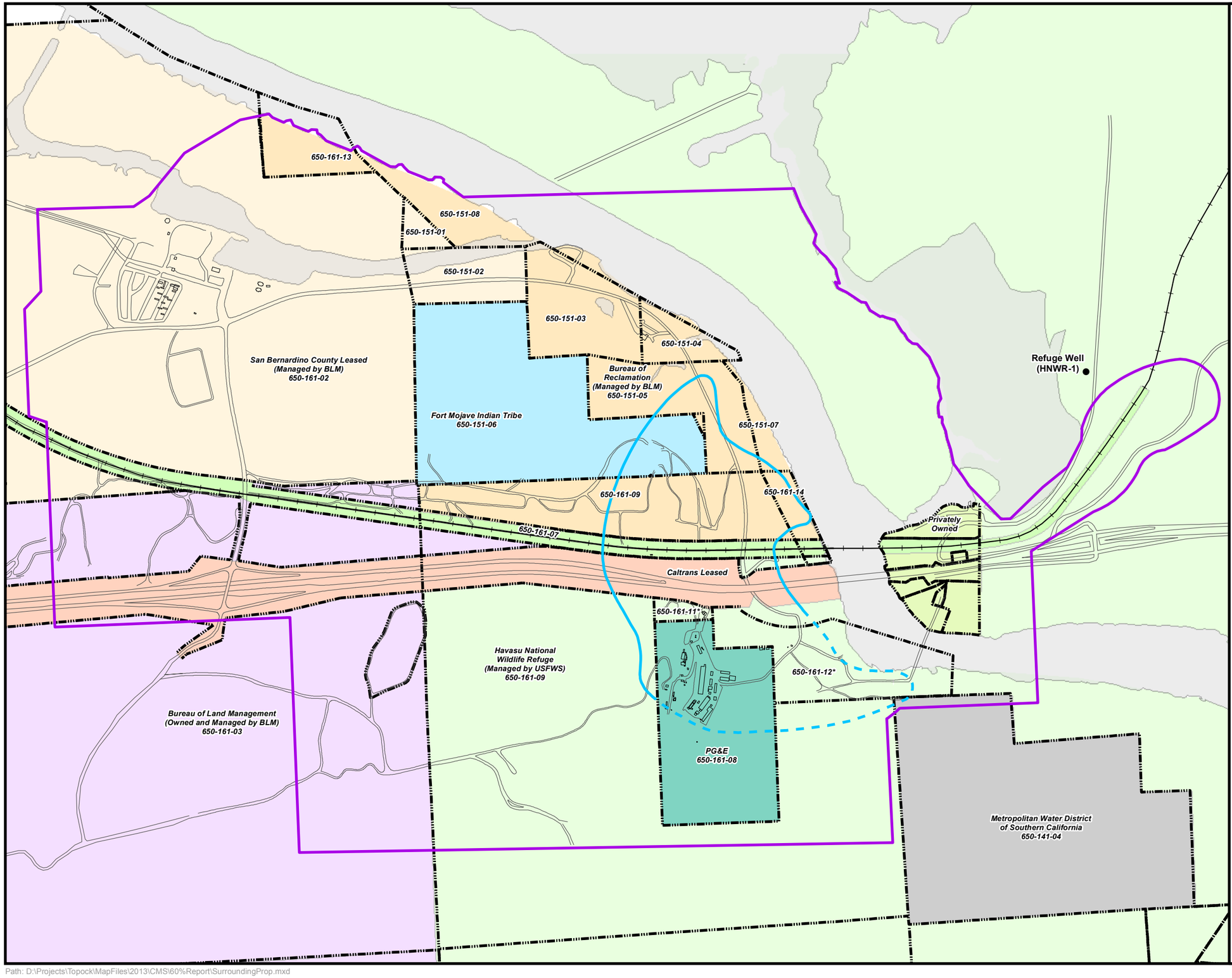
Signed:

Timothy Z Smith, Field Manager
BLM Lake Havasu Field Office

Topock Emergency Closure



Attachment 2
Surrounding Properties Map



LEGEND

- Refuge Well
- Area of Potential Effects (APE)
- Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on fourth quarter 2011 sampling events. Dashed where based on limited data.

Property Owner

- BNSF Railroad
- Bureau of Land Management (owned and managed by BLM)
- Bureau of Reclamation (managed by BLM)
- Caltrans Leased From Underlying Federal Owner
- Fort Mojave Indian Tribe Owner in Fee, With PG&E Easement and Access for Remediation
- Havasu National Wildlife Refuge
- Metropolitan Water Dirstrict of Southern California
- PG&E
- Privately Owned
- San Bernadino County Leased (managed by BLM)

Note:
1. * = PG&E has a possessory interest on these parcels (650-161-11,650-161-12) for the operation of a compressor station and associated pipelines.

0 350 700 1,400 Feet

N

FIGURE 2.4-1
SURROUNDING PROPERTY MAP

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Path: D:\Projects\Topock\MapFiles\2013\CMS\60%Report\SurroundingProp.mxd

CUL-1a-3(c:) Outreach to Visitors

CUL-1a-3(c) OUTREACH TO VISITORS

CUL-1a-3(c): PG&E shall enhance existing measures to prevent and reduce incursions from recreational and/or other outside users from affecting unique archeological and historically significant resources, including resources within the Topock Cultural Area, by: Coordinating with BLM and San Bernardino County to facilitate an outreach effort to the staff at Moabi Regional Park, requesting that they communicate to visitors the parts of the project area that are off limits to off-road vehicle usage because of health and safety concerns, public lands management plans, or landowner requests. PG&E shall make a good faith effort to involve the surrounding tribes in this outreach effort, providing Interested Tribes with the opportunity to comment on outreach materials or provide a tribal cultural resources specialist the opportunity to participate in the outreach activities. As part of this outreach effort, PG&E shall work with Park Moabi and offer to design, develop, and fund the installation of an informational kiosk within Park Moabi that informs visitors of the work being done at the project site. PG&E shall involve the tribes to the maximum extent feasible, as determined by DTSC, in the design and development of the informational kiosk.

Implementation Procedures

Coordination with Stakeholders

The purpose of this Mitigation Measure is to inform Moabi Regional Park visitors about the restrictions to off highway vehicles (OHV) use in the project area and the need to protect cultural resources that occur within and near Topock. PG&E has implemented this Mitigation Measure by coordinating with BLM, San Bernardino Regional Parks Department, Park Moabi concessionaires, and Interested Tribes. PG&E has undertaken the following to facilitate implementation of the Mitigation Measure:

- PG&E met with BLM to gather informational materials regarding OHV activities and use; information that identifies areas designated as off-limits to OHV use; and areas open to OHV use. PG&E met with San Bernardino Regional Parks Department and Park Moabi concessionaires to discuss assistance with outreach activities to Moabi Regional Park visitors regarding OHV use restrictions. PG&E also discussed funding with Parks Department staff and concessionaires for the design and printing of informational materials for Parks Department staff and visitors; training sessions for Parks Department staff to appropriately implement outreach activities; and the installation of an information kiosk to inform Park visitors about OHV restrictions and other information pertaining to the protection of environmental resources in the project area.

- PG&E met with Interested Tribes to solicit their input and comments regarding outreach materials and to provide a tribal cultural resources specialist the opportunity to participate in the outreach activities.

Develop Draft Visitor Outreach Plans

PG&E will use the information gathered during meetings with BLM, San Bernardino Regional Parks Department, Park Moabi concessionaires, and Interested Tribes to facilitate the execution of the visitor outreach efforts. PG&E will:

- Develop draft visitor outreach materials;
- Develop a draft training session for Park Moabi visitor-contact employees;
- Develop kiosk design concepts and draft informational content; and
- Develop a draft plan for executing other outreach ideas identified during meetings.

Review of PG&E Draft Plans by Stakeholders

PG&E will consult with BLM, San Bernardino Regional Parks Department, Park Moabi concessionaires, and Interested Tribes and provide these stakeholders an opportunity to review and comment on any outreach plan prior to its implementation. In particular, PG&E will consult with the BLM regarding the accuracy of information on OHV use areas; the San Bernardino Regional Parks Department and Park Moabi concessionaires regarding implementation of visitor outreach activities; and the Interested Tribes regarding the content of all written materials and participation in training sessions for Parks Department visitor-contact employees.

Implementation of Outreach

PG&E will initiate conversations with key stakeholders (i.e. BLM, San Bernardino County, Park Moabi) within six months of the final approval of the groundwater remedy design.

CUL-1a-3(d): Post Off-Road Vehicle Use Signage

CUL-1a-3(d) POST OFF-ROAD VEHICLE USE SIGNAGE

CUL-1a-3(d): Posting signage to indicate those parts of the project area that are off limits to off-road vehicle usage due to possible health and safety concerns and to reduce potential damage to environmental resources. If agreed to by land owners and/or local, state, or federal management entities within the project area, PG&E shall work with the relevant land owner or land management entity to develop, design, and fund the installation of easily visible and clear signage. This may include coordination with BLM to install signage noting the designation of the area as an Area of Critical Environmental Concern owing to its biological and cultural resources, while ensuring that signs are placed in a way that does not draw unwanted attention to specific resources.

Implementation Procedures

Coordination with Stakeholders

PG&E will meet with the local, state, or federal land owners and/or management entities within the project area to identify portions of their property that could be appropriate for designation as off-limits to off highway vehicles (OHV) use due to potential health and safety concerns and/or the presence of sensitive biological or cultural resources. PG&E will work with each stakeholder to design appropriate signage for each property and its associated resources.

Installation of Signage

PG&E will initiate conversations with key stakeholders (i.e. BLM, San Bernardino County, Park Moabi) within six months of the final approval of the groundwater remedy design.

CUL-1a-7: Protocols For Nighttime Lighting

CUL-1a-7: PROTOCOLS FOR NIGHTTIME LIGHTING

> CUL-1a-7: Nighttime construction-related activities shall be limited to work that cannot be disrupted or suspended until the following day, such as, but not limited to, well drilling and development or decommissioning activities. Lighting considerations, including the potential use of solar power for some lighting, shall be included as part of the remedial design plan to be developed with involvement of Interested Tribes and the U.S. Department of the Interior. To minimize construction and operations-related lighting impacts, the lighting in the remedial design plan shall include, at a minimum: (1) shrouding/shielding for portable lights needed during construction and operational activities; (2) installation of portable lights at the lowest allowable height and in the smallest number feasible to maintain adequate night lighting for safety; (3) shielding and orientation of lights such that off-site visibility of light sources, glare, and light from construction activities is minimized to the extent feasible. No additional permanent poles shall be installed for lighting. This mitigation measure is not meant to replace or subsume any actions required by the County or state or federal entities with regard to lighting required for minimum security and safety purposes.

Implementation Procedures

Nighttime Lighting

The Construction/Remedial Action Work Plan will include example circumstances whereby nighttime construction may be conducted and the standards that will be followed. These standards will be consistent with the Construction Lighting Principles. Construction Lighting Principles include: a determination by PG&E that nighttime work for construction activities is required; lighting only areas of active construction; a restriction on the installation of any new permanent poles for nighttime lighting; the use of portable lighting that includes shielding/shrouding (e.g., downward facing fixtures with cutoff shields to reduce light diffusion) to the extent feasible; the use of the lowest feasible amount of lighting at the lowest allowable height to maintain adequate night lighting for safety; orientation of lights such that off-site visibility of light sources, glare, and construction activities is limited; and designation of a responsible member of the construction crew (e.g., foreman or crew boss) to extinguish the lighting as soon as the nighttime construction work is completed.

Coordination with Stakeholders

The US Department of the Interior, Interested Tribes, and other stakeholders will be given the opportunity to comment on the design of outdoor lighting at groundwater remediation facilities through the design review process described in CUL 1a-8d. Details of the lighting design will be presented in the 100% final design package.

Regulatory Requirements

The following lighting standards will be followed for the project:

- Construction Industry 29 CFR 1926.56 (lighting safety requirements)
- General Industry 29 CFR 1910.120 (HAZWOPER) (lighting safety requirements)
- San Bernardino County Code Title 8 Section § 83.07.040 Glare and Outdoor Lighting - Mountain and Desert Regions
- Mohave County Outdoor Light Control Ordinance 87-1

CUL-1a-13: Development of Cultural Sensitivity Education Program

CUL-1a-13: DEVELOPMENT OF CULTURAL SENSITIVITY EDUCATION PROGRAM

PG&E shall, in communication with Interested Tribes, develop as part of the CMI Workplan, a worker cultural sensitivity education program. The program shall be implemented before commencement of construction and throughout construction and operations as personnel are added. This program may include information provided directly by tribal entities either in written form or on video, in a manner consistent with Appendix C in the existing BLM Programmatic Agreement. The worker cultural sensitivity education program shall ensure that every person working on the project as an employee or contractor, before participating in design or outdoor activities at the project site, is informed regarding:

- The cultural significance of the Topock Cultural Area,
- Appropriate behavior to use within the Topock Cultural Area,
- Activities that are to be avoided in the Topock Cultural Area, and
- Consequences in the event of noncompliance.

1. Applicability

1.1 Program Implementation

The Program will be implemented prior to commencement of any ground-disturbing activity or construction and throughout construction and operations as personnel are added. As required by the Topock Remediation's Programmatic Agreement (PA), the training will be conducted by PG&E with participation from Interested Tribes[1] and Tribal Monitors, Archaeological Monitors, and Federal agency staff, as appropriate.

[1] For purposes of this protocol and as defined in the EIR, Interested Tribes refers to the six tribes that have substantially participated in the various administrative processes surrounding remediation of the Topock Cultural Area with the California Department of Substances Control (DTSC), PG&E, and the U.S. Department of the Interior (DOI), including throughout development of the final remedy. Interested tribes include the Chemehuevi Indian Tribe, Cocopah Indian Tribe, Colorado River Indian Tribes, Fort Mojave Indian Tribe, Fort Yuma-Quechan Indian Tribe, and Hualapai Indian Tribe.

1.2 Training Required of All Staff, Consultants, and Workers

Personnel required to attend the training (which would include all workers doing remediation activities within the PA Area of Potential Effect (APE) or Groundwater Remediation Environmental Impact Report (EIR) Project Area will include each individual associated with construction or ground-disturbing activities throughout each phase of the project (including decommissioning and environmental reconstruction), including PG&E employees, consultants, contractors, and subcontractors ("workers").

1.3 Program Consistent with Appendix C of Programmatic Agreement

The Program will be consistent with the cultural sensitivity training outlined in the Tribal and Archaeological Monitoring Protocol provided as Appendix C to the PA for the Project. Appendix C states:

- Cultural sensitivity training will be required of all staff, workers, and contractors engaged in activities in the Topock Remediation Project Area of Potential Effect (APE) to familiarize them with the sacred nature of the area so that they will perform their jobs in a respectful manner.
- New personnel will be trained before they are allowed to do fieldwork within the Area of Potential Effects (APE).
- Training will be conducted by PG&E with participation by Tribes and Tribal Monitors, Archaeological Monitors, Federal agency staff, and PG&E supervising staff, as appropriate.
- Consistent with PG&E's stated policy, PG&E will not tolerate any disrespectful behavior in the field and will remove any staff, workers, or contractors who do not comply.

2. Program Development

2.1 Types of Training Sessions

Cultural Sensitivity Orientation training:

- All PG&E and contract workers engaged in field activities will be trained prior to conducting fieldwork.
- All PG&E and contract workers engaged in design work will be trained as soon as practical after being assigned to work on the Topock Project.

Training during Field Project Orientation Meetings:

- Cultural sensitivity and cultural resource protection training will be conducted at each Field Project Orientation meeting conducted prior to each substantial project work phase, in addition to communication about onsite safety, communications, and biological protection standards.

Additional Training Opportunities:

- PG&E will work collaboratively with Tribes and agencies to identify and develop additional cultural sensitivity training opportunities.

2.2 Key Points of Training

Training will cover each of the following main topics:

Significance and Sensitivity of Topock Cultural Area

- Area is sensitive for archaeological/historical sites and for its spiritual importance to Tribes.

Appropriate Onsite Behavior

- Be respectful of tribal views regarding the cultural significance of the Topock Cultural Area and treat Tribal monitors with respect.
- PG&E will not tolerate any disrespectful behavior in the field and will remove any staff, workers or contractors who do not comply.

Protection of Historically Significant Cultural Resources

- Avoidance, to the extent feasible, is key to protecting historically significant cultural resources, biological resources, endangered species and plants.
- Project area is mostly Federal land (BLM, FWS, and BOR) and also includes FMIT-owned land.
- Protection of sites is required by Federal and State law.
- PG&E will avoid and/or minimize adverse effects on historically significant cultural resources to the maximum extent practicable.

Worker Responsibility

- Avoid sensitive cultural resources to the extent feasible.
- Avoid fenced, barricaded, or closed locations.
- Keep equipment and personnel within designated routes.
- Avoid exploring the area when on free time.
- Do not disturb archeological sites and burials and do not collect artifacts; such activities are illegal.
- Communicate with PG&E representatives.
- Stay within work areas and do not wander.

Consequences of Noncompliance

- PG&E will not tolerate any disrespectful behavior in the field and will remove any staff, workers, or contractors who do not comply.
- PG&E will document any knowledge of damage or destruction of any historically significant cultural resource, and when required, shall report any such damage or destruction to the appropriate legal authorities.

2.3 Training Approach and Materials

PG&E will develop an outline of information to be covered in the training. This outline will be shared with Interested Tribes for their input.

In addition, presentation materials may also be developed and used. PG&E will share these materials with Interested Tribes for their input. These materials may include the following:

- Printed guideline materials for each attendee.
- PowerPoint and/or video presentations.
- Existing presentations (such as the orientation presentation materials).
- Additional new presentations as developed or suggested by Interested Tribes.

2.4 Training Session Presentations

PG&E will be responsible for conducting these training sessions. PG&E will discuss with Interested Tribes their interest and willingness to participate in some of the training sessions and will attempt to coordinate schedules accordingly. At all training sessions, tribal representatives present will be offered the opportunity to share information with the trainees.

- Materials from the Tribes will not be used for other purposes.
- Tribes will maintain the resources they will use during the training.

Orientation subcommittee items will be included in this Program.

2.5 Training Session Scheduling

Field Project Orientation Meetings will be scheduled when required for the initiation of substantial fieldwork project phases. These meetings will be scheduled in advance and communicated to all stakeholders.

Training for new workers to the site will not be scheduled in advance. These sessions will take place on an ad-hoc basis on or before the first day of fieldwork for the new site worker.

Similarly, training for new employees involved with design work will take place on an ad-hoc basis as soon as practicable for the new design worker, but at a minimum, before the new worker works in the field.

2.6 Training Records

PG&E will develop a training checklist document which will be dated, signed by the trainee, and signed by the trainer.

CUL-4: Discovery of Human Remains

CUL-4 DISCOVERY OF HUMAN REMAINS

CUL-4: PG&E shall notify and communicate with Tribes pertaining to any discovery and treatment of Native American human remains and/or burial goods. Ground-disturbing activities during all Project phases may disturb as-yet undiscovered human remains or Native American burials and associated burial goods potentially resulting in damage. To the maximum extent feasible, Mitigation Measure CUL-4 shall be implemented in a manner consistent with mitigation required by local, state, and federal requirements. PG&E shall retain a Qualified Cultural Resource Consultant (Consultant), a qualified archaeologist and/or physical anthropologist with expert skill in the identification of human osteological (bone) remains. In the event human remains and/or burial goods are uncovered over the course of Project construction, operation and maintenance, or decommissioning activities, the following procedures shall be followed to ensure compliance with all applicable local, state, and federal laws (see also CUL-4 in the 2011 *DTSC Topock Compressor Station Final Remedy FEIR* and the *Mitigation Monitoring and Reporting Program* (MMRP) documents). PG&E is responsible for implementing these measures with DTSC oversight.

Implementation Procedures

- The Consultant and a designated tribal monitor(s) shall train construction personnel in the identification of human remains and potential burial goods so they may aid in their identification.

- The Consultant and tribal monitor(s) shall be in place at the start of each construction event to adequately oversee all ground-disturbing activities.

- Upon discovery of materials that may be human remains and/or burial goods, the construction contractor shall immediately suspend work within the vicinity of the discovery.

- A determination if the remains discovered are human shall be made by the Consultant.

- If determined to be human remains and/or burial goods, the Consultant (and tribal monitor), or construction contractor, shall protect the discovered materials remaining in the ground from additional disturbance.

- All subsequent action shall conform to the protocols established in the state health and safety codes and regulations of California or Arizona depending on the discovery location.

- The Consultant, PG&E archaeologist, or construction site supervisor shall contact the appropriate county coroner, and the PG&E and DTSC project managers immediately.

- The coroner will determine if the remains are recent in origin and if an investigation of the cause of death is required (see California Health and Safety Code §7050.5 or Arizona Code of Criminal Procedure Title 1, Article 49.04).

- If the coroner determines the human remains are **not** Native American and not evidence of a crime, project personnel shall coordinate with the Consultant to develop an appropriate treatment plan which may include contacting the next-of-kin to solicit input on subsequent disposition of the remains.

    - If no next-of-kin is found, or recommendations by the next-of-kin are considered unacceptable by the landowner, the landowner will reinter the remains with appropriate dignity in a location outside the project area where they would be unlikely to be disturbed in the future.

- If on **Federal land** and the coroner determines the human remains are Native American and not evidence of a crime, PG&E shall notify the BLM Havasu City field office and initiate compliance with applicable federal laws and regulations, including the Native American Graves Protection and Repatriation Act, in conformance with §8.2 and Appendix D (Plan of Action) of the *Cultural and Historic Properties Management Plan* (CHPMP).

- If on **non-Federal lands** and the San Bernardino or Mohave County Coroner determines that the human remains are Native American and not evidence of a crime, the Consultant shall pursue the following actions to determine the proper treatment and disposition.

    - In California, Project personnel shall contact the California Native American Heritage Commission (NAHC) to identify a most likely descendent (MLD) as required under California Public Resources Code §5097.98.

        - The MLD(s) shall be invited to inspect the area in which the human remains were found and provide treatment recommendations to the landowner and PG&E site manager in accordance with the provisions of PRC §5097.98.

        - Treatments may include reburial, scientific removal of the discovered human remains and relinquishment to the MLD(s), nondestructive analysis of human remains and/or other culturally appropriate treatment.

        - If the MLD(s) so requests, the landowner will reinter the remains with the appropriate dignity in a location outside the area of disturbance in a location unlikely to be disturbed in the future.

    - In Arizona, Project personnel shall contact the Arizona State Museum (ASM) as required by Arizona Revised Statute (ARS) §41-844.

- ASM will follow procedures identified in the ASM's *A.R.S. §41-844 and §41-865 Guidelines*, issued November 12, 2009, to notify tribes that occupy or have occupied the place of discovery, the Arizona Commission on Indian Affairs, and the intertribal council of Arizona.

- ASM shall convene a meeting of notified entities to determine proper disposition and treatment of the materials, including curation or reburial.

- If no person of direct kinship is identified or a group with cultural affinity, ASM shall follow procedures in §41-844.G. for disposition

Appendix Q
Site Security Plan
(On CD-ROM Only)

Appendix Q

Site Security Plan for the Final Groundwater Remedy

PG&E Topock Compressor Station, Needles, California

Prepared for

Pacific Gas and Electric Company

November 2015

CH2MHILL®

155 Grand Avenue, Suite 800
Oakland, CA 94612

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Acronyms and Abbreviations

BLM	U.S. Bureau of Land Management
BOR	U.S. Bureau of Reclamation
DOI	U.S. Department of the Interior
DTSC	California Department of Toxic Substances Control
EIR	Environmental Impact Report
FCR	Field Contact Representative
PG&E	Pacific Gas and Electric Company
USFWS	U.S. Fish and Wildlife Service

SECTION 1

Introduction

Pacific Gas and Electric Company (PG&E) is implementing the selected groundwater remedy for chromium in groundwater at the Topock Compressor Station in San Bernardino County, approximately 15 miles southeast of Needles, California, and west of the Colorado River. Remedial activities at the Topock site are being performed in conformance with the requirements of the Resource Conservation and Recovery Act Corrective Action pursuant to a Corrective Action Consent Agreement entered into by PG&E and the California Department of Toxic Substances Control (DTSC) in 1996. In addition, PG&E and the United States executed a Remedial Design/Remedial Action Consent Decree, on behalf of the U.S. Department of the Interior (DOI), under the Comprehensive Environmental Response, Compensation and Liability Act in 2012, which was approved by with the U.S. District Court for the Central District of California in November 2013.

Implementation of the groundwater remedy consists of several phases, including design, construction, startup, operation and maintenance, post-remediation monitoring, decommissioning, and restoration. This Site Security Plan has been prepared to outline PG&E security plans and protocols for the groundwater remedy, including physical security measures, inspections, notification and reporting, and worker training and access.

1.1 Purpose and Objectives

Security measures and protocols identified in this plan are intended to fulfill the requirements of the DTSC's January 2011 *Final Environmental Impact Report for the Topock Compressor Station Groundwater Remediation Project* (EIR) Mitigation Measure Cul-1a-3b, which requires the preparation of a Site Security Plan outlining instructions for performing inspections of the project site and notifying land owners and DTSC of human-caused disturbance to project facilities or significant cultural resources. CUL-1a-3b requires:

> *The site security plan shall include, but not be limited to, instructions for PG&E personnel to inspect the project site routinely during construction and report any human-caused disturbance to project facilities and the surrounding environment to DTSC and the appropriate landowner, such as BLM, USFWS, or FMIT, as appropriate, depending on the ownership of the property involved in the incursion. Notification shall be within a specified period, as established in the site security plan for the event, and shall also be summarized as part of the periodic implementation status report, as approved by DTSC for remedy implementation. This measure does not impose any obligation on PG&E to perform law-enforcement duties on federal or private lands, but is intended to provide increased observation of potential intrusions into the project area during construction and operation of the final remedy that may impact significant cultural resources. PG&E staff, or assigned agents, should be instructed to report any outside disturbance to the environment personally observed over the course of the working day.*
>
> *Information shall be reported within a specific period, as established in the site security plan, to DTSC and the appropriate landowners, such as BLM, USFWS, or FMIT, depending on the ownership of the property intruded upon. The site security plan may also include the use of PG&E security cameras at major ingress/egress gates into the project site. Finally, if requested by the FMIT the plan may include the use of private security personnel to patrol the FMIT-owned parcel within the project area to prevent outside incursions.*

In addition, the Site Security Plan outlines additional PG&E-required security provisions for protection of equipment and facilities throughout the various phases of the remedy.

1.2 Site Security Approach

The selected groundwater remedy for the Topock site will be constructed and implemented over many years. Construction, functional testing, and startup will occur over approximate 3 to 5 years, and the system is expected to operate over several decades. Specific security measures many change over the course of the project.

Construction of the groundwater remedy will include:

- Performing mobilization and construction setup
- Installing approximately 135 groundwater wells (including provisional wells)
- Constructing more than 121,000 lineal feet of water/liquid/utility pipes and conduit and 97,000 feet of electrical conduits and cables.
- Constructing roads and temporary access areas
- Constructing aboveground infrastructure, including buildings, tanks, and power/controls as well as other supporting facilities.

The construction will occur over an approximately 35-acre area, with infrastructure installed on both the California and Arizona sides of the Colorado River. Remedial components will be constructed within a variety of settings, including the operating areas of the Topock Compressor Station, within the floodplain of the Colorado River, along and beneath existing transportation/utility corridors, and within washes and terraces. Owners of property where remedial systems will be installed include:

- U.S. Bureau of Reclamation (BOR) (managed by the U.S. Bureau of Land Management [BLM])
- Havasu National Wildlife Refuge (managed by the U.S. Fish and Wildlife Service [USFWS])
- BLM
- BNSF Railway
- Fort Mojave Indian Tribe
- Kinder Morgan
- PG&E
- California State Lands Commission
- Arizona State Lands Department
- Private property owners (LeVan, Smith)

In addition, infrastructure is planned on county roadways or their rights-of-way (San Bernardino County, Mojave County) as well as roadways and rights-of-way of state transportation agencies (California and Arizona Departments of Transportation) and utility easements.

Much of the groundwater remedy infrastructure will be constructed below ground, including the groundwater wells and much of the piping and conduit. Following construction, functional testing, and startup, operation of the groundwater remedy will include system operation, routine maintenance, and sampling and data collection.

The approach to site security for the groundwater remedy facilities includes the following general principles:

- Security for remedial facilities located inside the Compressor Station will be provided for by the existing Compressor Station security system and are not addressed further in this plan.
- Remedial facilities outside of the Compressor Station will be equipped with security features/systems consistent with PG&E's security standards. Security features for remedial facilities at Moabi Regional Park include but are not limited to the following:
    - Perimeter fencing with gates equipped with chains and locks. Vehicle entrance to certain areas may have sliding/motorized gate with keypad/card reader entry

  - Security alarm system (not connected to the Compressor Station).
  - Security/yard lighting
  - Closed-circuit security camera mounted to monitor entry to certain locations.

- PG&E is responsible for its employees and workers under direct contract, and PG&E has established worker-training procedures to limit the footprint of PG&E-performed activities. With regard to activities performed by site visitors and the general public, however, PG&E's worker training procedures are limited to the observation and notification protocols identified herein and do not obligate PG&E to perform law-enforcement duties on government or privately- lands.
- Construction contractors will establish and enforce their own separate security measures for safeguarding their equipment, materials, and constructed facilities.
- Separate from security measures discussed in this plan, the Hazardous Materials Business Plan and Health and Safety Plan outline control measures, such as temporary fencing or barriers for hazardous waste accumulation areas or work zones established for safety purposes that are otherwise accessible to the general public, as well as communication systems and signs that may be posted warning of the storage of hazardous materials or waste and emergency contact information. These measures are not repeated in this plan.

SECTION 2

Security Measures

2.1 Engineering Controls

Engineering controls are anticipated to be established for the purpose of safeguarding equipment, materials, and constructed remedial facilities; to ensure noninterference with remedy operations; and to protect the health and safety of personnel, the public, and the surrounding environment.

2.1.1 Engineering Controls during Construction

During construction, PG&E will establish a construction headquarters that will be equipped with security features consistent with PG&E's current security standards, such as perimeter fencing with gates equipped with chains and locks, security alarm system, lighting, and cameras. Separately, satellite staging areas will be established for use by construction contractors for storage of equipment and supplies. Some of the satellite staging areas may be fenced and locked and may include cameras and alarms. Lighting for security of construction equipment and materials will be temporary and will include: (1) shrouding/shielding for portable lights; (2) installation of portable lights at the lowest allowable height and in the smallest number feasible to maintain adequate night lighting for safety; and (3) shielding and orientation of lights such that offsite visibility of light sources, glare, and light is minimized to the extent feasible, in conformance with Mitigation Measure CUL-1a-7.

Construction contractors will have separately established security plans for safeguarding their equipment and materials. While contractors may elect to, and likely will, use the PG&E-established construction headquarters and satellite staging areas, contractors are solely responsible for the security of their equipment, materials, and associated property, even if stored at PG&E-established storage areas. The contractor/contractors may elect to install additional security measures; these measures need to be coordinated with and approved by PG&E or their responsible representative. Contractors are not allowed to establish new site staging areas without review and approval by PG&E or its representative. Installation, operation, and maintenance of security measures at non-PG&E-established areas, even if the area is approved by PG&E for use by the contractor, is the sole responsibility of the contractor.

Protocols for protective measures for archaeological/historic sites during construction are provided in the Cultural Impact Mitigation Program. Protective measures may include, but are not limited to, protective coverings of soil or riprap, onsite personnel to prevent access to sensitive areas, use of flagging, blaze orange mesh fencing secured to steel posts, bollards, natural barriers of rocks or piled brush, cables suspended between secure posts, and/or signage (for example, "This Area Closed" or "Exclusion Zone: Keep Out"). Such measures will be temporary (only as needed during construction) and will, to the extent practicable, not call undue attention to the nature of the resource being protected.

2.1.2 Engineering Controls during Operation and Maintenance

Site security measures for remedial facilities outside the compressor station will be equipped with security features/systems consistent with PG&E's current security standards. Such features are site specific, as necessary and, consistent with landowner, land manager and/or leaseholder requirements, could include, but are not limited to, security fencing to protect the equipment and provide safety for personnel and the public; locks and chains to prevent unauthorized access; security devices and instrumentation; security communication systems; alarms to notify PG&E's security operations; key card systems; and security cameras.

The Basis of Design Report/Final (100%) Design Submittal for the Final Groundwater Remedy (Final BOD) and engineering design plans/drawings (see Appendix D of the Final BOD) contain the engineering controls for permanent facilities. Examples of security features to be installed at remedy facilities at the Transwestern Bench, MW-20 Bench, and HNWR-1A well site are described below.

2.1.2.1 Transwestern Bench

Examples of security features to be installed at this site are as follows:

- A perimeter fence will be installed with a motorized main gate and a personnel gate. The main gate will have a security card reader and camera to monitor and prevent unauthorized access.
- Perimeter cameras will be installed at the Operations Building.
- The Operations Building will have card readers at entrances.

2.1.2.2 MW-20 Bench

Examples of security features to be installed at this site are as follows:

- Each new gate(s) will have a security card reader and camera.
- Additional perimeter cameras will be installed.
- Two motorized gates with security card readers and cameras will be installed.
- The carbon amendment building will have card readers at all entrances.

2.1.2.3 HNWR-1A Well Site

Examples of security features to be installed at this site are as follows:

- A perimeter fence will be installed.
- Security camera will be installed to monitor and prevent unauthorized access.
- A gate with a lock and/or card reader will be installed.

2.1.2.4 Moabi Regional Park Long-Term Remedy Support Area

- A perimeter fence will be installed.
- Gates will include a motorized sliding gate with keypad/card reader entry and swing gates equipped with high security chains and locks.

In compliance with the EIR mitigation measure CUL-1a-6, additional phone calls and alarms associated with remedial activities security systems will not be routed through PG&E's existing audible alarm annunciator system within the Compressor Station.

2.2 Inspections

Inspections will be performed to provide increased observation of potential intrusions during construction and operation of the final remedy that may impact significant cultural resources. Inspections for this purpose will be performed by site personnel during working hours and potentially by a security patrol during nonworking hours.

During working hours, inspections will be performed regularly by inspecting site work against pre-established work zones. The level of inspection will vary depending on the nature of the activity and the phase of the project. For construction and maintenance activities requiring staging of equipment and materials, work zones will be pre-established and demarcated with flags, fencing, or natural materials (rocks or piled brush) consistent with the Cultural Impact Mitigation Program. During the construction phase, PG&E has retained a qualified archaeologist, Applied EarthWorks, to define the construction zones and protective measures around archaeological or historical sites, and construction inspectors will review work activities routinely to ensure that the construction zones and protective measures are being maintained. For routine operation and maintenance functions following startup of the remedial system, inspections will occur less frequently and will be focused on those remedial facilities where vehicles and personnel routinely visit. Inspections will focus on ensuring that personnel are using designated travel routes and parking areas.

Inspections during working hours will focus on active construction, operation, and maintenance work performed by PG&E and its contractors. Inspectors will not be actively observing other landowner/land manager or leaseholder activities in the site vicinity nor activities by the public. Inspectors will stay on designated travel routes; evidence of human presence outside the designated travel routes or work zones will not be cause for inspectors to further investigate.

Inspections during nonworking hours are anticipated to be provided by a private security patrol service. During nonworking hours, the private security patrol officer will visit a number of site locations regularly. At each location, the security officer will document the visit, the time and unusual circumstances on a signoff form. The signoff forms will be completed daily; completed forms will be maintained. To ensure that the security officer regularly travels around the site, electronic time and date recorders may be installed at designated locations. The security officer will check in at each recorder unit to record the time and date that he or she visited the location. If visitors are expected at the site during nonworking hours, the Site Operations Manager or designee will brief the site security officer, and the site security officer will be given specific instructions regarding the activities of scheduled visitors. If a visitor arrives at the site during nonworking hours and the site security officer did not receive prior notice regarding the visitor, the site security officer will immediately contact the Site Operations Manager or designee to obtain further instructions. If authorization is not obtained, the visitor will be asked to leave the site. The surrounding area is used for recreation, and the security patrol cannot control activities that are not on PG&E property or related to the construction and operation of the groundwater remedy. The security officer will note any activities observed offsite that may affect cultural or biological resources, such as dirt-bike riding or use of all-terrain vehicles.

During construction, PG&E will not be responsible for performing any security inspections at any contractor-established storage or staging areas, even if they are approved by PG&E.

2.3 Notification and Reporting

PG&E staff or assigned agents will be instructed to report any outside disturbance to the environment personally observed over the course of the working day. Should a designated inspector or assigned agent observe disturbance to the environment over the course of the working day, notification will be provided to PG&E, DTSC, and the corresponding landowner/land manager. Notification will be provided by telephone within 1 working day of observation. Information to be provided in the notification includes:

1. Location of observation
2. Date and time
3. Nature of activity
4. Whether the activity is associated with the groundwater remedy construction, operation or maintenance

Identified disturbances will be reported to DTSC and the respective landowner/land manager. Notification will be made by telephone with the following contacts:

- **DTSC:** Aaron Yue at 714/484-5439
- **DOI**: Pam Innis at 602/417-9578
- **BLM, Lake Havasu Field Office, Lake Havasu City, AZ:** General Phone: 928/505-1200 or Jason West at 928/505-1205
- **USFWS, Havasu National Wildlife Refuge, Needles, CA:** General Phone: 760/326-3853 or Linda Miller at extension 22
- **San Bernardino County:** Maureen Snelgrove at 909/855-5709 or Troy Burton at 909/387-2648

- **BNSF Railway:** Scott Johnson (Corporate Security) at 815/403-8214
- **Fort Mojave Indian Tribe:** Linda Otero at 928/768-4475 or 702/526-4679
- **Kinder Morgan:** Robert Cefalu at 928/727-5441

As appropriate, law enforcement will be contacted for security observations related to theft or vandalism:

- **Local Emergency Response:** 911
- **San Bernardino County Sheriff, City of Needles Police Department, Needles, CA:** General Phone: 760/326-9200
- **Mojave County Sherriff Department:** General Phone: 928/768-7055

In conformance with EIR Mitigation Measure CUL-1a-3b, notifications of disturbance to the environment will also be included in the quarterly EIR mitigation measure compliance monitoring reports to be submitted to DTSC quarterly during the construction period and annually during the operations and maintenance period.

2.4 Worker Training and Access

PG&E has an established worker training program for contractors and subcontractors under its direct control, pursuant to its commitment to constructing and operating the groundwater remedy in a manner respectful of the sacredness and sensitivity of the resources at and near the project area. PG&E will also establish access procedures for visitors associated with the project but who are not under PG&E control, such as regulators, landowners and leaseholders of land or facilities that touch the footprint of construction, utility companies, stakeholders, and tribal monitors. With the exception of the Topock Compressor Station, PG&E will not establish training or other responsibilities associated with members of the general public who are not associated with the groundwater remedy project.

2.4.1 Worker Training

Consistent with its obligations under the Programmatic Agreement's Monitoring Protocol, existing PG&E standard practice, and the EIR mitigation monitoring and reporting program requirements, cultural sensitivity training is required of staff, workers, and contractors engaged in activities within the Area of Potential Effect to familiarize these personnel with the sacred nature and cultural significance of the area so that they will perform their jobs in a respectful manner. The training will occur before performing onsite work.

This training includes discussion of appropriate behavior, activities that are to be avoided, and consequences for noncompliance. Consistent with these obligations, PG&E will not tolerate any disrespectful behavior in the field and will remove staff, workers, or contractors who do not comply with this section.

2.4.1.1 Cultural and Historical Resources

Cultural and historical resources sensitivity education has been a central part of the Topock remediation project to date. The existing education on cultural/historical resources sensitivity for Topock occurs via periodic training and project initiation meetings. Sensitivity training classes are conducted at least annually and are attended by all workers available to participate. Sensitivity training/education is also provided at project initiation meetings, typically held at the site and prior to field work. Site orientation will stress that site activities will be conducted in a respectful manner. New site workers will be required to receive the training before working on ground-disturbing activities. Sensitivity training will be provided by PG&E Site Operations Manager and the PG&E Remediation Resources Specialist, and PG&E will invite participation from the Tribes, archaeological monitors, and agency staff, as appropriate.

Several EIR mitigation measures associated with the groundwater remedy (for example CUL-1a-13, CUL-1b/c-4, and CUL-4) are related to continued training of workers regarding cultural resources, historical

resources, and the identification of human remains. Implementation of the worker cultural sensitivity education program per CUL-1a-13 is underway.

2.4.1.2 Biological Resources

As with cultural and historical resources, biological resources sensitivity education has also been a central part of the Topock project. PG&E's education program covering threatened and endangered species, wetland awareness, and the general project management measures specified under the Programmatic Biological Assessment and agreements is provided at project initiation meetings, typically held at the site and prior to field work. The training is provided by the PG&E Topock Site Operations Manager, the PG&E Project Biologist, and supporting contract biologists. New employees will receive the training prior to working onsite.

In accordance with the Programmatic Biological Assessment, PG&E-designated Field Contact Representatives (FCRs) will be responsible for overseeing compliance with the general project management measures. The FCRs have the authority to halt activities that pose a danger to listed species and/or are in violation with the management measures. A qualified biologist will conduct a preconstruction survey for special-status wildlife species immediately prior to initiation of ground-disturbing activities. Within 60 days of completion of construction activities, the FCR and the qualified biologist will prepare a report for submittal to the Bureau of Land Management.

2.4.2 Visitor Access

During construction of the groundwater remedy, PG&E will establish a central meeting location (construction headquarters) for site visitors associated with the project but not under PG&E control, such as regulators, landowners and leaseholders of land or facilities touching the footprint of construction, utility companies, stakeholders and tribal monitors. Upon arrival at the site, visitors will check in at the designated construction headquarters first before entering the project site. At the construction headquarters, the visitor will sign the visitors' log and meet the designated PG&E representative for the site visit.

During operation and maintenance of the groundwater remedy, PG&E will establish a designated location for site visitors. Similar visitor check-in requirements will be established, as described above.

First-time visitors will be provided with natural and cultural resources awareness and site safety orientation prior to further work at the site and will complete a sign-off form before entering the site for the first time, acknowledging understanding of the site access requirements. Repeat visitors will be asked to renew their understanding of the site access requirements annually. A master list of companies and utilities and their employees and individuals who have signed the signoff form will be kept at a designated location and will be verified when each person arrives at the site.

Visitors to the site will meet the designated PG&E representative to verify that he/she is aware of the visit and to obtain instructions on access restrictions or considerations related to the purpose of the visit. To ensure safety for vehicular traffic on National Trails Highway, PG&E may arrange for transportation of visitors or otherwise organize consolidation of travel vehicles associated with the purpose of the visit. Visitors will not travel around the site without an escort unless the Site Operations Manager or designee permits otherwise. Visitors will be told not to enter restricted areas unless a cultural or biological monitor is present.

Visitor access procedures as described herein are intended to apply to visitors associated with the construction, operation, and maintenance of the groundwater remedy and are not intended to apply to parties that have established access rights to public and private land in the area, such as land owners/managers, utilities, law enforcement, concessionaires, or Compressor Station employees or suppliers.

2.5 Responsibilities

2.5.1 Regular Working Hours

Regular working hours have not yet been established for the remedy construction but will be set and communicated monthly. The Site Operations Manager (currently Curt Russell) or designee is responsible for controlling access during working hours. When the Site Operations Manager is not onsite, Field Activities Supervisor (currently Chris Smith) will act as an alternate for controlling site access. During working hours, the Site Operations Manager or Field Activities Supervisor are responsible for being aware of who is on the site.

2.5.2 Nonworking Hours

Outside of established regular working hours and all day on non-workdays, a private security firm may be employed to be responsible for patrolling the site and controlling access to constructed facilities.

PG&E will provide the site security firm with training regarding the procedures and rules outlined in this plan. The security officer on duty will be expected to understand security procedures and rules.

Appendix R
Waste Management Plan

Appendix R

Waste Management Plan for Groundwater Remedy Construction

PG&E Topock Compressor Station, Needles, California

Prepared for

Pacific Gas and Electric Company

November 2015

CH2MHILL®

155 Grand Avenue, Suite 800
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Acronyms and Abbreviations

ARAR	applicable or relevant and appropriate requirement
BMP	best management practice
C/RAWP	Construction/Remedial Action Work Plan
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DOI	U.S. Department of the Interior
EIR	Environmental Impact Report
IM-3	Interim Measures No. 3
MG	million gallons
PG&E	Pacific Gas and Electric Company
PPE	personal protective equipment
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
SDS	safety data sheet
STLC	soluble threshold limit concentration
SWRCB	State Water Resources Control Board
TC	toxicity characteristic
TCLP	toxicity characteristic leaching procedure
U.S.C.	United States Code
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
WET	California Waste Extraction Test

SECTION 1

Introduction

This Waste Management Plan presents procedures for the proper collection, characterization, storage, transportation, and disposal of waste generated during the construction and startup of the groundwater remedy at the Pacific Gas and Electric Company (PG&E) Topock Compressor Station (TCS) in Needles, California. Wastes generated from construction and startup activities will be managed onsite in compliance with the Environmental Impact Report (EIR) mitigation measures in the certified EIR (DTSC 2011), as adopted in the Mitigation Monitoring and Reporting Program (MMRP), and the applicable or relevant and appropriate requirements (ARARs) established in the Record of Decision (U.S. Department of the Interior [DOI] 2010) and will be disposed of offsite in a manner consistent with applicable local, state, and federal laws and regulations and in compliance with the Consent Decree (DOI 2013).

SECTION 2

Expected Waste Streams

Expected waste streams from remedy construction and startup activities and their estimated quantities are described in this section.

2.1 Wastewater

Expected waste streams resulting from wastewater are as follows:

- **Wastewater generated from well installation, development, testing, and sampling.** The current estimated total volume of wastewater generated over the entire construction period is 25 million gallons (MG). It is expected that the majority of this wastewater stream will be trucked or conveyed to and managed onsite at the existing Interim Measures No. 3 (IM-3) treatment plant, TCS evaporation ponds. In addition, water from well testing/sampling will be injected into an appropriate well (through a filter to remove particulate matter) of similar aquifer water quality subject to availability and in accordance with the substantive requirements. Excess or hazardous wastewater will be transported offsite for treatment/disposal.
- **Remedy-produced water generated during remedy startup, such as backwashing of wells.** This wastewater stream will be transported onsite via piping or trucking to the remedy-produced water conditioning plant (inside the TCS), conditioned by removing solids and pH adjustment, and transported via piping to the in-situ reactive zone wells for re-injection. The estimated total volume of remedy-produced water is 7.6 MG per year. No offsite transportation is anticipated for this waste stream.
- **Miscellaneous wastewater streams (for example, equipment decontamination, rainfall that collects in secondary containment areas).** These waste streams will be managed onsite via IM-3 and/or TCS evaporation ponds. During startup, these waste streams may be managed by piping or trucking to the remedy-produced water conditioning plant (inside the TCS). Excess wastewater will be transported offsite for disposal.
- **Water from hydrotesting of conveyance piping system.** It is anticipated that this water will be generally clean and therefore suitable for reuse in testing, dust control, backfill moisture control, and other similar onsite uses.

2.2 Displaced Soil

Displaced soil can include soil as the result of well drilling and installation of pipe trenches/access roads. Displaced soil will be managed in accordance with the Soil Management Plan, provided as Appendix L to the Construction/Remedial Action Work Plan (C/RAWP). After accounting for on-site processing and reuse of soils, approximately 11,000 cubic yards of clean soil will remain on site. The clean soil will include approximately 3,000 cubic yards of drill cuttings and 8,000 cubic yards of soil generated by other construction activities. Approximately 4,000 cubic yards of non-hazardous soil, which includes 3,000 cubic yards of drill cuttings and 1,000 cubic yards generated by other construction activities, will be disposed of off-site. In addition, approximately 800 cubic yards of excavated bedrock are expected to be removed for the construction of remedial facilities inside the TCS. Excavated bedrock will be managed in a manner similar to oversized rocks in displaced soil. Based on contaminant concentrations at soil investigation areas near the Topock Compressor Station, soil to be generated from construction activities is not expected to be characterized as hazardous waste.

2.3 Precipitated Solids, Sludge, and Spent Filters Generated from Remedy-produced Water Conditioning Process

The amount of precipitated solids and sludge is estimated to be 1.6 tons (dry weight) per year, based on 7.6 MG per year of remedy-produced water, using 25 percent caustic to neutralize the first flush of well rehabilitation water. The amount of spent filters is estimated to be 0.45 ton (dry weight) per year. These waste streams will be transported offsite for disposal.

2.4 General Construction Waste

The following general construction waste streams will be transported offsite for recycling or disposal:

- Concrete and asphalt pavement rubble (from construction within roads, TCS)
- Construction and demolition debris (lumber, gypsum wallboard, glass, metal, roofing material, carpeting, plastic pipe, etc.)
- Used personal protective equipment (PPE)
- Miscellaneous waste, including trash, paper bags, cardboard boxes, office debris, etc.
- Empty drums/cans, unused chemicals/paints, used oil, used solvents, oily solids, and used fuel filters/ parts from equipment maintenance, etc.
- Universal waste, including batteries, electronic devices, lamps, aerosol cans, and mercury-containing equipment.
- Sampling equipment, such as calibration gas cylinders

2.5 Sanitary Waste

This waste stream will be handled by portable toilets, with the exception of the temporary facilities that may be able to tie into existing sanitary systems, such as the Compressor Station and the planned construction headquarters at Moabi Regional Park.

SECTION 3

Waste Characterization and Classification

3.1 General Requirements

The majority of construction-related wastes are anticipated to be non-hazardous and can be classified (their regulatory status determined) and disposed of or recycled without prior characterization (testing to determine chemical or physical properties). Some wastes will require characterization prior to disposal so that they can be classified accurately. Wastes will be evaluated based on knowledge of the generating process, chemical composition of materials involved, and for environmental media, existing site characterization data. Waste classification will be performed following the hierarchy specified in California action-specific ARAR 74, Standards Applicable to Generators of Hazardous Waste (Title 22, California Code of Regulations [CCR] Section 66262.11) (DOI 2010), as follows:

- Determine whether the waste is exempt from regulation.
- Determine whether the waste is a listed hazardous waste.
- Determine whether the waste exhibits hazardous waste characteristics.
- If the waste is hazardous, determine whether waste-specific exclusions or restrictions apply.

Listed hazardous wastes are not present in environmental media at the site; therefore, classification of these materials will be based solely on hazardous waste characteristics. A listed waste determination will be performed for chemicals brought to the site as part of the construction process that must subsequently be disposed of as waste.

Sampling and analysis for hazardous waste characteristics will use methods specified in SW-846, *Test Methods for Evaluation Solid Waste, Physical/Chemical Methods* (USEPA 2007). Test results will be compared to hazardous waste characteristic levels presented in 22 CCR Division 4.5, Chapter 11, Article 3, Characteristics of Hazardous Waste.

Waste material with the potential to be hazardous wastes will be characterized per the procedures outlined below. Note that once the characteristics or profile of a waste stream is established, PG&E will continue to use the same waste profile unless a process change indicates that the waste stream should be re-characterized.

3.1.1 Liquid Wastes

Liquids will be classified as hazardous waste if they exhibit hazardous waste characteristics. Characterization will be conducted as appropriate as defined in the following sections. Three expected liquid wastes at the site include liquid with a pH of 2.0 or below or 12.5 or above, a dissolved chromium concentration equal to or greater than 5 parts per million (ppm), and/or dissolved arsenic concentration equal to or greater than 5 ppm. Liquids will be evaluated for the presence of metals having hazardous waste toxicity characteristic levels specified in 22 CCR 66261.24 using the following approach:

- For liquid wastes containing less than 0.5 percent filterable solids, the filtered liquid will be analyzed for total metals, and the results will be compared with the Resource Conservation and Recovery Act (RCRA) toxicity characteristic (TC) limits in 22 CCR 66261.24(a)(1) and the soluble threshold limit concentrations (STLC) in 22 CCR 66261.24(a)(2). If any constituent exceeds the RCRA TC limit, the waste will be classified as RCRA hazardous. If no constituents exceed the RCRA TC limit, but one or more constituents exceed the STLC, the waste will be classified as non-RCRA hazardous. If neither limit is exceeded, the waste will be classified as nonhazardous.
- For liquid wastes containing 0.5 percent or more filterable solids, the filter solids will be analyzed using the toxicity characteristic leaching procedure (TCLP), and the results will be compared with the RCRA TC limits. If a TC limit is exceeded, the waste will be classified as RCRA hazardous. If no TC limits are

exceeded, the waste will be analyzed using the California Waste Extraction Test (WET), and the results compared with the STLCs. If one or more STLCs is exceeded, the waste will be classified as non-RCRA hazardous. If neither limit is exceeded, the waste will be classified as nonhazardous.

3.1.2 Solid Wastes

Solid wastes will be analyzed for total metals expressed in milligrams per kilogram, and the results will be evaluated as follows:

1. If the total constituent concentration exceeds the total threshold limit concentration in 22 CCR 66261.24(a)(2), material will be classified as a non-RCRA hazardous waste. Additional evaluation of the STLC, as described in Step 3 below, will not be performed.
2. If the total constituent concentration exceeds the numeric value of the RCRA TC level by 20 times or more, the TCLP will be performed. If the constituent concentration in the TCLP leachate exceeds the TC level, the material will be classified as a RCRA hazardous waste. Additional evaluation of the STLC, as described in Step 3, will not be performed.
3. If the material has not been classified as hazardous waste in Steps 1 or 2, the total constituent concentration will be compared to the STLC. If the total constituent concentration exceeds the numeric value of the STLC by 10 times or more, the WET will be performed. If the constituent concentration in the WET exceeds the STLC, the material will be classified as a non-RCRA hazardous waste.

If the material has not been classified as a hazardous waste in Steps 1, 2, or 3, it will be classified as nonhazardous waste.

3.1.3 Miscellaneous Wastes

Miscellaneous waste, such as trash, paper bags, and cardboard boxes, will be disposed of as nonhazardous solid waste unless affected by potentially contaminated material or water. Potentially contaminated miscellaneous waste will be combined with other hazardous waste. Empty, used 55-gallon drums that formerly contained hazardous materials will be labeled with the word “empty” and the date emptied and will be returned to the original chemical supplier or turned over to a drum reconditioner. Containers managed as empty will meet the requirements of 22 CCR 66261.7. Drums being reconditioned will be removed from the site within 1 year.

3.2 Characterization Requirements for Specific Waste Types

Characterization requirements for specific waste types are provided below.

3.2.1 Calibration Gas Cylinders

Safety data sheets (SDSs) will be reviewed to verify that calibration gas is Division 2.2 nonflammable gas that can be disposed of by venting to the atmosphere, as described in Section 4.2.3.

3.2.2 Surplus or Partially Used Chemicals

SDSs will be reviewed for surplus chemicals or container residues that do not meet the definition of “empty.” If SDS information is insufficient to determine waste classification, collect one representative sample and evaluate as described in Section 3.1.2. Analytical parameters will be selected based on the composition of the material involved.

3.2.3 Contaminated Concrete and Asphalt Rubble

Concrete and asphalt rubble will be classified as nonhazardous unless visual evidence of contamination is observed or generator knowledge suggests that contamination may have occurred. Concrete and asphalt associated with known hazardous waste or hazardous materials operations (such as the inside of containment structures for process chemicals) or that exhibits visual evidence of contamination (staining,

residue, etc.) will be sampled by chipping or coring (see Remedy-SOP-10, Sampling of Concrete/Asphalt Demolition Waste, in Appendix B of the C/RAWP. One composite sample consisting of four subsamples will be collected at each distinct area of demolition. Depending on their size, individual stained areas may be sampled separately. Samples will be collected from the stained areas to identify the nature of the contaminants. For waste disposal purposes, samples will be collected in accordance with procedures that are acceptable to the disposal site. Analytical parameters will be selected based on the history of activities performed in the area. Asphalt that exhibits oil stains in areas with no history of polychlorinated biphenyl use will not be sampled.

3.2.4 Concrete Saw-cutting Slurry

Concrete saw-cutting slurry will be tested for pH using USEPA Methods 9040C or 9045D. A single representative sample will be collected for each batch of waste.

3.2.5 Concrete Washout Water

Concrete washout water will be tested for pH by USEPA Methods 9040C or 9045D. A single representative sample will be collected for each batch of waste until several representative samples test below the hazardous waste limit of 12.5, after which time the washout water will be presumed to be non-hazardous. Washout water will be recycled to the maximum extent feasible.

3.2.6 Decontamination Solutions

Solutions generated by decontaminating equipment are not expected to exhibit hazardous waste characteristics. Testing will be performed initially to profile the solutions and to verify that the acceptance criteria for the disposal method being used (e.g., disposal at TCS evaporation ponds, IM-3 treatment plant, or offsite disposal) are being met.

3.2.7 Groundwater from Well Installation, Development, and Sampling

Groundwater will be classified based on analytical results from nearby wells or analysis of groundwater samples once the well has been constructed. If these data are not available, a representative sample will be collected and analyzed for the metals specified in 22 CCR 66261.24(a)(2) (Title 22 metals) using USEPA Methods 6010B and 7470A.

3.2.8 Used Oil

Used oil must be tested for flash point, polychlorinated biphenyls, and halogens. Testing is the responsibility of the used oil transporter/recycler.

3.2.9 Oily Solids, Used Absorbents Containing Oil, and Oily Rags

Oily solids (soil and absorbents) will be presumed to be hazardous unless tested and determined to be nonhazardous. Testing will be based on the requirements of the disposal site for establishing a waste profile. Anticipated parameters are total petroleum hydrocarbons using USEPA Method 8015B and Title 22 metals using USEPA Methods 6010B and 7470A. Oily rags are presumed to be nonhazardous if they do not contain free liquids and will not be tested.

3.2.10 Paint Waste

If possible, paint waste will be classified based on composition information contained in the SDS for the paint and associated solvents/thinners. If testing is necessary, a representative sample will be analyzed for Title 22 metals using USEPA Methods 6010B and 7470A and volatile organic compounds using USEPA Method 8260B.

3.2.11 Personal Protective Equipment

PPE will be characterized based on whether it has come in contact with contaminants and the degree of contamination. If direct contact is experienced and the PPE is visibly contaminated, it will take on the same

characteristics as the contacted media; however, PPE that shows no visible evidence of contamination will be disposed of as nonhazardous waste. No sampling and analysis will be performed.

3.2.12 Remedy-produced Water Generated during Remedy Startup

Remedy-produced water generated during remedy testing and startup, such as backwashing of wells, will be characterized as described in Section 3.1.1.

3.2.13 Sampling Equipment

Disposable sampling equipment will be characterized based on whether it has come in contact with contaminants and the degree of contamination. Equipment that is visibly contaminated and cannot be decontaminated will take on the same characteristics as the contacted media. If the media has been classified as hazardous, the sampling equipment will be classified and managed as hazardous waste. If the media has been classified as non-hazardous, the sampling equipment will be classified and managed as non-hazardous waste. Disposable sampling equipment that shows no visible evidence of contamination will be disposed of as nonhazardous waste regardless of the classification of the media to which it has been exposed. No sampling and analysis will be performed.

3.2.14 Soil

Displaced soil will be characterized and classified in accordance with the Soil Management Plan, provided as Appendix L to this C/RAWP.

3.2.15 Solids, Sludge, and Spent Filters from Remedy-produced Water Conditional Process

Precipitated solids/sludge and spent filters generated from testing and startup of the remedy-produced water conditioning process will be characterized as described in Section 3.1.2.

3.2.16 Spent Solvents

If possible, spent solvent waste will be classified based on composition information contained in the SDS and knowledge of the process using the solvent. If testing is necessary, a representative sample will be analyzed for Title 22 metals using USEPA Methods 6010B and 7470 and volatile organic compounds using USEPA Method 8260B or other constituents specific to the process generating the waste. Spent solvents will be evaluated to determine whether they are a listed hazardous waste, as described in 22 CCR Division 4.5, Chapter 11, Article 4.

3.2.17 Stormwater from Secondary Containment

Stormwater may accumulate in secondary containment structures during construction, before the process using the structures becomes operational. This collected water will be considered stormwater unless visual evidence of contamination or pollutant sources are identified, then it will be managed in accordance with Best Management Practices (BMP) Plan (Appendix M of the C/RAWP), which is consistent with the substantive requirements of the General Permit for Stormwater Discharges Associated with Construction Activities (2009-0009-DWQ) .

3.2.18 Water from Hydrostatic Testing of Conveyance Piping

Water from hydrostatic testing of conveyance piping may be reused onsite in a manner that complies with the State Water Resources Control Board (SWRCB) Water Quality Order No. 2003-003-DWQ, Statewide General Waste Discharge Requirements for Discharges To Land With A Low Threat To Water Quality. The permit states that “[t]he discharge of water main, water storage tank, water hydrant pipeline flushing, or hydrostatic testing water from tanks or pipelines that have been used to store or convey any medium other than potable water is prohibited, unless the Discharger has demonstrated to the Regional Board that all residual pollutant concentrations have been reduced to levels below Regional Board Basin Plan groundwater quality objectives.”(Paragraph 7 on page 4). The water generated from hydrostatic testing will be low-volume discharges with minimal pollutant concentrations and will not be reused in a manner that results in

a discharge to waters of the United States or waters of the state. The volume and date of each reuse event will be recorded.

3.3 Waste Profiles

Waste profiles will be prepared by PG&E based on the requirements of the disposal site.

3.4 USEPA Identification Numbers

The PG&E Topock Groundwater Extraction Site holds USEPA ID number CAR000151118.

SECTION 4

Management of Waste

This section contains procedures for onsite management of wastes temporarily stored and accumulated, as well as onsite management of construction wastewater.

4.1 General Waste Management Procedures

The following waste accumulation and handling procedures apply to all wastes. Additional or alternate management procedures for specific wastes are presented in Section 4.2.

4.1.1 Waste Storage Time Limit

Non-RCRA and RCRA hazardous wastes will be removed from the site within 90 days of the date that waste was first placed into the container or stockpiled. If accumulation begins in a satellite accumulation area the waste must be removed from the site within 1 year of the accumulation start date, or within 90 days from the date that the waste was transferred to a central accumulation area (Section 4.1.4). Nonhazardous waste should be removed from the site as soon as practical.

4.1.2 Labels

The labeling of waste containers will be in accordance with ARAR 79, Standards Applicable to Generators of Hazardous Waste (22 CCR 66262.34) and 49 CFR 172. Containers used to store/accumulate waste (including soil and groundwater) shall display one or more labels similar to the labels described below as soon as waste is placed in the container. Labels other than the ones shown below may be used as authorized by PG&E; labeling requirements for soil are outlined in the Soil Management Plan, provided as Appendix L to the C/RAWP. A hazardous waste label must be used if there is a possibility that the waste will be classified as hazardous. Universal Waste labels must be used for hazardous waste that qualifies as Universal Waste (e.g., aerosol cans, batteries, lamps, and electronic devices); see Section 4.2.27.

4.1.2.1 "Analysis Pending" or "Waste Material"



A temporary or handwritten label can be used until analytical results are received and reviewed. This label shall include the accumulation start date. These labels should only remain on the container for the length of time necessary to receive the results of waste characterization analyses, typically no longer than 2 weeks. Once results are received, the analysis pending label must be removed and the container relabeled, if necessary, within 10 days. An analysis pending label should not be used for wastes that have been classified as hazardous or nonhazardous based on generator knowledge, even if lab analysis of the waste is being performed.

4.1.2.2 "Hazardous Waste"



- Preprinted hazardous waste labels with the following information can be used:
  - Accumulation start date
  - Generator Name: PG&E Topock Groundwater Extraction Site
  - Generator Address
  - USEPA ID number: CAR000151118
  - Waste codes
  - Description of waste, including hazardous properties and physical state
  - U.S. Department of Transportation (USDOT) proper shipping name
  - Manifest document number (added prior to transportation)
- A hazardous waste label, along with an analysis pending label, must be used if there is the possibility that the waste could be classified as hazardous. If the waste is suspected to be hazardous but analysis is being performed to confirm the classification, do not fill in the waste code or USDOT proper shipping name until the analytical results have been received.

4.1.2.3 "Nonhazardous Waste"

Preprinted labels with the following information can be used:

- Generator Name: PG&E Topock Groundwater Extraction Site
- Generator Address
- Waste-specific information (for example, contaminated soil)



4.1.2.4 USDOT Hazard Class

The appropriate USDOT hazard class label will be placed on the container prior to loading onto the transport vehicle.

4.1.3 Segregation and Aggregation

Hazardous wastes will be segregated from nonhazardous wastes. Additionally, if incompatible wastes are generated (for example flammable and corrosive wastes), they must be segregated. Wastes of the same matrix, contamination and the same source may be aggregated to facilitate storage and disposal. Hazardous wastes will be aggregated only if they are from the same source and if they carry the same hazardous waste codes. Hazardous wastes will not deliberately be diluted.

4.1.4 Waste Accumulation Areas

4.1.4.1 Central or 90-day Hazardous Waste Accumulation Areas

Unless specifically designated as a satellite accumulation area (Section 4.1.4.2), hazardous waste accumulation areas will be managed as central or 90-day accumulation areas.

Central accumulation areas must be equipped with the following:

- Spill control and decontamination equipment suitable for the waste being accumulated
- Fire control equipment suitable for the waste being accumulated.
- Communication equipment to notify onsite personnel and summon external aid in an emergency.

Waste accumulation areas should not be located near storm drains or in locations where spilled material could be discharged to surface water.

4.1.4.2 Hazardous Waste Satellite Accumulation Areas

Satellite accumulation areas may be used to store hazardous waste at or near the point of generation at a location under the control of the operator of the process generating the waste. Satellite accumulation areas are limited to 55 gallons of waste or 1 quart of acutely hazardous or extremely hazardous waste. A separate 55-gallon limit applies to each incompatible waste, and to wastes that are not practicable to combine (e.g., prevents recycling or requires unreasonable accumulation procedures). Within 3 days of reaching the 55-gallon limit, the container must be moved to a central accumulation area. In addition to the accumulation start date, satellite accumulation containers must be marked with the date that they are moved to a central accumulation area.

Containers in satellite accumulation areas must be under the control of the operator of the process generating the waste, in good condition, compatible with the contents, and be kept closed except when adding or removing waste.

Satellite accumulation areas are not required to maintain the equipment described in Section 4.1.4.1 and are not subject to the inspections described in Section 4.1.8; however, meeting these requirements is still a good practice.

4.1.4.3 Nonhazardous Waste Accumulation Areas

Nonhazardous wastes must be accumulated in accordance with the best management practices specified in the BMP Plan (Appendix M).

4.1.5 Container Management

Wastes in containers shall be accumulated according to the following requirements, in accordance with California action-specific ARAR 84, Use and Management of Containers (22 CCR Division 4.5, Chapter 14, Article 9). A container is a device capable of being moved when full and not hard-plumbed or permanently attached to the ground or to other structures.

4.1.5.1 Containers

- Containers will be transported to the temporary accumulation area using proper handling methods, such as transportation by forklift on wood pallets, secured together with nonmetallic bonding, etc., as appropriate for the type of container being transported.
- Empty drums and other reusable containers that will be used for waste accumulation will be inspected and inventoried upon arrival onsite for signs of contamination and/or deterioration. Containers arriving onsite with contents will be rejected.
- Adequate aisle space (for example, 36 inches) will be provided for hazardous waste containers to allow the unobstructed movement of personnel and equipment. A row of drums should be no more than two drums wide.
- Each container will be provided with its own label, and the container will be oriented so that the label is visible. Labels will be replaced if they become damaged or faded. If a label is replaced, the original accumulation start date will be transferred to the new label.
- Containers will remain securely closed except when removing or adding waste.
- If a container becomes damaged or begins to leak, the contents will be immediately transferred to a new container, or the leaking/damaged container will be overpacked.
- Containers must be compatible with the waste being accumulated.
- Incompatible hazardous wastes must not be placed in the same container.

4.1.5.2 Additional Requirements for Roll-off Boxes

- Roll-off boxes shall be provided with covers and disposable liners. Liners will be disposed of with the waste contained in the roll-off box.
- When not in use, securely fastened covers will be installed on all roll-off boxes.
- Roll-off boxes will be labeled as described previously. Old labels, if present, will be removed as soon as the box is received onsite.
- Roll-off boxes will be filled only to the point where applicable weight limits will not be exceeded. This is typically half full for boxes containing soil. A box may be filled more than half full if it has been determined that the applicable weight limit will not be exceeded.
- Free liquids will not be placed in standard roll-off boxes. Containers designed to contain and transport free liquids (for example, phase separators) should be used for this purpose.
- Materials placed into the roll-off boxes will be equally distributed to prevent the box and truck from tipping.

4.1.5.3 Secondary Containment

- Container storage areas for hazardous waste with free liquids must have a containment system that includes an impervious base sloped to drain liquids away from the containers unless the container are elevated.
- Secondary containment must have a capacity to contain the single largest container or 10 percent of the volume of all containers plus precipitation from a 25-year, 24-hour storm.
- The containment system must be certified by a California-registered Professional Engineer.

4.1.6 Tank Management

Accumulation of hazardous waste in tanks must meet the following requirements, in accordance with California action-specific ARAR 85, Tank Systems (22 CCR Division 4.5, Chapter 14, Article 10). A tank is a

device that cannot be moved when full or is hard-plumbed in place or permanently attached to the ground or other structure.

- Hazardous waste tanks must be labeled with "Hazardous Waste."
- Hazardous waste tank systems must have an integrity assessment that is certified by a California-registered Professional Engineer.
- Hazardous waste tank systems must have secondary containment capable of holding the contents of the largest single tank plus precipitation from a 25-year, 24-hour storm. Accumulated precipitation and spilled liquids must be removed within 24 hours.
- Hazardous waste tank systems must be equipped with controls to prevent overfilling.

Accumulation of nonhazardous waste in tanks must be in accordance with the BMP Plan, provided as Appendix M to this C/RAWP.

4.1.7 Stockpile Management

Stockpiling of soil will be in accordance with the Soil Management Plan, provided as Appendix L to this C/RAWP). Stockpiling of non-hazardous construction debris will be in accordance with BMP Plan (Appendix M).

4.1.8 Waste Accumulation Area Inspections

Areas used for hazardous waste accumulation shall be inspected for malfunctions, deterioration, discharges, and leaks that could result in a release. The following inspection schedule shall be followed:

- Weekly inspection of hazardous waste containers (for leaks, signs of corrosion or general deterioration, labeling, container closure, remaining accumulation time)
- Weekly inspection of overall hazardous waste accumulation area (for general condition, adequate supply of spill control equipment, fire control and communication equipment present and operating properly)
- Daily inspection of hazardous waste tank systems and associated secondary containment to detect corrosion, damage, or evidences of a release

Inspections will be recorded in a logbook or otherwise documented, and the record of inspection will be maintained onsite.

Regular, documented inspections are not required for nonhazardous waste accumulation areas. However, the containers should be inspected periodically for leaks, signs of corrosion or general deterioration, labeling, and container closure. The overall accumulation area should be inspected periodically for general conditions and adequate supply of spill control equipment.

4.2 Management Procedures for Specific Waste Types

4.2.1 Aerosol Cans

Aerosol cans that are empty (contain no residual pressure or liquid) or that contain residual liquid that is not a hazardous material (e.g., air freshener) but no residual pressure, can be disposed of in the trash. Aerosol cans that contain residual pressure or residual liquid that is a hazardous material (e.g., marking paint) cannot be disposed of in the trash and must be managed as a universal waste; see Section 4.2.27.

4.2.2 Batteries

Small batteries including alkaline, nickel-cadmium, and lithium batteries found in many common items, including power tools, radios, electronic equipment, mobile telephones, and portable computers cannot be disposed of in the trash and must be managed as a universal waste; see Section 4.2.27.

Used lead-acid batteries should be returned to the retailer for recycling. If necessary to store onsite prior to return, the battery should be placed in a secure location where it will not become damaged. If a battery becomes damaged or begins to leak, place it in a plastic or other compatible container with a securely fitting cover, label with the accumulation start date and transport to a battery recycler Used lead-acid batteries that are not returned to the retailer or recycler must be managed as hazardous waste.

4.2.3 Calibration Gas Cylinders

Calibration gas for field instruments is usually shipped in nonrefillable DOT-39 specification cylinders. They can be identified by a code stamped into the cylinder that begins with "DOT-39, NRC" followed by a series of other numbers and letters. These cylinders cannot be refilled and are intended to be disposed of by the end user once the contents are consumed. Because of the high cost of shipping partially full cylinders to an, equipment rental company or the manufacturer, most calibration gas cylinders should be disposed of locally using this procedure.

4.2.3.1 Applicability

This procedure applies only to nonrefillable DOT-39 specification cylinders containing calibration gas that is classified by USDOT as a Division 2.2 nonflammable gas. The cylinder will display the green nonflammable gas label. Calibration gas usually contains parts per million (ppm)-range concentrations of compounds such as isobutylene, hexane, or methane. This procedure does not apply to Division 2.1 flammable gasses, Division 2.3 poison gasses, corrosive gasses, or oxidizing gasses. It also does not apply to gasses contained in larger refillable USDOT-specification cylinders.

4.2.3.2 Disposal Procedure

1. Review the cylinder labeling and SDS to verify that the material in question is calibration gas containing ppm-range concentrations of materials such as isobutylene, hexane, or methane, and that the gas is classified as a Division 2.2 nonflammable gas. If the material is a flammable gas (Division 2.1), poison gas (Division 2.3) corrosive gas, oxidizing gas, or contains toxic air contaminants such as trichloroethylene, do not follow this procedure. Characterize and classify the gas in accordance with Section 3.
2. Attach the appropriate regulator or valve to the cylinder, open the valve, and allow the gas to vent slowly to the atmosphere in an unconfined, well ventilated area outdoors.
3. If a regulator is not available, depress the valve with a non-sparking tool (e.g., pencil, stick). Be sure that the cylinder is pointed away from you at all times. The valve operates the same way as the valve on a car or bicycle tire.
4. Wear leather work gloves and keep your hands away from the flow of gas.
5. Leave the valve open until all gas is discharged from the cylinder.
6. If the cylinder has a permanently attached valve, leave it open. If a removable regulator or valve was used, remove it from the cylinder.
7. Mark the cylinder as "EMPTY" or "MT."
8. Recycle the empty cylinder as scrap metal or dispose as solid waste after verifying that the solid waste collection company will accept this material in the trash.



9. If required to puncture the empty cylinder before disposal or recycling, do not attempt to do so using hand tools such as a hammer and nail or punch; obtain a tool that is designed for this purpose.

4.2.4 Concrete and Asphalt Rubble

Concrete and asphalt rubble which is not associated with known hazardous material operations, shows no visible evidence of contamination, or has been tested and found to be non-hazardous, will be managed as

non-hazardous waste, according to the procedures specified in the BMP Plan (Appendix M), and will be disposed of at a permitted construction and demolition debris recycling facility.

Concrete and asphalt rubble that may be classified as non-RCRA or RCRA hazardous waste per characterization in accordance with Section 3.2.3, must be managed as hazardous waste or decontaminated and then managed as non-hazardous waste.

4.2.5 Concrete Saw-Cutting Slurry

Concrete saw cutting slurry will be managed as hazardous waste unless the pH is verified through testing to be below 12.5, and will be disposed of at a permitted hazardous or non-hazardous waste disposal facility, as determined by the waste classification evaluation.

4.2.6 Concrete Washout Water

Water from washing out ready-mix concrete trucks and other concrete-containing equipment will be managed as specified in the BMP Plan (Appendix M) as non-hazardous waste. If the pH is measured at 12.5 or above it will be managed as hazardous waste. Non-hazardous washout water will be used to make new concrete onsite, will be removed by the concrete contractor, or will be disposed of at a permitted disposal facility. Hazardous waste washout water will be disposed of at a permitted hazardous waste disposal facility.

4.2.7 Construction and Demolition Debris

Construction and Demolition Debris will be managed as non-hazardous waste, according to the procedures specified in the BMP Plan (Appendix M).

4.2.8 Decontamination Solutions

Decontamination solutions will be managed at IM-3 or the TCS ponds, as determined by the waste classification evaluation and available capacity. Otherwise, solutions will be disposed of at a permitted offsite disposal facility.

4.2.9 Electronic Devices

Waste electronic devices will be managed as universal waste, as described in Section 4.2.27.

4.2.10 Empty Chemical Containers

Empty chemical containers that formerly held a hazardous material exhibiting hazardous waste characteristics must be managed as a hazardous waste unless handled in accordance with the following procedure.

The container must be “empty.”

- If the material is pourable, no hazardous material can be poured or drained from the container or inner liner when the container or inner liner is held in any orientation (e.g., tilted, inverted, etc.)
- If the material is not pourable, no hazardous material remains in or on the container or inner liner that can feasibly be removed by physical methods (excluding rinsing) which comply with applicable air pollution control laws and which are commonly employed to remove materials from that container or inner liner. Following material removal, the top, bottom and sidewalls of such a container shall not contain remaining adhered or crusted material resulting from buildup of successive layers of material or a mass of solidified material. A thin uniform layer or dried material or powder is considered acceptable
- If the material is an acute hazardous waste or extremely hazardous waste, the container or inner liner has been triple rinsed using a solvent capable of removing the waste and all pourable residues have been removed from the container or inner liner as described above for pourable material. Note that rinsing such containers is considered treatment of hazardous waste and is subject to additional requirements that are not addressed in this plan.

Empty containers five gallons or smaller can be disposed of as non-hazardous trash if they are acceptable to the solid waste management company. Rinsing such containers after they are empty is not considered treatment of hazardous waste as long as the rinsate is managed appropriately.

Empty containers larger than five gallons must be marked with "Empty" and the date emptied. Accumulation time is limited to one year. They must be reused onsite in a manner that is considered exempt recycling as described in CHSC Section 25142.3, sent to a reconditioner or to a recycler, or returned to the chemical supplier for refilling. Containers returned to the supplier for refilling are not subject to the marking and accumulation time requirements. Rinsing empty containers larger than five gallons is considered treatment of hazardous waste and is subject to additional requirements that are not addressed in this plan.

4.2.11 Fuel and Oil Filters, Used

Used fuel and oil filters will be drained to remove free-flowing liquid, and accumulated in closed containers that are labeled with "Used (oil or type of fuel) Filters" and the accumulation start date. Used filters will be removed from the site within one year and disposed of at a permitted recycler. Free liquid that is drained from the filters or accumulates in the container will be managed as hazardous waste.

4.2.12 Groundwater from Well Installation, Development, and Sampling

Groundwater from well installation, development, and sampling will be accumulated in containers at the point of generation. Groundwater from well installation, development, and sampling will be managed at IM-3 or the TCS ponds, as determined by the waste classification evaluation and available capacity. Otherwise, solutions will be disposed of at an offsite disposal facility permitted to receive the type of waste based on characterization and classification.

Groundwater from well testing will be injected back into the well as described in Section 4.3.3.

4.2.13 Lamps

Lamps containing mercury (e.g., fluorescent lamps, mercury vapor lamps) will be managed as universal waste as described in Section 4.2.27.

4.2.14 Lumber, Treated

Waste lumber that has been treated with preservatives will be managed according to the alternative management standards for treated wood waste (TWW) specified in 22 CCR Division 4.5 Chapter 34, as follows:

- Store off the ground by placing it on blocks or a paved surface and covered with a tarp, or in containers.
- Onsite storage time is limited to 90 days for blocked and tarped material, 180 days for material stored on a paved surface, and one year for material stored in a container.
- Do not burn or mix with other waste.
- Cover TWW during inclement weather.
- Label all TWW containers, bundles, and shipments with "Treated Wood Waste – Do Not Burn or Scavenge," the generator's name and address, and the accumulation start date.
- Dispose at a hazardous waste facility or landfill that has been authorized to accept TWW.

4.2.15 Oil, Used

Used oil will be managed as a hazardous waste and disposed of at a permitted recycling facility.

4.2.16 Oily Solids, Used Absorbents Containing Petroleum, Oily Rags

Oily solids (soil, used absorbents) are presumed to be hazardous waste unless tested and verified to be non-hazardous, and will be managed as hazardous waste.

Debris contaminated with petroleum products (e.g., rags) may be managed as non-hazardous waste if all of the following conditions are met:

- The debris consists exclusively of wood, paper, textile materials, concrete rubble, metallic objects, or other solid manufactured objects.
- The debris is not subject to regulation as a hazardous waste or used oil under federal law.
- The debris does not contain any free liquids
- The debris, if not contaminated with petroleum, would not otherwise be regulated as a hazardous waste
- The debris is not a container or tank that is subject to regulation as hazardous waste
- The debris is disposed of at a Class I or Class II disposal site.

4.2.17 Paint Waste

Paint waste will be managed as either hazardous or non-hazardous waste, based on the waste classification evaluation, and will be disposed of at a permitted offsite disposal facility.

4.2.18 PPE

Used PPE will be managed as non-hazardous waste except if it is visibly contaminated with hazardous waste or hazardous materials.

4.2.19 Sampling Equipment, Plastic Sheeting

Used disposable sampling equipment will be managed as non-hazardous waste unless it is visibly contaminated with hazardous waste or hazardous materials.

4.2.20 Sanitary Waste

Waste from portable sanitary/septic waste systems will be removed from the site by the vendor providing the equipment. Portable toilets will be managed in accordance with the BMP Plan (Appendix M).

4.2.21 Scrap Metal

Scrap metal will be managed in accordance with BMP Plan (Appendix M) and will be disposed of at an offsite recycling facility.

4.2.22 Soil

Displaced soil generated by construction activities will be managed in accordance with the Soil Management Plan, provided as Appendix L to this C/RAWP.

4.2.23 Spent Solvents

Spent solvents will be managed as hazardous or non-hazardous waste, as determined by the waste classification evaluation, and will be disposed of at a permitted offsite facility.

4.2.24 Stormwater from Secondary Containment Structures

Stormwater that accumulates in secondary containment structures during construction, before the process using the structure becomes operational, will be managed in accordance with the BMP Plan (Appendix M).

4.2.25 Trash

Miscellaneous debris will be managed as non-hazardous waste and will be disposed of at a municipal solid waste landfill. Recyclable materials such as cardboard, glass and plastic bottles, etc. may be recycled.

4.2.26 Water from Hydrostatic Testing of Conveyance Piping

Hydrostatic testing of conveyance piping will be conducted in a manner that will allow the test water to be reused onsite consistent with the SWRCB Water Quality Order No. 2003-003-DWQ, Statewide General

Waste Discharge Requirements for Discharges To Land With A Low Threat To Water Quality. Only clear, untreated potable water will be used for testing. The water will be managed in a manner that protects it from becoming contaminated. Water from hydrostatic testing of conveyance piping will be managed as non-hazardous waste unless visible evidence of contamination (e.g. discoloration, sheen, suspended solids) is observed. Hydrostatic testing water will be temporarily accumulated at the test site in portable tanks or containers. Hydrostatic testing water not reused onsite will be managed at IM-3, the TCS ponds, or disposed of at a permitted offsite disposal facility.

4.2.27 Universal Wastes

Universal waste (e.g., aerosol cans, batteries, lamps, and electronic devices) must be handled as follows:

- Store universal waste in containers or packages that remain closed; are structurally sound; adequate to prevent breakage; compatible with their contents; and lack evidence of leakage, spillage, or damage that could cause leakage under reasonably foreseeable conditions.
- Any universal waste that shows evidence of breakage, leakage, or damage that could cause the release of lead, mercury, or other hazardous constituents to the environment must be contained.
- Containers of universal waste should be labeled with the words “Universal Waste,” the type of waste (e.g., batteries, aerosol cans), and the accumulation start date.
- Have universal waste removed from the site by a registered hazardous waste transporter and taken to a permitted universal waste recycling location within 1 year of the accumulation start date.

4.3 Onsite Management of Construction Water

Wastewater will be generated during construction activities from well installation, development, and testing/sampling. In addition, other miscellaneous wastewater streams will be generated from equipment and vehicle decontamination, water from hydrotesting of conveyance piping, and rainfall that collects in secondary containment areas. Consistent with water conservation and sustainability practices, onsite reuse and disposal of wastewater generated during construction will be maximized. Onsite options are described in this section. Water not managed onsite will be transported offsite to a permitted facility.

4.3.1 Management at IM-3 and the TCS Ponds

ARARs for the operation of IM-3 (treatment and injection facilities) authorize the disposal of groundwater generated during well installation, well development, and aquifer testing, and purged groundwater and water generated in rinsing field equipment during sampling events for the area-wide groundwater monitoring program at the IM-3 treatment plant.

The lined evaporation ponds receive cooling tower blowdown water and evaporate the water as part of normal TCS operations. Solids are removed from the ponds periodically. The ponds operate under Waste Discharge Requirements issued by the California Regional Water Quality Control Board. Discharge of construction water to the ponds would require coordinating capacity with the TCS operations and authorization by the Water Board.

4.3.2 Onsite Reuse

Water from hydrostatic testing of conveyance piping may be reused onsite for dust control, backfill moisture control, and other similar uses in accordance with the substantive requirements of SWRCB Water Quality Order No. 2003-003-DWQ, Statewide General Waste Discharge Requirements for Discharges To Land With A Low Threat To Water Quality. The water generated from hydrostatic testing will be low volume discharges with minimal pollutant concentrations, and will not be reused in a manner that results in a discharge to waters of the United States or waters of the state. The volume and date of each reuse event will be recorded.

4.3.3 Injection at Individual Wells during Well Testing

Following well installation and development, a well may be tested to evaluate its maximum injection flow rate. This hydraulic testing involves extracting water from the well, storing the water in portable tanks, then injecting the water back into the aquifer at the same or nearby well through a filter to remove particulate matter. Because chemical additives will not be used during these well testing activities, the water will be injected without additional characterization.

SECTION 5

Waste Transportation and Disposal

After the wastes are containerized and labeled, those wastes ready for offsite disposal will be loaded onto trucks for transport to preapproved disposal facilities. A designated transportation and disposal coordinator will be onsite during transportation and disposal activities. This individual will be responsible for coordinating and overseeing these activities.

As truck loading is completed, the containers and trucks will be inspected and brushed as necessary to remove loose materials if the truck is transporting hazardous waste. Each load on the trucks will be inspected by the driver to ensure that the load is secure. Hazardous waste labels on all non-bulk containers will be verified to be accurate and complete, and non-bulk containers will be labeled with the appropriate USDOT hazard class label. Appropriate documentation to include waste manifests or shipping papers will be completed, checked, and kept onsite. In addition, a truck log with loading and transportation information will be maintained. Transport vehicles will proceed to the designated disposal facilities in accordance with local, state, and federal transportation requirements.

5.1 Transporter Requirements

The selected transporters will be licensed and insured in both the shipping and receiving states, and in any other states through which the waste will be transported. Prior to transporting hazardous waste, the driver's license of each driver will be checked to verify that it is the proper class and has the appropriate endorsements for the vehicle being driven. The transporter must be registered with California Environmental Protection Agency, Department of Toxic Substances Control as a hazardous waste hauler, and have a USEPA Identification number. Transporters operating in Arizona must also be registered with the Arizona Department of Environmental Quality. Transporters operating in Nevada must also hold a permit and certificate of registration issued by the Nevada Department of Environmental Protection.

Each load of hazardous waste shall be accompanied by a properly competed Uniform Hazardous Waste Manifest and, if necessary, a land disposal restriction notification/certification form. Each load of nonhazardous waste shall be accompanied by a properly completed nonhazardous waste manifest form or bill of lading.

The transporter will be responsible for ensuring that loaded trucks comply with all applicable weight limits. For each load of material, weight measurements will be obtained for each full and empty container and dump truck. Official disposal quantities for project records will be based on the difference of weight measurements between the full and empty container or dump truck measured at the disposal facility's scale. Weights will be recorded on the weight ticket by the disposal facility.

The transporter will observe the following practices when hauling and transporting hazardous and nonhazardous waste offsite:

- Minimize impacts to general public traffic.
- Line and cover trucks, trailers, and roll-off bins used for hauling soil before transport to comply with EIR mitigation measure HAZ-2f and to prevent spills or releases.
- Decontaminate exterior of vehicle using dry methods as necessary prior to leaving the site.
- Wastes or materials from other projects may not be combined with wastes generated during this project.
- Personnel involved in offsite disposal activities will follow safety and spill response procedures outlined in project-specific health and safety plans.

Requirements under 22 CCR 66262.30 through 66262.33 (California action-specific ARAR 78) will apply to offsite shipments of hazardous waste. The requirements of 49 CFR 171-178 (USDOT) will apply to shipments of hazardous waste that are also USDOT-regulated hazardous materials. These requirements do not apply to shipments of nonhazardous waste. It is the responsibility of a USDOT-trained individual to ensure that the requirements of 49 CFR 171-178 are met, including proper classification, marking, labeling, and placards.

5.1.1 Spill Reporting

In the event of a spill or release of hazardous or non-hazardous waste, the transporter must immediately notify a PG&E representative**.** The following information about the spill will be reported and recorded:

- Type of material (for example, soil) and contaminant
- Location
- Estimated volume
- Media affected (for example, spilled on concrete pad or soil)
- Time of spill/release
- Final disposition of spilled material

The transporter will also report serious transportation-related incidents, as defined in 49 CFR 171.15, or releases of a reportable quantity of a hazardous substance, to the National Response Center at 800/424-8802 or 202/426-2675. The transporter will also report, in writing, as required by 49 CFR 171.16, to the Director, Office of Hazardous Materials Regulations, Materials Transportation Bureau, Department of Transportation, Washington, DC 20590.

5.1.2 Spill Response

The transporter will clean up spills or releases of hazardous or nonhazardous waste (including soil) that occur during transportation or will take such action as may be required or approved by federal, state, or local officials. Spilled waste will be immediately cleaned up, including soils on the outside of the trucks, the truck and/or container, or road surface. Where appropriate, the spilled material will be returned to the original waste container. Regardless, the spilled material will be properly contained and disposed of.

5.2 Disposal Facilities

Disposal facilities that receive Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) waste (wastes that contain CERCLA hazardous substances, pollutants, or contaminants) will be in compliance with the CERCLA Off-Site Rule (42 U.S.C. 9621 (d) (3) and 40 CFR 300.440). Wastes designated as RCRA or non-RCRA hazardous wastes, and non-hazardous waste will be transported to and disposed of at an appropriately permitted facility. In accordance with the requirements of the Remedial Design/Remedial Action Consent Decree (DOI 2013), prior to the first shipment of waste material offsite, and annually thereafter, PG&E will demonstrate to DOI's satisfaction that USEPA has determined that the proposed receiving facility is operating in compliance with 42 U.S.C. 9621(d)(3) and 40 CFR 300.440. If PG&E knows or has reason to know the facility no longer meets the criteria of 40 CFR 300.440(b), PG&E will inform DOI, propose an alternate receiving facility prior to any subsequent shipments, and demonstrate to DOI's satisfaction that USEPA has determined that the alternate receiving facility is operating in compliance with 42 U.S.C. 9621(d)(3) and 40 CFR 300.440. The waste material will be stored onsite in accordance with this waste management plan until approval is received and the waste material is transported offsite. If the waste management facility is out of state, prior to the first shipment of waste material, PG&E will provide written notice for disposal of waste material at the listed facilities to the appropriate state environmental official in each receiving facility's state and the DOI Project Manager, and will comply with state law with regard to providing any further notifications. Additionally, PG&E will notify the state environmental official referenced above and the DOI Project Manager of any major changes in the shipment plan, such as a decision to ship the waste material to a different out-of-state facility.

PG&E proposes use of the following potential disposal facilities for the project as well as others, subject to the communication and approval processes under the Consent Decree outlined above:

Chemical Waste Management – Kettleman Hills Facility – Landfill
35251 Old Skyline Road
Kettleman City, CA 93239

US Ecology Inc. - Landfill
Highway 95 (12 miles South of Beatty, NV)
Beatty, NV 89003

Clean Harbors Button Willow – Landfill
2500 West Lokern Road
Button Willow, CA 93206

SECTION 6

Training and Recordkeeping

6.1 Training

Personnel who handle waste will receive initial and annual training in accordance with California action-specific ARAR 79, Standards Applicable to Generators of Hazardous Waste (22 CCR 66262.34). Training will be documented by records that include:

- The job title for each position related to hazardous waste management and the name of the employee filling each job
- A written job description for each position related to hazardous waste management that includes the requisite skill, education, or other qualifications and duties of facility personnel assigned to each position
- A written description of the type and amount of introductory and continuing training that will be given to each person filling a position related to hazardous waste management
- Records that document that the training or job experience required has been completed

6.2 Recordkeeping

Recordkeeping will be in accordance with California action-specific ARAR 80 (22 CCR 66262.40), Standard Applicable to Generators of Hazardous Waste (22 CCR 66262.40 and 66262.41). Records related to waste management will be maintained for a minimum of three years.

Further, 22 CCR 66262.41 requires large quantity generators of RCRA hazardous waste to submit a biennial report to USEPA by March 1 of each even-numbered year that describes hazardous waste generated in the previous odd-numbered year. In addition, the Consent Decree (DOI 2013) requires that project-related records be retained until 10 years after receipt of the Certificate of Completion. The following records and documents will be maintained for hazardous waste shipment:

- Transportation and offsite disposal records, including:
  - Profiles and associated characterization data
  - Manifests, Land Disposal Restriction notifications/certifications, bills of lading, and weight tickets
  - Offsite facility waste receipts, certificates of disposal/destruction/recycle
  - Trucking logs
- Training records
- Inspection records

In addition, in accordance with the Revised Management Protocol for Handling and Disposition of Displaced Site Material (PG&E 2015), PG&E will maintain a Displaced Material Inventory for all displaced soil, as described in the Soil Management Plan, provided as Appendix L to the C/RAWP).

SECTION 7

References

California Environmental Protection Agency, Department of Toxic Substances Control (DTSC). 2011. *Final Environmental Impact Report for the Topock Compressor Station Groundwater Remediation Project*. January 31.

Pacific Gas and Electric Company (PG&E). 2015. *Revised Management Protocol for Handling and Disposition of Displaced Site Material, Topock Remediation Project, Needles, California*. November.

United States Department of the Interior (DOI). 2010. *Groundwater Record of Decision, Pacific Gas and Electric Company, Topock Compressor Station, Needles, San Bernardino County, California*. ROD cover date is December 2010; signed/approved by DOI on January 20, 2011.

_____. 2013. Remedial Action/Remedial Design Consent Decree (CD) between the United States of America and Pacific Gas & Electric Company. Case 5:13-cv-00074-BRO-OP, Document 23. Entered November 21.

United States Environmental Protection Agency (USEPA). 2007. *Test Methods for Evaluation Solid Waste, Physical/Chemical Methods. (SW-846).* February.

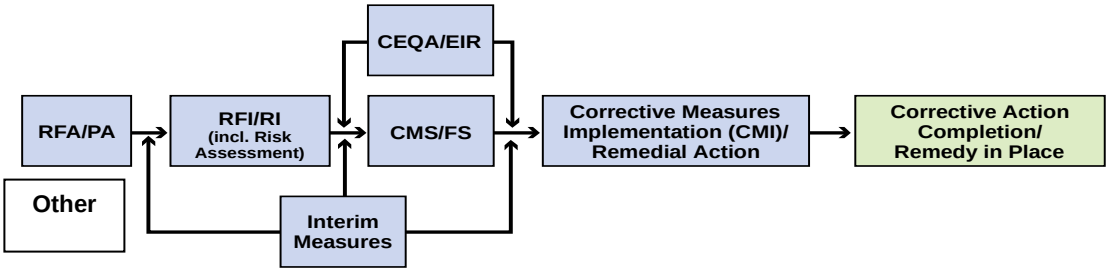
Appendix S
Bird Impact Avoidance and Minimization Plan
(On CD-ROM Only)

Topock Project Executive Abstract

Document Title: *Final Bird Impact Avoidance and Minimization Plan, Topock Groundwater Remediation Project* Submitting Agency: DTSC, RWQCB Final Document? ☒ Yes ☐ No	Date of Document: April 30, 2014 Who Created this Document?: (i.e. PG&E, DTSC, DOI, Other) – PG&E
Priority Status: ☐ **HIGH** ☐ **MED** ☒ **LOW** Is this time critical? ☐ Yes ☒ No Type of Document: ☐ Draft ☒ Report ☐ Letter ☐ Memo ☐ Other / Explain:	Action Required: ☒ Information Only ☐ Review & Comment Return to: _____ By Date:_____ ☐ Other / Explain:
What does this information pertain to? ☐ Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA)/Preliminary Assessment (PA) ☐ RCRA Facility Investigation (RFI)/Remedial Investigation (RI) (including Risk Assessment) ☐ Corrective Measures Study (CMS)/Feasibility Study (FS) ☐ Corrective Measures Implementation (CMI)/Remedial Action ☒ California Environmental Quality Act (CEQA)/Environmental Impact Report (EIR) ☐ Interim Measures ☐ Other / Explain:	Is this a Regulatory Requirement? ☒ Yes ☐ No If no, why is the document needed?
What is the consequence of NOT doing this item? What is the consequence of DOING this item? This plan is required by EIR mitigation measure BIO-2a. If this work was not performed, it would constitute a non-compliance with the EIR mitigation measure.	Other Justification/s: ☐ Permit ☐ Other / Explain:
Brief Summary of attached document: The Bird Impact Avoidance and Minimization Plan (BIAMP) describes how impacts to special-status bird species, including those protected under the Federal and California Endangered Species Acts and Migratory Bird Treaty Act will be avoided and minimized during implementation of the Topock Groundwater Remediation Project. Written by: PG&E	
Recommendations: This report is for your information only.	
How is this information related to the Final Remedy or Regulatory Requirements: This plan will be used in remedy design and implementation, in compliance with EIR Mitigation Measure BIO-2a. .	
Other requirements of this information? None.	

Related Reports and Documents:

Click any boxes in the Regulatory Road Map (below) to be linked to the Documents Library on the DTSC Topock Web Site (www.dtsc-topock.com).



Legend
RFA/PA – RCRA Facility Assessment/Preliminary Assessment
RFI/RI – RCRA Facility Investigation/CERCLA Remedial Investigation (including Risk Assessment)
CMS/FS – RCRA Corrective Measure Study/CERCLA Feasibility Study
CEQA/EIR – California Environmental Quality Act/Environmental Impact Report

Version 9

Pacific Gas and Electric Company®

Yvonne J. Meeks
Manager

Environmental Remediation

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April 30, 2014

Mr. Aaron Yue
Project Manager
California Department of Toxic Substances Control
5796 Corporate Avenue
Cypress, CA 90630

Subject: *Final Bird Impact Avoidance and Minimization Plan, Topock Groundwater Remediation Project*

Dear Mr. Yue:

Enclosed is the *Final Bird Impact Avoidance and Minimization Plan, Topock Compressor Station Groundwater Remediation Project.* This plan describes how impacts to special-status bird species, including those protected under the Federal and California Endangered Species Acts and Migratory Bird Treaty Act will be avoided and minimized during implementation of the Topock Groundwater Remediation Project.

The draft plan was submitted in July 2013 and revised to final after CDFW, DTSC and DOI reviews.

Please contact me at (805) 234-2257 or Virginia Strohl at (559) 263-7417 if you have any questions about this.

Sincerely,

Yvonne Meeks
Topock Project Manager

Enclosure

Final Bird Impact Avoidance and Minimization Plan, Topock Groundwater Remediation Project

cc: Karen Baker/DTSC
Pam Innis/DOI
Carrie Marr/FWS
Linda Miller/ HNWR
Victoria Chau/CDFW
Chris Hayes/CDFW

Final

Bird Impact Avoidance and Minimization Plan Topock Groundwater Remediation Project

Prepared for

Pacific Gas and Electric Company

April 2014

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2485 Natomas Park Drive
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Appendix

A Migratory Bird Treaty Act Protected Bird Species Anticipated To Occur Within the Project Area

Acronyms and Abbreviations

ACS	Avian Conservation Strategy (Draft)
AGFC	Arizona Game and Fish Commission
AGFD	Arizona Game and Fish Department
AMM	Avoidance and Minimization Measure
APE	Area of Potential Effect
APLIC	Avian Power Line Interaction Committee
ARAR's	Applicable or Relevant and Appropriate Requirements
BLM	United States Bureau of Land Management
BOR	Unites States Bureau of Reclamation
BNSF	Burlington Northern-Santa Fe
CDFW	California Department of Fish and Wildlife
CESA	California Endangered Species Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CFGC	California Fish and Game Code
CNDDB	California Natural Diversity Database
Compressor Station	PG&E Topock Compressor Station
Cr(VI)	hexavalent chromium
DOI	United States Department of the Interior
DTSC	Department of Toxic Substances Control
FCR	field contact representative
EIR	Final Environmental Impact Report
ESA	Federal Endangered Species Act
gpm	Gallons per minute
HNWR	Havasu National Wildlife Refuge
IRZ	In-situ Reactive Zone
I-40	Interstate 40
LCR MSCP	Lower Colorado River Multi-Species Conservation Plan
MBTA	Migratory Bird Treaty Act
PBA	Programmatic Biological Assessment
PG&E	Pacific Gas and Electric Company
Plan	Bird Impact Avoidance and Minimization Plan
RCRA	Resource Conservation and Recovery Act

RWQCB	Regional Water Quality Control Board
SSC	California Species of Special Concern
USFWS	United States Fish and Wildlife Service
WSCA	Wildlife of Special Concern in Arizona

SECTION 1

Introduction

Pacific Gas and Electric Company (PG&E) has prepared this Bird Impact Avoidance and Minimization Plan (Plan) to describe how impacts to special-status bird species, including those protected under the Migratory Bird Treaty Act (MBTA), the California Fish and Game Code (CFGC), and Arizona Game and Fish Commission (AGFC), will be avoided and minimized during implementation of the Topock Groundwater Remediation Project.

This plan is required pursuant to the *Final Environmental Impact Report for the Topock Compressor Station Groundwater Remediation Project* (EIR; DTSC 2011)*;* specifically, EIR Mitigation Measure BIO-2a, which addresses Disturbance of Special-Status Birds and Loss of Habitat[1].

BIO-2a: Disturbance of Special-Status Birds and Loss of Habitat. To the extent feasible, the project implementation plans shall be designed to minimize removal of habitat for special-status birds. During the design process and before ground disturbing activities (except within the East Ravine as described in the Revised Addendum and unless otherwise required as noted below), a qualified biologist shall coordinate with PG&E to ensure that the footprints of project elements and construction zones, staging areas, and access routes are designed to avoid direct or indirect effects on habitat and nesting habitat for other special-status species, to the extent feasible. DTSC will ensure compliance with all preconstruction and construction phase avoidance measures identified during this process and included in any design plans. Vegetation removal and other activities shall be timed to avoid the nesting season for special-status bird species that may be present. The nesting cycle for most birds in this region spans March 15 through September 30.

Preconstruction Measures: Preconstruction breeding season surveys shall be conducted during the general nesting period, which encompasses the period from March 15 through September 30, if the final design of the project (including East Ravine investigation Sites I, K and L) could result in disturbance or loss of active nests of special-status bird species. If vegetation removal or other disturbance related to project implementation is required during the nesting season, focused surveys for active nests of special-status birds shall be conducted before such activities begin. A qualified biologist shall conduct preconstruction surveys to identify active nests that could be affected. The appropriate area to be surveyed and the timing of the survey may vary depending on the activity and species that could be affected. For the Yuma clapper rail, the preconstruction surveys shall specifically identify habitat within 300 feet of construction areas, in accordance with substantive policies of USFWS including those set out in USFWS protocols.

Construction Measures: Before the initiation of project elements that could result in disturbance of active nests or nesting pairs of other special-status birds, a qualified biologist shall be consulted to identify appropriate measures to minimize adverse impacts during the construction phase of the project. If deemed appropriate for the final project design because of the potential for impacts, minimization measures will include focusing construction activities that must be conducted during the nesting season to less sensitive periods in the nesting cycle, implementing buffers around active nests of special-status birds to the extent practical and feasible to limit visual and noise disturbance, conducting worker awareness training, and conducting biological monitoring (including noise monitoring to determine if construction noise at the edge of suitable nesting habitat is elevated above 60 dBA Leq or ambient levels). An avoidance and minimization plan for special status bird species, as defined in Table 4.3-3 and those species protected under the federal Migratory Bird Treaty Act, including the Yuma clapper rail, shall be developed and implemented in consultation with USFWS, and agreed upon by DTSC. Avoidance and impact minimization measures, such as prohibiting construction near or in sensitive bird habitat, limiting construction during breeding seasons, and requiring an on-site biological monitor, shall be included in the design plan and implemented to the extent necessary to avoid significant impacts on sensitive bird species.

This Plan addresses project activities and their potential impacts to bird species and includes Avoidance and Minimization Measures (AMMs) that will be implemented to ensure that project impacts to special-status bird

[1]Decommissioning will be addressed in a separate plan per EIR Mitigation Measure BIO-2C

species are not significant. The AMM's proposed for southwestern willow flycatcher and Yuma clapper rail, the two federally listed bird species with potential to be affected by the Topock Groundwater Remediation Project, are consistent with measures addressed in the *Programmatic Biological Assessment [PBA] for Pacific Gas and Electric Topock Compressor Station Remedial and Investigative Actions (CH2M HILL 2007)*.

1.1 Background

In December 1951, the PG&E Topock Compressor Station (compressor station) began operations to compress natural gas supplied from the southwestern United States for transport through pipelines to PG&E's service territory in central and northern California.

From 1951 to 1985 chromium-based products were added to cooling water to inhibit corrosion, minimize scale, and control biological growth. PG&E replaced the chromium-based cooling water treatment products with phosphate-based products in 1985, at which time PG&E discontinued operation of the wastewater treatment system. Currently, four Class II double-lined ponds are in use and operated under the jurisdiction of the Colorado River Basin Regional Water Quality Control Board (RWQCB).

In 1996, PG&E entered into a Corrective Action Consent Agreement with Department of Toxic Substances Control (DTSC) to govern the investigation and remediation of the compressor station site under California state law. DTSC is the California state lead agency charged with directing investigative activities in the action area in accordance with the Resource Conservation and Recovery Act (RCRA). In July 2005, PG&E and the United States Department of the Interior ("DOI") on behalf of the U.S. Fish and Wildlife Service ("USFWS"), the Bureau of Land Management ("BLM"), and the Bureau of Reclamation ("BOR"), entered into a Consent Agreement that outlined the process by which PG&E would comply with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements during the investigation and remediation of the action area, which includes the implementation of a final remedy.

The final remedy will be implemented to address groundwater contamination in the project area, and the EIR includes several mitigation measures that are required to be implemented during the design, construction, and operation phases of the project to protect sensitive biological resources. Project activities have the potential to impact special-status bird species; therefore, the EIR includes Mitigation Measure BIO-2a to ensure the protection of these birds and requires the preparation of this Plan.

1.2 Location

The compressor station is located near the California and Arizona border in eastern San Bernardino County, approximately 12 miles southeast of the city of Needles, California (Figure 1). The town of Topock, Arizona is located approximately one-half mile to the east. Access to the compressor station is from the Park Moabi Road exit off of Interstate 40. At Moabi Regional Park, the roadway connects to National Trails Highway, which extends eastward and then southward for approximately one mile along the Colorado River to the Topock Compressor Station.

1.3 Project Description

Groundwater near the compressor station has been contaminated by chemicals associated with historical releases in areas known as Bat Cave Wash and East Ravine. The main contaminant of concern in groundwater is Cr(VI), which was used in the past as an additive to the cooling water at the compressor station, and is harmful to human health and ecological receptors in the environment. Other chemicals present in the groundwater include Cr(T), molybdenum, selenium, and nitrates. Although currently not being used as a drinking water source, the affected groundwater has the potential to come into contact with drinking water wells and the Colorado River. Cleanup of the contaminated groundwater plume is being designed to protect all identified potential receptors and maintain groundwater as a resource.

The proposed project involves flushing the contaminated groundwater plume through an in-situ reactive zone (IRZ) of extraction and injections wells and installing extraction wells near the Colorado River to hydraulically control the plume, accelerate cleanup of the groundwater within the floodplain, and flush the groundwater with

elevated Cr(VI) through the IRZ. The proposed project consists of five main elements: (1) an IRZ zone along a portion of National Trails Highway, (2) an Inner Recirculation Loop (IRL) that consists of extraction wells near the Colorado River that would pump contaminated groundwater that would be amended with organic carbon before reinjection in the western end of the plume, (3) a TCS Recirculation Loop that includes extraction wells in the eastern end of the East Ravine, eastern side of the TCS, and injection wells northwest of the TCS, and (4) freshwater supply system to convey water from a supply well in Arizona to assist with flushing the chromium plume.

The project description is divided into sequential phases of project implementation: construction, operations and maintenance, long-term monitoring, and decommissioning. It is estimated that the duration of these four project phases is 3 years, 29 years (up to 110 years), 10 years, and 2 years, respectively.

Specific project activities with potential to impact special-status birds are described in Section 4 of this Plan, and potential impacts to special-status birds from these activities are discussed in Section 5.

SECTION 2

Plan Goals

The goals of this Plan are to:

- Identify measures to ensure the avoidance or minimization of impacts to protected bird species during project construction. In general and pursuant to EIR Mitigation Measure BIO-2a, measures will include to the extent necessary (as determined by a qualified biologist and in consultation with the appropriate regulatory agencies):
  - prohibiting construction near or in special-status bird habitat,
  - limiting construction during breeding seasons,
  - requiring an on-site biological monitor during field activities,
  - implementing buffers around active nests to the extent practical and feasible to limit noise and visual disturbances, and
  - conducting worker awareness training and noise monitoring where 60 dBA L_{eq} or ambient levels may be exceeded during construction at the edge of nesting habitats.
- Facilitate project design avoidance of suitable special-status bird habitat, to the extent feasible, via mapping of such habitats.
- Ensure compliance with the regulations described in section 2.1 of this Plan.

2.1 Regulatory Framework

The project is required to comply with the following federal and State (Arizona and California) regulations that protect bird species as identified in the table of Applicable or Relevant and Appropriate Requirements ("ARARs") in the DOI Record of Decision for the groundwater remedy.

2.1.1 Federal Regulations and Standards

2.1.1.1 Federal Endangered Species Act

The Federal Endangered Species Act (ESA) is implemented by the United States Fish and Wildlife Service (USFWS). Section 9 of the ESA prohibits the "take" of federally listed as threatened or endangered species, unless permitted. "Take" is defined to include any harm or harassment, including significant habitat modification or degradation that could potentially kill or injure wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. The project is subject to consultation pursuant to ESA Section 7 that addresses federally listed species with potential to occur in the project area and their habitat. This document includes measures proposed for federally listed species in the *PBA (CH2M HILL 2007)*.

2.1.1.2 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) is implemented by the USFWS and prohibits the "take" of migratory birds, including causing failure of a nest, unless permitted.

2.1.2 State Regulations and Standards

2.1.2.1 California Endangered Species Act

The California Endangered Species Act (CESA) is implemented by the California Department of Fish and Wildlife (CDFW) and prohibits any activities that would jeopardize or take a species listed as threatened or endangered within the State, unless permitted.

2.1.2.2 California Fully Protected Wildlife Species Provisions

This provision is implemented by CDFW and prohibits the take and permitting of take of fully protected species.

2.1.2.3 California Species of Special Concern

This provision is applicable to bird, mammal, amphibian, and reptile species designated by CDFW as California Species of Special Concern (SSC). While this designation does not include additional regulatory protections, SSC species are typically considered by projects that are subject to the California Environmental Quality Act and were addressed in the EIR for the Topock Remediation Project.

2.1.2.4 Protection of Bird Nests and Raptors (California Fish and Game Code §3500 and 3503.5)

Implemented by CDFW, Section 3503 of the California Fish and Game Code (CFGC) states that it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise proved by the CFGC or any regulation made pursuant to the CFGC. Section 3503.5 specifically states that except as otherwise authorized by the CFGC or related regulations, it is unlawful to take, possess or destroy any raptors (i.e., birds of prey in the orders Falconiformes or Strigiformes that includes eagles, hawks, falcons, owls, and others), including the nests or eggs of such birds.

2.1.2.5 Migratory Bird Provision (California Fish and Game Code §3513)

This provision is implemented by CDFW and prohibits any take or possession of birds that are designated by the MBTA as migratory nongame birds except as allowed by federal rules and regulations promulgated pursuant to the MBTA (see above for MBTA description).

2.1.2.6 Taking Birds; Possession of Raptors (Arizona Game and Fish §17-236)

This provision is implemented by Arizona Game and Fish Department and makes it unlawful to take or injure any bird or harass any bird upon its nest, or remove the nests or eggs of any bird, except as could occur in normal horticultural and agricultural practices and except as authorized by the commission. This regulation is the equivalent, in terms of project applicability, to the CFGC §3503.5.

2.1.2.7 Wildlife of Special Concern in Arizona (Arizona Game and Fish §17)

Under authorities implicit in Arizona Revised Statute 17, the Arizona Game and Fish Department maintains a list of wildlife of greatest concern. The list focuses on the degree to which habitats or populations are threatened and the probability of extirpation of a taxon from Arizona. There are four categories for species on the WSCA list: extinct, endangered, threatened, and candidate.

2.2 Avian Conservation Strategy

In April 2013, PG&E released the *Draft Avian Conservation Strategy: Guideline for Bird Protection and Mitigation* (ICFI, 2013) (ACS) to provide a comprehensive avian conservation strategy thereby avoiding and minimizing adverse effects on nesting migratory birds within PG&E's service area in compliance with applicable federal and state regulations. The ACS recommended buffers were used in this report to avoid and minimize impacts to protected bird species. Any buffer identified in the PBA for a state or federally listed threatened or endangered species was incorporated into this report instead of the ACS buffer.

Protected Bird Species

This section describes the bird species with regulatory protection that are anticipated or known to occur in the project area. Measures to avoid or minimize impacts to these species are provided in Section 6.

Sections 3.1 and 3.2 discuss bird species that are protected by the MBTA and CFGC, respectively. Section 3.3 provides an account of special-status birds with additional regulatory protections that could occur in the project area.

The EIR (*Volume II, Section 4.3*) describes the locations of suitable habitat for special-status bird species in the project area. In order to facilitate project design avoidance of special-status bird habitat, a qualified biologist conducted a literature review that included the EIR, mapping developed for southwestern willow flycatcher presence/absence surveys (GANDA, 2009), mapping developed for Yuma Clapper Rail and California Black Rail Yuma clapper rail surveys (Konecny Biological Services, 2012), and mapping of Vegetation Communities from plant surveys (CH2M HILL 2012). A map that cross references these sources to depict special-status bird species habitat within the project area is included in this Plan as Figure 2.

Many common bird species protected by MBTA may nest in almost any area where nesting structures occur, including widespread upland habitats (e.g., creosote bush scrub) and man-made facilities (e.g., compressor station buildings). Section 6 describes a combined approach to avoid or minimize impacts to sensitive habitats and active nests, to the extent feasible, to ensure that impacts to special-status bird species are less than significant.

3.1 Migratory Bird Treaty Act Protected Bird Species

The number of bird species protected by the MBTA is extensive and listed at 50 CFR §10.13. A list of MBTA protected species that are anticipated to occur within the project area is included in Appendix A. Section 6.1 provides the general avoidance and mitigation measures applicable to MBTA protected birds.

3.2 CFGC §3503 and §3503.5 Protected Bird species

CFGC §3503 protects the nest and eggs of any bird. Raptors and raptor nests protected by CFGC §3503.5 that are anticipated to occur within the project area include American kestrel (*Falco sparverius*), Northern harrier (*Circus cyaneus*), osprey (*Pandion haliaetus*), red-tailed hawk (*Buteo jamaicensis*), and great horned owl (*Bubo virginianus*). The general avoidance and mitigation measures in Section 6.1 also address mitigation for potential impacts to bird species protected by the CFGC.

3.3 Species Accounts

This section provides the regulatory status, habitat requirements, nesting information, and occurrence potential for eight special-status bird species that could occur in the project area as determined by the EIR. New information from recent protocol surveys, new surveys of the expanded APE, and research conducted in the preparation of this Plan are also provided, as is a species account for the western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), previously determined unlikely to occur in the project area but was documented in the area during bird surveys in 2012 (GANDA, 2012).

Mapping of suitable habitat in the project area is included in Figure 2. No critical habitat for listed bird species occurs in the project area. With the exception of western yellow-billed cuckoo, special-status species determined by the EIR as unlikely to occur in the project area, and that have not been detected in the project area, are not discussed in this Plan.

3.3.1 Southwestern willow flycatcher (*Empidonax traillii extimus*)

This species is federally and California State listed as Endangered, and is considered endangered on the list of Wildlife of Special Concern in Arizona. It is associated with dense riparian habitats along streams, rivers, and other wetlands.

Historically the southwestern willow flycatcher nested in native vegetation including willows, seepwillow, boxelder, buttonbush, and cottonwood. Following modern changes to riparian communities, this subspecies still nests in native vegetation, but also uses thickets dominated by non-native tamarisk and Russian olive, or in mixed native non-native stands.

It builds nests and lays eggs in late May and early June with a clutch size of 2 to 5 eggs. The nest is a small open cup, most often 6.5 to 23 feet above ground in a fork or on a horizontal branch of a medium-sized bush or small tree with dense vegetation above and around the nest. Young fledge in early to mid-July, and second clutches only occur if the first clutch failed.

The project area contains suitable nesting (primarily in tamarisk thickets) and foraging habitat for this species along the Colorado River floodplain and Topock Marsh area in Arizona. This species has been documented in riparian areas around the site, primarily at Topock Marsh, and has been detected near Park Moabi Lagoon (GANDA 2009).However, several protocol surveys were conducted since 2004 in the project area and none have detected nests or breeding behaviors. A protocol survey conducted in 2012 identified two transient individuals and no nesting pairs. If an active nest is detected during future surveys, an avoidance zone will be implemented around the nest. The PBA states that all construction activity within 200 feet of active nesting areas will be prohibited until the nesting pair/young have vacated the nests. To the extent feasible, future project activities should be avoided within the sensitive areas such as potential SWFL habitat, wetlands, 100-year floodplain, and a 60-foot buffer from the Colorado River.

Sections 6.1 and 6.2.1 provide the avoidance and minimization measures for southwestern willow flycatcher.

3.3.2 Arizona Bell's vireo (*Vireo bellii arizonae*)

This species is California State listed as Endangered and associated with early to mid-successional riparian habitat that includes a structurally diverse canopy.

It is a summer resident that generally breeds between late March and late September. The nest is usually placed less than 5 feet above the ground. A typical vireo nest is a basket attached to twigs and made of various fibers such as split large grasses, and mixed with strips of soft inner bark, fine grasses, willow fluff, plant down, spider nests, and cattle hair. Three or four eggs usually are laid and incubation lasts about 14 days. Egg laying typically begins in early April, two broods generally are raised each season, and nesting occurs through the summer. Although normally timid, shy, and retiring, both parents are aggressive defenders of eggs and young.

Individuals were detected in Arizona near Needles and the Topock Marsh during project related surveys conducted in 2008 and 2012; therefore, this species is known to forage in the project area (GANDA, 2012). However it is unlikely to nest in the project area due to a general lack of suitable nesting habitat.

Section 6.2.1 provides the avoidance and minimization measures for Arizona Bell's vireo. The ACS recommends a standard activity-free buffer distance of 500 feet from active nests of this species.

3.3.3 Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)

This species is a federal candidate for listing, a California State Endangered species, and is considered threatened on the list of Wildlife of Special Concern in Arizona. It is associated with large blocks of riparian woodland composed of cottonwood and willow.

The onset of breeding is apparently correlated with an abundant local food supply or periods of greatest rainfall. Cuckoos may not breed if local food supply is inadequate on breeding grounds following spring migration. The breeding cycle is extremely rapid and requires only 17 days from egg-laying to fledging of young. Nesting activities take place between late June and late July, but may begin as early as late May and continue into September. Nest building typically takes 2-4 days. One brood of two to three young is raised per season. Cuckoos will occasionally double-brood in western populations if abundant food resources exist. Incubation begins with initiation of the first egg laying, known as asynchronous hatching, resulting in eggs and nestlings at different developmental stages in the same nest. Asynchronous hatching permits survival of the oldest nestlings in the event of a food shortage. The incubation period for yellow-billed cuckoos is 10 to 12 days. The young are fed large food items for the 5-8

day nestling period. Most young cuckoos leave the nest on day 6. After fledging, the young are dependent on the adults for at least 2 weeks.

This species has been documented within Topock Marsh (GANDA 2009) and one individual was detected during a previous survey conducted in 2012 in the project area on the Arizona side of the Colorado River (GANDA 2012). However, this species is not anticipated to nest in the project area due to lack of suitable habitat.

Section 6.2.1 provides the avoidance and minimization measures for western yellow-billed cuckoo. The Fish and Wildlife Service recommends a standard buffer distance of 300 feet for the western yellow-billed cuckoo.

3.3.4 California black rail (*Laterallus jamaicensis coturniculus*)

This marsh bird is California State listed as Threatened, is a California Fully Protected species, and is considered Wildlife of Special Concern in Arizona. California black rail is associated with fresh or brackish water wetlands that include cattail and bulrush stands.

The California black rail form pairs as early as late February. The nest is a well-defined bowl, with a canopy of dead or living vegetation woven over the top and a ramp of dead vegetation leading to an entrance on the side of the nest. Nests are primarily made of southern cattail or spikerush, and are elevated above the mud substrate in clumps of vegetation.

California black rail lays eggs between early March and early July. Average clutch size ranges from 3 to 8 eggs. The incubation period for nests ranges from 17 to 20 days. Chicks hatch one at a time and are born semi-precocial; they require brooding by one parent for the first few days after hatching.

The project area contains suitable foraging and nesting habitat for this species on the Arizona side in the Topock Marsh and marginal habitat in small patches along the Colorado River and mouth of the East Ravine. California black rail was not detected during 2012 protocol surveys (GANDA, 2012). However, during marsh bird surveys performed by HNWR over four years ago a California black rail was detected within the marsh (Linda Miller personal communication, April 30, 2014). The East Ravine and other small patches of cattail and bulrush habitats along the Colorado River are likely subject to too much disturbance from river associated recreation activities and water level fluctuations for this species. This species is not anticipated to nest in the project area due to lack of suitable habitat.

Avoidance and minimization measures for this species are provided in Section 6.2.1. The ACS recommends a standard activity-free buffer distance of 500 feet from active nests of California black rail.

3.3.5 Yuma clapper rail (*Rallus longirostris yumanensis*)

This marsh bird is federally listed as Endangered, California State listed as Threatened, is a California Fully Protected species, and is considered endangered on the list of Wildlife of Special Concern in Arizona.

The Yuma clapper rail is a marsh bird found in dense cattail or cattail-bulrush marshes along the lower Colorado River in Mexico north to the lower Muddy River and Virgin River in Utah above those rivers' confluence with Lake Mead.

Yuma clapper rails are generally found in freshwater and alkali marshes dominated by stands of emergent vegetation interspersed with areas of open water and drier, upland benches. This subspecies prefers mature marsh stands along margins of shallow ponds with stable water levels. Nest sites selected by this subspecies are near upland areas in shallow sites dominated by mature vegetation, often in the base of a shrub. Yuma clapper rails move into different cover types in winter, showing a preference for denser cover than in summer.

This rail usually lays 7 to 11 eggs in a cup nest of grasses or sedges. The first brood appears in March, although pairs may nest again after failure of a previous nest. Chicks begin to forage independently on small prey soon after hatching, and begin to feed farther from adults as fledging age approaches (Meanley 1985). Young can fly in about 9 to 10 weeks.

This species is known to occur in the Topock Marsh, and it was detected during 2012 protocol surveys in the project area in the Topock Marsh on the Arizona side northwest of County Highway 10. These protocol surveys

were also conducted at the East Ravine and in other areas of potentially suitable foraging or nesting habitats in the project area, but no rails were detected in these areas.

Sections 6.1 and 6.2.2 provide the avoidance and minimization measures for Yuma clapper rail, as provided in Section 5.3.1.8 of the PBA. The PBA states that all construction activity within 300 feet of active nesting areas will be prohibited until the nesting pair/young have vacated the nests.

3.3.6 Western least bittern (*Ixobrychus exilis hesperis*)

This marsh bird is a California Species of Special Concern and is considered a candidate species on the list of Wildlife of Special Concern in Arizona. It occurs in the same habitats as the aforementioned rail species (cattail and bulrush stands).

In Arizona, resident least bitterns likely begin breeding before migratory populations, with males initiating their cooing calls in March and April. They are a locally common breeder from April through September.

Throughout their entire range, nests are typically built among dense stands of emergent or woody vegetation. Nests are well concealed, and are usually located adjacent to open water. Nests have been found scattered throughout suitable habitat or concentrated in loose groupings. Typical clutches are 4-5 eggs and the time from laying the first egg to the hatching of the first egg ranges from 19 to 21 days. Young can forage on their own within 1-2 weeks. The young normally leave the nest permanently by 13-15 days but linger nearby for 1-2 weeks. Approximate age at first flight is 29 days. The least bittern will re-nest and double brood.

Western least bittern is known to occur at Topock Marsh (Reclamation 2004). The protocol survey for both rail species included a protocol survey for Western least bittern, and the species was not detected in the project area in any areas of suitable or potentially suitable habitat during surveys in 2012. Therefore, it is unlikely that this species occurs and is not expected to nest in the project area.

Section 6.2.1 provides the avoidance and minimization measures for western least bittern. The ACS recommends a standard activity-free buffer distance of 100 feet from active nests of this species.

3.3.7 Crissal thrasher (*Toxostoma crissale*)

This species is a California Species of Special Concern, associated with riparian woodlands, and primarily found in dense stands of honey mesquite.

Crissal thrasher nests are generally well hidden in the interior of dense shrubs, and consist of coarse twigs lined with finer material. Clutch size is usually 2-3 eggs, the incubation period is 14 days, and young fledge 11 to 16 days after hatching (Cody 1999).

This species has been documented along the Colorado River on the Arizona side near Needles and within the Havasu National Wildlife Refuge (GANDA 2008). Marginally suitable habitat occurs in the project area within tamarisk thickets and honey mesquite bosque. Avoidance and minimization measures for this species are provided in Section 6.2.1. The ACS recommends a standard activity-free buffer distance of 75 feet from active thrasher nests.

3.3.8 Sonoran yellow warbler (*Dendroica petechia sonorana*)

This species is a California Species of Special Concern, associated with riparian woodlands composed of cottonwood and willow.

The Sonoran yellow warbler breeds in the willow and cottonwood habitats that line the lower Colorado River. Yellow warblers begin arriving on their breeding grounds in April. Nest building activity has been observed in mid-April, and the egg laying likely begins in late April, with nestlings and fledglings by early May. Nests are typically found in the forks of cottonwoods, willows, or tamarisk from 10 to 20 feet (3-6 m) high. Yellow warblers will attempt several nests throughout the season but typically produce only one brood with a clutch size of 4 eggs. Adults have been observed feeding a fledgling into August.

The species is known to occur in the Topock Marsh, and the project area contains suitable nesting and foraging habitat.

Section 6.2.1 provides avoidance and minimization measures for Sonoran yellow warbler. The ACS recommends a standard activity-free buffer distance of 75 feet from active nests.

3.3.9 Yellow-breasted chat (*Icteria virens*)

This species is a California Species of Special Concern associated with riparian woodlands at the edges of open water. The species is associated with cottonwood, willow, tamarisk, and stands of arrow weed.

The nesting season begins in mid-May and lasts through early August. Nests are usually placed near the ground in dense thickets and shrubs that provide concealment. The nest is a bulky cup composed of grasses, leaves, strips of bark, or stems of weeds and is lined with finer grasses, wiry plant stems, pine needles, and sometimes roots and hair (Oberholser 1974). Three to four eggs are incubated for 10 to 12 days, and the young typically fledge the after 7 to 10 days.

Yellow-breasted chat is known to occur near Needles and at Topock Marsh (CNDDB 2008). The project area contains suitable foraging and nesting habitat for this species along the Colorado River floodplain and Topock Marsh. Avoidance and minimization measures for yellow breasted chat are provided in Section 6.2.1. The ACS recommends a standard activity-free buffer distance of 75 feet from active nests.

TABLE 3-1
Special-Status Species Potentially Occurring in the Project Area

Species	Status[a]	Habitat	Potential for Occurrence[b]	Nesting Season
Southwestern willow flycatcher *Empidonax traillii extimus*	Fed: E CDFW: E AGFC: E LCR MSCP	Dense riparian habitats along streams, rivers, and other wetlands, and breeds in stands of dense cottonwood, willow, and tamarisk thickets.	Known to occur in the project area as transient (non-nesting) based on recent years' protocol surveys. The project area provides some suitable habitat. This species has been documented in riparian areas around the site, primarily at Topock Marsh, and has been detected near Park Moabi Lagoon (GANDA 2009: Figure 5, page 7).	May 1 to September 1
Arizona Bell's vireo *Vireo bellii arizonae*	CDFW: E LCR MSCP	Associated with willow thickets with mulefat.	Known to occur as transient; documented in Arizona near Needles and the Topock Marsh (CNDDB 2008; GANDA 2008:5-1, GANDA 2012), but project area provides little suitable nesting habitat.	May 1 to September 30
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	CDFW: E AGFC: T Fed: C LCR MSCP	Riparian forest nester in flood bottoms of larger river systems. Requires multistory habitat for foraging.	Known to occur as transient; however project area provides no suitable nesting and little foraging habitat. Documented within the Topock Marsh (CNDDB, 2008; GANDA 2009:6).	April 15 to September 30
California black rail *Laterallus jamaicensis coturniculus*	CDFW: FP, T AGFC: E LCR MSCP	Habitat includes shallow freshwater and brackish marshes dominated by bulrush species.	Could occur; potentially suitable habitat within the Topock Marsh, but no CNDDB records near area; documented at delta of Colorado River.	February 1 to August 1
Yuma clapper rail *Rallus longirostris yumanensis*	Fed: E CDFW: T, FP AGFC: T LCR MSCP	Only along the Lower Colorado River (from Topock Marsh southward) and around the Salton Sea. It occupies heavily vegetated freshwater.	Known to occur in the Topock Marsh within the Arizona side of the project area based on 2012 protocol surveys. However, the project area within/adjacent to the river provides little suitable habitat on the California side. This species has been documented in the Topock Marsh and the Topock Gorge (CNDDB 2008; GANDA 2009:6).	March 15 to July 31
Western least bittern *Ixobrychus exilis hesperis*	CDFW: SSC LCR MSCP	Freshwater marshes with dense vegetation.	Could occur; known to occur at Topock Marsh (Reclamation 2004). Along the Lower Colorado River all documented occurrences were in Arizona.	May 1 to August 31
Crissal thrasher *Toxostoma crissale*	CDFW: SSC	Nests within desert riparian and wash habitats.	Could occur; documented along the Colorado River on Arizona side near Needles and within the Havasu National Wildlife Refuge (HNWR) (CNDDB, 2008; GANDA 2008: B-1), but project area provides little suitable nesting habitat.	February 1 to July 31
Sonoran yellow warbler *Dendroica petechia sonorana*	CDFW: SSC LCR MSCP	Historically nesting in riparian forests associated with open water but along the LCR; tamarisk is a habitat component.	Could occur; documented along the Colorado River near Needles (CNDDB 2008), but project area provides little suitable nesting habitat.	May 1 to June 30

TABLE 3-1
Special-Status Species Potentially Occurring in the Project Area

Species	Status[a]	Habitat	Potential for Occurrence[b]	Nesting Season
Yellow-breasted chat *Icteria virens*	CDFW: SSC	Riparian areas with dense woody vegetation bordering open areas.	Could occur; known to occur near Needles and at Topock Marsh (CNDDB 2008).	March 15 to September 30

[a] Legal Status Definitions:

U.S. Fish and Wildlife Service (USFWS) Federal Listing Categories

E = Endangered

C = Candidate proposed for listing

California Department of Fish and Wildlife (CDFW) State Listing Categories

E = Endangered

T = Threatened

FP = Fully Protected (no take permitted)

SSC = California Species of Special Concern

Arizona Game and Fish Commission (AGFC) Listing Categories

E = Endangered

T = Threatened

C = Candidate

Other Status Categories

LCR MHCP = Lower Colorado River Multi-species Habitat Conservation Program covered species (included for informational purposes)

Sources: EIR; CNDDB, 2008; GANDA, 2008 and 2009; Reclamation, 2004, USFWS 1999

[b] Potential for Occurrence Definitions:

Could occur: Suitable habitat is available in the project area; however, there are few or no other indicators that the species might be present.

Known to occur: Species or evidence of its presence was observed in the project area during protocol or reconnaissance-level surveys or was reported by others.

SECTION 4

Project Activities

This section summarizes the activities as described in EIR Section 3.5 that have potential to impact special-status bird species. Biologists participated in a 60 percent design field meeting with the project design team on April 23 and 24, 2012, to assist in ensuring that the project design includes avoidance of sensitive habitats, as feasible, and that the majority of project features have been located away from identified special-status bird habitats.

Construction of the proposed project would occur during an estimated 4 years: 3 years for constructing the remediation facilities at the onset of the proposed project and 1 year for decommissioning of the existing IM-3 Facility after final remedy is considered operating properly and successfully. The length of time required for construction is dependent on a number of factors, including the number of wells, pipelines, and other infrastructure, the geologic conditions encountered during well installation, the time required for regulatory and landowner approvals, and the availability of construction labor and materials at the time of construction.

Construction will be primarily limited to daylight hours to minimize the need for lighting and to conserve energy to the extent practical and/or feasible; however, some nighttime construction efforts may be required. For example, nighttime construction activity could be required for the continuous drilling of large-diameter wells. Lighting associated with construction and decommissioning activities will be limited to active construction equipment in operation during nighttime operations and will consist of downward facing fixtures fitted with cutoff shields to reduce light diffusion. Staging areas will be located to the extent feasible in areas that are already developed or disturbed, such as within the fenced and developed areas at the compressor station. However, staging could also be located elsewhere within the project area.

Construction practices will be designed to limit dust, noise, and nighttime light generation where feasible.

Heavy equipment may include trucks and excavators or backhoes to lay the pipeline network, and cranes to place control sheds and reductant storage tanks. Trucks may be necessary for making deliveries and hauling waste from the site.

The project consists of the following primary features: remediation facilities, freshwater flushing, monitoring wells, water conveyance, utilities, and roadways, each of which has the potential to impact protected birds.

4.1 Remediation Facilities

Remediation facilities will consist of extraction wells, injection wells, IRZ wells, and reductant storage facilities.

4.1.1 Extraction, Injection, and IRZ wells

Remediation and monitoring wells could be installed either using conventional truck-mounted drilling equipment or all-terrain capable equipment. Up to 126 wells will be installed, not including any replacement wells that may be necessary during the operation and maintenance phase. The sonic drilling method could be used for smaller-diameter extraction and injection wells. Wells that are located within the bedrock area may involve diamond coring or air rotary drilling methods in conjunction with sonic or rotary methods for setting surface casing. For wells greater than 4 inches in diameter, mud rotary drilling methods may be used. Sonic drilling methods will be used for construction of 4-inch-diameter or smaller diameter wells to the depths necessary to reach bedrock at much of the project area. Tanks, bins, or tanker trucks may be used to contain excess water and drill cuttings at the drill site and at designated staging areas. Typical well vaults would be 6 feet long by 8 feet long by 8 feet deep, and will house wells between 4 and 12 inches in diameter.

Based on the activities that have occurred to date in the project area during installation of similar wells, the length of time required to construct the injection and extraction wells range from 1 day to 5 weeks per well, depending on the diameter and depth of the well.

To support the drilling rig, a support truck, a forklift, and one or more pickup trucks may be used to transport personnel, equipment, and materials from staging areas to the drill site. The forklift will also be used to transport

cuttings and excess core generated from drilling the soil borings to lined, steel roll-off soil bins that will be temporarily staged. Up to four 20,000 gallon tanks and four to six roll-off bins might be required for large-diameter deep wells. The area surrounding each borehole that may be disturbed, including temporary equipment lay down areas, during drilling is estimated to be up to one-half acre.

4.1.2 Reductant Storage Facilities

The maximum footprint of the reductant storage and associated facilities will be 35,000 square feet, which may consist of facilities at multiple locations.

4.2 Freshwater Flushing

Freshwater flushing involves the use of injection wells, discussed above, to introduce clean water to the aquifer. Freshwater injection would involve piping water in from an off-site source and will be pumped either from new or existing Arizona wells, from new wells in California north of the compressor station, or from a new surface water intake at or near the Colorado River. Freshwater will be transported by pipeline to injection wells located north, west, and/or south of the plume. Any water pipelines that may be needed to deliver water from freshwater wells will be built primarily underground and within existing utility corridors or roadways. The source of freshwater may change during the operation and maintenance period of the remedy; not all freshwater supply structures (wells, intakes, pipelines) will need to be constructed at the outset of the remedy, but could be constructed as needed during the operation and maintenance period. To accommodate the flow volume that is required for remediation, new pipelines will likely need to be constructed connecting the water supply with the injection wells.

If a well is determined the most appropriate method for obtaining freshwater for flushing, wells will be drilled in the typical method for drilling wells as described above. Should a river intake approach be used, the intake will consist typically of belowground perforated or solid pipes (or rectangular channels) extending into the river. The intake pipes lead to pumps that push the water to the desired location. Reinforced concrete is often used to support the pipes. Because the intake pipes are usually installed below the water table, dewatering is necessary to allow for safe construction. Dewatering can be accomplished by pumping or installing sheet piles or cofferdams.

An alternative approach is to install pumps below the river surface with riser pipes extending to a concrete and steel platform. The pump motors, air compressors, monitoring and control equipment, equipment hoists, and an operator's structure will be installed on the platform. The platform will be supported by pylons or piers drilled into bedrock beneath the river bottom or mounted on the existing pipe bridge structure. The area of the platform will be from 2,000 to 10,000 square feet, and could be accessed by boat or by vehicles.

As described above, pipelines that deliver the freshwater could be installed above or belowground depending on the required service life, security and access needs, ground disturbance considerations, and type of pipeline. The diameter of pipelines is estimated to vary between 1 inch and 2 feet. Air release valves will typically be constructed inside underground concrete vaults surrounded by protective bollards.

4.3 Monitoring Wells

Approximately 100 monitoring wells currently exist near the compressor station, and a maximum of 19 new monitoring wells are anticipated as part of the proposed project. Monitoring wells could be replaced throughout the operation and monitoring phase, as necessary. Monitoring wells are typically between 4 and 8 inches in diameter and are completed at the ground surface with a concrete pad (typically 4 square feet) and include a manhole-type cover to the well. Where a ground surface completion is not feasible, monitoring wells may be installed with aboveground completion with steel protective casing. Monitoring wells will be situated in areas that provide relevant data on groundwater hydraulics and chemistry.

4.4 Water Conveyance, Utilities, and Roadways

The proposed project will require pipelines to transfer freshwater, treated water, and reductant-amended water throughout the treatment area. It will also require other utility connections such as electrical power, signal communications, small solar panels, diesel fuel, and natural gas. Where underground pipelines or utilities are

determined most appropriate, trenches will be excavated to depths of 3 to 4 feet (or more), buried, and covered to match the surrounding area, whether it is soil or pavement.

Depending on required service life, security and access, landowner requirements, agency requirements, type of pipeline, and environmental constraints (such as the subsurface geologic features or cultural resources), pipelines could be installed aboveground or belowground. The diameter of pipelines may vary from 1 to 14 inches, depending on the specific utility and required flow rate. Trenching will vary according to the size of pipeline and electrical conduit needed, as follows: 1.5-foot-wide trench for 1- to 4-inch piping, 3-foot-wide trench for 6- to 12-inch piping, and 5-foot-wide trench for 12- to 14-inch piping. An estimated 120,000 linear feet of pipeline may be required to serve the proposed project. Electric utility transformers and access vaults (which may include the use of protective bollards) will be placed at selected points along the pipeline corridor.

Electric conduit and cable will be installed to supply communication and power to pumps and instrumentation and will typically be installed underground in the same location as piping. Wherever feasible, trenches will be dug to place utility connections underground, which will reduce wear from weather and vandalism. As with pipelines, approximately 70,000 linear feet of electrical and signal communications is expected to be required for project implementation. Small solar panels may be installed to provide supplemental power, or as a primary power source for a lower power demand, such as for instrumentation and communication systems.

A road network for accessing the existing network of monitoring wells runs throughout the project area. This road network will be used where feasible for construction and operation of the proposed project; however, additional roads will be required. Approximately 1,000 linear feet of new roads could be needed throughout the project area, for both construction and long-term operation and maintenance of the proposed project. An access road will be required to provide service to each well. At some wells, a vehicle turnaround will be required. For wells where a turnaround is needed, the final disturbed area at each wellhead could be as large as 3,000 square feet. For wells located along an access road where no turnaround is needed, the area used for the well activities would be approximately 1,000 square feet. Access roads will be graded to create a smooth surface and proper drainage and will be routed with topographical and built structures and will consider sensitive natural resources. The roads will be maintained throughout the operation and maintenance period of the proposed project. Depending on their location, condition, frequency of use, and purpose, roads may be paved with asphalt, covered in gravel, or left unpaved. Following determination that the remedial or monitoring structure is no longer needed, the road will be closed and restored to pre-project conditions.

Depending on the location of extraction, treatment, and injection facilities, additional access routes could be constructed, or existing roads improved to support the level of activities proposed. The length of new or improved roads is estimated to be up to 6,000 linear feet and will be designed to minimize grading and disturbance of sensitive resources and existing structures and to maximize the use of existing roads. Typical road design and construction involves topographic surveying, grading, installing surface drainage systems (culverts, gutters, and riprap for slope protection), and constructing retaining walls.

4.5 Nonspecific Activities

Nonspecific activities support the project but are not considered a primary project feature. For example, habitat restoration activities may include preparing impacted areas for planting of native vegetation and maintaining planted vegetation until success criteria are met, which could be up to 5 years.

SECTION 5

Potential Impacts

This section describes the potential impacts of project features and activities described in Section 4. The mechanism of project related impact to birds can be broadly grouped into the following four categories: 1) nesting and foraging habitat degradation or loss, 2) direct nest disturbances, including visual and auditory disturbances, that could result in nest failure, abandonment, or decreased viability of eggs or young, 3) direct injury or mortality resulting from entrapment in equipment and materials, and 4) increased predation of protected birds, especially from feral animals or mesopredators.

5.1 Habitat Loss and Degradation

Habitat loss is one of the most substantial and direct threats to avian species. Permanent loss of habitat is often associated with development such as residential, industrial or agricultural land use conversions. In addition, human uses and development often alter ecosystem function. Losing natural habitat across a landscape further leads to fragmentation and alterations in spatial patterns that influence how avian species utilize the remaining habitat (CalPIF 2009).

Habitat degradation can also affect the foraging and nesting habitats of avian species. For example, the introduction of invasive species to an area can diminish the abundance of native plants, leading to fewer foraging opportunities for seed-dependent species or loss of nesting sites.

5.2 Impacts on Nests or Nesting Territories

The project area supports suitable nesting habitat for birds protected by the MBTA and several special-status birds, and these species could be affected during construction, operation and maintenance, and decommissioning. Nesting can occur in vegetation and/or in burrows on or near the project site. In the project vicinity, the avian nesting season for most bird species is from March 15 through September 30. Active nests may be directly impacted (i.e., destroyed or disturbed) by project construction activities resulting in nest abandonment and failure. Nesting territories, the areas surrounding nests which the parents utilize to support successful nesting (e.g., foraging and hunting for feeding of young, vegetation buffers that provide protection from predators), may be directly impacted by project activities (e.g., vegetation removal and habitat degradation), resulting in nest failure or reduced viability of young.

Visual or auditory disturbances related to construction, operation, maintenance, and decommissioning can affect special-status bird species during the breeding seasons. For example, birds that are startled by the sound or visible presence of project equipment may abandon nests, resulting in the reduced viability of eggs and young. Visual disturbances that may impact birds include those resulting from night-time lighting.

5.3 Entrapment from Equipment and Materials

Equipment and materials on site may entrap special-status birds leading to injury or mortality. Open-top vertical pipes are known to trap birds, especially cavity nesters or birds escaping from predators or seeking shade. Once birds enter pipes, they cannot grip the slick surface or spread their wings to fly out, and suffer death from dehydration, starvation, and exposure. Birds have also become trapped in large water storage tanks with small openings around the top.

To ensure that equipment and materials, especially vertical pipes, do not result in significant impacts to protected birds, the AMMs described in section 6 will be implemented.

5.4 Attracting Predators

Habitat that becomes fragmented from human development often results in an increase in feral animals and mesopredators (carnivores of small or intermediate body size). In addition, an increase in trash often functions as food subsidies for these species, which leads to an increase in predator viability. Land uses can dramatically

influence the sustainability of desert bird populations by increasing the populations of brown-headed cowbirds, domestic cats, jays, skunks, raccoons, ravens, crows, and other predators (CalPIF 2009).

5.5 Effect Categories

Table 5-1 qualifies overall impacts related to the project activities presented in Section 4 and is derived from information presented in *Draft Avian Conservation Strategy: Guidelines for Bird Protection and Mitigation* (ACS; ICFI 2013). Section 6 discusses how these impacts will be avoided or minimized, and Tables 6-1 and 6-2 provide recommended activity buffers based on the identified effect categories.

As discussed in the ACS, effect scores for each impact mechanism were aggregated to assign an overall effect score for each PG&E activity. The overall effect score (Low, Medium, and High) is an aggregation of the effect category scores assigned for each of four impact mechanisms (occupied nest location or nesting substrate, personnel and equipment activity, activity duration, and noise level. Effects categorized as low or short were assigned a value of 1; effects categorized as medium were assigned a value of 2; and effects categorized as high or long were assigned a value of 3. These four effect category values were added to assign the overall effect score. Cumulative values between 4 and 6 were assigned an overall effect category of low; values between 7 and 9 were assigned a category of medium; and values between 10 and 12 were assigned a category of high. It is important to note that the effect categories (low, medium, and high) are relative to each other at any given distance from an activity and that effect category assignments will not change when such activities occur at varying distance from a nest. A detailed discussion of the impact mechanisms is provided in Section 3.3 of the ACS.

Effects of PG&E activities decrease with distance, which is taken into account by the assignment of activity-free buffers in Chapter 6 below. The overall effect categories were used to assign activity free buffer requirements discussed in Chapter 6.

TABLE 5-1
Potential Activity Effects[1]

Activity	**Overall Effect Category** [a]	Occupied nest location or nesting substrate	Personnel and equipment activity	Activity duration	Noise level
Remediation Facilities					
Installation of Extraction, Injection, and IRZ Wells	Medium	Medium	High	Short	High
Construction of Reductant Storage Facilities	High	Medium	High	Long	High
Freshwater Flushing					
Installation of Water Supply Wells	High	Medium	High	Medium	High
Construction of Water Pumping Platform	High	Medium	High	Medium	High
Monitoring Wells					
Installation of Monitoring Wells	Medium	Medium	High	Short	High
Water Conveyance, Utilities, and Roadways					
Pipeline Construction	High	Medium	High	Long	High
Installation of Electrical Conduit and Cable	Medium	Medium	Medium	Short	Medium
Road Construction	High	Medium	High	Long	High
Operation and Maintenance					

TABLE 5-1
Potential Activity Effects[1]

Periodic well maintenance	Medium	Medium	Medium	Short	High
Equipment maintenance and inspections	Medium	Medium	Medium	Short	High
Periodic replacement of wells and other structures	High	Medium	High	Short	High

[1] Based on ICFI 2013, in part

[a] The effect categories (Medium and High) for each activity are relative to each other at any distance that an activity occurs from a nest. Distance is taken into account with the implementation of activity-free buffers as presented in Chapter 6.

Avoidance and Minimization Measures

As described in Section 4, the majority of project features has been located away from special-status bird habitats and avoids special-status bird habitat areas to the extent feasible. Because complete avoidance of direct impacts to suitable habitat is not feasible, and the project may result in direct (e.g., project related disturbance) and indirect (e.g., increased predation) impacts to protected birds, this section includes measures that have been developed to ensure that direct and indirect impacts to protected birds during the construction, operation, maintenance, and decommissioning phases of the project are not significant. General avoidance and minimization measures that address all bird species are provided in Section 6.1, and additional measures specific to Yuma clapper rail, southwestern willow flycatcher, and the western yellow-billed cuckoo are provided in Section 6.2. The recommended activity buffers in Tables 6-1 and 6-2 are derived from information presented in the ACS, and draw on the effect categories presented in Table 5-1. These tables provide standard buffer distances for each species group or for individual species, followed by minimum buffer distances for medium and high overall effect category activities identified in Table 5-1.

6.1 General Avoidance and Minimization Measures

1. Prior to the initiation of any ground disturbing or noise generating project activities outside of the fenced areas of the Compressor Station between March 15 and September 30, a qualified biologist shall conduct a preconstruction survey in areas of potentially suitable habitat for nests and nesting bird behavior. The appropriate area to be surveyed and the timing of the survey may vary depending on the activity and species that could be affected.
2. The location of any active nest shall be flagged, mapped, and communicated to the project foreperson. For each identified active nest the biologist will record species, nest location, behavior, site conditions, estimated date of nest establishment, and estimated fledge date.
3. To avoid impacts to nesting MBTA protected and California Fish and Game Code §3503 and 3503.5 species, a buffer of up to 400 feet will be established around all identified active nests, as recommended in Table 6-1. Buffer distances will be dependent on feasibility and practicability, and a biologist will develop a site-specific plan (i.e., a plan that considers the type and extent of the proposed activity, the duration and timing of the activity, and the sensitivity and habituation of the birds, and the dissimilarity of the proposed activity with background activity) to minimize impacts to nesting birds. As discussed in Section 7.2, the biologist will assess the activity effect, ambient activities, site conditions, and bird behavior to determine the efficacy of activity-free areas.
4. To avoid impacts to other special-status bird species, a buffer of up to 500 feet will be established around identified active nests as recommended in Table 6-2. In conformance with PBA General Requirement 3.4-25, riparian areas surrounding the proposed action site and subject to influence of operations and maintenance activities shall be surveyed for southwestern willow flycatcher according to the protocol established by the USFWS. Activities within Southwestern willow flycatcher habitat and the floodplain will be avoided during nesting season (March 15 – September 30). Species-specific AMMs in Section 6.2 include additional restrictions for southwestern willow flycatcher, Yuma clapper rail, and the western yellow-billed cuckoo.
5. Activity-free buffers should be designated around active nesting areas in conformance with PBA General Project Management Measure 3.4-25. Project activities within the activity-free area will be prohibited until the nesting pair and young have vacated the nests. The biologist will use maps, flagging, signage, and tailboard meetings as needed to ensure that project crews are aware of the location and intent of the activity-free area.
6. The biologist will monitor bird behavior in relation to project activities. With approval from DTSC and the Federal Agencies, the activity-free area may be reduced if specific factors or additional protection measures (e.g., visual screening) will ensure the protection of the nest.

TABLE 6-1
Recommended Activity-Free Buffers for MBTA and CFGC Protected Species Groups[a]

Species Group	Representative Species	Standard Buffer (feet)[1]	Medium Impact Minimum Buffer (feet)[1]	High Impact Minimum Buffer (feet)[1]
Waterfowl	American wigeon, Bufflehead , Blue-winged teal, Canada goose, Canvasback, Cinnamon teal, Common goldeneye, Common merganser, Gadwall, Greater white-fronted goose, Green-winged teal, Lesser scaup, Mallard, Northern pintail, Northern shoveler, Redhead, Red-breasted merganser, Red-necked duck, Ring-necked duck, Ross' goose, Ruddy duck, Snow goose, American Coot, common moorhen	100	15	30
Rails and Green Heron	Virginia Rail, Sora, Green Heron	100	15	30
Quails and Relatives	Gambel's quail	100	15	30
Colonial Herons, Egrets, and Cormorants	American white pelican, Black-crowned Night-heron, Clark's grebe, Double-crested Cormorant, Eared grebe, Great blue heron, Great Egret, Green heron, Pied-billed grebe, Snowy egret, Western grebe, White faced ibis	400	25	50
Birds of Prey (Cavity-nesting)	American Kestrel, Barn Owl, Great horned owl, Western Screech-owl, Northern Pygmy-owl	200	25	50
Birds of Prey (Platform nesting)	Turkey Vulture, Red-tailed Hawk, Merlin, Prairie Falcon, Osprey, Sharp-shinned hawk, Cooper's Hawk, Northern harrier	300	50	100
Shorebirds 1	Black-necked Stilt, American Avocet, Common snipe, Dunlin, Greater yellowlegs, Least sandpiper, Lesser yellowlegs, Long-billed dowitcher, western sandpiper, Wilson's snipe	150	15	30
Shorebirds 2	Killdeer	75	15	30
Gulls and Terns	Caspian Tern, Forster's Tern, California Gull, Ring-billed gull	300	50	100
Kingfishers	Belted Kingfisher	100	25	50
Doves	Common ground dove, Inca dove, Mourning Dove	50	10	20
Roadrunners and Band-tailed Pigeon	Greater Roadrunner, Band-tailed Pigeon	100	25	50
Caprimulgidae	Lesser Nighthawk	75	20	30
Hummingbirds	Black-chinned Hummingbird, Anna's Hummingbird, Costa's Hummingbird	50	15	20
Woodpeckers	Downy Woodpecker, Gila woodpecker, Hairy Woodpecker, Northern Flicker, Red-breasted Sapsucker, Red-naped sapsucker, White-headed Woodpecker.	50	10	20

TABLE 6-1
Recommended Activity-Free Buffers for MBTA and CFGC Protected Species Groups[a]

Passerines (cavity and crevice nesters)	Ash-throated Flycatcher, Tree Swallow, Mountain Chickadee, Oak Titmouse, Red-breasted Nuthatch, White-breasted Nuthatch, Pygmy Nuthatch, Brown Creeper, Rock Wren, Canyon Wren, Bewick's Wren, House Wren, Western Bluebird	50	10	15
Passerines and other bridge, culvert, and building nesters	Black Phoebe, Say's Phoebe	75	15	30
Colonial Swallows	Cliff Swallow	50	15	30
Passerines (ground nesters, open habitats)	Horned Lark, Lark Sparrow, Western Meadowlark	75	15	30
Passerines (understory and thicket nesters)	Abert's towhee, Gray Flycatcher, Dusky Flycatcher, Pacific-slope Flycatcher, Gray Vireo, Cassin's Vireo, Western Scrub-jay, Bushtit, Bewick's Wren, Blue-gray Gnatcatcher, Swainson's Thrush, Hermit Thrush, Wrentit, California Thrasher, Orange-crowned Warbler, Yellow-rumped Warbler, Black-throated Gray Warbler, MacGillivray's Warbler, Common Yellowthroat, Wilson's Warbler, Yellow-breasted Chat, Green-tailed Towhee, Spotted Towhee, California Towhee, Rufous-crowned Sparrow, Chipping Sparrow, Brewer's Sparrow, Black-chinned Sparrow, Sage Sparrow, Fox Sparrow, Song Sparrow, Dark-eyed Junco, Blue Grosbeak, Lazuli Bunting, Red-winged Blackbird, American Goldfinch	75	15	30
Passerines (scrub and tree nesters)	Gray Flycatcher, Dusky Flycatcher, Pacific-slope Flycatcher, Western Woodpewee, Cassin's Kingbird, Western Kingbird, Cassin's Vireo, Hutton's Vireo, Warbling Vireo, Steller's Jay, American Crow, Common Raven, Verdin, Bushtit, Blue-gray Gnatcatcher, Cactus Wren, American Robin, Northern Mockingbird, Le Conte's Thrasher, Phainopepla, Yellow-rumped Warbler, Black-throated Gray Warbler, Chipping Sparrow, Black-throated Sparrow, Western Tanager, Black-headed Grosbeak, Brewer's Blackbird, Great-tailed Grackle, Hooded Oriole, Bullock's Oriole, Scott's Oriole, Purple Finch, Cassin's Finch, House Finch, Pine Siskin, Lesser Goldfinch, Lawrence's Goldfinch, American Goldfinch	75	15	30
Passerines (tower nesters)	Western Kingbird, Common Raven	75	15	30
Passerines (marsh nesters)	Common Yellowthroat, Red-winged Blackbird, Great-tailed Grackle	75	15	30
Species not covered under MBTA[2]	Rock Pigeon, Ring-necked Pheasant, Chukar, Eurasian Collared-dove, Spotted Dove, European Starling, House Sparrow, and other nonnative/domestic birds	N/A	N/A	N/A

TABLE 6-1

Recommended Activity-Free Buffers for MBTA and CFGC Protected Species Groups[a]

[a] Standard buffer distances are provided for each species group or for individual species, followed by minimum buffer distances for medium and high overall effect category activities (for use in cases where reduced buffers are deemed appropriate).

[1] ICFI 2013

TABLE 6-2
Recommended Activity-Free Buffers for Special-Status Species[a]

	Standard Buffer (feet)[1]	Medium Impact Minimum Buffer (feet)[1]	High Impact Minimum Buffer (feet)[1]
Southwestern willow flycatcher *Empidonax traillii extimus*	CR	CR	CR
Arizona Bell's vireo *Vireo bellii arizonae*	500	CR	CR
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	150	CR	CR
California black rail *Laterallus jamaicensis coturniculus*	300	CR	CR
Yuma clapper rail *Rallus longirostris yumanensis*	300[3]	CR	CR
Western least bittern *Ixobrychus exilis hesperis*	100	15	30
Crissal thrasher *Toxostoma crissale*	75	15	30
Sonoran yellow warbler *Dendroica petechia sonorana*	75	15	30
Yellow-breasted chat *Icteria virens*	75	15	30

[a] Standard buffer distances are provided for each species group or for individual species, followed by minimum buffer distances for medium and high overall effect category activities (for use in cases where reduced buffers are deemed appropriate).

CR – Consultation Required

[1] ICFI 2013
[2] ICFI 2012
[3] USFWS 2008

7. All PG&E employees and the contractors involved with the project shall be required to attend a worker education program prior to working on-site and outside of fenced areas (e.g., the compressor station). This program shall include information about protected bird species (and where they may occur in the project area) and the AMMs described in this Plan to ensure impacts on special-status birds are not significant. New employees shall receive training prior to working onsite.
8. Project activity footprints and access routes shall be confined to pre-determined areas. No vehicle travel off of established roads or approved access routes shall be permitted.
9. Any vertical pipes or small cavities on equipment or materials that may trap birds shall be capped or otherwise covered when work activity is not occurring at site.
10. Trash and food items shall be contained in closed containers and removed daily to reduce attractiveness to opportunistic predators such as coyotes and feral animals.
11. Night-time project site lights outside of the compressor station shall be angled toward the ground and reduced in intensity to levels compatible with safety concerns, and limited in duration of usage.
12. Upon project completion, all unused material and equipment shall be removed from the site. This condition does not apply to fenced sites.

13. Intentional harassment, killing or collection of any wildlife (including birds) at construction sites and surrounding areas shall be prohibited. Wildlife shall not be handled except in the case of injury or mortality, as described in AMM 15.
14. PG&E shall designate a field contact representative (FCR) who will be responsible for overseeing compliance with the AMMs during major ground disturbing (including vegetation removal) or loud noise generating (above ambient levels) project activities outside of the compressor station or fenced areas. The FCR must be onsite during all construction activities. The FCR shall have authority to halt activities that are in violation of the AMMs and/or pose a danger to protected bird species. The FCR will have a copy of the AMMs when work is being conducted on site. The FCR may be a project manager, PG&E representative, or a biologist.
15. Any dead or injured special status bird species found in the project area shall be reported to the PG&E project biologist, USFWS, CDFW, BLM and, as appropriate, AGFD. Upon locating an individual dead or injured special-status bird species, PG&E shall make initial notification to the BLM and USFWS within three working days of its finding. The notification must be made by telephone and writing to the Lake Havasu BLM Office (2610 Sweetwater Avenue, Lake Havasu City, Arizona 86406, 928-505-1200) and the US Fish and Wildlife Service, Ecological Services Field Office (2321 West Royal Palm Road, Suite 103, Phoenix, AZ 85021, 602-242-0210). The report will include the date and time of the finding or incident (if known), location of the carcass, a photograph, cause of death (if known), and other pertinent information. Animals injured through PG&E activities shall be transported to a qualified veterinarian for treatment at the expense of PG&E. If an injured animal recovers, the USFWS, CDFW, BLM and, as appropriate, AGFD, shall be contacted for final disposition of the animal.

6.2 Species-Specific Mitigation Measures

The following mitigation measures from the PBA pertain to specific special-status species:

6.2.1 Southwestern Willow Flycatcher

1. The intent of PG&E will be to minimize the net increase of disturbed habitat in the area of potential effect (APE).
2. Riparian areas surrounding the proposed action site and subject to influence of operations and maintenance activities shall be surveyed for southwestern willow flycatcher according to the protocol established by the USFWS. These surveys shall be completed every two years by a biologist permitted by the USFWS to carry out flycatcher surveys until the action has been completed and all facilities have been removed. The monitoring frequency reduced from annual surveys to biennial surveys in agreement with the USFWS and BLM in March 2010. Reports shall be provided to the biologists in the BLM Lake Havasu Field Office on a biennial basis.
3. Construction and development activities that use heavy equipment should occur between October 1 and March 15. The use of any heavy equipment in or near southwestern willow flycatcher habitat after March 15 will be required to be reassessed and additional conservation measures considered.
4. To the extent feasible, future project activities within the sensitive areas identified on Figure 2 (i.e., potential southwestern willow flycatcher habitat, wetlands, 100-year floodplain, and a 60-foot buffer from the Colorado River) should be avoided. Further, if greater than 8.8 acres of floodplain habitat is lost or manipulated, specific project consultation with the USFWS will be required and mitigation may be required. Habitat loss includes the removal of trees and perennial shrubs, but does not include the trimming of vegetation.

6.2.2 Western Yellow-billed Cuckoo

1. The intent of PG&E will be to avoid investigative or response actions in or near riparian habitat, if at all possible.
2. Riparian areas surrounding the designated work areas and subject to influence of operations and maintenance activities shall be surveyed by a USFWS permitted biologist for western yellow-billed cuckoo according to the protocol established by the USFWS. After the initial 2 years of surveys, ongoing surveys shall

be performed according to USFWS's recommendations until the action has been completed and all facilities have been removed. Reports shall be provided to the biologists in the BLM Lake Havasu Field Office and to the USFWS's Phoenix AESO each time they are performed.

3. Construction and development activities that use heavy equipment should be completed prior to May 15. The use of any heavy equipment in or near western yellow-billed cuckoo habitat after May 15 will be required to be reassessed and additional conservation measures may be considered. Preferably such activities would occur from September 30 to May 15.
4. To the extent feasible, future project activities within the sensitive areas identified on Figure 2 (i.e., potential yellow-billed cuckoo habitat, wetlands, 100-year floodplain, and a 60-foot buffer from the Colorado River), should be avoided. Further, if greater than 8.8 acres of floodplain habitat is lost or manipulated, specific project consultation with USFWS will be required and possible mitigation may be required. Habitat loss is defined as the removal of trees and perennial shrubs. The trimming of vegetation is not considered habitat loss.
5. A biologist should be assigned to field teams for remediation activities within western yellow-billed cuckoo habitat during the period of May 15 through September 30.

6.2.3 Yuma Clapper Rail

1. The intent of PG&E will be to avoid investigative or response actions in or near marshes or wetlands, if at all possible.
2. If future actions are proposed to occur within 300 feet of wetlands or marshes (specifically the eastern boundary of the APE on the Arizona floodplain), project specific review will occur to ensure compliance with the PBA and associated USFWS consultation.
3. Specific to the Arizona portion of the APE, all construction and development activities should be completed prior to March 15. Preferably, such activities would occur from October 1 to March 15.
4. Where feasible, actions should not be proposed within the tamarisk habitat under the Interstate 40 and BNSF railway bridges that occur on the HNWR unless otherwise agreed to by the USFWS.
5. No more than 8.8 acres of floodplain habitat can be impacted without triggering additional ESA consultation requirements.

Monitoring and Reporting

Post-construction monitoring will document any avian fatalities that might occur and will identify factors that might warrant additional avoidance and minimization measures or improvement or elimination of avoidance and minimization measures found to be ineffective. Implementation of the proposed monitoring will help USFWS, BLM, and PG&E to evaluate the effectiveness of the avoidance and minimization measures.

If a dead or injured listed state and federal species is found, PG&E will notify the BLM,USFWS, CDFW, and AGFD, as noted in General AMM 15.

SECTION 8

Adaptive Management

8.1 Accounting for Policy Changes

With the possibility of future implementation of new policies it is understood that commitments made in this Plan may require adaptation relative to potential forthcoming guidance. PG&E will work collaboratively with BLM and USFWS to apply necessary policy changes to this Plan.

SECTION 9

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Figures

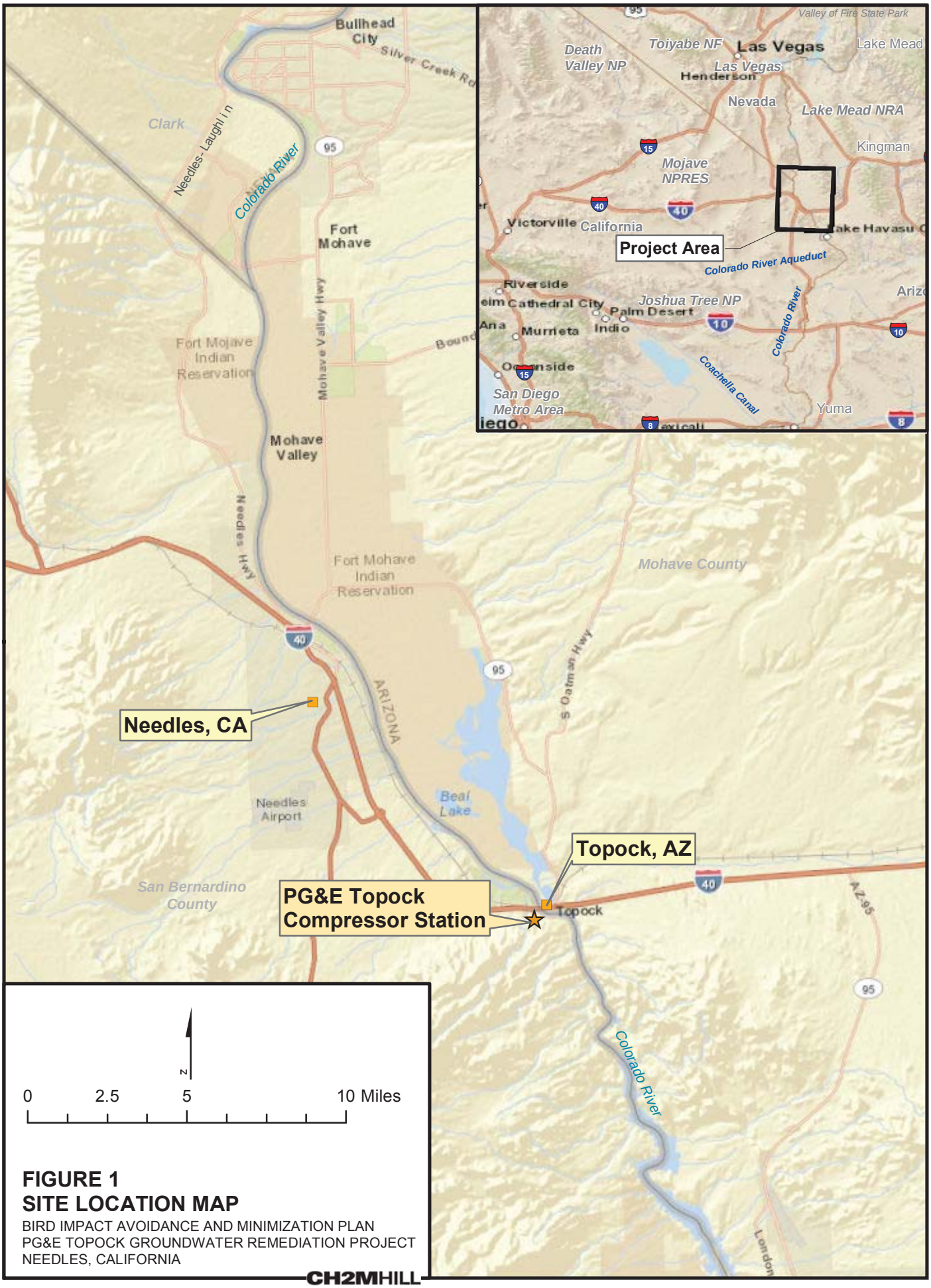

FIGURE 1
SITE LOCATION MAP

BIRD IMPACT AVOIDANCE AND MINIMIZATION PLAN
PG&E TOPOCK GROUNDWATER REMEDIATION PROJECT
NEEDLES, CALIFORNIA

CH2MHILL

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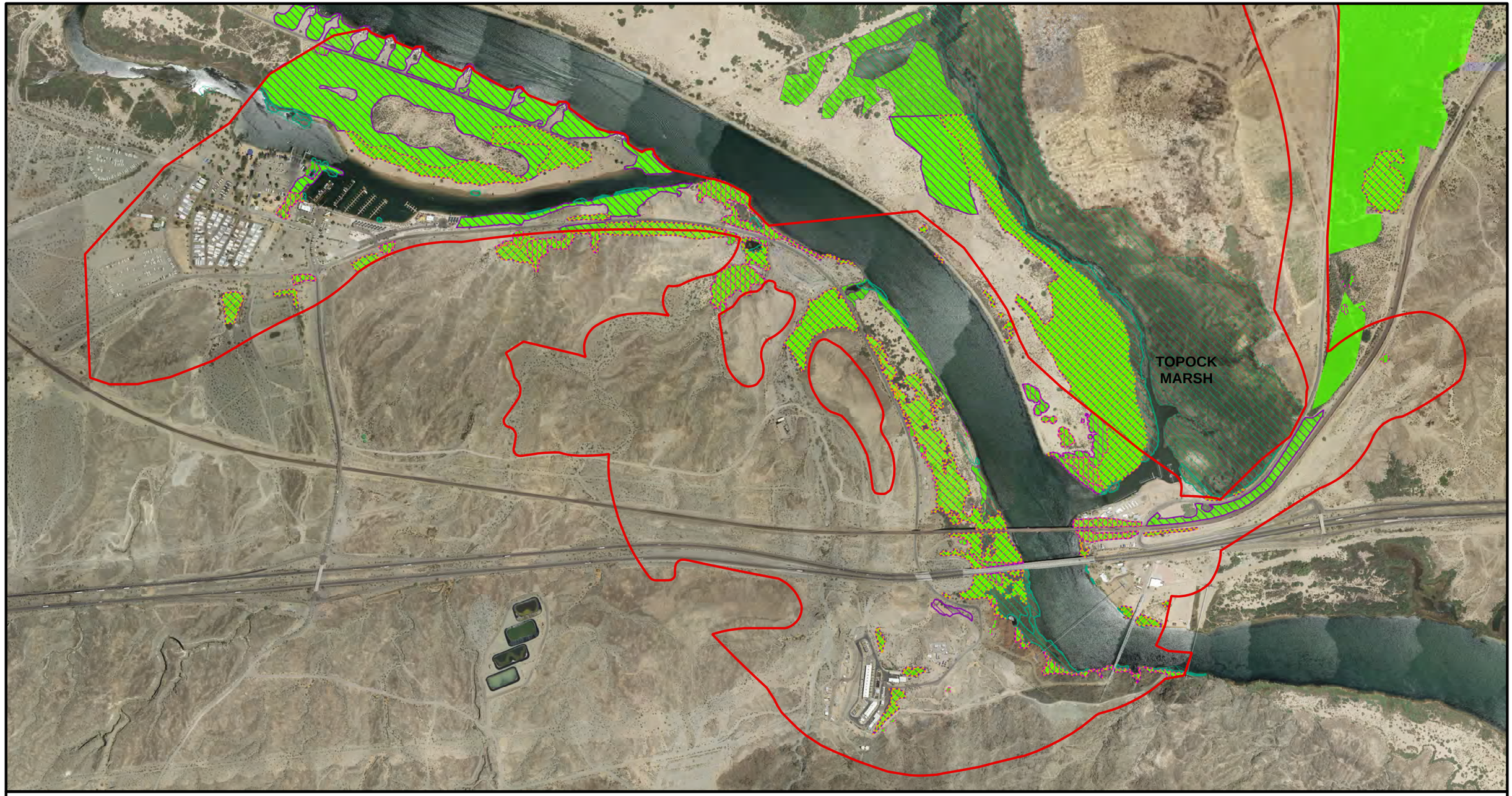

LEGEND

EIR Project Area

Habitat Areas

- Yuma clapper rail, Western least bittern, California black rail
- Western yellow-billed cuckoo (non-nesting), Yellow-breasted chat
- Southwestern willow flycatcher, Arizona Bell's vireo (non-nesting)
- Sonoran yellow warbler
- Crissal thrasher

N

0 500 1,000 2,000 Feet

FIGURE 2
HABITATS OF SPECIAL-STATUS AVIAN SPECIES
APRIL 2014
PG&E Topock Groundwater Remediation Project
Needles, California

CH2MHILL

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Appendix A
Migratory Bird Treaty Act Protected Bird Species

APPENDIX A

Migratory Bird Treaty Act Protected Species Anticipated To Occur Within The Project Area

Order (Group)	Species	Nesting Season
Anseriformes (waterfowl)	American wigeon	March 15 - September 30
	Bufflehead	
	Blue-winged teal	
	Canada goose	
	Canvasback	
	Cinnamon teal	
	Common goldeneye	
	Common merganser	
	Gadwall	
	Greater white-fronted goose	
	Green-winged teal	
	Lesser scaup	
	Mallard	
	Northern pintail	
	Northern shoveler	
	Redhead	
	Red-breasted merganser	
	Red-necked duck	
	Ring-necked duck	
	Ross' goose	
	Ruddy duck	
	Snow goose	
Apodiformes (swifts and hummingbirds)	Anna's hummingbird	March 15 - September 30
	Black-chinned hummingbird	
	Costa's hummingbird	
Caprimulgiformes (nightjars and allies)	Lesser nighthawk	March 15 - September 30
Charadriiformes (gulls, plovers and allies)	American avocet	March 15 - September 30
	Black-necked stilt	
	California gull	
	Caspian tern	
	Common snipe	
	Dunlin	
	Greater yellowlegs	
	Killdeer	
	Least sandpiper	
	Lesser yellowlegs	
	Long-billed dowitcher	
	Ring-billed gull	
	Western sandpiper	
	Wilson's snipe	
Columbiformes (doves and pigeons)	Common ground dove	March 15 - September 30

APPENDIX A

Migratory Bird Treaty Act Protected Species Anticipated To Occur Within The Project Area

Order (Group)	Species	Nesting Season
	Inca dove	
	Mourning dove	
Coraciiformes (kingfishers)	Belted kingfisher	March 15 - September 30
Cuculiformes (cuckoos and allies)	Greater roadrunner	March 15 - September 30
Falconiformes (falcons)	American kestrel	March 15 - September 30
	Merlin	
	Prairie falcon	
Accipitriformes (hawks, eagles and allies)	Cooper's hawk	March 15 - September 30
	Northern harrier	April 1 - August 15
	Osprey	April 1 - August 31
	Red-tailed hawk	April 1 - August 15
	Sharp-shinned hawk	April 1 - July 15
	Turkey vulture	May 1 - August 15
Galliformes (fowl)	Gambel's quail	March 15 - September 30
Gruiformes (cranes and allies)	American coot	March 15 - September 30
	Common gallinule	
	Common moorhen	
	Green heron	
	Sora	
	Virginia rail	
Passeriformes (perching birds)	Abert's towhee	March 15 - September 30
	American gold finch	
	American pipit	
	American robin	
	Ash-throated flycatcher	
	Bell's vireo	
	Bewick's wren	
	Black pheobe	
	Black-tailed gnatcatcher	
	Black-throated sparrow	
	Blue grosbeak	
	Blue-gray gnatcatcher	
	Brewer's blackbird	
	Brown-headed cowbird	
	Bushtit	
	Canyon wren	
	Chipping sparrow	
	Cliff swallow	
	Common raven	
	Common yellowthroat	
	Dark-eyed junco	

APPENDIX A

Migratory Bird Treaty Act Protected Species Anticipated To Occur Within The Project Area

Order (Group)	Species	Nesting Season
	Great-tailed grackle	
	House finch	
	House wren	
	Lazuli bunting	
	Lesser goldfinch	
	Lincoln's sparrow	
	Loggerhead shrike	
	Lucy's warbler	
	Marsh wren	
	Northern mockingbird	
	Northern rough-winged swallow	
	Orange-crowned warbler	
	Phainopepla	
	Purple finch	
	Red-winged blackbird	
	Rock wren	
	Rose breasted grosbeak	
	Ruby-crowned kinglet	
	Sage sparrow	
	Savannah sparrow	
	Say's pheobe	
	Song sparrow	
	Spotted towhee	
	Tree swallow	
	Verdin	
	Vermilion flycatcher	
	Warbling vireo	
	Western kingbird	
	Western meadowlark	
	White-crowned sparrow	
	Wilson's warbler	
	Yellow-headed blackbird	
	Yellow-rumped warbler	
Pelecaniformes (pelicans and allies)	American white pelican	March 15 - September 30
	Black-crowned night-heron	
	Double-crested cormorant	
	Great blue heron	
	Green heron	
	Great egret	
	Western grebe	
	White faced ibis	

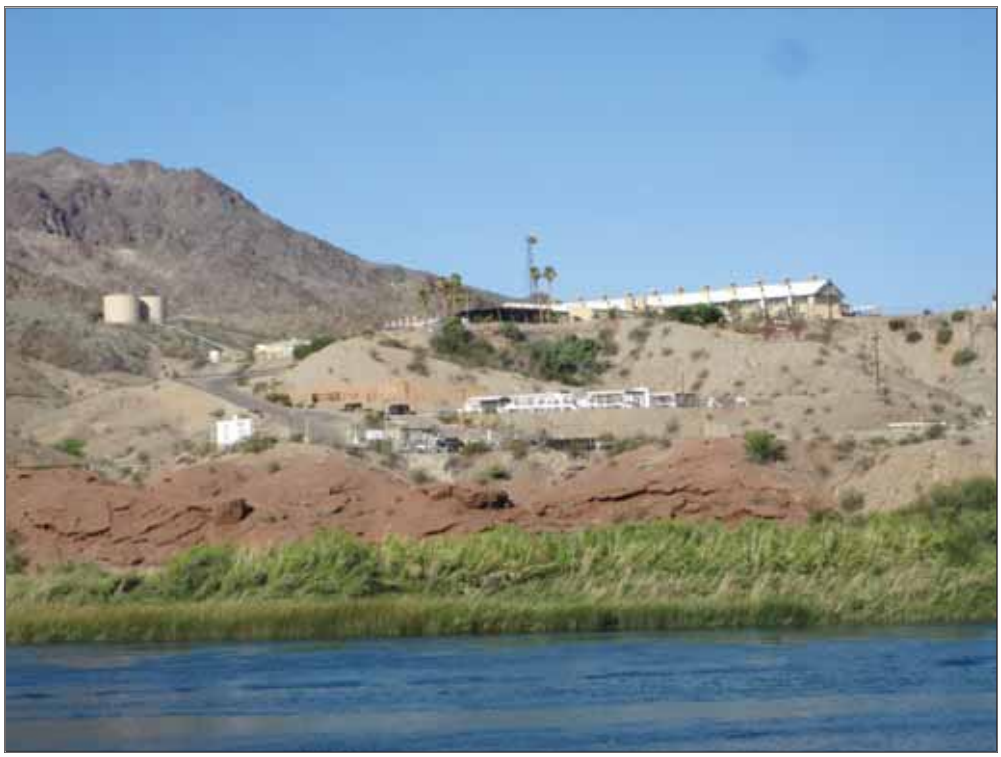
APPENDIX A

Migratory Bird Treaty Act Protected Species Anticipated To Occur Within The Project Area

Order (Group)	Species	Nesting Season
	Snowy egret	
Piciformes (woodpeckers and allies)	Gila woodpecker	March 15 - September 30
	Ladder-backed woodpecker	
	Northern flicker	
	Red-naped sapsucker	
Podicipediformes (grebes)	Clark's grebe	March 15 - September 30
	Eared grebe	
	Pied-billed grebe	
	Western grebe	
Strigiformes (owls)	Great horned owl	March 15 - September 30

Appendix T
Geoarchaeological Assessment for the Topock Remediation Project
(On CD-ROM Only)

Geoarchaeological Assessment for the Topock Remediation Project, Mohave County, Arizona, and San Bernardino County, California



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February 2014; revised September 2015

EXECUTIVE SUMMARY

This investigation assesses the potential for geologic units within areas that may be disturbed by the Pacific Gas and Electric Company Topock Compressor Station groundwater remedy to contain buried archaeological and or historical sites. The work was completed in response to mitigation measure CUL-lb/c-2 of the California Department of Toxic Substances Control's (DTSC) Final Environmental Impact Report (FEIR) for the Groundwater Remediation Project. The area examined is in the Mojave Valley, 12 miles southeast of Needles, California. It extends on both the California and Arizona sides of the Colorado River along the northwestern Mohave Mountains of Arizona, and northeastern Chemehuevi Mountains of California.

The geoarchaeological study was specifically intended to identify the potential for buried archaeological and historical sites to exist in the Project area; it was not meant to identify non-archaeological cultural values. A geologic unit's capacity to contain buried archaeological or historical sites is a function of: (1) the type of geologic material, (2) the unit's geological age, and (3) geologic processes of deposition, erosion, and soil formation and their effect on site preservation.

Nine geologic units were mapped in the area, including Mesozoic and older bedrock plus various Tertiary and Quaternary continental sedimentary strata of mainly alluvial fan and fluvial origin. Based on the factors noted above, the relative archaeological sensitivity of each unit was ranked in one of four levels ranging from "None" to "Higher."

Of the nine units mapped, only the Holocene River Floodplain Sediment, which is widespread on the Arizona side of the river and occurs to a lesser extent on the California side, was considered to have "Higher" sensitivity to contain buried archaeological sites. The sole unit deemed to be of "Moderate" sensitivity is the Alluvium of Modern Washes. The sensitivity for buried sites of all other units is "Lower" to "None." Aside from the few places where Artificial Fill and Alluvium of Modern Washes overlie the Holocene Floodplain Sediment, the archaeological sensitivity decreases with depth throughout the Project area.

It is recommended that excavations in the River Floodplain Sediment (higher sensitivity) and Alluvium of Modern Washes (moderate sensitivity) be minimized and, if required, be monitored by trained archaeological personnel and tribal representatives. Although the Older River Gravels were assigned lower sensitivity for buried sites, lithic sites are common on the surface of this unit, so it should be avoided as well until a thorough surface survey of any disturbance site is completed. Excavations extending through the Artificial Fill (lower sensitivity) where it overlies the River Floodplain Sediment (higher sensitivity) should be monitored if those excavations will extend to or below depths where the River Floodplain Sediment may be encountered. Otherwise, monitoring is not recommended in units where sensitivity is Lower or None.

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1
INTRODUCTION

1.1 PURPOSE AND SCOPE

Pacific Gas and Electric Company (PG&E) is currently implementing the Topock Remediation Project (the Project), which is designed to remove chromium from groundwater and prevent contaminated groundwater from reaching the Colorado River. The Project is located in the vicinity of the Topock Gas Compressor Station in San Bernardino County, California, and extends into Mohave County, Arizona. With respect to archaeological and historical resources, the Project is considered both an "undertaking" for purposes of compliance with the National Historic Preservation Act (NHPA), and a "project" subject to the California Environmental Quality Act (CEQA).[1]

Pursuant to the NHPA and its regulations (36 CFR 800), the Bureau of Land Management (BLM), State Historic Preservation Officers (SHPOs) of California and Arizona, and the Advisory Council on Historic Preservation (ACHP) entered into a Programmatic Agreement (PA) for the undertaking (Bureau of Land Management et al. 2010). In compliance with the California Environmental Quality Act (CEQA), the California Department of Toxic Substances Control (DTSC) prepared a Final Environmental Impact Report (FEIR) for the Groundwater Remediation Project (AECOM 2011) which included a Mitigation Monitoring and Reporting Program (MMRP) consisting of various required mitigation measures (CUL-1a–CUL-4) to address the Project's anticipated impacts on cultural and paleontological resources. BLM is the lead federal agency for compliance with the NHPA and PA, and DTSC is the state agency responsible for executing the MMRP set forth in the FEIR.

Mitigation measure CUL-lb/c-2 of the FEIR calls for PG&E to prepare:

> a cultural resources study that assesses the potential for the construction, operations, or decommissioning of specific proposed improvements to result in significant impacts on historically significant resources. . . . *This may include a geoarchaeological investigation and/or non-destructive remote-sensing surveys of potentially disturbed areas to determine if a potential exists for buried historical and archaeological resources* [AECOM 2011:5-27; *italics added*].

This report describes the results of a geoarchaeological investigation in the groundwater remediation area carried out to comply with these requirements. The geoarchaeological study was specifically intended to identify the potential for buried archaeological and historical sites to exist; it was not meant to identify non-archaeological cultural values. All personnel working on the geoarchaeological study received cultural sensitivity training prior to conducting the work.

[1] For the purposes of the NHPA and the Programmatic Agreement, the "undertaking" or "Project" includes the remedial investigations and groundwater and soil removal and response actions being conducted pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

1.2 GEOARCHAEOLOGY AND ARCHAEOLOGICAL SENSITIVITY

Archaeological sensitivity as used herein is the relative capacity for a geological unit to contain buried archaeological remains. This is a function of: (1) the type of geologic material (e.g., igneous vs. sedimentary), (2) the unit's geological age (millions vs. thousands of years), and (3) geologic processes of deposition, erosion, and soil formation and their effect on site preservation.

Assessment of a unit's archaeological sensitivity within the Project area is *relative* rather than absolute. In other words, "Higher" sensitivity does not mean that archaeological materials are likely to be encountered, but rather that the unit bearing this designation is more capable of containing buried archaeological remains than other units in the area for the reasons described above. For example, the upslope areas of alluvial fans represent a geologically unstable environment where mainly coarse-grained sediment is often deposited by debris flows during intense but short-lived storm events. Subsequent lesser or equivalent storms cause erosion of the deposits. Archaeological sites tend to be uncommon in this environment because erosion is active there; thus, archaeological remains are unlikely to be present. However, lower alluvial fan and river floodplain deposits are more capable of containing buried archaeological remains because this is an area of net deposition, and depositional hydraulics are less violent and thus less likely to break or destructively abrade artifacts. Archaeological sites are more likely to be present in these settings, and thus river floodplain sand and silt deposits would have a higher archaeological sensitivity than fanglomerates deposited in upper alluvial fans. Intrusive igneous and metamorphic rocks form under temperatures hundreds of degrees above that of boiling water and at pressures equivalent to miles of burial depth, thus these rocks do not contain archaeological sites.

Geologic age is also a consideration and is determined in many ways. In this study, the ages of geological units are assessed on the basis of: (1) correlation with units whose ages have been scientifically established and reported in the literature; (2) stratigraphic relationships (units underlying a dated unit are older); and (3) time-dependent soil morphological and geomorphological characteristics (Birkeland 1999).

Throughout the globe, evidence of human habitation has not been found in deposits older than 400,000 years (Pleistocene). The oldest evidence of human occupation in the Topock area is the "Lake Mojave Complex" dating from about 12,000 to 7,500 years before present (Davy et al. 2004). There is no physical evidence of archaeological sites in rocks older than Pleistocene in the Topock area. Therefore, sedimentary rocks dating in the millions of years have no sensitivity ("None") because they are too old to contain archaeological sites.

1.3 METHOD

1.3.1 Background Literature Review

The general geology of the Project area is well illustrated in the FEIR (AECOM 2011) at a small scale (1 inch = 1,500 feet) and is based solely on data from existing reports, mainly those of Metzger and Loeltz (1973), John (1987), and Howard et al. (1997). This map is sufficiently accurate for background information, but it lacks the precision required for a geoarchaeological assessment. Other works (Metzger et al. 1973; Todd 1976) include useful geologic information, but none describes the local geoarchaeology. These works, along with published and unpublished

reports, documents, boring and trench logs, and maps were examined to understand the local geology and geomorphology, and the distribution of archaeological materials on the landscape.

1.3.2 Field Reconnaissance and Mapping

The geoarchaeological study area was the where there is potential for disturbance due to placement of groundwater remediation facilities. It lies in the Mojave Valley, approximately 12 miles southeast of Needles, California, along the Colorado River and in the northwestern Mohave Mountains of Arizona, just east and northeast of the Chemehuevi Mountains of California (Figure 1).

Dr. Roland Brady, the Project Geoarchaeologist, made three visits to the Project area for a total of eight days. Prior to the fieldwork, Dr. Brady and other staff working on the project received cultural sensitivity training. During the initial field inspection, Dr. Brady examined the entire Project area and surrounding vicinity to determine stratigraphic relationships. Subsequently, he performed detailed geologic field mapping at a scale of 1 inch = 400 feet using aerial photographs and topographic bases. Because of the increased mapping precision and field verification developed by Dr. Brady during this study, the geostratigraphic units defined on the maps herein differ somewhat from those on maps displayed in the FEIR (AECOM 2011).

Geologic mapping concentrated on determining: (1) the geologic material; (2) geologic age based on stratigraphic sequence (order of deposition) and geomorphic/soil features such as degree of desert pavement and varnish, reduction of bar-and-swale morphology, extent of in situ clast fracturing, and development of Av, Bt, and Bk soil horizons; and (3) the potential that artifacts would be preserved as a function of geologic processes of deposition (tendency for archaeological remains to be damaged during transport and deposition). This was accomplished by surficial field survey, profiling of soil exposures, and subsurface sampling. Each is discussed below. Profile and sampling locations were identified in advance (Figure 1) and accepted by tribal representatives with the provision that soil disturbance could be monitored by the tribes.

1.3.3 Survey Locations

During the initial field inspection, Dr. Brady identified several locations worthy of more detailed surface survey and closer examination (Figure 1). The more detailed surface examination of these key locations involved no surface disturbance due to the availability of erosional cuts that provided sufficient exposure. During the site visit of June 5, 2012, several tribal monitors were shown these locations and they agreed that mapping could continue unaccompanied.

1.3.4 Soil Profile Exposures

To better reveal soil characteristics, and hence, relative age, six surface exposures were cleared by hand on June 5, 2012 (Figures 1 and 2). Surface exposures of various geologic units were completed by scraping away loose materials at the edges of mesas with a hand trowel and whisk broom. The exposed soil profile was described (logged) and photographed, particularly to note the extent of soil development, which is a function of geologic age. All earth movement was monitored by tribal representatives.

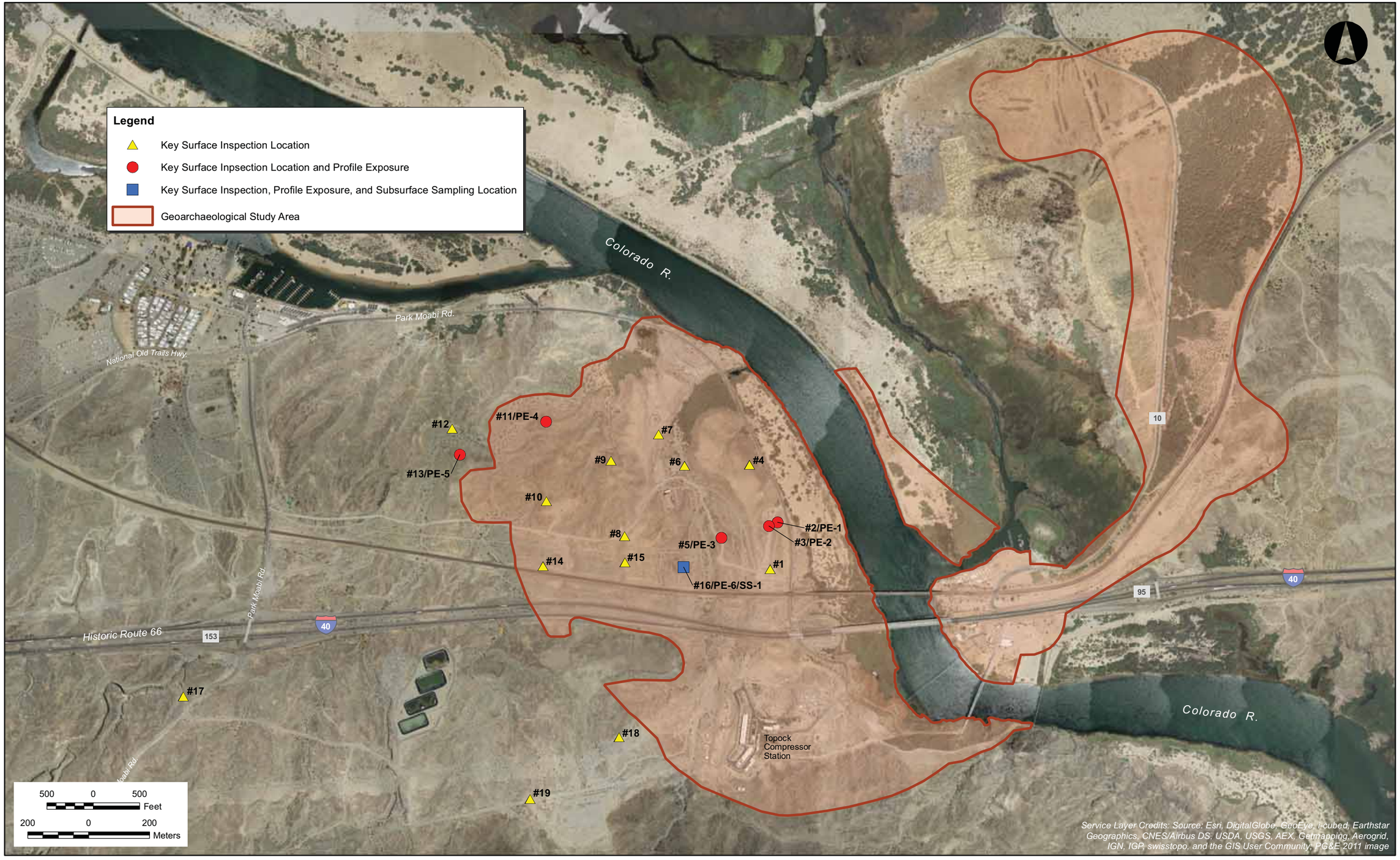

Figure 1 Locations of key surface inpections, profile exposures, and subsurface sampling.



Figure 2 Example of a soil profile exposure, Older Alluvium unit (Tof).

1.3.5 Subsurface Sampling

Because the Younger Alluvium (Qya) unit is soft and erodes to gentle slopes, its soil is neither exposed naturally, nor can it be seen in a profile exposure. To view the subsurface soil, an excavation is needed. To do this, first, an appropriate spot was identified at a location where approximately 40 percent of the surface had been previously severely disturbed by heavy tracked vehicles, but the undisturbed parts still represent the fan surface well overall (Figures 1 and 3). By placing the pit in these undisturbed areas, the excavation would not affect the old, pristine fan surfaces elsewhere. The proposed location was accepted by tribal representatives.

A small (3 foot long by 2 foot wide by 1.5 foot deep) pit was excavated at this location using a pick and hand shovel, under the review of tribal monitors on June 6, 2012. Surface rocks were removed by hand and stockpiled, and excavated spoils were placed on a plastic tarp. The pit was described and photographed, the soil was replaced in order of depth and compacted; finally, the surface stones were replaced one by one with their varnished sides up (Figure 4).

1.4 REPORTING

The results of the literature review and field studies are compiled into this report and accompanying maps contained in Appendix C, which show the area geology and geoarchaeological sensitivity, indicating the units' likelihood to contain buried archaeological materials.



Figure 3 **Location of subsurface soil sample pit on Younger Alluvium unit (Qya), west of Bat Cave Wash and south of IM-3 (in background).**



Figure 4 **Soil sample unit following refilling and replacement of surface stones. Residual, pink "fines" will be washed into ground during the next significant rain.**

2
SITE GEOLOGY AND ARCHAEOLOGICAL SENSITIVITY

2.1 BACKGROUND

The study area lies on deeply eroded, coalesced alluvial fan and lake deposits on the north flank of the Chemehuevi Mountains, and river and floodplain deposits of the Colorado River. Bedrock of the Chemehuevi Mountains is a complex of Precambrian and Mesozoic (see Appendix B) plutonic and metamorphic rocks that have been truncated and tilted along Tertiary, low-angle, "detachment faults" (Bishop 1963). These rocks are stratigraphically overlain by and faulted against Miocene sedimentary and volcanic rocks. Mid-Tertiary alluvial fan and lake deposits overlie these rocks and have been tectonically uplifted hundreds of feet (Spencer et al. 2008). These deposits are, in turn, overlain by Quaternary alluvial fan and fluvial (river) deposits that grade eastward (California side) and westward (Arizona side) into Holocene floodplain fine sands and silts of the Colorado River.

2.2 GEOLOGIC UNITS

This section describes each of the geologic units mapped for this study and their interpreted archaeological sensitivity. Each unit is referenced to those in the FEIR (AECOM 2011: Chapter 4.5) because this is the operative work on site geology.

2.2.1 Crystalline Bedrock (pTbr)

Pre-Tertiary bedrock of the Chemehuevi Mountains is a complex of metamorphic and plutonic rocks including gneiss and schist, and diorite through granitic varieties. These rocks are not differentiated on the accompanying map. The map symbol (pTbr) used herein is the same as that in the FEIR (Exhibit 4.5-2).

The metamorphic rocks are largely Proterozoic in age, while the intrusive rocks are thought to be mainly Mesozoic (Cretaceous) but may also include Proterozoic (Howard et al. 1997).

Geoarchaeological Sensitivity: None

Due to its plutonic/metamorphic origin and great age, the bedrock unit would not contain buried archaeological remains.

2.2.2 Conglomerate (Tmc)

Dark, reddish-brown fanglomerate and conglomerate are exposed in limited outcrops near the base of the Interstate 40 (I-40) bridge on the California and Arizona sides of the river (Figure 5). The map symbol (Tmc) used herein is the same as that in the FEIR (Exhibit 4.5-2).

The unit is well indurated, massively to poorly bedded, has a silty matrix, and contains clasts of volcanic, metamorphic, and plutonic rocks locally derived from the Chemehuevi Mountains. The unit was deposited in alluvial fan complexes by a combination of mixed debris and stream flow mechanisms.

Although the lower contact is not exposed at the site, elsewhere in the quadrangle the unit overlies Peach Springs Tuff, which has been argon-argon dated at 18.5 ± 0.2 million years ago (Ma). Furthermore, since bedding dips at angles of 10–32 degrees, the unit was deposited before cessation of extensional faulting which locally took place during the Miocene, between 23 and 13 Ma (Howard et al. 1997).

Geoarchaeological Sensitivity: None

The Miocene Conglomerate has no potential to contain buried archaeological sites because it is at least 10 million years older than the oldest recorded human occupation.

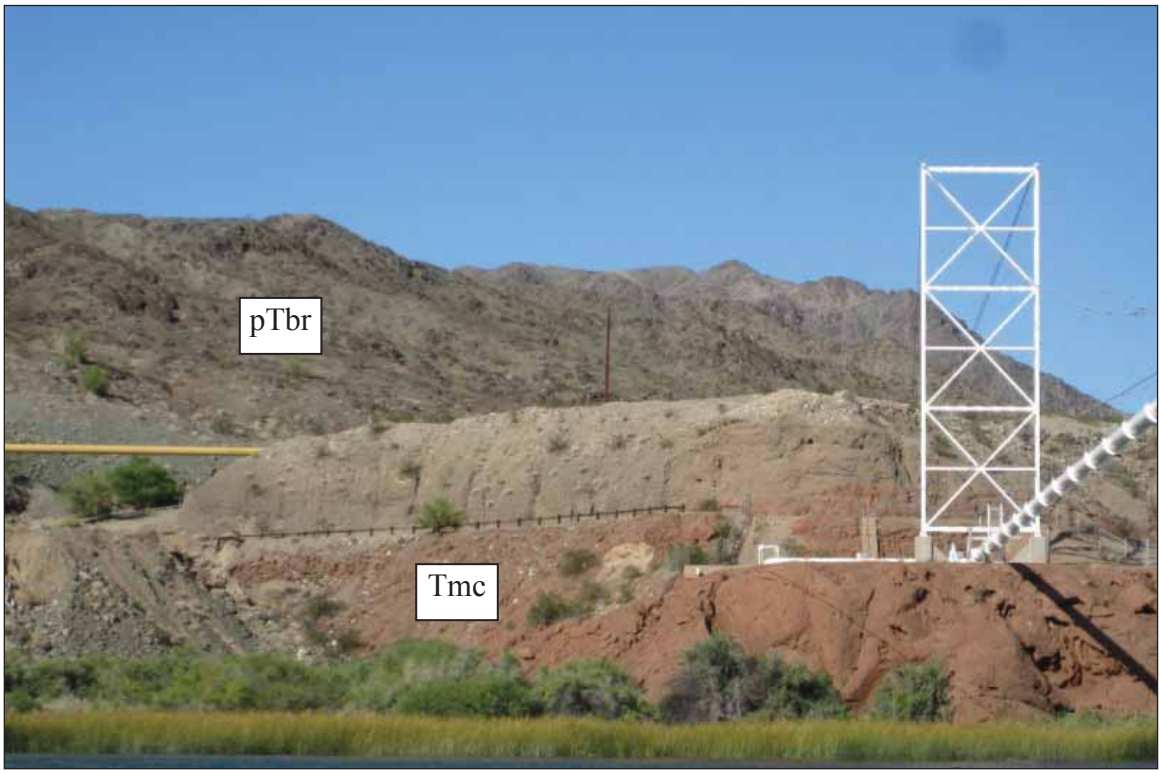

Figure 5 **Pre-Tertiary crystalline bedrock (pTbr) of Chemehuevi Mountains in background and dark, reddish brown Miocene conglomerate (Tmc) below pipeline carrier on the southeastern edge of the Project area on the California side of the Colorado River.**

2.2.3 Older Alluvium (Tof)

This unit, described in detail as "Fanglomerate" in Metzger and Loeltz (1973), is composed of well-indurated, sandy, angular gravel forming massive, well-defined beds up to several feet thick that dip gently (<5 degrees) toward the river. In the study area, the unit is characteristically gray green and forms nearly vertical cliffs (Figures 6 and 7). The clast composition is nearly entirely intermediate plutonic and metamorphic rock. Deposition by both debris flow (inversely graded clasts "floating" in a muddy matrix) and streamflow (gravel clasts touching one another fining upward to clean sands) mechanisms is evident.

Locally derived fanglomerate crops out throughout the study area west of the Colorado River. It is also shown on the FEIR (Exhibit 4.5-2) geologic map as "Older Alluvium-Toa."

The Older Alluvium has not been dated, but its age is constrained stratigraphically. Although its lower contact is not exposed, its upper contact underlies pale marl (dirty limestone) of the Bouse Formation in a canyon just northwest of the Park Moabi on-ramp to I-40 (Figure 7). Thus, the Older Alluvium is older than the lower Bouse Formation, which is late Miocene to early Pliocene in age (8.1–5.5 million years).

Geoarchaeological Sensitivity: None

The Older Alluvium lacks potential to contain buried archaeological sites because it is millions of years older than the oldest recorded human fossils. In addition, the harsh hydrologic conditions of its transport and deposition mechanisms preclude the preservation of archaeological sites within.

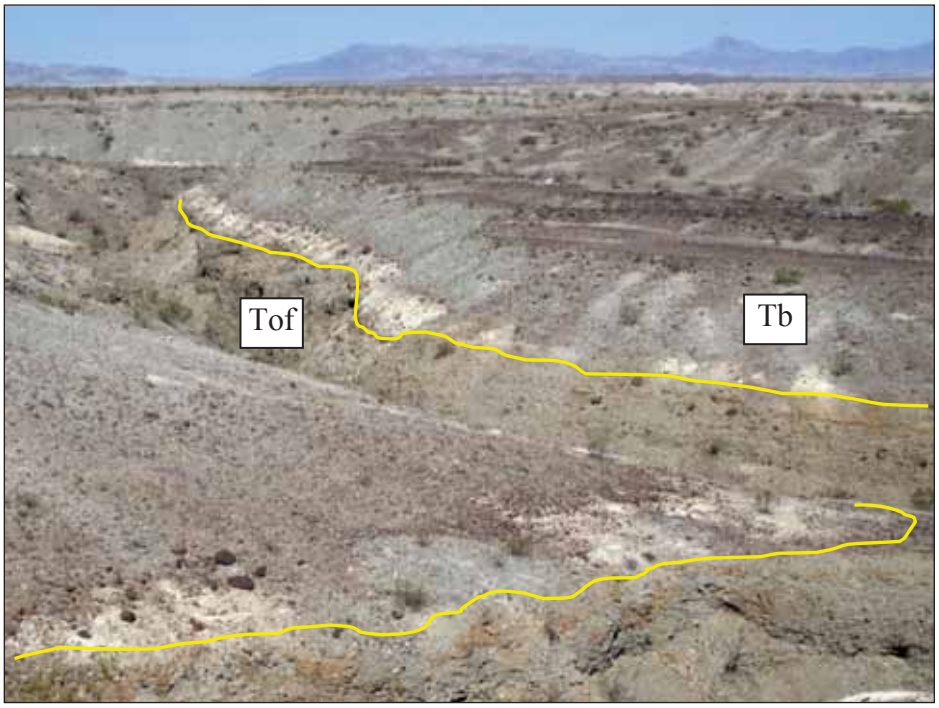

Figure 6 **Contact between Older Alluvium (Tof) and Bouse Formation (Tb) south of I-40 just west of the Project area, showing pale basal limestone of the Bouse Formation. Much of Bouse Formation is covered by coarse-grained scree from overlying Younger Alluvium.**

2.2.4 Bouse Formation (Tb)

The Bouse Formation was not encountered in the study area (due to its removal by erosion) so is not included on the accompanying geoarchaeological map. However, its description is included herein because the unit places important age constraints on geologic units that were mapped, and it may be encountered in the subsurface. The geological map in the recent Paleontological Resources Management Plan (Arcadis/Parus 2012) includes the Bouse Formation, also outside the limits of the area mapped in this study.

Locally, the Bouse Formation is more than 100 feet thick (Metzger and Loeltz 1973) and is exposed on the road to Park Moabi, along old Route 66 next to the Colorado River east of Pirates



Figure 7 **Older Alluvium (Tof) (fanglomerate) adjacent to Bat Cave Wash. Note steep walls.**

Cove, and in the large wash northwest of the study area. The Bouse Formation is shown on FEIR Exhibit 4.5-2 and was encountered in subsurface boreholes in the western part of the study area, but it was not encountered in borings in the central and eastern parts of the Project area. It is extensively exposed west of Park Moabi, and discontinuous patches appear along the road to Park Moabi, along the old Highway 66 alignment between Park Moabi and the Topock Compressor Plant, and in washes in between.

The Bouse Formation basin was deposited from south of Las Vegas to Blythe and throughout the Mojave Valley (Metzger and Loeltz 1973). It contains a pronounced basal white limestone (Figure 7) overlain by tan to greenish siltstone, claystone, fine-grained sandstone, and minor gravel. The presence of marine vertebrate and invertebrate fossils (Todd 1976) and freshwater and brackish aquatic invertebrate fossils indicates that the basin contained lacustrine and/or estuarine (marginal marine–Gulf of California) waters associated with early opening of the proto-Gulf of California (review in Spencer et al. 2008).

The age of the Bouse Formation has been debated for the last 30 years due to the paucity of diagnostic fossils, but recent evidence from its stratigraphic position relative to dated volcanic ashes indicates that it was deposited between 5.5 and 5.3 Ma (Pliocene) (Spencer et al. 2005), and it is overlain by Colorado River deposits to no younger than 4 Ma.

Geoarchaeological Sensitivity: None

The Bouse Formation was not exposed in the study area and therefore, is not included on the geoarchaeological map, but it may occur in the subsurface. However, due to its Pliocene (5.5-5.3 million years) age it is too old to contain archaeological resources.

2.2.5 Older River Gravels (Qog)

Older fluvial sediments and river gravel are widely exposed in the study area, particularly at the edges of mesas and ridges on both sides of the Colorado River up to elevations of 250 feet above the present water level (Figure 8). This unit is discontinuous and thickest in the northeast on the California side of the river; on the Arizona side of the river it conformably overlies the Older Alluvium (Figure 9). The FEIR geological map includes this unit within their "Quaternary Alluvium and Surficial Deposits, Undifferentiated (Qa)," but the text describes it separately (as "Qrg") and reports that it does not occur in the subsurface.



Figure 8 **Older River Gravels (Qog), roadcut to IM-3 off old Route 66. Note large basalt boulder; these are present mainly in outcrops closest to river. Most of the prehistoric archaeological sites in the Project area are associated with surface exposures of this unit where cobbles of fine-grained siliceous material (metaquartzite, chalcedony, chert, rare petrified wood) were worked.**

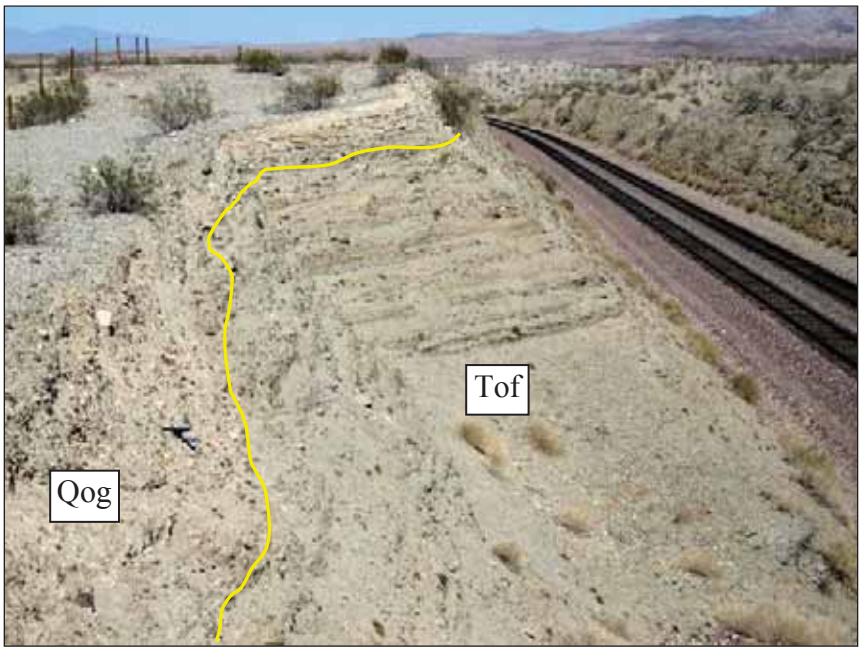

Figure 9 **Unconformable contact between Older Alluvium (Tof) and Older River Gravels (Qog) south side BN&SF tracks, west of Bat Cave Wash; view to the west.**

Older River Gravels include sandy pebble-cobble gravel containing well-rounded clasts of granite, gneiss, fine-grained metaquartzite, chert, petrified wood, jasper and chalcedony, limestone, silicified rhyolite, andesite, basalt, and other rock types from distant and local sources (Figure 9). In places clasts of gneiss and more commonly basalt are up to 3 feet in diameter, but the grain size is mostly cobble and pebble. The unit is discontinuous and its thickness varies from less than a foot to over 30 feet along Bat Cave Wash. In many areas, the unit has eroded nearly completely away, leaving behind scattered basalt boulders.

The unit is important archaeologically because most of the prehistoric sites recorded in the area contain artifacts manufactured from fine-grained silicic clasts from this unit. It also provided the source for the few basalt artifacts, mainly grinding stones, identified. Its exposures along the edges of mesas and ridges explain the similar (and previously unexplained) distribution of archaeological sites in the study area (BLM 2012; Davy et al. 2004).

The Older River Gravels have not been dated directly, but based on the presence of well-rounded "exotic" clasts, this unit represents the basal deposit of the "modern" Colorado River. Such deposits are widespread in the area and attest to a period of massive river downcutting and aggradation that ended about 4 Ma as indicated by an overlying volcanic ash (Buising 1993; Spencer 2011; Spencer and Patchett 1997; Spencer et al. 2005; Todd 1976).

Geoarchaeological Sensitivity: None

The Older River Gravels have no archaeological sensitivity because they are older than 4 Ma. The numerous archaeological sites spatially coincident with this unit are so located because the silicic clasts provided material for edged tools and were picked up after the unit was exposed by erosion: the artifacts lie atop the geological unit but were clearly not deposited as part of the unit because the edges are very sharp and fresh, showing no evidence of abrasion or natural rebreaking (Davy et al. 2004).

2.2.6 Younger Alluvium (Qya)

Younger Alluvium unconformably overlies the Bouse Formation (Tb) just west of the study area and the Tertiary Older Alluvium (Tof) throughout the study area (Figure 10). On both the California and Arizona sides of the river, it conformably overlies the Quaternary Older River Gravels (Qog) where they are present. However, despite their lithologic similarity and similar stratigraphic position, it is not certain that the fanglomerates on either side of the Colorado River are in fact the same unit (Figure 11). Therefore, this unit (Qya) is shown on the map herein in peach color on the California side and in orange on the Arizona side.

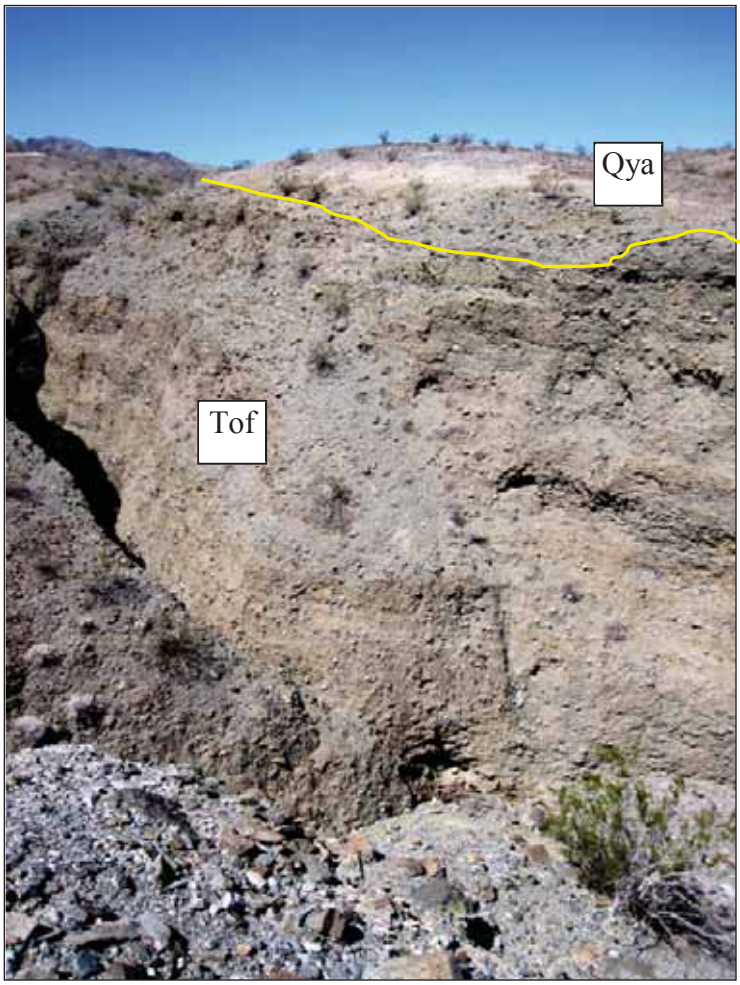

Figure 10 **Unconformable contact between Older Alluvium (Tof) and Younger Alluvium (Qya) east of Bat Cave Wash marked by break in slope and paler color/presence of fines in Qya. Commonly, Older River Gravels (Qog) lie between these units.**

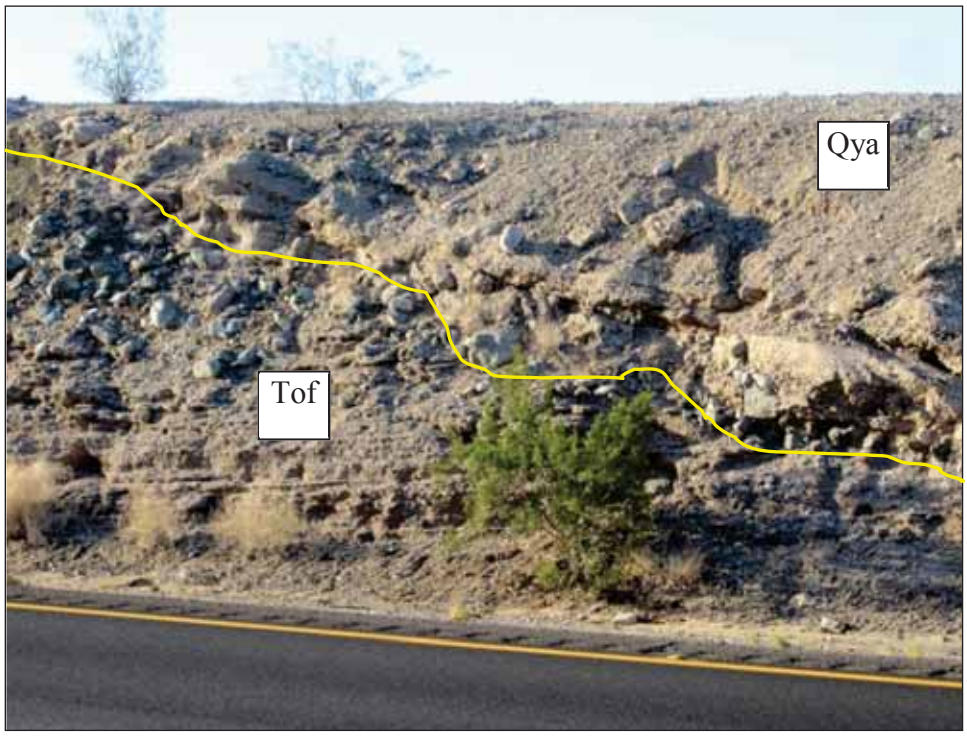

Figure 21 **Younger Alluvium (Qya) channeled into dipping beds of the underlying Older Alluvium (Tof) north of I-40 on the Arizona side of the river.**

The FEIR includes the Younger Alluvium (referred to therein as "Older Fluvial Sediments-Qrs") within their "Older Quaternary Alluvium (Qoa)," but it is not shown on the FEIR's geological map.

The Qya unit consists of locally derived angular gravels in muddy and sandy matrix (fan deposits) interbedded with and overlain by sand and rounded gravel (fluvial deposits) (Figure 12). The fan deposits comprise massive to weakly bedded, clast- and matrix-supported gravel composed of locally derived plutonic and metamorphic clasts closely resembling the Tertiary fanglomerate underlying the Bouse Formation, but this fanglomerate is somewhat less well indurated and is gray rather than hard and greenish, and its slopes are significantly less steep (<30 degrees) than those in Older Alluvium (Toa).

The river deposits include interbedded pinkish-tan sand and silt; root casts were noted along the pipeline road 1,000 feet west of the IM-3 treatment plant (Figure 12). Carbonate concretions are common, and buried paleosols were encountered in several of the surface scrape sites. The topographically lower sand beds are planar and tabular bedded and appear to be have been deposited on floodplains, but higher beds in the southern margin of the site are discontinuous and have high-angle cross beds consistent with aeolian deposits. The sand beds superficially resemble those in the Bouse Formation but here are more pink and are associated with fanglomerate and gravel rather than with finer-grained strata in the Bouse Formation. The gravels are clast-supported and cross-bedded pebbles containing well-rounded cobbles and pebbles of quartzite, limestone, and other rock types derived from distant sources.



Figure 12 **Younger Alluvium (Qya) showing locally derived fanglomerate (below) and pink silt and sand (above) river floodplain deposits on the north side of the BN&SF railroad cut on the California side of the river. Fine-grained section not always present.**

The unit overall probably represents deposition and erosion in a fluctuating mid to lower fan environment with periodic flood deposits and dunes from the early incursions of the ancestral Colorado River.

Metzger et al. (1973) considered the sand and finer gravel facies of this unit to be equivalent to the Chemehuevi Formation, which extends discontinuously from Lake Mead to Yuma, Arizona, a distance of over 330 miles. Howard et al. (1997) interpret the age of the Chemehuevi Formation elsewhere in the region to be 0.1–0.27 Ma, based on normal paleomagnetic polarity, degree of soil development on underlying alluvial fan deposits, and thorium-uranium and protactinium-uranium dating of a fossil tusk and overlying soils. Mammoth fossils *(Mammuthus meridionalis)* found north of the study area at Golden Shores suggest deposition during the Irvingtonian (Pleistocene) land-mammal stage 1.5–1.7 Ma (Agenbroad et al. 1992; House et al. 2005).

Geomorphological Surface and Soil on the Younger Alluvium

Although alluvial fan surfaces have formed on several of the units in the Project area, the one on the Younger Alluvium is particularly important because it contains evidence (described below) of the unit's minimum geological age. The following description is typical and was made at the location of the subsurface sampling (soil pit) west of Bat Cave Wash and south of IM-3 (Section 1.4.5) where approximately 40 percent of the surface had been severely disturbed by heavy tracked vehicles. A small, undisturbed location was selected here for the excavation because it would not disturb pristine fan surfaces elsewhere, but would still represent the alluvial fan overall. Tribal monitors were present during the work and approved the location of the sampling pit.

The alluvial fan surface has a moderately developed pavement of interlocked angular cobbles and pebbles, predominantly of intermediate intrusive rocks (see Figure 3) and a trace of rounded quartzite. Bar-and-swale morphology has been reduced to single-clast relief. Most of the larger clasts have parted in situ. The soil (Figure 13) is typical of those underlying geomorphic surfaces such as this (Birkeland 1999; McFadden et al. 1989; Vincent and Bull 1994), and is summarized in Table 1.

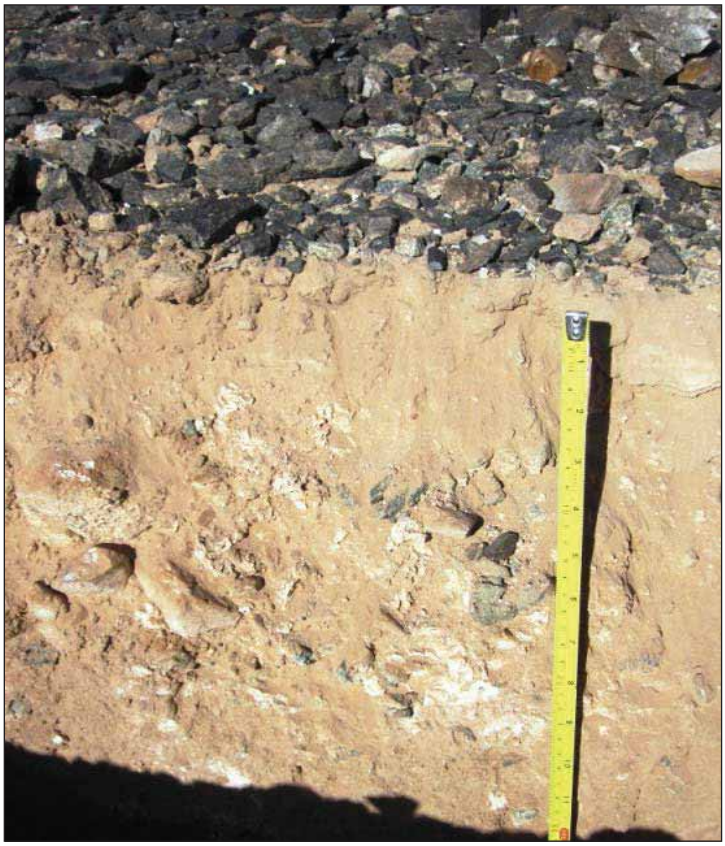

Figure 13 **Soil pit in Younger Alluvium (Qya). Note stone-free Av horizon at top, reddened color, and patchy Stage II carbonate "caliche."**

Table 1
Log of Younger Alluvium Soil Pit

Interval (cm)	Horizon	Description
0–3	Surface	Angular stony fan surface. Desert varnish is moderate—dark brown (7.5YR 3/2); clast undersides reddened to reddish yellow (5YR 6.6).
3–7	Av	Silt with minor clay. Light brown (7.5YR 6/4). 40% small spherical vesicles. Stone free. Very slightly sticky, nonplastic. Friable.
7–10	A	As above but nonvesicular. Gradual lower boundary.
10–25	Btk	Stony sandy silt. Brownish yellow (5YR 6/6, dry). Weak blocky structure. Slightly sticky. Clay films on grains. Common discontinuous soft, porous white carbonate patches in matrix and thin, hard carbonate coating on clast undersides. Clast tops reddened pink (5YR 7/4). Carbonate decreases downward. Grades downward to brownish yellow silty sand. Gradational lower boundary.
25–32	C	Brownish yellow silty sand (5YR 6/6, dry). Friable.

The overall alluvial fan deposit represents a weathered alluvial fan mudflow (mid to upper fan) derived from the adjacent Chemehuevi Mountains. At one time, flooding on the ancient Colorado River deposited a veneer of river cobbles (Younger River Gravels—Qyg), which were subsequently largely eroded away. Since then, the surface has weathered to produce a soil profile having an Av horizon from aeolian input of dust and carbonate material, indicating formation in an arid environment. This overlies a B horizon of increased clay, redder color on stones, and accumulation of calcium carbonate to State I–II. Soils having these characteristics are typical of Latest Pleistocene-Early Holocene in the Mojave Desert area (e.g., Birkeland 1999; McDonald and McFadden, 1995; McFadden et al. 1989; Vincent and Bull 1994; Wells et al. 2003) and are approximately 10,000 years old in geologic time.

Geoarchaeological Sensitivity: Lower

Fanglomerate parts of this unit have low archaeological sensitivity due to the harsh mechanism of scour and deposition, which is likely to remove any archaeological deposits. Sands have higher sensitivity since they represent deposition on the river floodplain and adjacent area, but the fossil evidence indicates the unit is well over a million years old.

2.2.7 Younger River Gravels (Qyg)

Sparse, discontinuous patches of cobble and pebble gravel overlie the Younger Alluvium (Qya). The deposits are thin—always less than 1 foot thick, and mostly a patchy veneer one clast thick—and are unconsolidated. Clasts are subangular to very well rounded and are mainly less than 3 inches in diameter (Figure 14). The composition is similar to that of the underlying gravel (Qrg1) except volcanic rock (especially basalt) is sparse. The surface usually has a dark desert varnish, moderately rubified clast undersides, and a well-developed Av soil horizon. Howard et al. (1997) included this unit as “Older Alluvium”; it is not shown on the FEIR’s geologic map (AECOM 2011).

Although the clasts in this unit are similar in composition to those in the Older River Gravels (Qog), those eroding from this unit are significantly less utilized archaeologically, probably because they are smaller, and thus less useful, than those in the older gravel.

The Younger River Gravels cannot be dated directly (having nothing to yield a minimum age), but based on their soil characteristics and stratigraphic position are most likely late Pleistocene or possibly Holocene in age directly overlying the Younger Alluvium. They represent flood event(s) on the ancestral Colorado River.

Geoarchaeological Sensitivity: Lower

The Younger River Gravels have low potential to contain buried archaeological material because: (1) the unit is insufficiently thick to contain sites (it is usually so thin the underlying unit shows through) and (2) as with the Older River Gravel, the turbulent hydraulics associated with the scour and deposition of this unit would most likely damage or destroy included archaeological remains and remove them from their original context.



Figure 14 **Rounded cobbles and pebbles of the Younger River Gravels (Qyg) forming a typical, discontinuous veneer over Younger Alluvium (Qya) deposits (angular clasts). Note angular clasts on the fan surface showing through. Fewer utilized clasts occur on outcrops of the Younger River Gravels than on the Older River Gravels, probably because most clasts in the former are small.**

2.2.8 River Floodplain Sediment (Qrf)

Unconsolidated silt, mud, and sand from the modern floodplain of the Colorado River lie on both sides of the river, but are much more widespread on the Arizona side (Figures 15 and 16). Sediment characteristics, fluvial geometry, stratigraphic relationships, and historical records indicate that the River Floodplain unit is Holocene (and in part, historic) in age. Metzger and Loeltz (1973) note that the 1938 closure of Parker Dam accounts for an upstream rise of 16.5–26 feet in the average river stage near Topock. Thus, the river bed and the floodplain unit have aggraded and widened during historic time. This unit's symbol herein (Qrf) is consistent with that used in the FEIR geologic map (2011, Exhibit 4.5-2).

Geoarchaeological Sensitivity: Higher

This unit has a higher potential to overlie archeological sites situated along the older floodplain and banks of the Colorado River. As discussed in Section 2.2.10 below, however, dredge spoils as much as 10-20 feet thick may cover the River Floodplain Sediment in some locations. These dredged sand and gravels have Lower archaeological sensitivity, but may overlie the Higher sensitivity River Floodplain Sediment.

2.2.9 Alluvium of Modern Washes (Qaw)

The Youngest Alluvium consists of sand, gravel, and lesser boulders eroded from adjacent slopes and upstream bedrock in modern washes. This material is transported during periodic mudflow and streamflow events, usually during summer monsoon storms, which tend to be short-lived but energetic. This unit is neither differentiated in the FEIR text nor shown on the geologic map (Exhibit 4.5.2).

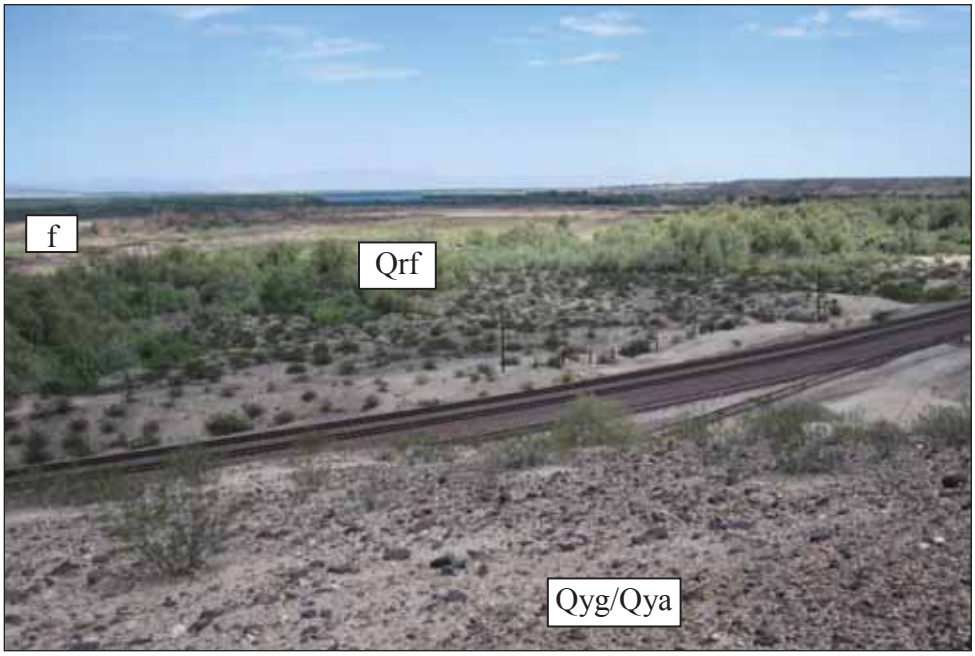

Figure 15 **View toward Colorado River from Arizona side overlooking River Floodplain Sediment (Qrf) in background across tracks—includes area in trees and beyond. Far left background is dredged fill (f). Foreground is Younger River Gravels (Qyg) overlying Younger Alluvium (Qya).**

Geoarchaeological Sensitivity: Moderate

Although the turbulent and abrasive nature of transport of these deposits makes the occurrence and preservation of all but the most robust of archaeological remains unlikely, occupation sites tend to be common along watercourses. Cobbles eroded from the Older River Gravels are abundant in this unit, so worked clasts from these gravels could be present as well. Therefore, this unit has moderate potential to contain buried archaeological sites, but most likely their contents would be damaged by hydraulic abrasion and displaced from their original context.

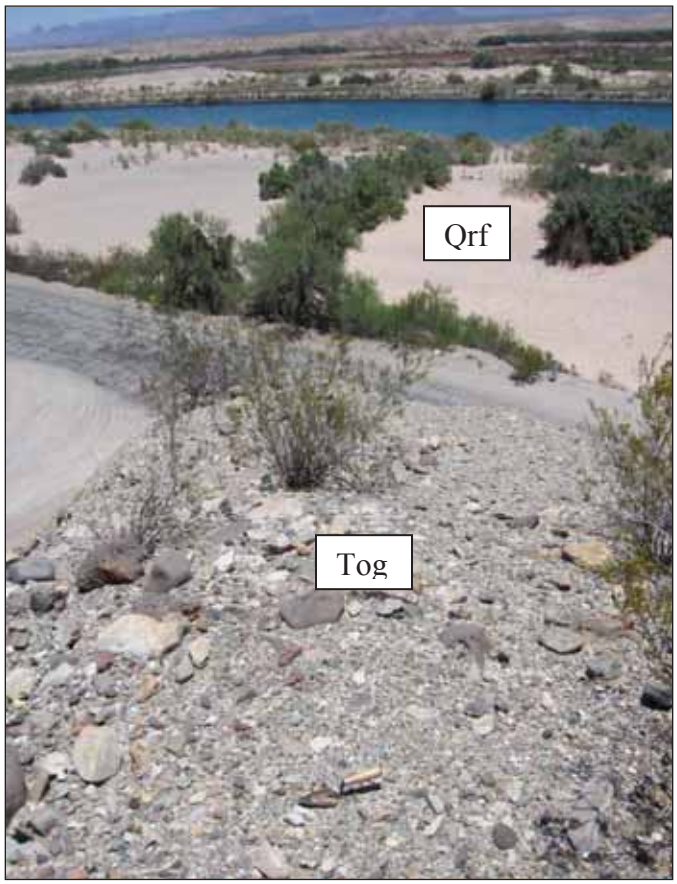

Figure 16 River Floodplain Sediment (Qrf) with wind-blown, dredged fill (f) on California side of river. Foreground is Older River Gravels (Tog); old Route 66 below. View to east.

2.2.10 Artificial Fill and Dredging Spoils (f)

On both sides of the Colorado River north of the I-40 bridge, dredging spoils (also included as fill) form a belt overlying River Floodplain Sediment. Artificial fill forms bodies from a few feet to more than 20 feet thick and underlies roadways, bridge abutments, and roadbeds throughout the study area. The material, consisting of sand and gravel, was dredged from the Colorado River or excavated from older geologic units and emplaced during construction operations to maintain grade. Following the end of World War II, the Army Corps of Engineers began to dredge the Colorado River and create channels to facilitate navigation. By the mid-1950s, when the work was completed, in excess of 20 feet of dredged sand and gravel had been deposited in some locations along the river banks and within the floodplain, creating sand islands and other landscape features that had not existed previously.

Geoarchaeological Sensitivity: Lower

The dredging spoils and fill have Lower archaeological sensitivity. Where it was excavated from River Floodplain Sediment or other older geologic units, it could contain archaeological remains; however, such remains would have lost their depositional context. Because the fill's thickness varies, care should be taken when excavating through it into the River Floodplain Sediment, which has Higher archaeological sensitivity, or other units beneath.

3
CONCLUSIONS AND RECOMMENDATIONS

3.1 CONCLUSIONS

Archaeological sensitivity of geologic units in the Topock area is ranked at four levels: none, lower, moderate, and higher. The sensitivity for the presence of buried sites was assigned on the basis of: (1) the type of geologic material (e.g., igneous vs. sedimentary), (2) the unit's geological age (millions vs. thousands of years), and (3) geologic processes of deposition and their effect on the preservation of archaeological and historical sites.

Nine geological units were mapped in the study area, and their potential to contain buried archaeological sites assessed. These units and assessments are summarized in Table 2 and indicated on the maps contained in Appendix C. Most units in the area have no (None) or Lower sensitivity due to (1) inappropriate deposit type; (2) excessive age (in millions of years); (3) turbulent hydrology during their deposition; or (4) subsequent mechanical disturbance making the presence of sites unlikely.

Table 2
Summary of Site Geology and Archaeological Sensitivity

Unit Symbol	Name	Age	Description	Archaeological Sensitivity
f	Artificial Fill, Dredging Spoils	Recent	Excavated and mechanically emplaced sand and gravel. Roadbeds and shoulders; bridge abutments.	Lower
Qaw	Alluvium of Modern Washes	Recent	Sand, gravel, and boulders in modern washes occurs throughout the site.	Moderate
Qrf	River Floodplain Sediment	Recent–Holocene	Fine sand and silt deposited by floods on the Colorado River. Most widespread on the Arizona side.	Higher
Qyg	Younger River Gravels	Late Pleistocene–Holocene	Subrounded to rounded "exotic" and subangular, locally derived clasts. Forms veneer on mesa tops.	Lower
Qya	Younger Alluvium	Pleistocene	Grayish fanglomerate; minor rounded gravel; pinkish, bedded, floodplain and aeolian sand.	Lower
Qog	Older River Gravels	Pleistocene	Heterolithic boulder-cobble gravel. Well-rounded clasts from distal sources including metaquartzite and basalt.	None
Tof	Older Alluvium	Miocene	Moderately indurated greenish fanglomerate of locally derived clasts. Forms steep canyon walls.	None
Tmc	Miocene Conglomerate	Miocene	Well-indurated reddish brown fanglomerate and conglomerate with minor sand.	None
pTbr	Pre-Tertiary Bedrock	Proterozoic–Mesozoic	Undifferentiated crystalline metamorphic and plutonic igneous rocks. Occurs in southern margin of site.	None

The most sensitive unit for buried sites is the River Floodplain Sediment (Qrf). Because of its young geologic age, fine grain size, and relatively moderate hydraulics of deposition (along with probable high initial habitation density), archaeological remains could become buried in this unit and could be preserved in good condition.

Although the turbulent and abrasive nature of transport of these deposits makes the occurrence and preservation of all but the most robust of archaeological remains unlikely, the Alluvium of Modern Washes (Qaw) has moderate sensitivity because it could contain artifacts eroded from topographically higher units or from relatively recent occupation along the watercourse, particularly along Bat Cave Wash, which has numerous archaeological sites along its length. Cobbles eroded from the Older River Gravels are abundant in this unit, so worked clasts from these gravels also could be present.

Prehistoric archaeological sites in the study area are typically associated with the Older River Gravels (Qog) and contain artifacts manufactured from the fine-grained silicic rocks found in this unit. These sites were deposited on the surface where the unit crops out; however, they do not signify exposures of formerly buried sites and the age and context of the unit indicate that buried sites will not be present.

Importantly, aside from in the few areas where fill or Modern Alluvium overlies the River Floodplain Sediment, archaeological sensitivity decreases with depth.

3.2 RECOMMENDATIONS

3.2.1 Excavations in the River Floodplain Sediment

The archaeological sensitivity of River Floodplain Sediment (Qrf) is higher than any other unit in the area mapped. This unit lies adjacent to the Colorado River and forms extensive deposits on the Arizona side and lesser ones on the California side. Since human occupation was likely widespread on the river's floodplains, its deposits have more potential to contain buried sites. Therefore, excavations in areas underlain by the River Floodplain Sediment should be monitored by appropriately trained personnel.

Dredge spoils fill (f) and Alluvium of Modern Washes have Lower archaeological sensitivity. These units occupy a relatively small part of the surface of the Project area, but in places they overlie the River Floodplain Sediment, which has Higher sensitivity. Excavations that might cut through fill or dredge spoils into the River Floodplain Deposits should be monitored.

3.2.2 Moderate Sensitivity Unit

One unit has moderate sensitivity: the Alluvium of Modern Washes (Qaw). Since this unit may contain buried artifacts eroded from the Older River Gravels (Qaw) or washed directly into the unit, excavations in this unit should be monitored.

3.2.3 Disturbance of the Older River Gravels

Lithic scatters are common on surfaces overlying Older River Gravels because Native people utilized fine-grain, siliceous clasts from within. Therefore the Older River Gravels should be avoided, and if they cannot, detailed surface surveys should be undertaken before any ground disturbance occurs there.

4
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Appendix A
Glossary (terminology as used in this report)

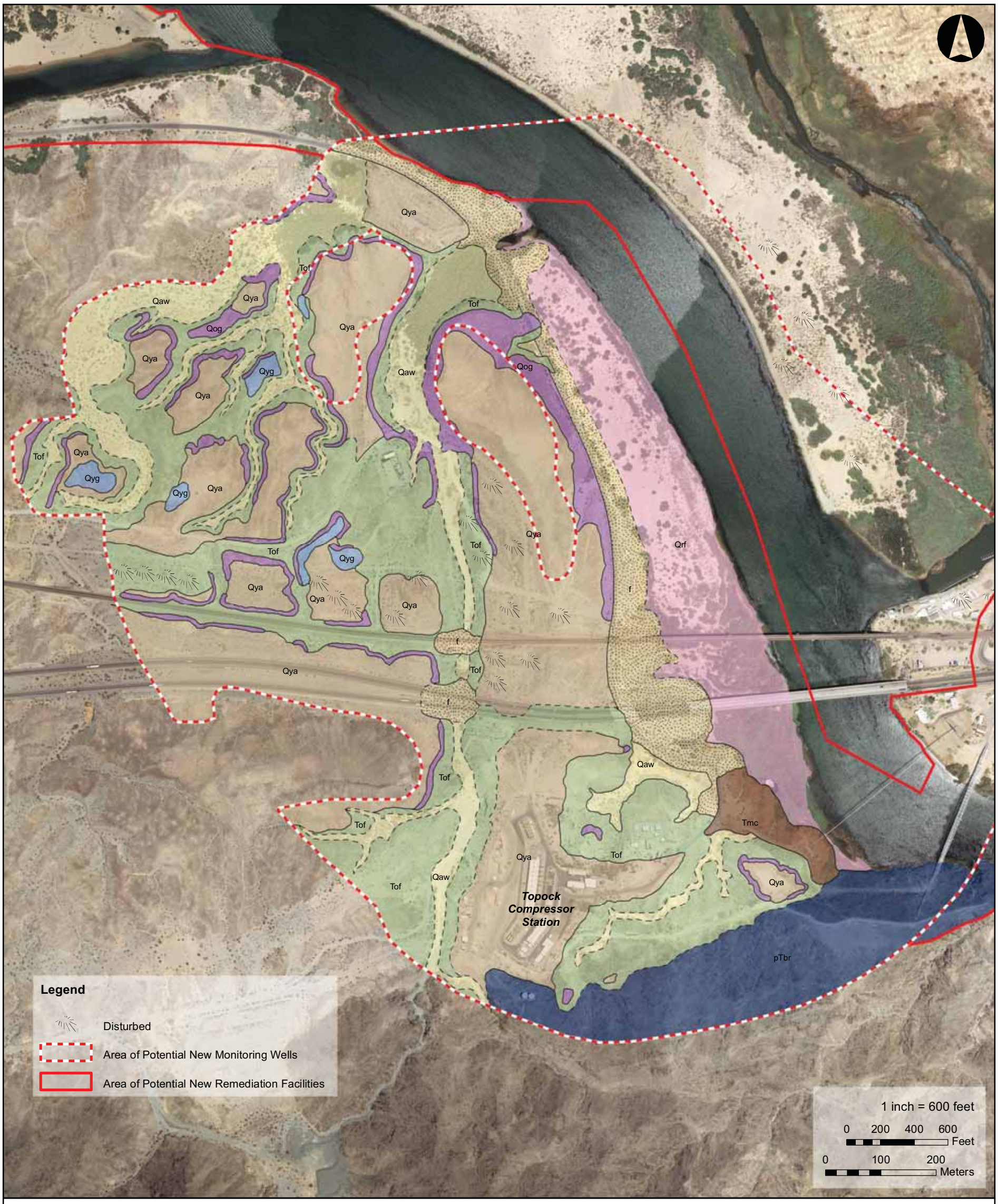
Av soil horizon	Vesicular A horizon. Fine, silty surface soil with numerous pores due to effervescence of carbon dioxide.
Aeolian	Windblown.
Bk soil horizon	Zone cemented most commonly by calcium carbonate. Ranges from minor and patchy cementation to highly indurated "caliche." Accumulates with increasing age.
Bt soil horizon	Zone of accumulated clay from the overlying A horizon, and reddish color due to oxidation of iron. Thickness and depth of color increase with time.
Bar-and-swale	Surface morphology of levees and channel on alluvial fans caused by debris flows.
Clast	Rock or mineral fragment.
Desert pavement	Interlocking surface of stones on a fan surface caused by removal of fine material by wind over time.
Desert varnish	Dark coating of Mn oxides and clay coating upper surfaces of clasts on alluvial fans. Accumulates with increasing age.
Fanglomerate	Deposit of angular rock fragments, sand, and mud formed at the mountain front. Usually coarsens down fan. Includes interlayered debris-flow (muddy matrix) and stream-flow (clean gravel and sand) deposits.
Fluvial	Refers to rivers or streams
Lacustrine	Refers to lake.
Ma	Mega annum—millions of years.
Rubification	Reddening on clast undersides due to the translocation of iron oxides. Accumulates with time.
Unconformity	Gap in time between two successive sedimentary beds. Usually represents erosion.

Appendix B
Geologic Time Scale (courtesy American Geological Union)

ERA	PERIOD	MILLION YEARS		EPOCH
		DURATION	BEFORE PRESENT	
CENOZOIC	QUATERNARY (Q)		0.01	HOLOCENE (Recent)
		1.99	2.5	PLEISTOCENE (Qp)
	TERTIARY (T)	5	7	PLIOCENE (Tpl)
		19	26	MIOCENE (Tm)
		12	38	OLIGOCENE (To)
		16	54	EOCENE (Te)
		11	65	PALEOCENE (Tp)
MESO-ZOIC	CRETACEOUS (K)	71	136	
	JURASSIC (J)	54	190	
	TRIASSIC (TR)	35	225	
PALEOZOIC	PERMIAN (P)	55	280	
	PENNSYLVANIAN (P)	30	310	
	MISSISSIPPIAN (M)	35	345	
	DEVONIAN (D)	50	395	
	SILURIAN (S)	35	430	
	ORDOVICIAN (O)	70	500	
	CAMBRIAN (C)	70	570	
	PROTEROZOIC	1930	2500	
	ARCHEAN	1900	4600	

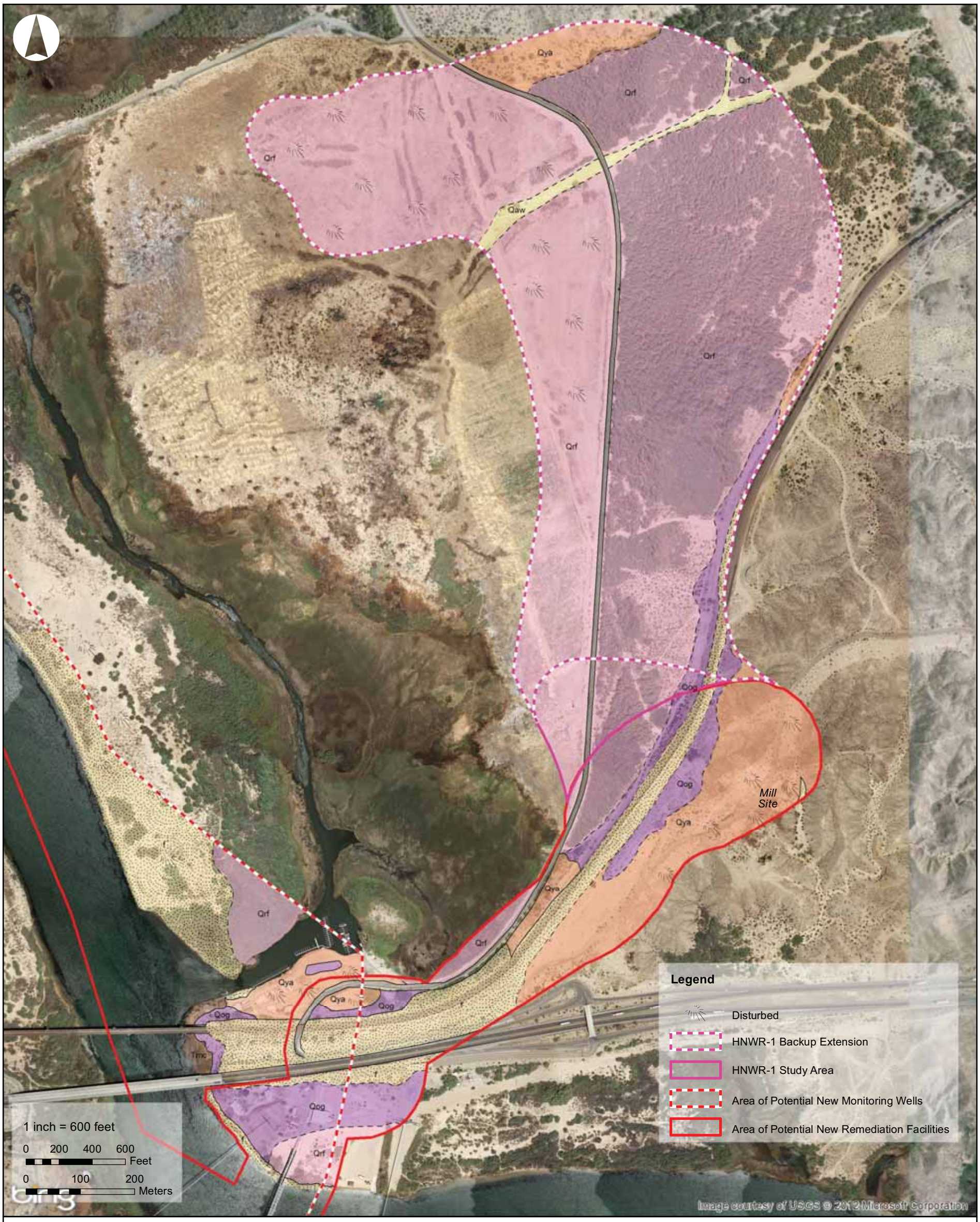
APPENDIX C

Geologic Maps and Geoarchaeological Sensitivity Maps



Age		Symbol	Unit	Description
Quaternary	Recent		Artificial Fill, Dredge Spoils	Excavated and mechanically emplaced sand and gravel. Roadbeds and shoulders; bridge abutments.
	Recent	Qaw	Alluvium of Modern Washes	Gravel, boulders, and minor sand eroded from Tertiary sedimentary units and local bedrock.
	Recent-Holocene	Qrf	River Floodplain Sediment	Unconsolidated fine sand, silt, mud of Colorado River Floodplain.
	Pleistocene-Holocene (?)	Qyg	Younger River Gravels	Subrounded to rounded "exotic" and subangular, locally derived clasts. Forms veneer on mesa tops.
	Pleistocene	Qya	Younger Alluvium	Locally derived, gray fanglomerate and pink silty sand. Shown in tan color on CA side of river; orange on AZ side.
	Pleistocene	Qog	Older River Gravels	Gravel and minor sand. Well rounded pebbles to cobbles with some boulders from local and distal sources. Characteristic metaquartzite and basalt clasts. Discontinuous; channeled into the Older Alluvium. Numerous archaeological sites where exposed.
Tertiary	Miocene	Tof	Older Alluvium	Locally derived, greenish-gray, fanglomerate. Forms steep-walled cliffs only on CA side of river. Underlies Bouse Formation just east of the Project area.
	Miocene	Tmc	Conglomerate	Dark reddish brown, well indurated, fanglomerate and conglomerate. Limited exposures near the I-40 bridge.
PreCambrian -Cretaceous	Pre-Tertiary	pTbr	Crystalline bedrock	PreCambrian through Cretaceous plutonic and metamorphic rocks. Not exposed in AZ.

Map 1A Geoarchaeological Map of the Topock Remediation Site, San Bernardino County, California



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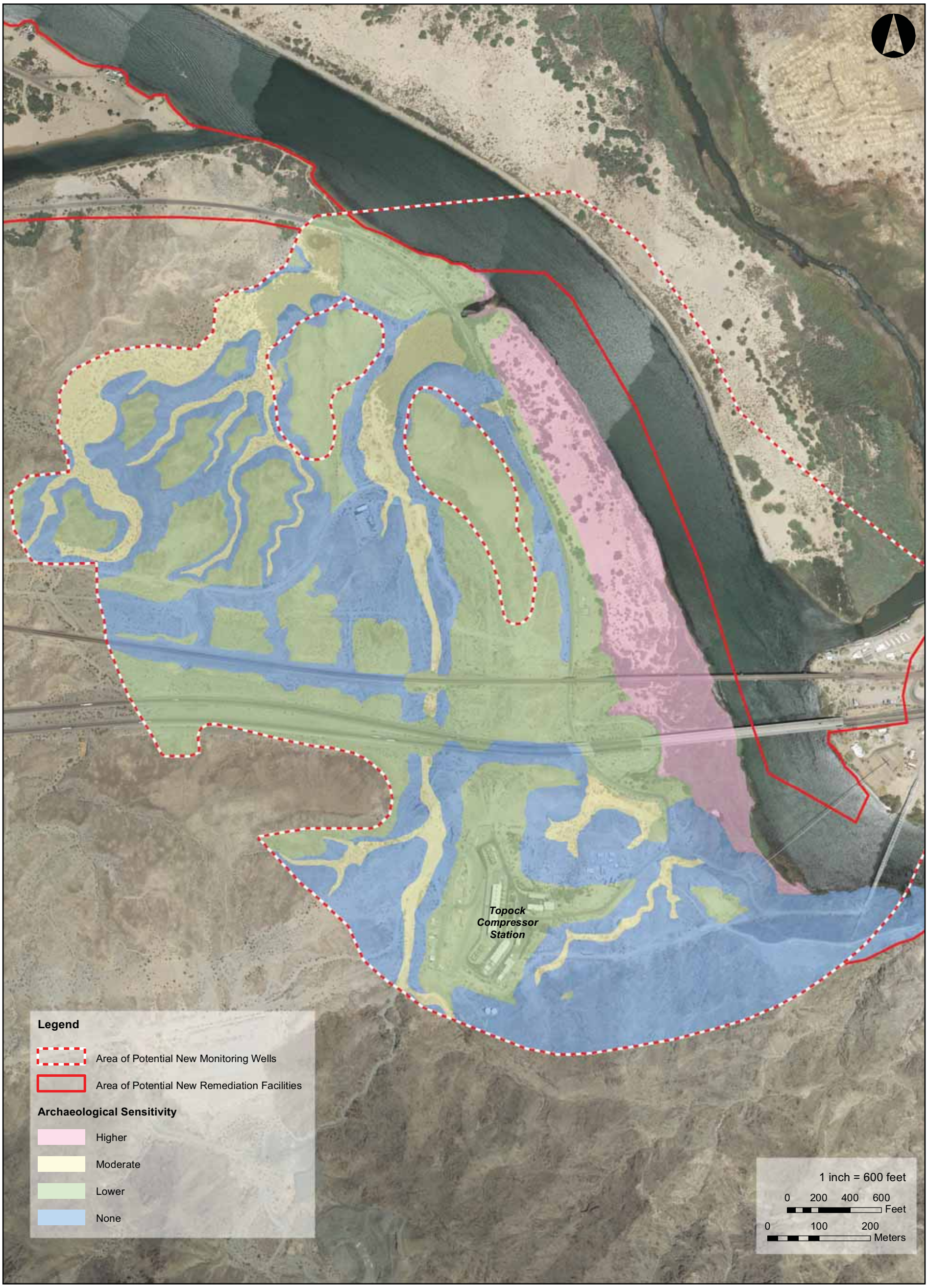
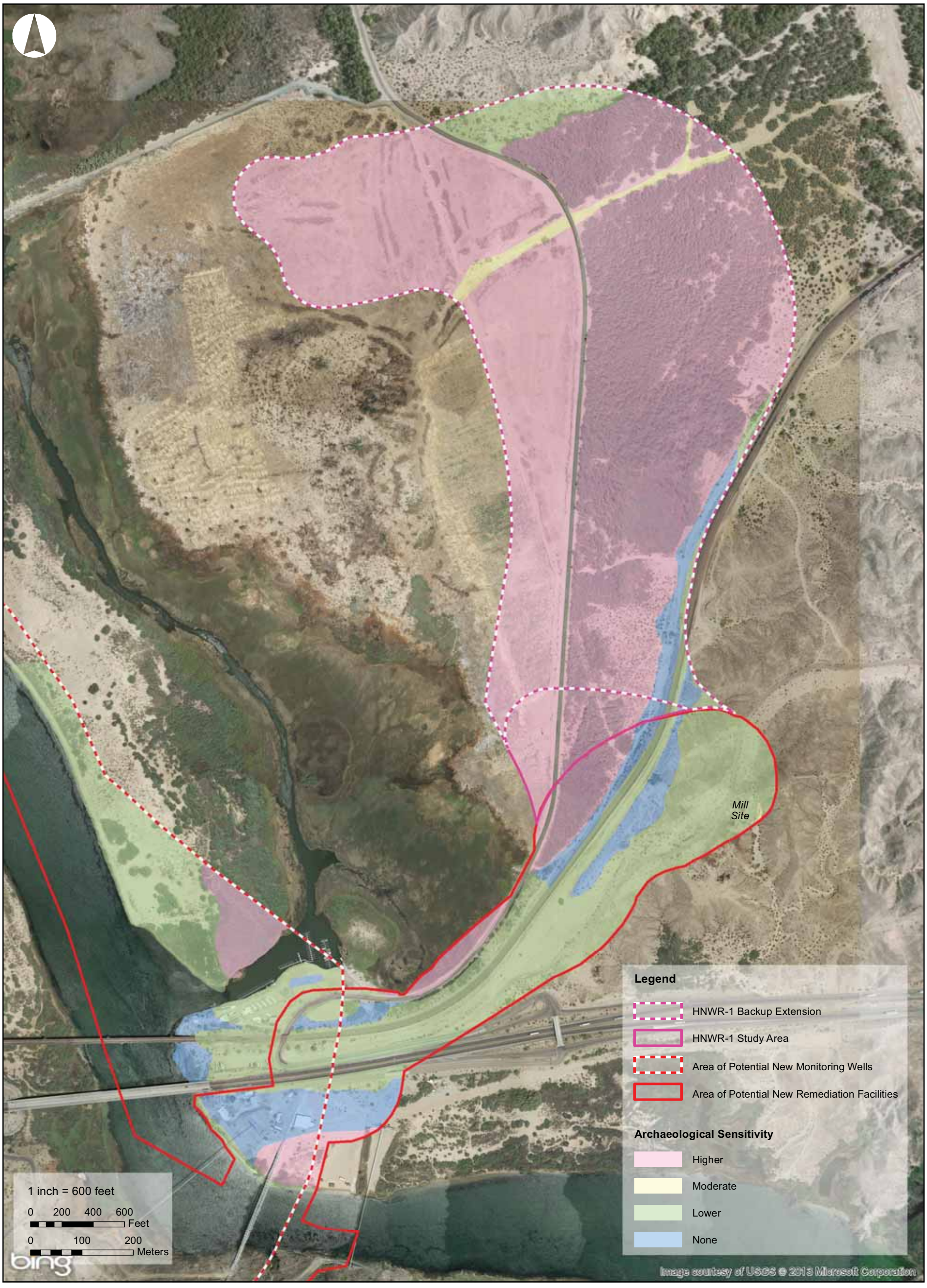
PreCambrian -Cretaceous	Pre-Tertiary	pTbr	Crystalline bedrock	PreCambrian through Cretaceous plutonic and metamorphic rocks. Not exposed in AZ.

Map 1B Geoarchaeological Map of the Topock Remediation Site, Mohave County, Arizona



Map 2A Geoarchaeological Sensitivity Map of the Topock Remediation Site, San Bernardino County, California



Map 2B Geoarchaeological Sensitivity Map of the Topock Remediation Site, Mohave County, Arizona

Appendix U
Programmatic Biological Assessment
(On CD-ROM Only)

Final

Programmatic Biological Assessment for Pacific Gas and Electric Topock Compressor Station Final Groundwater Remedy

Prepared for

Pacific Gas and Electric Company

April 2014

CH2MHILL

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Acronyms and Abbreviations

2007 PBA	*Programmatic Biological Assessment for Pacific Gas and Electric Topock Compressor Station Remedial and Investigative Actions*
µg/L	micrograms per liter
amsl	mean sea level
AOC	Area of Concern
ARAR	applicable or relevant and appropriate requirement
ATV	all-terrain vehicle
BIAMP	Bird Impact Avoidance and Mitigation Plan
BLM	United States Bureau of Land Management
BNSF	Burlington Northern-Santa Fe Railroad
CACA	Corrective Action Consent Agreement
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHHSL	California Human Health Screening Level
CIP	Clean-In-Place
CMP	Compliance Monitoring Program
CNPS	California Native Plant Society
Cr(III)	trivalent chromium
Cr(T)	total chromium
Cr(VI)	hexavalent chromium
CRPR	California Rare Plant Ranks
CSM	conceptual site model
CTUC	California Trail Users Coalition
DOI	United States Department of Interior
DTSC	Department of Toxic Substances Control
ER	East Ravine
ESA	Endangered Species Act
FCR	field contact representative
GMP	Groundwater Monitoring Program
HNWR	Havasu National Wildlife Refuge
IM	Interim Measure

IMPM	Interim Measures Performance Monitoring
IRL	Inner Recirculation Loop
IRZ	In situ Reactive Zone
ISPT	in situ pilot study
NHD	National Hydrologic Dataset
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance
ORV	off-road vehicle
PBA	programmatic biological assessment
PG&E	Pacific Gas and Electric Company
PMP	performance monitoring program
ppm	parts per million
RAO	remedial action objective
RB	River Bank
RCM/ PCMP	Corrective Measure/Remedial Action Monitoring Program
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RI	CERCLA Remedial Investigation
ROD	Record of Decision
ROW	right-of-way
SAP	Sampling and Analysis Plan
SCADA	Supervisory Control and Data Acquisition
SMP	Soil Management Plan
SWMU	Solid Waste Management Unit
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TCLP	toxicity characteristic leaching procedure
TSC	Topock Compressor Station
TWB	Transwestern Bench
USBR	United States Bureau of Reclamation
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WET	Waste Extraction Test

SECTION 1.0

Introduction

Pacific Gas and Electric Company (PG&E) is implementing the selected groundwater remedy for chromium in groundwater at the PG&E Topock Compressor Station (TCS, or the Compressor Station) in San Bernardino County, California. The TCS site is located about 15 miles southeast of Needles (Figure 1). The existing chromium contamination in groundwater is largely attributable to historical wastewater discharge from TCS operations to Bat Cave Wash, designated as Solid Waste Management Unit (SWMU) 1/Area of Concern (AOC) 1, and within the East Ravine, designated as AOC 10.

Remedial activities at the TCS site are being performed in conformance with the requirements of the Resource Conservation and Recovery Act (RCRA) Corrective Action pursuant to a Corrective Action Consent Agreement (CACA) entered into by PG&E and the California Department of Toxic Substances Control (DTSC) in 1996, as well as the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) pursuant to the Remedial Design/Remedial Action Consent Decree between the United States and PG&E, approved by the United States District Court for the Central District of California in November 2013. Soils investigation work is proceeding under the CACA and pursuant to the Administrative Consent Agreement entered into between PG&E and the federal agencies (U.S. Department of the Interior [DOI], Bureaus of Land Management [BLM] and Reclamation [USBR] and the U.S. Fish and Wildlife Service [USFWS]) (collectively the "Federal Agencies") in 2005.

In December 2010, the DOI issued a Record of Decision (ROD) selecting the groundwater remedy for the site, and in January 2011, DTSC also adopted the Final Remedy for the groundwater contamination. The Consent Decree requires the planning, design, construction, operation and maintenance (O&M), post-remediation monitoring, decommissioning, and restoration of the groundwater remedy selected in the ROD.

This Final Groundwater Remedy Programmatic Biological Assessment (PBA) has been prepared to address potential effects on federal listed species resulting from present or planned investigative and remedial activities related to implementation of the final groundwater remedy to address contamination resulting from historical operations at the TCS.

PG&E is requesting federal Endangered Species Act (ESA) coverage for these activities through the end of the project, which is currently estimated for up to 50 years.

The Action Area for this consultation is shown in Figure 2 and described in Section 3.1, and has been refined based on the final remedy design process. The Action Area term is defined as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 Code of Federal Regulations [CFR] 402.02)." Activities undertaken pursuant to the federally approved investigative and remedial program, including those that require subsequent discretionary federal review and approval, have been and will continue to be evaluated for potential project effects to species that are listed under the federal ESA. There are several species protected by the California Endangered Species Act (CESA) that could potentially occur within the Action Area; however, implementation of the protective measures that are described in this PBA are expected to reduce the risk of take for those species and therefore eliminate the need for incidental take coverage under the California Fish and Game Code Section 2081(b).

BLM is the designated federal representative for this PBA consultation. As of December 2011, BLM has designated PG&E as the non-federal representative for the Topock Remediation Project. This designation pertains to informal consultations pursuant to Section 7 of the ESA (DOI, 2011).

This Final Groundwater Remedy PBA serves as supporting documentation for the BLM Lake Havasu Field Office as the lead federal agency, under the provisions of the ESA of 1973, as amended, and implementing

regulations found at 50 CFR Part 402 for the evaluation of project effects on listed species and resulting determinations. Because the western yellow-billed cuckoo was recently proposed for listing, this document also serves as supporting documentation to conference on that species consistent with 50 CFR 402.10.

1.1 Consultation to Date

In January 2000, PG&E was issued a non-jeopardy biological opinion for ongoing maintenance activities on the PG&E gas pipeline system in the California desert on lands that were managed by BLM and covered the pipeline's effects on the desert tortoise and its critical habitat. However, that biological opinion specifically addressed maintenance of the gas pipeline and did not apply to the past, present, or planned investigative and remedial activities associated with the Action Area.

In September 2004, the BLM Lake Havasu Office initiated an informal consultation with the USFWS Ventura Office on behalf of PG&E regarding potential impacts to the Mojave (now Agassiz's) desert tortoise and southwestern willow flycatcher related to a time-critical removal action/interim measure within the Action Area. The anticipated biological impacts were addressed in the *Final Biological Resources Investigations for Interim Measures No. 3: Topock Compressor Station Expanded Groundwater Extraction and Treatment System San Bernardino County, California* (CH2M HILL, 2004a). Based on the proposed activities, which included a proposed groundwater treatment system, a "no effect" determination was considered appropriate for that project. To date, Interim Measure (IM) No. 3 has been working under this determination and no effect on (or take of) listed species has occurred.

Based on prior discussions, PG&E received a letter from USFWS Havasu National Wildlife Refuge (HNWR) staff in January 2005 requesting that protocol surveys for the Yuma clapper rail not be performed because HNWR staff were interested in avoiding duplication of existing USFWS survey efforts and were concerned with potential added stress to the Yuma clapper rail (USFWS, 2005a).

In March 2005, a work plan was produced and submitted to BLM, USFWS (HNWR and Phoenix, Arizona, USFWS offices), and California Department of Fish and Game (CDFG) representatives that described the proposed surveys within suitable habitat for the southwestern willow flycatcher, Mojave desert tortoise, and Yuma clapper rail within the Action Area (CH2M HILL, 2005a).

In addition, a biological assessment and Section 7 ESA informal consultation was completed in December 2005 related to construction of the PE-1 groundwater pipeline and implementation of the floodplain in situ pilot study, both located on the floodplain of the Colorado River. The applicable *Biological Assessment for the Pacific Gas and Electric Topock Compressor Station Remedial and Investigative Actions* (CH2M HILL, 2005b) was completed in November 2005. The subsequent consultation resulted in a USFWS determination of "may affect, not likely to adversely affect" for southwestern willow flycatcher and a "no effect" finding for all other federal listed species potentially occurring within the Action Area. Concurrence was provided via BLM authorization to proceed on December 9, 2005 (BLM, 2005a).

In 2006, informal consultation was conducted for the *Site Access and Sampling Procedures for Groundwater Monitoring Wells Located Near Potential Southwestern Willow Flycatcher Habitat, Topock Compressor Station, Technical Memorandum, Rev. 3* (CH2M HILL, 2006a). USFWS concurred with a determination of "may affect, but not likely to adversely affect" on April 28, 2006. These access and sampling procedures are currently being implemented and will be carried forward to the project conclusion.

As part of the interim measures on federal lands, Action Memoranda were issued by the Federal Agencies pursuant to Section 104 of the CERCLA. These Action Memoranda include general mitigation measures (outlined in Section 3.4) to manage biological resources. In addition, several measures were subsequently specified or clarified, specifically, access routes and dates, to avoid impacts to nesting migratory birds and southwestern willow flycatcher and their habitats.

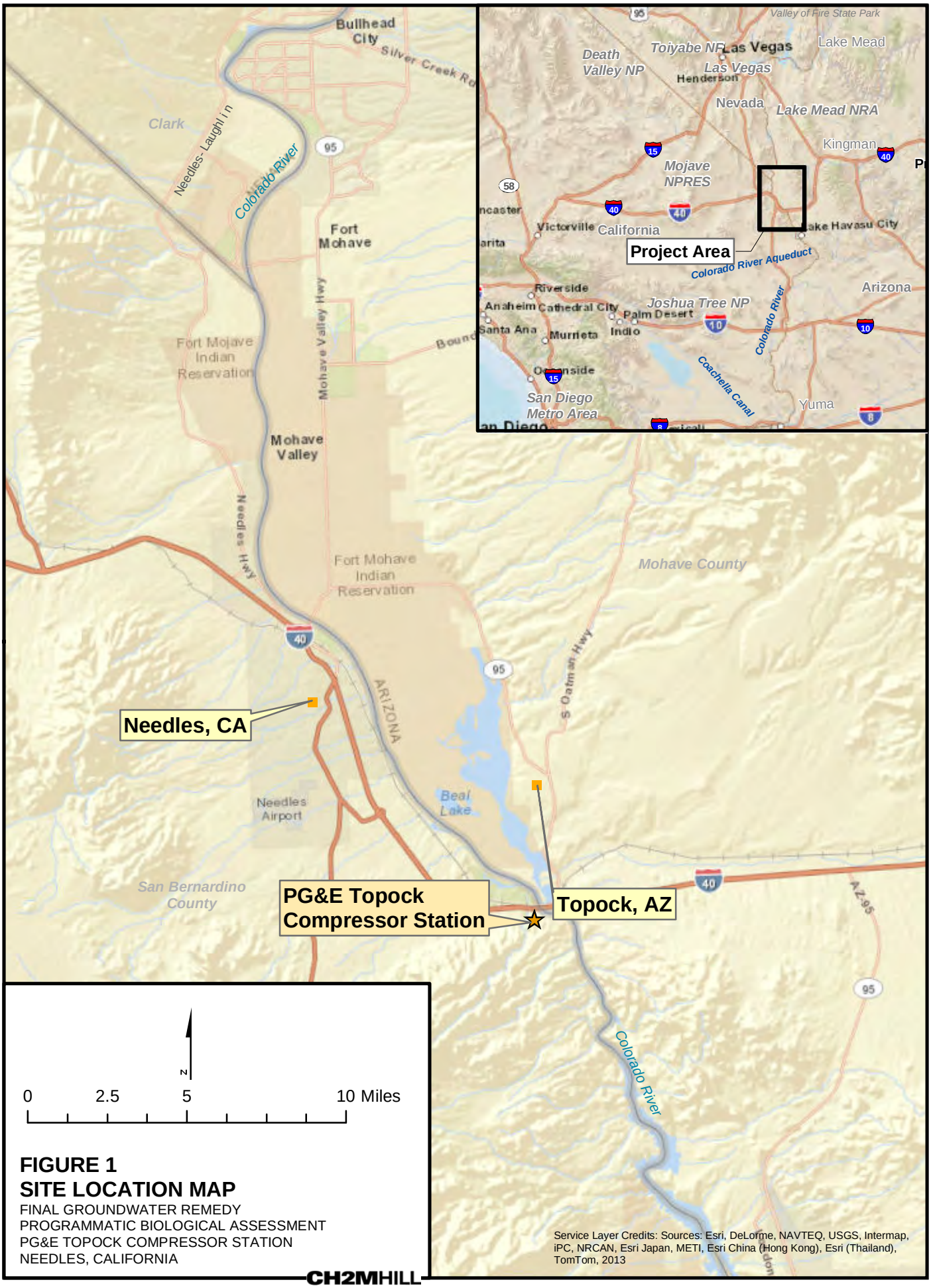

FIGURE 1
SITE LOCATION MAP
FINAL GROUNDWATER REMEDY
PROGRAMMATIC BIOLOGICAL ASSESSMENT
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

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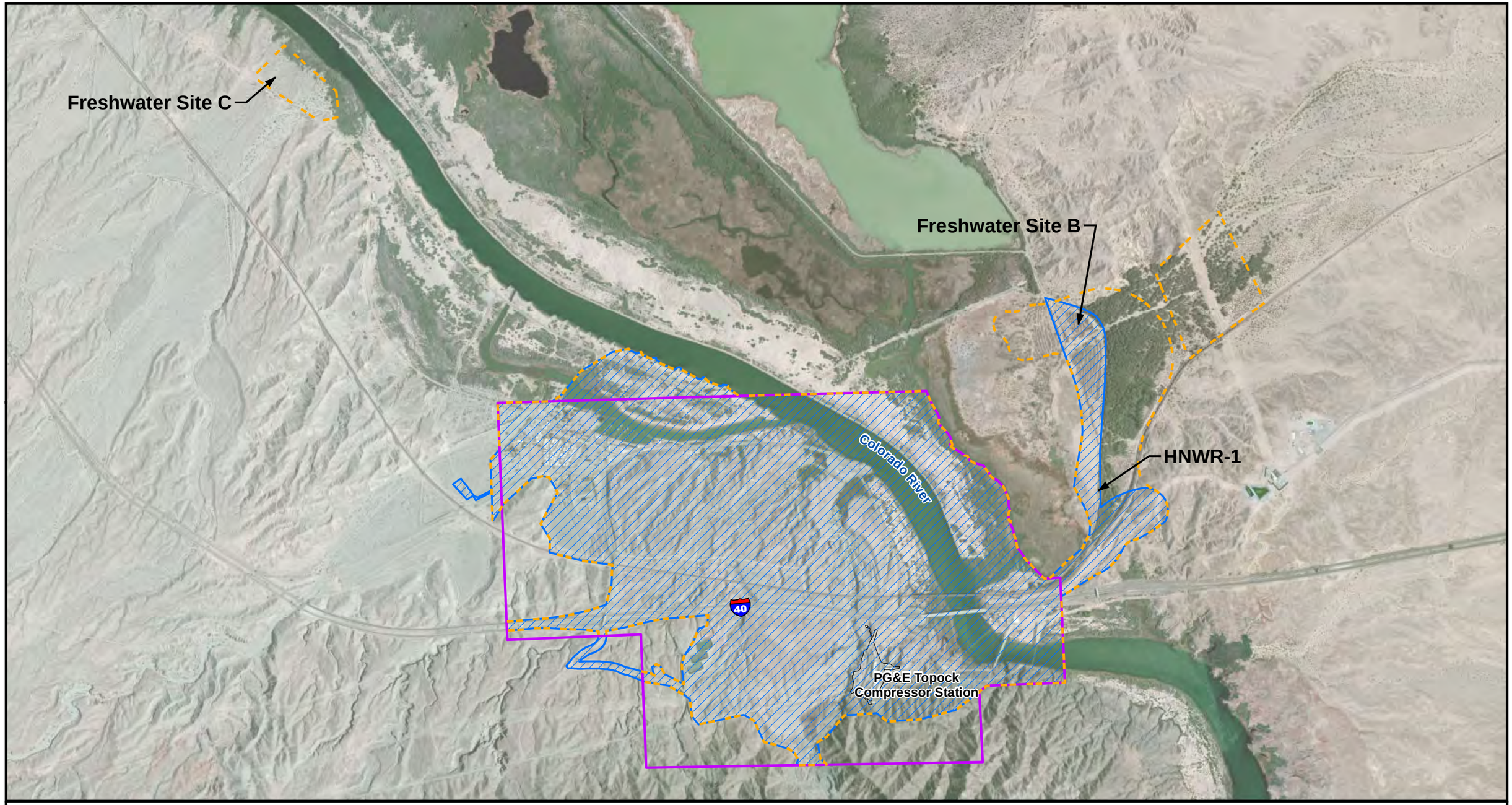

LEGEND

- 2007 PBA Area of Potential Effect (APE)
- 2012 PBA Re-Initiation Action Area
- PBA Update Action Area

N

0 1,000 2,000 4,000 Feet

FIGURE 2
ACTION AREA
FINAL GROUNDWATER REMEDY
PROGRAMMATIC BIOLOGICAL ASSESSMENT
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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In 2007, informal consultation with USFWS pursuant to Section 7 of the ESA was conducted in support of the *Programmatic Biological Assessment for Pacific Gas and Electric Topock Compressor Station Remedial and Investigative Actions* (2007 PBA; CH2M HILL, 2007a). This document addressed the potential effects on species that were protected under the ESA that could result from remedial and investigative activities at the TCS. USFWS concurred with the determinations provided in the 2007 PBA, as documented in a letter dated February 8, 2007 (USFWS, 2007a). In that letter, USFWS concurred with the determinations of "may affect, but not likely to adversely affect" for the southwestern willow flycatcher, Mojave desert tortoise, Yuma clapper rail, razorback sucker, and bonytail chub.

In 2010, a Programmatic Agreement was established between PG&E, BLM, and the California State Historic Preservation Officer pertaining to Native American tribes' concerns regarding historic and cultural properties. Based on that agreement, USFWS was notified of the need for additional surveys in three areas located outside of the 2007 PBA Action Area to determine the status of federal listed species in these areas. These additional survey areas were the expanded Action Areas to the north and west in California and the eastern portion of the Action Area in Arizona, as shown in Figure 2. The expanded portions of the Action Area in California were surveyed in 2010 (CH2M HILL, 2010a), while the expanded Action Area in Arizona was surveyed in 2013 (WSA, 2013). These surveys were completed in accordance with approved survey protocols, and a brief summary of the survey results is included in this section.

The project area has been surveyed annually according to approved survey protocols for the presence of southwestern willow flycatcher between 2005 and 2010 (GANDA, 2005a, 2006a, 2007a, 2008a, 2009a, 2010). Similarly, the project area was surveyed according to approved survey protocols for Mojave desert tortoise annually between 2005 and 2009 (GANDA, 2005b, 2006b, 2007b, 2008b, 2009b). As discussed below, the survey for Mojave desert tortoise in 2010 was limited to three areas in California where the Action Area had been expanded (CH2M HILL, 2010a).

In February 2010, PG&E submitted a letter to USFWS proposing modifications to the frequency of performed protocol surveys for the southwestern willow flycatcher and Mojave desert tortoise (PG&E, 2010). Based on the 2005–2009 protocol survey results, PG&E proposed a reduction of southwestern willow flycatcher protocol survey frequency from annual to biennial. The request was based on the negative findings from 5 years of completed surveys in which no nesting pairs and only transient southwestern willow flycatchers have been observed within the Action Area. PG&E also proposed a cessation of Mojave desert tortoise protocol surveys. The request was based on the absence of tortoise sightings in 5 years of annual protocol surveys conducted between 2005 and 2009. In March 2010, PG&E received concurrence from USFWS (USFWS, 2010a) approving the proposed frequency modifications to the southwestern willow flycatcher and Mojave desert tortoise protocol surveys. The revised frequency for protocol surveys for southwestern willow flycatcher were implemented in 2010, so that the next survey was completed in 2012 (GANDA, 2012).

On November 3, 2010, BLM requested a partial re-initiation of consultation regarding the 2007 PBA for an additional 15 monitoring well clusters. The additional wells increased the number of upland well clusters from 15 to 30; however, it did not increase the area of upland habitat disturbance from 3.0 acres, as originally provided for in the 2007 PBA. On November 16, 2010, the USFWS issued a letter to the BLM stating that the revised project did not change its concurrence of "may affect, but not likely to adversely affect" for species covered under the 2007 PBA (USFWS, 2010a).

In 2011, USFWS requested clapper rail surveys in portions of the Action Area that had not been previously surveyed by USFWS as part of its ongoing annual survey and monitoring program. PG&E proposed a modified survey protocol for the Yuma clapper rail to identify suitable habitat of the Action Area along with other project modifications, which the USFWS accepted. The protocol is based on recommendations provided in the *Survey Guidelines to Determine Presence/Absence of the Light-footed Clapper Rail in Southern California; Recommendations of the Clapper Rail Study Team* (Konecny et al., 2009).

In December 2012, BLM requested re-initiation of consultation regarding the 2007 PBA for a proposed 5-year extension of the 2007 PBA, and a revised Action Area (Figure 2) that included an additional well to

the north of HNWR-1 as part of the Final Groundwater Remedy freshwater source (BLM, 2012). It also requested an additional 5.0 acres of allowable upland habitat disturbance to accommodate soil sampling activities. On December 27, 2012, USFWS provided concurrence and approval of the 5-year extension of the 2007 PBA (USFWS, 2012). On January 9, 2013, USFWS issued a correction letter to its December 27, 2012, letter stating additional 5.0 acres of upland habitat disturbance would bring the new total acreage of disturbance to 8.0 acres, rather than 6.4 acres (USFWS, 2013a).

On December 3, 2013, a conference call was held to kick-off the final PBA for the Topock Groundwater Remedy. The call included participants from BLM, USFWS, and DOI, as well as PG&E and its consultant, CH2M HILL. Because the soils investigation is proceeding under the federal Consent Agreement and the groundwater investigation and remediation is proceeding under the federal Consent Decree, topics of discussion included an explanation of how the current PBA would focus on the final groundwater remedy, while ongoing soil investigations would continue until 2017 under the re-initiated 2007 PBA. If remedial/corrective action is determined to be needed for soil, a Final Soils Remedy would be selected, and a new consultation would be initiated. It was noted that the current PBA would follow the organization of the 2007 PBA with completed work summarized and details provided for ongoing or planned activities. An agreement was sought and received to use the term Action Area in the current PBA as long as it was clearly defined. It was also noted that the western yellow-billed cuckoo would be added as a "proposed for listing" species for conferencing consistent with 50 CFR 402.10 and to seek coverage under the Final Groundwater Remedy PBA, should that species' listing occur before the project's completion. Lastly, a schedule for submittal and review was discussed.

1.2 Content and Scope

The scope of this Final Groundwater Remedy PBA includes coverage for present and planned activities that are associated with the implementation of the Final Groundwater Remedy. It also addresses past and present activities approved at the site, including those that will be conducted for the soils investigation, consistent with the re-initiated 2007 PBA. The federal ESA coverage of the activities described in this PBA is being requested through the end of the project, currently estimated to be up to 50 years.

The content of a biological assessment is at the discretion of the federal agency and depends on the nature of the action for which consultation is requested. The term "action" refers to discretionary activities or programs that are authorized, funded, or carried out, in whole or in part, by federal agencies. In coordination with PG&E, BLM (as the lead Federal Agency for DOI) has initiated consultation with USFWS to comply with agency responsibilities to consider the effects of activities to federal ESA listed species within the Action Area.

This consultation does not preclude future consultations or additional management restrictions by the BLM or the USFWS beyond the measures that are presented in this document, nor does it authorize final ESA coverage on current or future response or corrective actions. The primary purpose of this Final Groundwater Remedy PBA is to put into context the status and management of federal ESA listed species within or near the Action Area and to better evaluate the effects of current and future proposed groundwater investigation and remediation activities on those species and habitats.

Under the scope of this Final Groundwater Remedy PBA, ESA consultation will be applied to species and habitat located within or near the Action Area. If future activities are proposed to occur outside the Action Area, it will be necessary to reinitiate consultation with USFWS.

"Action Area" refers to all lands that may be directly or indirectly affected by the action and not merely the immediate area involved in the action. Present and planned response activities in the Action Area will take place on BLM- and USFWS-managed lands, as well as non-federal lands.

"Species" and "habitat description" refers to all potentially affected listed species, or species proposed to be listed, and the habitat to be considered. Several federal listed species that are known to occur, or may occur within or near the Action Area have been identified.

"Effects of the action" include direct and indirect effects of an action on the species or associated habitats, together with the effects of other activities that will be added to the environmental baseline. The environmental baseline includes the past and present impacts of all federal, state, or private actions and other human activities in the Action Area; the anticipated impacts of all proposed federal projects in the Action Area that have already undergone Section 7 consultation; and the impact of state or private actions that are contemporaneous with the consultation in process. For purposes of this Final Groundwater Remedy PBA, these activities are assessed for their potential effect on species listed under the ESA.

"Indirect effects" are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur. For example, an action that results in subsequent changes to land use patterns would be considered an indirect effect.

"Cumulative effects" are those effects of future state or private activities that are reasonably certain to occur within the Action Area of the federal action subject to consultation.

"Direct effects" include the direct or immediate effect of the action on the species or its habitat.

"Relevant reports" include any available information on the action, Action Area, affected listed species, or critical habitat. The references section of this document includes a list of works cited—specific references to relevant reports are provided throughout this Final Groundwater Remedy PBA.

SECTION 2.0

Background

In December 1951, the TCS began operations to compress natural gas supplied from the southwestern United States for transport through pipelines to PG&E's service territory in central and northern California. The compressor station is an actively functioning facility and is anticipated to remain active into the foreseeable future. The operations at the compressor station consist of six major activities: water conditioning, compressing natural gas, cooling compressed natural gas and compressor lubricating oil, wastewater treatment (including cooling water), facility and equipment maintenance, and miscellaneous operations.

From 1951 to 1985, chromium-based products were added to the cooling water to inhibit corrosion, minimize scale, and control biological growth. From 1951 to 1964, untreated waste cooling water (i.e., "blowdown") that contained chromium was discharged to Bat Cave Wash. Beginning in 1964, PG&E began to treat the facility's wastewater. About this time, PG&E also constructed a percolation bed within Bat Cave Wash by creating soil berms to impound the discharged wastewater and allow it to percolate into the ground and/or evaporate. Beginning in May 1970, the majority of treated wastewater was discharged to an injection well located on PG&E property. In 1973, PG&E discontinued use of this injection well, and wastewater was discharged exclusively to a set of four, single-lined evaporation ponds, located about 1,600 feet west of the compressor station.

PG&E replaced the chromium-based cooling water treatment products with phosphate-based products in 1985, at which time PG&E discontinued operation of the wastewater treatment system. Use of the four, single-lined evaporation ponds continued from 1985 to 1989. In 1989, the single-lined ponds were replaced with four new, Class II (double-lined) ponds on BLM-managed lands. The wastewater treatment system and the single-lined ponds were physically removed and "clean-closed" between 1988 and 1993. The four Class II double-lined ponds are still in use and are operated under the jurisdiction of the Colorado River Basin Regional Water Quality Control Board.

In 1996, PG&E entered into the CACA with DTSC to govern the investigation and remediation of the TCS site under California state law. DTSC is the California state lead agency charged with directing investigative activities in the affected area in accordance with the RCRA. In July 2005, PG&E and the Federal Agencies entered into a Consent Agreement that outlined the process by which PG&E would comply with CERCLA requirements during the investigation and remediation of the affected area.

DTSC and DOI meet regularly with stakeholders and have conducted community outreach regarding investigative and cleanup activities at the TCS and within the Action Area. BLM has been delegated the authority to represent the Federal Agencies for purposes of consulting with Native American tribes pursuant to Section 106 of the National Historic Preservation Act, and other federal laws and Executive Orders, concerning potential adverse effects on cultural and historic properties that may result from the Topock Remediation Project.

The activities and consultations that pre-date current interim measures are described in the 2007 PBA and summarized in Section 3.0. In order to expedite the groundwater remedy schedule, after entry of the Consent Agreement, the investigation and remediation effort was split by DOI and DTSC between groundwater and soils; the hydrogeologic characterization and groundwater and surface water investigations were completed in 2009, and soil investigations are ongoing. These include the completed RCRA Facility Investigation / CERCLA Remedial investigation (RFI/RI) reports volume 1 (site background and history; CH2M HILL, 2007b) and volume 2 (groundwater and surface water CH2M HILL, 2009a), the *Human and Ecological Risk Assessment of Groundwater Impacted by Activities at SWMU 1/AOC 1 and SWMU 2* (ARCADIS, 2009), and pending soil RFI/RI and soil risk assessment reports. The Feasibility Study / Corrective

Measure Study for groundwater (CH2M HILL, 2009b) and the Groundwater Risk Assessment (ARCADIS, 2009) followed the Groundwater RFI/RI Report.

In December 2010, the DOI issued a ROD selecting the groundwater remedy for the site to remediate chromium to appropriate cleanup levels, and in January 2011, DTSC also adopted the Final Remedy for the groundwater contamination. A Remedial Design/Remedial Action Consent Decree between the United States and PG&E under CERCLA was approved by the United States District Court for the Central District of California in November 2013. The Consent Decree requires the planning, design, construction, O&M, post-remediation monitoring, decommissioning, and restoration of the groundwater remedy selected in the ROD. A study of alternative freshwater sources for the groundwater remedy is currently ongoing. Currently, the soils investigation is proceeding pursuant to the 2005 federal Consent Agreement and the groundwater investigation and remediation is proceeding pursuant to the 2013 federal Consent Decree.

Consistent with the Consent Decree, the next step in groundwater Remedy Design will be the 90% Basis of Design Report, which is currently in preparation with submittal planned in summer 2014.

As noted previously, this Final Groundwater Remedy PBA has been prepared for consultation with USFWS pursuant to Section 7 of the ESA prior to implementation of the Final Groundwater Remedy. Ongoing soil investigation activities are addressed more specifically under the re-initiated PBA to cover soil-related activities until 2017. If remedial/corrective action is determined to be needed for soil and the Final Soils Remedy has been selected, additional consultation with USFWS will occur.

SECTION 3.0

Description of Activities

The following subsections describe the Action Area and provide a summary of past, present, and planned activities that are part of the Final Groundwater Remedy.

3.1 Action Area

The 2007 PBA Action was originally defined by BLM and DTSC as an approximately 1,528-acre area to facilitate a cultural resources assessment, and an identical boundary was subsequently used to define the area in which annual protocol surveys are conducted for listed species (CH2M HILL, 2005c). The 2007 PBA Action Area (then referred to as the Area of Potential Effects) included portions of land in California and Arizona, as well as the Colorado River separating them (see Figure 2). Since its origin, as the area for the groundwater remedy has become more refined, the 2007 PBA Action Area has undergone several modifications as described below, so that the current Groundwater Remedy Action Area is approximately 1,434.4 acres in size. Within the Action Area, California and Arizona are separated by the Colorado River, such that open water makes up approximately 157.13 acres (about 11 percent of the total Action Area) and includes an excavated channel associated with a day-use/camping area and resort (see Figures 2 and 3).

Additional investigations related to a freshwater source for the groundwater remedy dictated an expansion of the Action Area to the north and west in California and to the east in Arizona. In the December 2012 letter requesting extension and modification of the 2007 PBA (BLM, 2012), these modifications to the existing Action Area were formally requested, as shown in Figure 2. In California, these changes included an expansion of the northern boundary (47.13 acres), the northwestern boundary (5.24 acres), and an isolated area to the north-northwest known as Freshwater Site C (28.73 acres). Other additions to the Action Area included the roadway connection from the Interstate 40 exit and the evaporation ponds (7.69 acres) and a proposed construction laydown area southwest of Moabi Regional Park (2.04 acres). The Action Area changes also included reductions of the original 2007 PBA Action Area along the southern, southwestern, and western boundaries that totaled approximately 257.8 acres. No future work is anticipated within these areas, including the 28.7-acre Freshwater Site C; and therefore, no direct or indirect impacts are expected. The portion of land area in California within the Action Area is approximately 1,012.67 acres (about 71 percent of the total Action Area).

In Arizona, the 2012 Action Area modifications (BLM, 2012) included an approximately 307.13-acre expansion of the original 2007 PBA Action Area (163 acres) for the Freshwater Implementation Plan. Within this area, no future work is anticipated within approximately 205.49 acres after initial evaluations for the Freshwater Implementation Plan were completed. The portion of the Action Area in Arizona where future work is anticipated is approximately 264.63 acres (about 18 percent of the total Action Area). This includes approximately 101.63 acres of expanded area that will include the freshwater supply wells HNWR-1 and the back-up well to the north within Sacramento Wash as well as the supply pipeline that will connect them to the distribution wells in California, as described later in this document. The figures for this PBA identify an area as the “PBA Update Action Area” to facilitate an understanding of the area that may be affected directly or indirectly from work anticipated to occur in the future for purposes of this consultation.

In California, the northern portion of the Action Area is mostly developed and occupied by the Moabi Regional Park on land that is leased by San Bernardino County and managed by BLM. This park has day-use and recreational vehicle camping facilities that are located primarily on the north side of the National Trails Highway to the west of Park Moabi Road. The park also includes the peninsula of land on the north side of the excavated channel.

A portion of this park, mostly east of Park Moabi Road and north of National Trails Highway, is run as a commercial resort, Pirate’s Cove, which has a restaurant and separate lodging facilities. Other resort facilities include a motorized and non-motorized zip-line from the main Pirate Cove resort buildings that

cross the excavated channel, as well as wastewater infiltration ponds south of National Trails Highway and east of Park Moabi Road.

The park facilities also include an extensive network of off-road vehicle (ORV) trails within the peninsula on the north side of the channel. Additional ORV trails extend from the resort on the north side of the National Trails Highway as far east as the outlet from Bat Cave Wash. To the south of the National Trails Highway, in the vicinity of Moabi Regional Park and Pirate's Cove, approximately 400 acres of land has been designated as an open riding area for ORVs according to the California Trail Users Coalition (CTUC, 2011). Numerous ORV trails are present in this area extending as far south as the Burlington Northern Santa Fe (BNSF) railroad in the eastern portion and Interstate 40 in the western portion of the open riding area. It should be noted that BLM (2006) issued an ORV roadway closure for the portion of the open riding areas to the east of Park Moabi Road.

In Arizona, the portion of the Action Area that lies to the east of Topock Marsh and west of the Oatman-Topock Highway was burned in the 2008 Sacramento Wash Fire. An unpaved access road runs through the middle of this area along a north-south alignment. The portion west of this road is part of a restoration area that has been replanted and supplied with irrigation to address the effects of the 2008 Sacramento Wash Fire. The burned area between this unpaved access road and the Oatman-Topock Highway has been mechanically cleared in anticipation of future restoration planting efforts. The area to the east of the Oatman-Topock Highway did not burn and is characterized by dense tamarisk trees and shrubs, and an active wash channel that lacks vegetation.

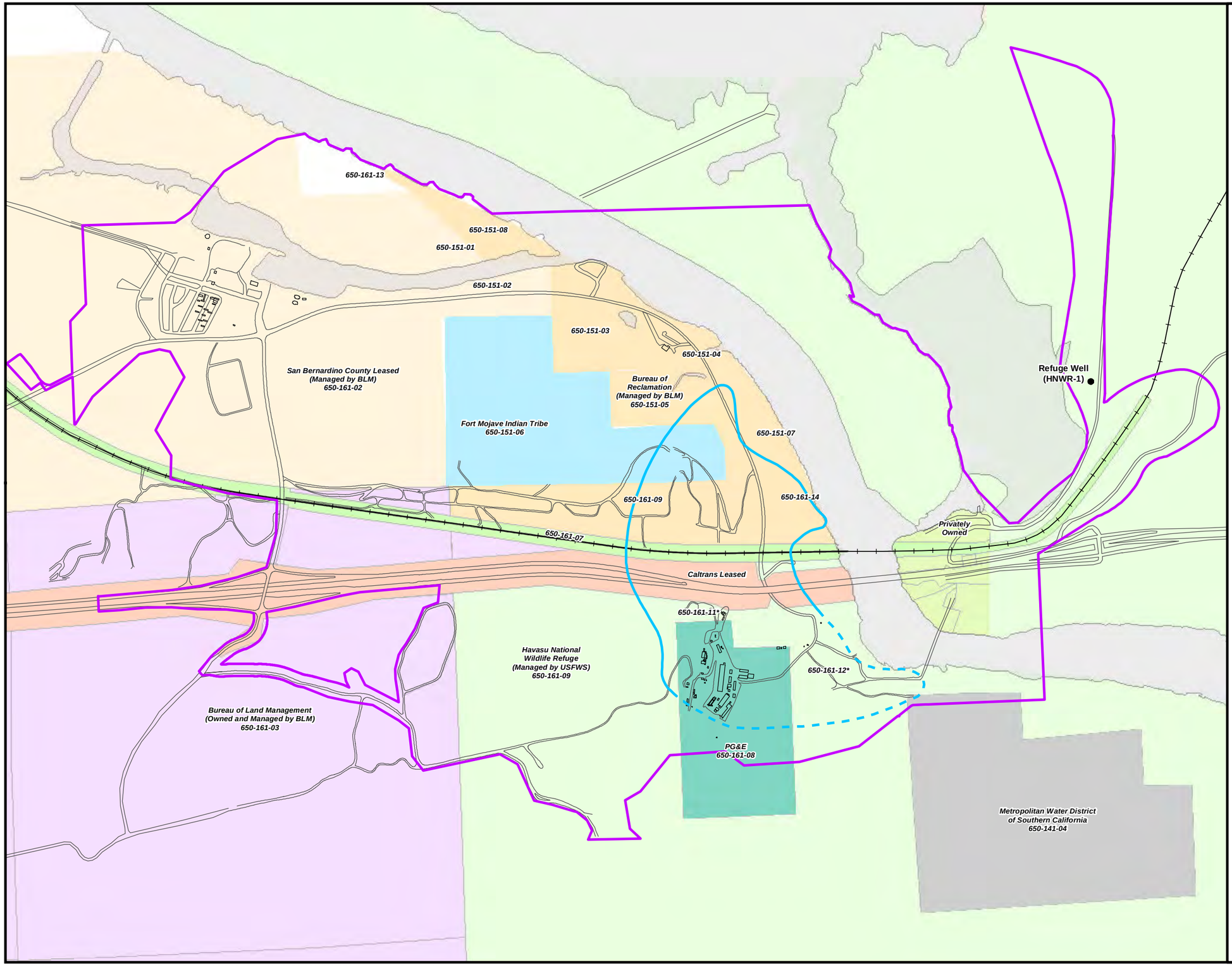
The TCS occupies approximately 65 acres of PG&E-owned land within the Action Area. PG&E also owned a 100-acre parcel located about 0.25 mile north of the compressor station that was purchased to facilitate interim remedial measures, but subsequently transferred the parcel to the Fort Mojave Indian Tribe as shown in Figure 3. The area surrounding these parcels within the Action Area includes land owned and/or managed by a number of government agencies including BLM, USFWS, and USBR.

The Action Area lies within a larger cultural area of significance to federally recognized tribes. In addition, the Colorado River itself is of spiritual and cultural importance to local tribes in the region. The continued contemporary traditional and spiritual use of the area and the management of the land, animals, plants, and water are of great importance to the tribes.

Primary access to the California portion of the Action Area is provided by Park Moabi Road and National Trails Highway, a two-lane paved roadway extending for approximately 2 miles across the Action Area. Park Moabi Road connects with Interstate 40 in the western portion of the Action Area and extends north to Moabi Regional Park in the northwest. At Moabi Regional Park, the roadway connects to the National Trails Highway, which extends eastward and then southward along the Colorado River to the TCS. Various unnamed roadways traverse the Action Area, including abandoned segments of former Historic U.S. Route 66 and National Old Trails Road. The BNSF railway alignment traverses the central portion of the Action Area and crosses the Colorado River to the north of Interstate 40. The Historic U.S. Route 66 connects the National Trails Highway to Park Moabi Road on the north side of the BNSF railroad alignment.

Access to the HNWR in Arizona is provided from the Oatman-Topock Highway. The levee road along the eastern shore of the Colorado River provides access to the northeast portion of the Action Area. The Topock Marina to the south is accessed from the Oatman-Topock Highway, north of Interstate 40. Land use in the Action Area is primarily open space with the following prominent exceptions. Interstate 40 and the BNSF railway run east-west, roughly bisecting the Action Area. The compressor station and associated evaporation ponds are located in the southern portion of the Action Area. Moabi Regional Park and the Pirate's Cove Resort are located in the northwestern portion of the Action Area and include numerous mobile home sites, boat docks, a restaurant, individual lodging, and associated infrastructure. The Topock Marina is located on the Arizona side of the river, north of the railway—the Topock Marina and other nearby parcels encompass approximately 29 acres of private land north and south of Interstate 40 in Arizona (see Figure 3).

Various telecommunication lines and gas transmission pipelines traverse the Action Area. These are primarily subsurface pipelines, with occasional surface expressions (e.g., to bridge ravines or the river).



LEGEND

- PBA Update Action Area
- Refuge Well
- Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on fourth quarter 2011 sampling events. Dashed where based on limited data.

Property Owner

- BNSF Railroad
- Bureau of Land Management (owned and managed by BLM)
- Bureau of Reclamation (managed by BLM)
- Caltrans Leased From Underlying Federal Owner
- Fort Mojave Indian Tribe Owner in Fee, With PG&E Easement and Access for Remediation
- Havasu National Wildlife Refuge
- Metropolitan Water Dirstrict of Southern California
- PG&E
- Privately Owned
- San Bernadino County Leased (managed by BLM)

Note:
1. * = PG&E has a possessory interest on these parcels (650-161-11,650-161-12) for the operation of a compressor station and associated pipelines.
2. Property ownership for the Caltrans ROW (Parcel Number 650-161-09) is U.S Bureau of Reclamation 'withdrawn land' that is managed by the U.S. Fish and Wildlife Service.

0 362.5 725 1,450 Feet

N

FIGURE 3
SURROUNDING PROPERTY MAP
FINAL GROUNDWATER REMEDY
PROGRAMMATIC BIOLOGICAL ASSESSMENT
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2013\PBA\2013Q4\FIG3_SurroundingProp.mxd

Developed facilities associated with previously installed interim measures include numerous groundwater wells and an interim groundwater treatment system (IM No. 3). Between the National Trails Highway and the Colorado River floodplain is an approximately 1-acre area, referred to as the MW-20 Bench (see Figure 4), upon which are located facilities associated with past and present interim measures. These facilities are described further in Section 3.2.

Land ownership and management in the Action Area is depicted in Figure 3. BLM manages the federally owned land north of the BNSF railway and west of the Colorado River. This includes lands managed on behalf of USBR along the Colorado River. USFWS manages the HNWR lands that are located in the southern portion of the Action Area in California and immediately surround the TCS on the south side of Interstate 40/Highway 95. The HNWR is also located in the eastern portions of the Action Area and includes most lands located on the Arizona-side of the Colorado River. Outside of the Action Area, the 37,515-acre HNWR stretches for approximately 26 miles along the Colorado River, extending from Needles, California, to Lake Havasu City, Arizona.

Recreational activities within the HNWR include sightseeing, boating, bird watching, fishing, and hunting. Prior damming and channelization of the Colorado River have significantly altered the aquatic, marsh, and riparian habitats associated with the river. These water-control and diversion actions have also contributed to increased housing development along the river and facilitated an increase in the intensity of river-related recreation, including watercraft, fishing, and hunting (USBR, 1996, 2000, 2002, 2004).

The Colorado River flows southeast between California and Arizona and provides the primary aquatic habitat within the Action Area. The river is approximately 700 to 900 feet wide and 8 to 15 feet deep through the Action Area. The adjacent river floodplain averages about 500 feet in width but narrows at the Topock Gorge, to the south of the Action Area. The topography of the floodplain in California is relatively flat with a gentle slope toward the river. The Arizona floodplain is more mound-like, creating a low divide between the Colorado River and the wetlands of the Topock Marsh.

The Colorado River has been stocked with various game fish that have been linked to predation of native listed fish species (USBR, 2004). Changes to the flow regime on the Colorado River due to damming and water diversion have significantly altered the riparian habitat. The exotic tree salt cedar is able to exploit the hydrological changes and now dominates and displaces native plant communities. USBR is responsible for managing the river and has consulted with USFWS on its actions (USBR, 1996, 2000, 2002, 2004). Several biological opinions have been issued to USBR (USFWS, 1997a, 1997b, 2002a, 2005b). The Lower Colorado River Multi-Species Conservation Plan was developed for the Colorado River (USBR, 2004).

The terrestrial portions of the Action Area are characterized by arid conditions (precipitation averages less than 5 inches per year) and high temperatures (routinely exceeding 110 degrees Fahrenheit in the summer) that are typical in the Mojave Desert. The landscape in the California portion of the Action Area is considerably eroded by natural processes resulting from the effects of wind and water erosion. For these reasons, the land forms are characterized by alluvial terraces and deeply incised drainage channels. One of the largest of these incised channels is the Bat Cave Wash, which runs from the Chemehuevi Mountains in the south of the Action Area, past the west side of the TCS toward the northeast to the Colorado River. Terraces within the Action Area are relatively homogeneous and are composed of rocky soils with sparse vegetation. Of tribal concern and spiritual importance, it is upon these terraces where the physical evidence of the Topock Maze is most observable. Elevations in the Action Area range from about 450 feet mean sea level (amsl) at the river floodplain to approximately 550 feet amsl at the TCS. The area to the north of the Topock Marina within the Arizona portion of the Action Area is part of the HNWR. Historical dredging of the Colorado River for flood control since the 1940s has resulted in the placement of the sandy dredge spoils on the east and west sides of the river within the Action Area and a dune-like, mounded topography in these deposition areas. The river floodplain is otherwise planar with a gentle slope toward the river.

On the California (western) side of the Action Area, the local geology consists of riverine deposits that become older and higher with distance from the river until they transition to the coalesced alluvial fans associated with the local mountains. Sand, gravel, and cobbles dominate these riverine deposits, which

constitute the principal groundwater aquifer within the Action Area. The main surface water drainage channel from the Action Area toward the Colorado River is Bat Cave Wash and another large, unnamed desert wash with several tributaries located farther to the west. These ephemeral desert washes are dry most of the year, but flow during heavy precipitation events.

Structurally diverse vegetation is primarily limited to the Colorado River floodplain and the ephemeral washes near the Colorado River. The uplands consist primarily of sparse creosote bush (*Larrea tridentata*) scrub community with scattered brittlebush (*Encelia farinosa*) and Hillside palo verde (*Parkinsonia microphylla*), whereas the floodplains on the California and Arizona shorelines are composed of sandy soils that are characterized by dense stands of salt cedar (*Tamarix ramosissima*), Phragmites (*P. communis*), or arrow weed (*Pluchea sericea*) with scattered individuals of western honey mesquite (*Prosopis glandulosa* var. *torreyana*) and blue palo verde (*Parkinsonia florida*). Similar to the floodplains, the incised washes also contain a more diverse community of perennial plants that includes creosote bush, blue palo verde, smoketree (*Psorothamnus spinosus)*, brittlebush, and desert-thorn (*Lycium cooperi*). Small, dense patches of cattail (*Typha* sp.), arrow weed, and/or bulrush occur at the wash outlets to the Colorado River and within constructed wash impoundments. A more detailed description of the flora and fauna in the Action Area, including species listed under the federal ESA, are described in Section 4.0.

Based on the information above, the Action Area in California was divided into three primary habitat types as shown in Figure 9 that correspond to habitats that would be used by the PBA-listed species: uplands, historical river floodplain, and current river floodplain. Upland habitats include all undeveloped areas with upland vegetation that could be potentially suitable habitats for desert tortoise. Upland habitats include the ephemeral washes, but specifically exclude the historical and current river floodplains. The historical river floodplain is the zone with riparian vegetation including mesquite, tamarisk, and arrow weed patches. In the Action Area, the historical river floodplain is found between MW-20 Bench and National Trails Highway and the 100-year floodplain (see Figure 9) and has portions of dune-like habitat where dredge sands were deposited. The current floodplain refers to the terrestrial portions within the 100-year floodplain.

3.2 Past Activities

Past activities have occurred on both the California and Arizona portions of the Action Area and within the Colorado River, and are summarized in Table 1. Activities listed in Table 1 are grouped based on whether they were initiated and completed prior to the 2007 PBA, initiated prior to the 2007 PBA but were ongoing through coverage of the 2007 PBA, or were initiated and completed after the 2007 PBA was issued.

The past activities were initially related to environmental investigations of groundwater, surface water, and soils that were associated with historical contamination from the TCS. Some of these activities were part of the RFI/RI, such as the installation and sampling of numerous groundwater monitoring wells and soil sampling. Between 1997 and 2004, RFI activities included the installation of monitoring wells at 32 locations within the Action Area, as well as approximately 300 soil samples that were collected and analyzed at locations within and surrounding the TCS. A soil removal action occurred at the same time the former wastewater treatment structures were removed to the west of the compressor station.

Other past activities were related to IM time-critical removal actions to prevent the migration of hexavalent chromium [Cr(VI)]-contaminated groundwater into the Colorado River. These actions were designated as IM No. 1, IM No. 2, and IM No. 3, and generally involved plume characterization and control, including pumping and treating of affected groundwater. Because the IMs were sequential, each one supplanted its predecessor. Currently, IM No. 3 is the only ongoing IM activity and it will be put in a “lay-up” mode prior to start-up of the Final Groundwater Remedy. A description of the ongoing activities associated with IM No. 3 is provided in Section 3.3, Planned Activities. In addition to the IM removal action, the AOC 4 Removal Action was initiated separately to remove fill material and debris deposited over the northern slope, as well as the debris accumulating in the bottom of the “debris ravine,” AOC 4. As summarized in Table 1, the removal action began in January 2010 and continued through December 2010.

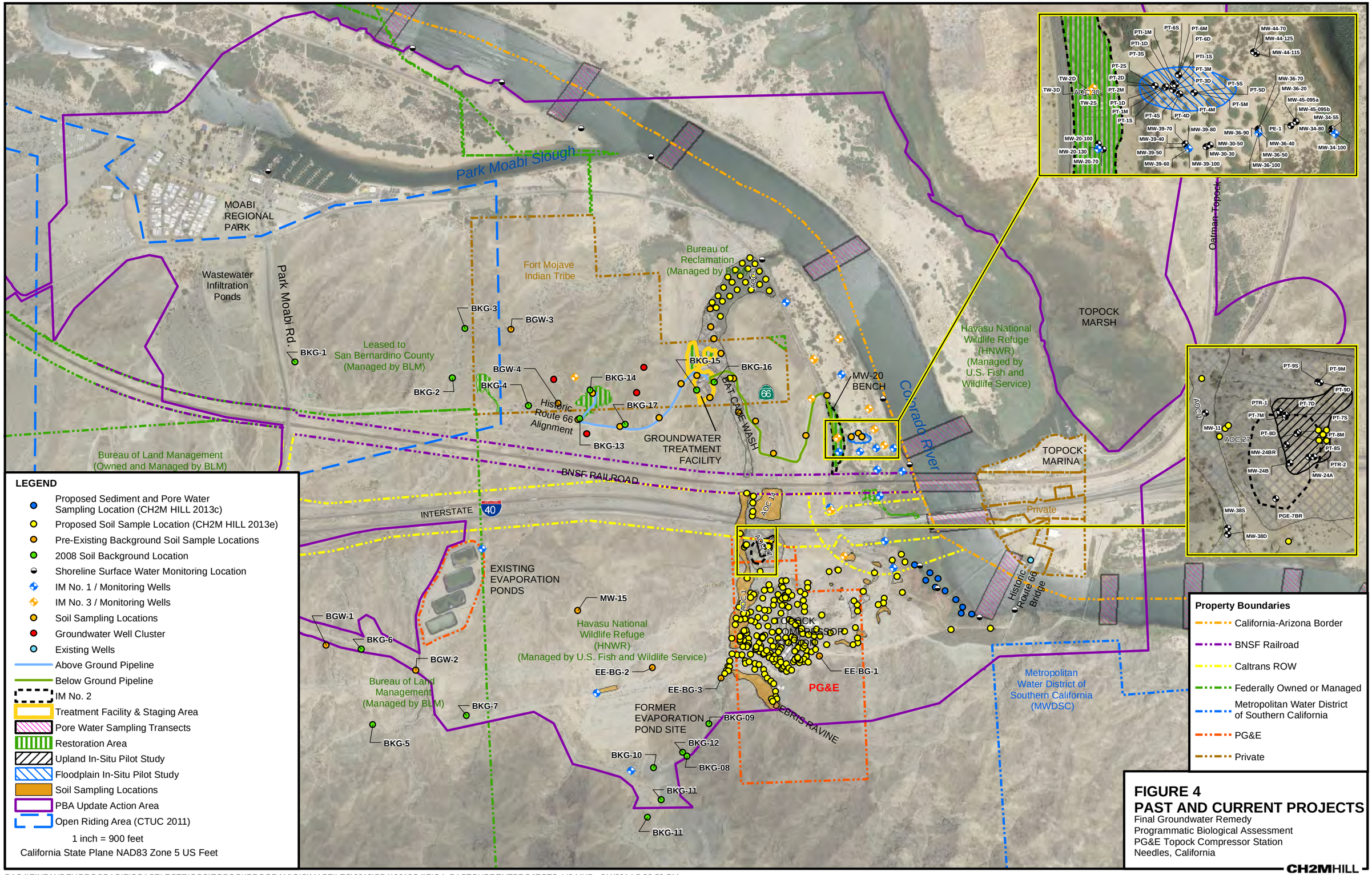
Past and present projects are depicted in Figure 4 and summarized in Table 1, and the existing network of monitoring wells that is part of the ongoing groundwater monitoring program and will be incorporated into the Final Groundwater Remedy is depicted in Figure 5. All of the past activities fall within the General Activity Categories described in the following subsection. In addition to a description of the past activities, Table 1 also documents consultation and approvals, and provides a current tally of the number of wells and acreages of floodplain and upland habitats that have been affected under the 2007 PBA and its re-initiation. A description of O&M activities for infrastructure from past activities (i.e., monitoring wells, extraction wells, pipeline, etc.), that will continue to function and support the Final Groundwater Remedy are included in Section 3.3, Planned Activities.

3.2.1 General Activity Categories

Past and present response and investigative activities have occurred throughout the Action Area and have typically comprised one or more of the following categories of activity. Many of these same activities will occur in the future as part of the Final Groundwater Remedy and are the subject of this consultation.

1. **Well installation, maintenance, operation, and decommissioning**. Includes access to injection, extraction, and monitoring well sites for surveys, drilling, installation of wellheads, pumps and equipment, aquifer testing, monitoring, testing, well maintenance, retro-fitting, decommissioning (e.g., well abandonment), and sampling. Up to 30 new well clusters were allowed to be installed throughout Action Area. Also includes related improvements such as dedicated well pumps to facilitate well sampling activities. Access to well locations would use existing access roads and/or pre-defined travel corridors wherever possible.
2. **Pipeline installation, maintenance, and operation**. Includes above- and belowground piping and appurtenances to and from wells, water treatment, and water and waste management facilities.
3. **Facility maintenance and operation**. Includes water treatment facilities, such as IM No. 2 batch treatment, IM No. 3 treatment facilities, water and waste management facilities, and in situ treatment operations. Periodic maintenance activities include routine repairs, well maintenance, waste removal, and deliveries of supplies and treatment compounds.
4. **Colorado River and soil sampling**. Includes open water sample collection from shore and by boat, as well as pore water sampling using techniques including but not limited to those and similar techniques as described in the Revised Pore Water and Seepage Study Work Plan (CH2M HILL, 2005d). This category also includes soil and sediment sampling activities as described in the Soil Work Plan (CH2M HILL, 2013a) via a number of collection methods including, but not limited to: boring, augers, trenching, and such sampling methods conducted via track- and truck-mounted apparatus. Other sampling activities may include seismic studies and/or bedrock sampling using drilling equipment. Non-intrusive test methods (i.e., geophysical methods) may also be employed if useful data can be collected by such means. Access to soil sampling locations would use existing access roads and/or pre-defined travel corridors wherever possible.
5. **Road maintenance**. Includes maintenance of roads and/or paths to project facilities (wells, pipelines, and treatment facilities) within the Action Area on public and private land. Examples include regrading and/or re-paving of existing access routes, and the installation of stormwater culverts to limit roadway erosion during storm events.
6. **Restoration and mitigation activities**. Includes activities to restore spiritual, cultural, ecological, aesthetic, or other values to areas where project activities/facilities are no longer necessary or have been removed. Also includes revegetation and removal of debris located within the Action Area (e.g., scrap metal, wood, brick, plastic, or similar materials). Some restoration sites will require removal or addition of soil and rocks to recontour the landscape, and drainage ditches that may require barriers and irrigation facilities.

7. **Emergency activities**. Includes any activity that cannot be reasonably foreseen but, due to public health/safety concerns, requires immediate response and/or corrective action. Examples of such activity include, but are not limited to, response of police, fire, ambulance or other personnel to the site, and subsequent work, in the event of explosion, fire, vehicle accident, spill, natural disaster, equipment failure, chemical reaction, heat illness, heart attack, or other medical emergencies.



LEGEND

- Proposed Sediment and Pore Water Sampling Location (CH2M HILL 2013c)
- Proposed Soil Sample Location (CH2M HILL 2013e)
- Pre-Existing Background Soil Sample Locations
- 2008 Soil Background Location
- Shoreline Surface Water Monitoring Location
- IM No. 1 / Monitoring Wells
- IM No. 3 / Monitoring Wells
- Soil Sampling Locations
- Groundwater Well Cluster
- Existing Wells
- Above Ground Pipeline
- Below Ground Pipeline
- IM No. 2
- Treatment Facility & Staging Area
- Pore Water Sampling Transects
- Restoration Area
- Upland In-Situ Pilot Study
- Floodplain In-Situ Pilot Study
- Soil Sampling Locations
- PBA Update Action Area
- Open Riding Area (CTUC 2011)

1 inch = 900 feet

California State Plane NAD83 Zone 5 US Feet

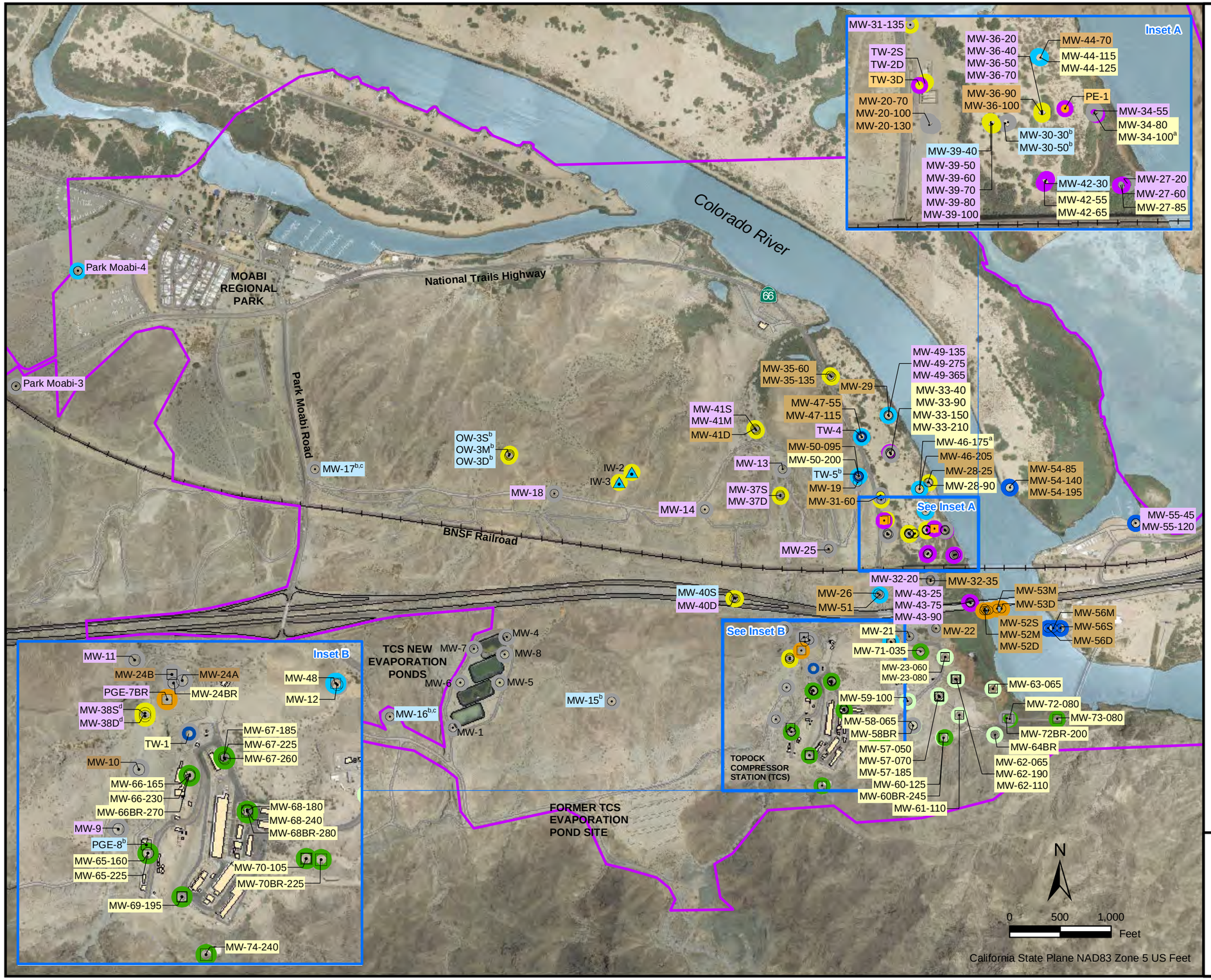
Property Boundaries

- California-Arizona Border
- BNSF Railroad
- Caltrans ROW
- Federally Owned or Managed
- Metropolitan Water District of Southern California
- PG&E
- Private

FIGURE 4
PAST AND CURRENT PROJECTS

Final Groundwater Remedy
Programmatic Biological Assessment
PG&E Topock Compressor Station
Needles, California

CH2MHILL



LEGEND

- Groundwater Well Completed in Bedrock
- Injection Well
- Groundwater Monitoring Well
- Test Well or Supply Well (inactive)
- Extraction Well
- PBA Update Action Area

Well Year Install

- Prior to November 2003/TW-1 Installation
- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2011

Sampling Frequency for Groundwater Monitoring Program (GMP)

MW-17	Biennial Sampling
MW-9	Annual Sampling
MW-22	Semiannual Sampling
MW-12	Quarterly Sampling
TW-3D	Monthly Sampling

Notes:

[a] **Monthly sampling November through February, otherwise quarterly.**

[b] **These wells required to be sampled biennially, will be sampled annually for the water quality snapshot.**

[c] **Background metals collected semiannually.**

[d] **Sampled following repair**

FIGURE 5
MONITORING WELL LOCATIONS AND SAMPLING FREQUENCY

FINAL GROUNDWATER REMEDY
PROGRAMMATIC BIOLOGICAL ASSESSMENT
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

BAO \\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2013\PBA\2013Q4\FIG5_SAMPLING_FREQUENCY.MXD ECLARK1 3/10/2014 10:52:09 AM

TABLE 1
Past and Present[a] Activities Within the Project Action Area

Project Title	Project Summary (including location, project description, conclusion)	Approval/Consultation	Start/End Dates	Habitat Disturbance	Well/Well Clusters[b] (see Figures 4 and 5 for locations)
Projects initiated prior to 2007 PBA					
Topock Compressor Station Wells	Seven groundwater monitoring wells (MW-1 and MW-3 through MW-8) were installed around the new, lined evaporation ponds that replaced the former unlined ponds (see Figure 5). Two additional wells (MW-15 and MW-16) were subsequently installed downgradient and upgradient of the ponds. These wells are not associated with corrective actions but have been and continue to be used to monitor operation of the existing ponds. The Topock Remediation Program has supported some activities associated with the evaporation pond wells from around 2009 to the present including sampling and lysimeter measurements for leak detections and O&M performance for the groundwater sampling pumps. The remediation program also includes water level measurements and periodic sampling of the upgradient/downgradient wells. Because these wells are considered part of the TCS operations, the results are reported separately from the Topock Remediation Program.	Colorado River Regional Board, Order R7-2004-0080, adopted October 13, 2004	Pond wells installed between August 1989 and June 1989; downgradient well installed July 1998; upgradient well installed April 1998. Ongoing sampling in compliance with Water Board order (monitoring program) and Waste Discharge Requirements for the TCS	None, previously disturbed locations of former unlined ponds	Seven (MW-1 and MW-3 through MW-8)
Groundwater and Surface Water Monitoring Program	Routine groundwater and surface water monitoring activities were initiated in 1998 as a continuation of the RCRA Facility Investigation and have been ongoing through the Groundwater Monitoring Program (GMP). The number of groundwater well and surface water sampling locations, as well as the frequency of sampling from each location, have varied since the GMP inception and continue to be refined as data needs are evaluated. Under the original 2007 PBA, monitoring occurred semiannually, quarterly, monthly, biweekly, and biennially, as follows: • -Fourteen (14) groundwater wells that were sampled semiannually (Figure 4); • -Sixty-two (62) groundwater wells that were sampled quarterly; • -Twelve (12) groundwater wells on the floodplain that were sampled monthly; • -Four (4) groundwater wells on the floodplain that were sampled bi-weekly; • -One extraction well, one injection well, and two inactive supply wells are sampled biennially; • -Nine (9) shoreline surface water stations along the Colorado River that were sampled monthly; • -Nine (9) depth-specific sampling stations within the Colorado River channel that were sampled quarterly (except during winter low-river stage conditions, when the stations are sampled monthly). Typically, access to the monitoring wells was accomplished with a pickup truck or an all-terrain utility vehicle with a trailer. On average, two field personnel were engaged in sampling activities for each individual well. Sampling procedures require purging the wells before sampling can be conducted so, depending on the well characteristics, between 15 and 200 gallons of water were typically purged. This purge water was subsequently transported to the IM No. 3 water treatment facility. Purge water pumping often involved the use of a portable generator to power a well pump. After this program began, several wells on the Colorado River floodplain had dedicated pumps installed that were powered from an electrical power source at the PE-1 wellhead. Several monitoring sites included clusters of two to three wells sampled at different groundwater depths so that the time frame involved with completing sampling activities at an individual well ranged from approximately 15 minutes to several hours. The total time frame to complete a sampling event ranged from 1 day for monthly events or 2 days for surface water/river sampling events, to 7 or 8 weeks for a biennial event. Vehicles traveling throughout the Action Area used existing roads and/or predetermined routes to access each of the monitoring wells (CH2M HILL, 2005d).	RCRA Facility Investigation under DTSC Order; 2007 PBA; and 2012 Re-initiated PBA	Installed between July 1997 and March 2004. Sampling ongoing. Future sampling will be incorporated into the Sampling and Monitoring Program of the Final Groundwater Remedy,	None, access routes made along unvegetated portions of the floodplain or previously disturbed upland areas	Forty-two (MW-9 through MW-33)

TABLE 1
Past and Present[a] Activities Within the Project Action Area

Project Title	Project Summary (including location, project description, conclusion)	Approval/Consultation	Start/End Dates	Habitat Disturbance	Well/Well Clusters[b] (see Figures 4 and 5 for locations)
Floodplain Sampling	In June 2005, modified sampling procedures were developed to avoid concerns regarding the potential effects to the southwestern willow flycatcher. Floodplain sampling and access procedures during the 2005 southwestern willow flycatcher nesting season were modified to include limited use of all-terrain vehicles (ATV) and staging of equipment and tanks within specified areas for the purpose of reducing potential impacts to southwestern willow flycatcher (CH2M HILL, 2005e). These procedures to avoid any potential effects to southwestern willow flycatcher constituted a "no effect" avoidance strategy. In April 2006, PG&E proposed modifications to the floodplain sampling procedures implemented during the southwestern willow flycatcher nesting season (May 1 through September 30). The modified procedures include the use of lower-noise ATVs, dedicated well pumps, electrical power supply outlets on the floodplain in lieu of portable generators, reduced sampling frequencies at certain wells, use of 4-inch "lay-flat" hose to purge water outside of potentially sensitive areas, and additional staging areas to limit equipment movement. These procedures are detailed in the *Site Access and Sampling Procedures for Groundwater Monitoring Wells Located Near Potential Southwestern Willow Flycatcher Habitat, Rev. 3* (CH2M HILL, 2006b) that was provided to the BLM on April 20, 2006. Based on the above-referenced technical memorandum and the biological analysis provided therein, BLM and HNWR initiated informal consultation with USFWS. The approved ATV access routes and staging areas to be used during the southwestern willow flycatcher nesting season along the Colorado River floodplain are shown in Figure 7. It is PG&E's intent to carry these or similar access and sampling procedures forward and to consider them as general management measures throughout the duration of the project.	In a letter dated April 28, 2006, USFWS provided its concurrence with the BLM determination of "may affect, but not likely to adversely affect" for the proposed sampling procedure modification with respect to the southwestern willow flycatcher. USFWS also concurred with the BLM determination that implementation of these sampling procedures would have "no effect" to the Yuma clapper rail. The sampling procedures described in the April 20, 2006, technical memorandum were subsequently approved by BLM in a letter dated May 1, 2006, and by HNWR in a letter dated May 11, 2006.	Wells installed between April 23, 1998 and March 21, 2006; Sampling procedures changed in June 2005. Sampling ongoing. Future sampling will be incorporated into the Sampling and Monitoring Program of the Final Groundwater Remedy,	None, existing access routes within unvegetated portions of the floodplain	Seventeen (MW-22, MW-27 through-36, MW-42 through-44; MW-46, and MW-49)
Surface Water Sampling	Surface water sampling procedures were described in the *Monitoring Plan for Groundwater and Surface Water Monitoring Program* (CH2M HILL, 2005d), The revised sampling procedures for depth-specific surface water sampling on the Colorado River involve the use of a motorized boat and a global positioning system device. At each sample location, river samples are taken from 1 foot off the river bottom, at the mid-point of the water column, and 1 foot below the river surface. Shoreline surface water samples are taken at a depth of approximately 6 inches below the water surface from the shoreline or from a boat. Twenty-five shoreline surface stations along the Colorado River and in-channel depth-specific sampling stations within the Colorado River channel are sampled quarterly with one additional low-river stage sampling event in winter. To date, these activities have occurred with no known take of listed species.	USFWS also concurred with the BLM determination that implementation of these sampling procedures would have "no effect" to the razorback sucker, bonytail chub, and Colorado pikeminnow. The sampling procedures described in the April 20, 2006, technical memorandum were subsequently approved by BLM in a letter dated May 1, 2006, and by HNWR in a letter dated May 11, 2006.	Sampling began in May 2006. Sampling ongoing. Future sampling will be incorporated into the Sampling and Monitoring Program of the Final Groundwater Remedy,	None	None

TABLE 1
Past and Present[a] Activities Within the Project Action Area

Project Title	Project Summary (including location, project description, conclusion)	Approval/Consultation	Start/End Dates	Habitat Disturbance	Well/Well Clusters[b] (see Figures 4 and 5 for locations)
Interim Measure No. 1	The IM No. 1 project was initiated as a time-critical removal action in response to a January 22, 2004, direction from DTSC to prepare a work plan to mitigate potential impacts to the Colorado River. This project was described in a technical memorandum work plan: Field Activities for Groundwater Well Installation, PG&E Topock Project (CH2M HILL, 2004b) and included additional groundwater monitoring wells at eight locations to complement the existing network of monitoring wells within the Action Area (CH2M HILL, 2004b). An additional well, MW-37, was proposed on BLM land within Bat Cave Wash (Figure 5). In early 2005, a second phase of IM No. 1 was implemented that involved the installation of groundwater wells at five additional locations on the Colorado River floodplain (CH2M HILL, 2005f). IM No. 1 also included several potential extraction wells (PE-1 and PE-3). However, the groundwater extraction portion of IM No. 1 was not implemented, but rather was supplanted by IM No. 2, which provided a more comprehensive program to extract, treat, and haul groundwater containing chromium. An assessment of the land used during the second phase of IM No. 1 construction activities was prepared for BLM and USFWS, in accordance with the stipulations that were provided in their approval. Monitoring wells installed under IM No. 1 include wells that are used for both the Groundwater Monitoring Program and Performance Monitoring Program.	The first phase of IM No. 1 was authorized by BLM in March in the IM No. 1/2 Action Memorandum (BLM, 2004a) and by two letters dated March 15, 2004 from BLM Lake Havasu Field Office (BLM, 2004b). Well MW-37 in Bat Cave Wash was authorized by April 8, 2004 letter (BLM, 2004c) Second phase of IM No. 2 was authorized with stipulations by letter dated December 29, 2004 (BLM, 2004d) and by Action Memorandum with special conditions dated February 15, 2005 from the USFWS (2005c).	Well installation began on March 22, 2004 and was completed by March 5, 2005. Ongoing sampling of selected wells. Future sampling will be incorporated into the Sampling and Monitoring Program of the Final Groundwater Remedy.	None in Phase 1, new well locations and existing access routes within previous disturbed areas or unvegetated portions of the floodplain. In Phase 2, floodplain vegetation removed for PE-1, MW-27 and MW-43 wells or access totaled 0.372 acre (tamarisk and arrow weed) (CH2M HILL, 2005g)	Eight Phase 1 wells (TW-2S/D and MW-31D on the MW-20 Bench; MW-28D, MW-35 through -37, and MW-39 on the floodplain; and MW-40 within the I-40 corridor) Six Phase 2 wells (MW-27M/D, MW-33D, MW-34D; MW-42S/M/D; and MW-43S/M/D and PE-1). Two other floodplain boreholes PE-1A and PE-1B were sampled but not completed as wells.
Interim Measure No. 2	IM No. 2 involved the extraction, treatment, and hauling of treated water to an offsite disposal facility (CH2M HILL, 2004c). As shown in Figure 4, the IM No. 2 facilities and operations were limited to an approximately 1-acre area on BLM land, referred to as the MW-20 Bench, where two extraction wells (TW-2S and TW-2D) were installed. Groundwater was extracted at rates of up to approximately 90 gallons per minute and pumped into a series of Baker tanks. A batch treatment process to remove chromium occurred within the Baker tanks, resulting in a 99 percent reduction in the volume of hazardous waste (CH2M HILL, 2004d). The treated water was pumped into tanker trucks for disposal at a permitted treatment facility in Los Angeles. Groundwater treatment operations at IM No. 2 were phased out in July 2005 following commencement of groundwater treatment at the IM No. 3 plant at the MW-20 Bench.	IM No. 2 was authorized by BLM in March in the IM No. 1/2 Action Memorandum (BLM, 2004a) and by Action Memorandum from the Lake Havasu Field office on May 20, 2004 (BLM, 2004d).	Extraction wells (TW-2S and TW-2D) were installed between April 3 and 6, 2004. These two wells became backup extraction wells once the new well (TW-3D) was installed on October 27, 2005.	None, aboveground pipelines located on the developed MW-20 Bench where temporary holding tanks were located.	Two extraction wells on the MW-20 Bench (TW-2S and TW-2D)

TABLE 1
Past and Present[a] Activities Within the Project Action Area

Project Title	Project Summary (including location, project description, conclusion)	Approval/Consultation	Start/End Dates	Habitat Disturbance	Well/Well Clusters[b] (see Figures 4 and 5 for locations)
Interim Measure No. 3	IM No. 3 facilities include extraction, treatment, conveyance, injection, and monitoring facilities, shown in Figure 4. As described in the IM No. 3 Work Plan (CH2M HILL, 2004e, 2004f, 2004g, 2004h, 2004i, 2005c, 2005f, 2005h) these measures were designed to provide greater groundwater extraction and management capacity to maintain hydraulic control of groundwater near the Colorado River. Under IM No. 3, former MW-20 Bench groundwater extraction wells (TW-2S/D) were replaced by a new extraction well (TW-3D) and a new floodplain extraction well (PE-1). Extracted groundwater was then conveyed by underground pipeline to a reverse osmosis treatment facility located in an upland treatment facility to the west. The treated water was then managed by re-injection into the groundwater aquifer at an upgradient location, while reverse osmosis wastewater (brine) was conveyed back to temporary holding tanks at MW-20 Bench prior to trucking to an approved offsite disposal facility. IM No. 3 operations provided a significantly higher rate of extraction and treatment than IM No. 2. Access to IM No. 3 is provided by roads extending from the east and west off Park Moabi Road and National Trails Highway, which have been improved to facilitate effective transportation to the treatment plant and to protect key cultural resources. The roads are maintained several times each year to repair storm damage and control dust using graders, backhoes, and water trucks. The IM No. 3 treatment plant occupies an approximately 1-acre site. Double-walled influent conveyance piping is subsurface and generally follows the eastern access road. Effluent piping from the treatment system to the injection wells is mostly located aboveground, along the shoulder of the western IM No. 3 access road. The subsurface and aboveground piping extend for approximately 3,000 and 1,900 feet, respectively. Periodic maintenance activities include routine repairs, waste removal, and deliveries of supplies and treatment compounds. Maintenance activities may also involve enhancement of existing facilities to optimize operations (e.g., upgrading or replacing equipment). Delivery of supplies and materials occurs several times per week. Repair activity includes repairs to the IM No. 3 access road that include the installation of sufficiently sized culverts to convey stormwater below the roadway and the addition of fill material to eroded sections. As part of the BLM mitigation for Historic Route 66, which is the primary access route to IM No. 3, approximately 5 inches of road base is maintained over the original Historic Route 66 surface to protect the historic road from potential vehicular impacts (BLM, 2004f). During IM No. 3 operations, brine wastewater from the water treatment process is pumped back to the MW-20 Bench and trucked to an offsite disposal facility. Currently, the offsite disposal facility receiving the brine wastewater is located in Phoenix, Arizona. The required trucking activity varies throughout the year as the flow rate requirements change.	Prior federal ESA consultation between BLM and USFWS regarding IM No. 3 construction and operation (CH2M HILL, 2004a, 2004e, 2004f, 2004g, 2004h, 2004i) resulted in a determination of "no effect" to the desert tortoise, a listed threatened species. Authorization of the activities and stipulations are provided in the Action Memorandum (BLM, 2004e). The protective gravel blanket over Historic Route 66 was approved in a letter from the Lake Havasu Field Office on October 14, 2004 (BLM, 2004f). Approval of floodplain borings (PE-1, PE-1A, and PE-1B) was provided in a letter dated February 25, 2005 (BLM, 2005b).	Construction of IM No. 3 facilities commenced in September 2004 and was completed in July 2005. IM No. 3 operations are ongoing pending start-up of the Final Groundwater Remedy, at which time the IM No. 3 facilities will be put into "lay up" mode until approved for decommissioning and removal.	The construction completion report documents that total land used by the IM No. 3 facilities was 8.0 acres (of which, 3.9 acres was previously disturbed); for a net ground disturbance of 4.1 acres (CH2M, 2005g)	One floodplain extraction well (PE-1); Two other floodplain borings (PE-1A and PE-1B) were abandoned without installing wells; One extraction well (TW-3D) on the MW-20 Bench; and Two upland injection wells (IW-2 and IW-3)

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Project Title	Project Summary (including location, project description, conclusion)	Approval/Consultation	Start/End Dates	Habitat Disturbance	Well/Well Clusters[b] (see Figures 4 and 5 for locations)
Performance Monitoring Program	The performance monitoring program (PMP) involves monitoring, data evaluation, reporting, and response actions associated with the IM No. 3 pumping, treatment, transport, and disposal of extracted groundwater near the floodplain area (CH2M HILL, 2005d). The network of groundwater wells used for performance monitoring included previously installed extraction well (PE-1) and twelve monitoring well clusters in the floodplain (MWs-22, MW-27 through -30, MW-32 through -34, MW-36, MW-39, MW-42 and MW-43); seven intermediate upland wells (MW-12, MW-19 through -21, MW-26, MW-31, and MW-35) and extraction wells (TW-2S and -2D); and two monitoring wells (MW-10 and MW-25) in the upland interior portion of the Cr(VI) plume, as shown in Figure 5. Based on the performance monitoring results, three new floodplain monitoring well installations were proposed (MW-44 through-46). As part of the PMP, a network of pressure transducers are maintained and operated to continuously monitor water levels and assess hydraulic gradients (horizontal and vertical) in the floodplain area. The transducer data are downloaded biweekly to the PMP database. Manual water levels are measured periodically at the monitoring wells, river locations, and extraction wells to calibrate and supplement the pressure transducer data. The majority of the PMP wells used for hydraulic data and groundwater sampling are clusters consisting of two or three individual wells installed at one monitoring location.	BLM and HNWR approval of the Interim Measures Performance Monitoring (IMPM) well clusters was provided in a letter dated February 21, 2006, pursuant to prior authorization provided by the September 2004 Action Memorandum related to IM No. 3 activities. Construction of the IMPM well clusters commenced in February 2006 and concluded in May 2006.	Well installation between February 13, 2006 and March 11, 2006. Sampling is ongoing and future sampling will be incorporated into the Sampling and Monitoring Program of the Final Groundwater Remedy,	None, new well locations within unvegetated portion of the floodplain and access gain using existing routes	Three floodplain wells (MW-44 through-46)
Compliance Monitoring Program	The compliance monitoring program (CMP) monitors the aquifer in the IM No. 3 injection well area to ensure that injection of treated groundwater is not causing an adverse effect on the aquifer water quality (CH2M HILL, 2005d, 2005j). Groundwater levels are measured in the vicinity of the IM No. 3 injection wells (IW-2 and IW-3), and groundwater samples are collected and analyzed. Groundwater analyses are performed to ensure that the distribution and concentrations of constituents of concern remain consistent with the baseline sampling results. The CMP monitoring well network consists of both observation wells and compliance monitoring wells.	A December 2004 BLM letter of approval (BLM, 2004e) for the CMP facilities makes reference to prior authorization provided under the March 2004 IM No. 1/2 Action Memorandum and applies all stipulations included in the September 2004 IM No. 3 Action Memorandum.	New CMP wells installed between January 13 and February 7, 2005. Sampling is ongoing and future sampling will be incorporated into the Sampling and Monitoring Program of the Final Groundwater Remedy.	0.596 acre of upland or wash habitat removed for CW-2 through-3 wells or access (5 beavertail cactuses transplanted; 5 coyote brush removed or crushed) (CH2M HILL, 2005g)	Four compliance wells (CW-1 through-4). All on the upland mesa or within dry washes to west of groundwater treatment facility in Figure 5.
Floodplain In Situ Pilot Study	The floodplain in situ pilot study (ISPT) activities involve injection of food-grade compounds into the groundwater aquifer and measurement of the reduction of chromium levels in nearby monitoring wells (MWH, 2005a). The pilot study was located on the floodplain within an approximately 0.25-acre area 300 feet east of the MW-20 Bench. Facilities at the site include one injection well cluster (PTI-1S/M/D) and six monitoring well nests (PT-1 through PT-6, all with S/M/D intervals). The floodplain pilot study project area is shown in Figure 4; however, the individual wells are not shown. The pilot study wells were installed in early 2006, prior to the southwestern willow flycatcher nesting season. Construction of the injection and monitoring wells occurred over approximately 2 months. Beyond the project wells, no other permanent equipment or facilities are required for in situ pilot study operations; temporary hoses connect the injection well to temporary containers during injection activities. Operations commenced in April 2006, and involved injection of reagents at up to four separate times over the 8-month operation period as well as groundwater monitoring. Groundwater monitoring occurred as frequently as daily over the first week of operations, and then weekly to monthly until the end of the study in late 2006. Potential biological impacts associated with these activities were covered under the *Biological Assessment for the Pacific Gas and Electric Topock Compressor Station Remedial and Investigative Actions* (CH2M HILL, 2005b) prepared in November 2005.	An ESA Section 7 consultation process was completed in December 2005. The result of that consultation was a finding of "may affect, not likely to adversely affect" for the southwestern willow flycatcher, and a "no effect" finding for all other listed species. As documented in the completion report for these facilities (CH2M HILL, 2006b), the construction activities were completed with no take of any listed species; Master CDFG Streambed Alteration Agreement Notification 1600-2005-0140-R6, signed December 25, 2005, and valid until December 31, 2007. Subsequently, a CERCLA exemption was recognized by CDFW and the project was required to comply with a set of Avoidance and Minimization Measures (CDFW, 2013a).	Pilot test wells installed between January 26, and February 14, 2006; pilot test was concluded in October 2006. While the ISPT is complete, sampling of selected wells is ongoing. Future sampling will be incorporated into the Sampling and Monitoring Program of Section 3.3 (Planned Activities).	The permanent nested well structures have a surface expression of less than 500 square feet (0.01 acre) on the floodplain; total floodplain land use is about 0.85 acres (CH2M HILL, 2006b)	Seven (Injection well PTI-1S/M/D and monitoring wells (PT-1 through -6, all with S/M/D sample intervals). All on historical floodplain

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Past and Present[a] Activities Within the Project Action Area

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PE-1 Pipeline	A work plan was prepared for the conveyance piping and power supply for floodplain extraction well PE-1 (CH2M HILL, 2005i). Construction of a double-walled conveyance pipeline to connect the PE-1 extraction well with existing conveyance pipeline at the MW-20 Bench was completed in January 2006. The pipeline and associated power conduit alignment extend for approximately 500 feet between PE-1 and the MW-20 Bench (Figure 4). As documented in the completion report for PE-1 Pipeline (CH2M HILL, 2006b) and included in Appendix A, the construction activities were completed with no take of any listed species.	Potential biological impacts associated with this facility were covered under the *Biological Assessment* (CH2M HILL, 2005b) and an ESA Section 7 consultation process was completed in December 2005. The result of that consultation was a finding of "may affect, not likely to adversely affect" for the southwestern willow flycatcher, and a "no effect" finding for all other listed species.	The PE-1 extraction well was installed in March 2005 and the pipeline was installed between December 12, 2005 and January 27, 2006. Use and maintenance are ongoing. PE-1 extraction well is planned for decommissioning as part of IM No. 3 facilities.	Total floodplain land use was 0.88 acre, most of which (0.85 acre) overlapped with floodplain ISPT area for an added area of 0.03 acre; removed 0.19 acre of arrow weed and 0.22 acre of tamarisk (CH2M HILL, 2006g)	None, conveyance pipeline only
TW-3D Extraction Well	A work plan was prepared for the new MW-20 Bench extraction well (TW-3D) (CH2M HILL, 2005h). This extraction well began extracting groundwater in December 2005, while the other two extraction wells (TW-2S and TW-2D) were taken off-line and kept for backup. Approximately 50 feet of underground piping was constructed to connect TW-3D to the existing IM No. 3 groundwater conveyance system, and all these construction activities occurred entirely within the MW-20 Bench. Details on the well construction are provided in the installation report (CH2M HILL, 2005k)	No biological consultation was conducted for this well because of the developed nature of the site and the timing of installation outside of the southwestern willow flycatcher season.	Well TW-3D was installed October 27, 2005, but brought on-line in December 2005. TW-3D extraction well is planned for decommissioning as part of IM No. 3 facilities.	None, all activities occurred within the previously developed MW-20 Bench	One (TW-3D) On MW-20 Bench
IM No. 3 Soil Sampling	As described in the Work Plan (CH2M HILL, 2006c) soil samples were collected at 21 locations associated with the IM No. 3 facilities: PE-1 pipeline, MW-20 Bench to treatment facility pipeline, treatment facility, effluent pipeline, and area of potential impact (Bat Cave Wash). These samples were collected prior to IM No. 3 startup to document pre-existing (baseline) soil conditions to support eventual closure of those facilities. The sample locations are shown to the north of the BNSF railroad in Figure 4.	No biological consultation was conducted for this well because of the developed nature of the site and/or the timing of sampling outside of the southwestern willow flycatcher season.	Early 2006	None, all activities occurred within the previously developed or disturbed areas or within unvegetated portions of Bat Cave Wash	None, soil samples only
Pore Water Study and Seismic Survey	The pore water study focused on water within pore spaces in sediments immediately beneath the Colorado River. Samples from the river were taken along approximately 16 transects—eight downstream of the groundwater plume and eight upstream of the groundwater plume (CH2M HILL, 2005d). Pore water transects within the Action Area are shown in Figure 4. Approximately four samples were taken at each transect. In addition, approximately 10 core samples of river sediment were taken. Sampling depths ranged from 2 to 6 feet below the riverbed. Prior to implementation of the pore water study, the United States Geological Survey (USGS) conducted a seismic survey within the Colorado River to better understand bedrock characteristics below the riverbed. This survey involved the use of a small watercraft utilizing equipment similar to a fish finder to conduct the seismic bedrock survey.	Prior review and approval by the USFWS HNWR concluded that no effect to sensitive fish species would result from implementation of the pore water study (USFWS, 2005d). Authorization and approval for the pore water study provided by the USFWS HNWR on November 15 included a prohibition on take of any wildlife, particularly threatened and/or endangered species.	Sampling began in December 2005/early January 2006, and is now complete. It should be noted that other pore water samples will be conducted as part of the East Ravine Investigation as described in the RFI Soil Investigation Work Plan (CH2M HILL, 2013a).	None, all activities were completed within the Colorado River	None, surface water and sediment samples only.
Restoration	Restoration activities completed to date involved the revegetation of the area affected by installation of monitoring well MW-43 and decommissioning of the IM-2 batch treatment system at the MW-20 Bench. Restoration at MW-43 involved the planting of approximately 100 mesquite trees along the approximately 250-foot access corridor to MW-43. Decommissioning of the IM No. 2 batch treatment system to date has involved cleaning and removing tanks and associated containment structures, removal of support facilities (including the field trailer, field laboratory, generator, ice machine and potable water tanks, etc.), securing batch treatment pumps, piping and appurtenances, and modifying the security fencing to reduce the footprint of the secured area.	Decommissioning of the MW-20 Bench was performed in phases, as described in the *MW-20 Bench Decommissioning Work Plan,* submitted to BLM on August 8, 2005 (CH2M HILL, 2005l).	The MW-20 Bench batch treatment system was decommissioned in February and March 2009 (CH2M HILL, 2009c).	None, activities related to restoration of areas disturbed by MW-43 well installation	None

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Project Title	Project Summary (including location, project description, conclusion)	Approval/Consultation	Start/End Dates	Habitat Disturbance	Well/Well Clusters[b] (see Figures 4 and 5 for locations)
Past and Present Activities Within the Project Action Area Post 2007 PBA					
California Slant Drilling Project	The California Slant Drilling Project involved groundwater characterization beneath the Colorado River using a slant drilling method. This method was used to install two multi-level groundwater monitoring wells (MW-52 and MW-53), extending below the Colorado River. As documented in the completion report for the California Slant Well Project facilities, (CH2M HILL, 2007c), the construction of these wells did not result in take of any of the listed species. However, this activity required the removal of 0.082 acres of vegetation on the Colorado River floodplain.	The project was conducted under a "may affect, not likely to adversely affect" determination for the southwestern willow flycatcher, and a 'no effect' determination for the remaining species listed in the 2007 PBA.	Installed between February 24 and March 30, 2007/ ongoing sampling. Future sampling will be incorporated into the Sampling and Monitoring Program of the Final Groundwater Remedy,	**Floodplain:** 0.082 acres **Uplands:** None	Two (MW-52 and MW-53) On floodplain beneath Interstate 40 Bridge
Upland In-Situ Pilot Study	Similar to the Floodplain ISPT, the Upland ISPT activities involved circulating different reducing reagents through the groundwater aquifer between two recirculation wells (PTR1 & PTR2) at the MW-24 Bench. The test performance was determined by measuring the reduction of chromium levels in three monitoring wells (PT7, PT8, and PT9) located between the two recirculation wells as described in the Work Plan (MWH, 2005b). The Upland ISPT equipment and operation are similar to those described for the Floodplain ISPT and involve injection of reagents at up to four separate times over the 7-month operation period and groundwater monitoring. Groundwater monitoring occurs as frequently as daily over the first week of operations, and then weekly to monthly until the end of the study on February 23, 2008. The ISPT wells are all located within the previously disturbed areas at the MW-24 bench and the Topock Compressor Station. Because the project area, staging areas, and access routes have been used extensively for past activities, these areas were already devoid of vegetation prior to the initiation of this project. As documented in the completion report for these facilities (CH2M HILL, 2008a), the construction and testing activities were completed with no take of any listed species.	The Upland ISPT activities were approved in an email from the HNWR Refuge Manager John Earle, dated March 23, 2007 (BLM, 2007b) that provided clarification of the USFWS authorization letter dated March 14, 2007 (USFWS, 2007b).	Installed between April 23 and July 18, 2007; Pilot test ran between July 2007 and February 23, 2008. While the ISPT is complete, sampling of selected wells is ongoing. Future sampling will be incorporated into the Sampling and Monitoring Program in Section 3.3 (Planned Activities	**Floodplain:** None **Uplands:** None All activities within previously disturbed, unvegetated areas at MW-24 Bench.	Five (PT7, PT8, PT9, PTR1, and PTR2) All on MW-24 Bench
Arizona Drilling Program	As described in the work plan (CH2M HILL, 2007d), the Arizona Drilling Project involved the installation of three groundwater monitoring wells, designated as MW-54, MW-55, and MW-56, at separate locations on the east shore of the Colorado River. Monitoring wells MW-55 and MW-56 were installed on private land, while monitoring well MW-54 was installed on federal (HNWR) land. As documented in the completion report for the Arizona Drilling Project, (CH2M HILL, 2008b), the construction of these facilities did not result in take of any of the listed species.	These activities were discussed in the 2007 PBA and so fell under a determinations of "may affect, but not likely to adversely affect" for southwestern willow flycatcher, desert tortoise, Yuma clapper rail, razorback sucker, and bonytail chub; and a "no effect" determination for the Colorado pikeminnow (CH2M HILL, 2007a). The Arizona Drilling Program activities were authorized in a letter from BLM Lake Havasu Field Office dated February 11. (BLM, 2007a).	The wells were installed between March 11 and April 23, 2008. Sampling is ongoing. Future sampling will be incorporated into the Sampling and Monitoring Program of the Final Groundwater Remedy.	**Floodplain:** None **Uplands:** None All three of these wells were installed in locations that had been previously disturbed and, so did not require any removal of vegetation.	Three (MW-54, MW-55, and MW-56). Two on floodplain and one on southern margin of Topock Marsh
Soil Investigation	Based on the RCRA Facility Investigation, Soil Investigation Work Plan Soil investigations were conducted in 2008 to characterize environmental conditions at six different Areas of Concern (AOC) including AOC 4, AOC 9 through AOC 12, and AOC 14. It also included soil samples within Bat Cave Wash (AOC 1 and SWMU 1); at the former 300B Liquids Tank east of the TCS, and the potential pipe disposal area on a previously disturbed portion of the HNWR. This soil investigation also included background soil sampling at seventeen locations, as shown in Figure 4, as well as any soil sampling that will occur under the 2012 re-initiation of original 2007 PBA, which is now valid until 2017.	Authorization letter for soil sampling activities received from USFWS on August 22, 2008 CDFG Streambed Alteration Agreement; These activities were discussed in the 2007 PBA and so fell under a determinations of "may affect, but not likely to adversely affect" for southwestern willow flycatcher, desert tortoise, Yuma clapper rail, razorback sucker, and bonytail chub; and a "no effect" determination for the Colorado pikeminnow (CH2M HILL, 2007a). As documented in the biological resources completion report for these activities (CH2M HILL, 2008c), the soil sampling was completed with no take of any listed species.	Soil sampling completed between August 22 and October 24, 2008. This also includes all future soil sampling activities to be completed under the 2012 re-initiation of original 2007 PBA, which is now valid until 2017.	**Floodplain:** None **Uplands:** None As documented in the Biological Completion Report (CH2M HILL, 2008c), approximately 0.162 acres of temporary disturbance to the unvegetated Bat Cave Wash active channel for equipment access during sampling. All upland soil sampling was conducted on unvegetated, previously disturbed areas. No vegetation removal of any kind was required, so no habitat loss occurred as a result of this activity.	None, soil samples only

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East Ravine Groundwater Investigation (Part 1)	As described in the work plan (CH2M HILL, 2008d), the East Ravine Groundwater Investigation involved the installation and development of eight groundwater monitoring wells (MW-57 through MW-64) within the unvegetated dry wash and in upland locations that were used to characterize groundwater conditions associated with TCS activities. All wells were installed within unvegetated wash or previously disturbed areas such as existing dirt roads and road shoulders so that no habitat loss occurred as a result of these activities.	These activities were part of the 2007 PBA and so fell under a determinations of "may affect, but not likely to adversely affect" for southwestern willow flycatcher, desert tortoise, Yuma clapper rail, razorback sucker, and bonytail chub; and a "no effect" determination for the Colorado pikeminnow (CH2M HILL, 2007a). On November 3, 2010, BLM requested a partial re-initiation of consultation regarding the 2007 PBA for an additional 15 monitoring well clusters increasing the number of upland well clusters from 15 to 30 without increasing the area of upland habitat disturbance from 3.0 acres. East Ravine Investigation activities were authorized by letter dated November 7, 2008 (DOI, 2008). On November 16, 2010, USFWS issued a letter to BLM stating that the revised project did not change its concurrence of "may affect, but not likely to adversely affect" for species covered under the 2007 PBA (USFWS, 2010b).	Wells installed between January 21, 2009 and May 2, 2009. Sampling ongoing. Future sampling will be incorporated into the Sampling and Monitoring Program of the Final Groundwater Remedy.	**Floodplain:** None **Upland:** 0.00207 ac 0.000745 ac of permanent disturbance in unvegetated wash for MW-58. No vegetated habitat was removed for these wells. As documented in the biological resources completion report for these activities (CH2M HILL, 2009d), the well installations were completed with no take of any listed species	Eight (MW-57 through MW-64)
East Ravine Groundwater Investigation (Part 2)	The East Ravine Groundwater Investigation was continued based on a revised work plan (CH2M HILL, 2010b) and involved the installation and development of groundwater monitoring wells at eleven new locations (MW-65 through MW-74) in the East Ravine and TCS area (plus one deep well at existing Location MW-60) to provide additional groundwater characterization data for the RFI/RI. Twenty new monitoring wells installed within 16 boreholes were established in the 11 locations during the investigation. However, because wells were constructed in unvegetated and previously disturbed areas such as within the existing TCS or within dirt roads and road shoulders, no habitat loss occurred as a result of these activities.	Additional investigations were conducted under the original consultation and authorization letter (DOI, 2008). These activities were part of the 2007 PBA (as re-initiated in 2012) and so fell under a determinations of "may affect, but not likely to adversely affect" for southwestern willow flycatcher, desert tortoise, Yuma clapper rail, razorback sucker, and bonytail chub; and a "no effect" determination for the Colorado pikeminnow (CH2M HILL, 2007a).	Wells installed between March 15 and late September 2011. Sampling ongoing. Future sampling will be incorporated into the Sampling and Monitoring Program of the Final Groundwater Remedy.	**Floodplain:** None **Upland:** None As documented in the biological resource completion reports for this investigation (CH2M HILL, 2012a), the well installations were completed with no take of any listed species.	Eleven (MW-65 through MW-74); note one additional deep well interval was added to previous well location MW-60
AOC 4 Removal Action	As described on the work plan (CH2M HILL, 2009e), the AOC 4 Removal Action was performed to remove fill material and debris deposited over the northern slope, and debris accumulating in the bottom of the "debris ravine" designated as AOC 4. The removal action began in January 2010 and continued to December 16, 2010. Three primary methods were employed to remove fill and debris material from AOC 4: manual collection, vacuum excavation, and mechanical excavation. Two small check dams were constructed within the AOC 4 debris ravine and a rock gabion with geotextile filter fabric was installed at the confluence of the AOC 4 ravine with Bat Cave Wash to prevent subsequent migration of debris or contaminants into the wash.	AOC 4 Removal Action activities were authorized by letters dated December 15, 2009 (DOI, 2009) and January 7, 2010 (USFWS, 2010c). These activities were part of the 2007 PBA and so fell under a determinations of "may affect, but not likely to adversely affect" for southwestern willow flycatcher, desert tortoise, Yuma clapper rail, razorback sucker, and bonytail chub; and a "no effect" determination for the Colorado pikeminnow (CH2M HILL, 2007a). Master CDFG Streambed Alteration Agreement Notification 1600-2005-0140-R6, as amended on January 10, 2007. As documented in the biological resource completion reports (CH2M HILL, 2011), the AOC 4 Removal Action activities were completed with no take of any listed species.	Project was initiated on January 26, 2010 and finished on December 16, 2010	**Floodplain:** None **Upland:** None Approximately 1.6 acres of disturbance of upland habitat occurred from the AOC 4 Removal Action. Other disturbance occurred within washes includes 0.043 acre within the AOC 4 Debris Ravine for two small check dams and 0.072 acre within Bat Cave Wash for a rock gabion for a total of 0.115 acre. Several creosote bushes were removed from the north wall and one honey mesquite was trimmed (CH2M HILL, 2011)	None, debris removal only
Geophysical Survey	The Geophysical Survey (surface resistivity logging) was conducted in support of the Freshwater Implementation Plan to locate the most favorable portion of the subsurface channel for water yields at locations within California and Arizona. The soil resistivity logging was completed before drilling exploratory borings to support the evaluation of alternative freshwater sources for the Final Groundwater Remedy. The geophysical survey areas were located in pre-existing disturbed areas. No additional areas were disturbed and no habitat loss occurred as a result of this activity.	These activities were part of the 2007 PBA (as re-initiated in 2012) and so fell under a determinations of "may affect, but not likely to adversely affect" for southwestern willow flycatcher, desert tortoise, Yuma clapper rail, razorback sucker, and bonytail chub; and a "no effect" determination for the Colorado pikeminnow (CH2M HILL, 2007a). No other consultation for these activities that occurred outside of the bird nesting season in the Action Area. As documented in the biological resource completion report for these activities (CH2M HILL, 2013b), the geophysical survey activities were completed with no take of any listed species.	October 22 to 26, 2012	**Floodplain:** None **Upland:** None The geophysical survey areas were in previously disturbed areas, which required only minimal trimming of creosote bush and tamarisk. No habitat loss occurred as a result of this activity (CH2M HILL, 2013b).	None, soil resistivity measurements only

TABLE 1
Past and Present[a] Activities Within the Project Action Area

Project Title	Project Summary (including location, project description, conclusion)	Approval/Consultation	Start/End Dates	Habitat Disturbance	Well/Well Clusters[b] (see Figures 4 and 5 for locations)
Utility Potholing	This project was undertaken to help plan future pipeline alignments by accurately locating existing utilities features in the Action Area at 39 locations. The utilities investigated included telecommunication lines, fuel and natural gas lines, and remediation water lines owned by Frontier Communications; Kinder Morgan; Mojave Electric; SoCal Gas, Southwest Gas, Transwestern Gas, and PG&E. All holes were refilled upon completion.	These activities were part of the 2007 PBA (as re-initiated in 2012) and so fell under a determinations of "may affect, but not likely to adversely affect" for southwestern willow flycatcher, desert tortoise, Yuma clapper rail, razorback sucker, and bonytail chub; and a "no effect" determination for the Colorado pikeminnow (CH2M HILL, 2007a). No other consultation for these activities was required because they occurred outside of the bird nesting season in the Action Area. As documented in the biological resource completion report for these activities (WSA, 2014), the geophysical survey activities were completed with no take of any listed species.	October 15 to October 24, 2013	**Floodplain:** None **Upland:** None The potholing activities occurred solely within previously disturbed areas (roadway shoulders or developed industrial areas) that were devoid of vegetation. There was no habitat loss or vegetation removal (WSA, 2014).	None, shallow potholes only that were re-filled upon completion.
Alternative Freshwater Sources Evaluation Implementation Plan	This project includes the construction of up to two water supply wells in Arizona along the west side of the Oatman-Topock Highway. The first well, HNWR-1, was already constructed by the HNWR. A second (Site B) well to the north within Sacramento Wash, was recently constructed under the 2007 PBA (as re-initiated in 2012).	This work was included in and is occurring under the 2012 re-initiation of original 2007 PBA, which is now valid until 2017.	Fall 2010 to end of February 2014 (estimated)	**Floodplain:** To Be Provided **Upland: None** Located within the 100-year floodplain of the Colorado River floodplain.	Two (HNWR-1 and additional Site B well to north)
			Total	**Floodplain: 0.08407 acre** **Washes: 0.115 acre** **Upland: 1.6 acres**	**Wells/Well Clusters: 32**

Notes:

[a] Many of these same activities will occur in the future as part of the Final Groundwater Remedy and are the subject of this consultation as presented in Table 2.

[b] Tally of wells or areas of disturbance that pre-date the January 2007 PBA, do not count against the total in that document.

3.3 Planned Activities

Remedial actions for the Final Groundwater Remedy are identified in this section. Implementation of the groundwater remedy consists of several phases, including construction, O&M, post-remediation monitoring, decommissioning, and restoration. The Final Groundwater Remedy description has been summarized from the Basis of Design Report / Intermediate (60%) Design Submittal for the Final Groundwater Remedy that was submitted on April 5, 2013 (CH2M HILL, 2013c) but also incorporates the latest information related to the Freshwater Implementation Program and freshwater pre-injection treatment discussions with regulatory stakeholders. The Final Groundwater Remedy activities are listed below and described later in this section and represent the latest available information at this time. Table 2 includes a list of planned activities and an estimate of potential habitat loss resulting from those activities. It should be noted that the 90% design is expected in August 2014. It is possible that in response to comments, further refinements to the alignments and impacts may result. Table 3 provides a summary of the Final Groundwater Remedy impacts from Tables 1 and 2.

The Final Groundwater Remedy will be constructed and operated until the following remedial action objectives (RAO) are achieved:

1. Prevent ingestion of groundwater as a potable water source having hexavalent chromium (Cr[VI]) in excess of the regional background concentration of 32 micrograms per liter (μg/L).
2. Prevent or minimize migration of total chromium (Cr[T]) and Cr(VI) in groundwater to ensure concentrations in surface water do not exceed the designated "beneficial use" water quality standard of 11 μg/L Cr(VI) s for the Colorado River.
3. Reduce the mass of Cr[T] and Cr(VI) in groundwater at the site to achieve compliance with the applicable or relevant and appropriate requirements (ARAR) in groundwater. This RAO will be achieved through the cleanup goal of the regional background concentration of 32 μg/L of Cr(VI).
4. Ensure that the geographic location of the target remediation area does not permanently expand following completion of the remedial action.

Figure 6 shows the planned Final Groundwater Remedy system layout in California and Arizona. The Final Groundwater Remedy is expected to operate for several decades (up to 50 years).

Generally, the Final Groundwater Remedy will include the following key features:

- An **In situ Reactive Zone (IRZ)** along the National Trails Highway that will use a line of wells that may be used as both injection and extraction wells to circulate groundwater and distribute an organic carbon source that will promote reduction of the Cr(VI) to trivalent chromium (Cr[III]).
- An **Inner Recirculation Loop (IRL)** that comprises:
  - Extraction wells near the Colorado River (referred to as the River Bank [RB] extraction wells) to provide hydraulic capture of the deep Cr(VI) groundwater concentrations, accelerate cleanup of the floodplain, enhance the flow of contaminated groundwater through the IRZ line, and control migration of IRZ-generated byproducts toward the Colorado River.
  - Injection wells to re-inject groundwater extracted from the River Bank extraction wells, which may be amended with an organic carbon source, in the upgradient portion of the Cr(VI) plume to flush the plume through the IRZ.
- A **TCS Recirculation Loop**, which includes:
  - East Ravine (ER) extraction wells in the eastern end of the East Ravine to capture contaminated groundwater in the shallow bedrock.

  - Transwestern Bench (TWB) extraction wells along the eastern side of the TCS to capture contaminated groundwater downgradient of TCS.
  - TCS injection wells located northwest of the TCS for the re-injection of groundwater extracted from the East Ravine and Transwestern Bench extraction wells. The extracted water will be amended with an organic carbon source to promote reduction of the Cr(VI) to Cr(III) and reduce elevated Cr(VI) groundwater concentrations from the alluvial aquifer in the vicinity of the TCS.
- **Freshwater Supply System** will convey water from a supply well in Arizona to assist with flushing the chromium plume through the National Trails Highway IRZ and to constrain the westward spread of carbon-amended water and in situ byproducts from the IRL.

The Final Groundwater Remedy will also include utility and support facilities necessary to make the remedy effective and safe over the anticipated decades-long operation. Utilities will include electrical power supply, communications systems, and instrumentation and control systems. Support facilities will include carbon amendment facilities, access routes, facilities to manage wastewater, operator's facilities (office space, bathrooms, etc.), long-term storage of excess soil, equipment and materials storage, equipment maintenance and testing areas, waste or refuse containers, and an onsite laboratory.

In addition, temporary facilities will be required for the construction of the remedy. Potential locations within the project area have been identified in the project area for temporary staging locations for construction activities including a construction yard. These temporary staging areas and the construction yard are located in areas that are already developed or disturbed. It is anticipated that the construction yard will include at a minimum: multiple trailers serving as a work place for personnel, a central check-in/out location for site visitors, a place for daily briefings/project meetings, and staging area for equipment and materials as well as other construction-related functions.

In compliance with the mitigation measures and agreements that govern the project, the remedy infrastructure has been designed in a manner that gives: (1) priority to previously disturbed areas for the placement of new physical improvements, and (2) priority to re-use of existing physical improvements, such as, but not limited to, wells and pipelines, but not including the IM No. 3 Treatment Plant.

The description of the planned activities for the Final Groundwater Remedy follow the format of Table 2 and are described in the following subsections as they relate to the construction of the facilities; the operation and maintenance of those facilities; the sampling and monitoring of those facilities; soil storage; and decommissioning, restoration, and post-remediation monitoring.

3.3.1 Construction of the Final Groundwater Remedy

Additional details on these key features of the Final Groundwater Remedy, as well as supporting systems are provided in the following subsections. During the design, PG&E has located all remedy infrastructure to avoid or minimize impacts to biological resources to the maximum extent practicable. Biologists performed field reviews together with the design team prior to selection of locations for the design. In addition, a pre-construction survey will also be conducted by biologists to minimize the impacts to biological resources. The potential impacts to biological resources from these activities are described within Section 5.0 of this PBA.

3.3.1.1 Remediation Wells

At the 60% design stage, the Final Groundwater Remedy will require 48 new wells, with the flexibility to add approximately 37 provisional wells in the future, as needed to optimize the remedy system. The total estimated number of new remediation wells (including future provisional wells) is 95. The 90% remedy design submittal is planned for the summer of 2014 and will be incorporated into the current consultation.

TABLE 2
Summary of Planned Activities for the Final Groundwater Remedy

Final Remedy Item	Planned Activity Description (refer to Figure 6 for locations of these features, unless otherwise noted)	Estimated Future Habitat Loss[c]
Construction[a]		
Remediation Wells: a total of 48 new wells plus 37 provisional wells[b]	**National Trails Highway In Situ Reactive Zone (IRZ):** -Twenty-four (24) IRZ Injection wells (plus 30 future provisional wells) -Four (4) IRZ Extraction wells (plus one future provisional well) **Inner Recirculation Loop (IRL):** -Four (4) Injection wells (plus 3 future provisional wells) -Five (5) Riverbank Extraction wells **Topock Compressor Station (TCS) Recirculation Loop:** -Two (2) TCS Injection wells -Five (5) East Ravine Extraction wells (plus 1 future provisional) -Two (2) Transwestern (TW) Bench Extraction wells (plus two future provisional wells) **Freshwater Injection:** -Two (2) Freshwater Injection wells	**Required Additional Current Floodplain[d] Acreage:** 0.1 acres **Required Additional Historical Floodplain[d] Acreage:** 1.6 acres **Required Additional Upland Acreage**: 0.2 acres **Required Additional Wells**: 85 planned and provisional Primary floodplain habitat impacts will be for the Riverbank Extraction wells, pipelines, and access routes which will be placed to the extent possible outside of dense vegetation areas. Primary upland habitat impacts will be for new wells, pipelines and access routes in previously undeveloped or undisturbed areas. The locations will avoid perennial vegetation and shrubs to the extent possible. Note that approximately 95 percent of the current and historical floodplain acreage impacts are associated with tamarisk and arrow weed vegetation units.
Monitoring Wells	Nineteen (19) new monitoring well locations (plus 6 future provisional wells) Re-use existing monitoring wells where possible	**Required Additional Current Floodplain Acreage:** None **Required Additional Historical Floodplain Acreage:** 0.9 acres **Required Additional Upland Acreage:** 0.1 acre **Required Additional Wells:** 19 planned and 6 provisional clusters. Primary historical floodplain habitat impacts will be for the monitoring wells (A, B, C, D, H, and O) and access routes which will be placed to the extent possible outside of dense vegetation areas. The floodplain impacts are limited to the historical river floodplain and there are no expected impacts within current river floodplain. Primary upland habitat impacts will be for new wells, pipelines and access routes in previously undeveloped or undisturbed areas. The locations will avoid perennial vegetation and shrubs to the extent possible.
Carbon Amendment and Carbon Storage Facilities	One 3,000-gallon aboveground carbon storage tank and carbon amendment facility at the TW Bench One 15,000-gallon aboveground carbon storage tank and carbon amendment facility at the MW-20 Bench	**Required Additional Current Floodplain Acreage:** None **Required Additional Historical Floodplain Acreage:** None **Required Additional Upland Acreage:** None **Required Additional Wells:** None No additional habitat impacts are expected because these facilities will be placed within previously developed upland areas. Any unavoidable impacts to individual native trees will be addressed through established salvage or replacement approaches.

TABLE 2
Summary of Planned Activities for the Final Groundwater Remedy

Final Remedy Item	Planned Activity Description (refer to Figure 6 for locations of these features, unless otherwise noted)	Estimated Future Habitat Loss[c]
Freshwater Source/Supply wells/Pre-injection Treatment/Storage Facilities	At this time, field work is being conducted to determine the best location for a primary freshwater supply well in Arizona. It is anticipated that DTSC and DOI will provide direction to PG&E on freshwater supply by April 2014. In the meantime, there are two candidate locations for freshwater supply for the remedy, as follows: The first location for freshwater supply being considered is the existing well HNWR-1 located on the Refuge in Arizona or a new well at a nearby location. A second well located north of HNWR-1 (provisional designation, Site B Well) is also being evaluated. If needed, freshwater can be supplemented from the existing supply wells to TCS, namely, Topock-2/3 wells. One Fresh Water Pre-Injection Treatment System (FWPTS) and associated chemical storage tank and two small process tanks will be located at the Compressor Station, if required. [Note: Initial details are preliminary and these items will be included as a contingency in the 90% Design] Two freshwater storage tanks at the Topock Compressor Station. Note that these freshwater storage tanks will be operated separately from the Topock Compressor Station water supply tanks.	**Required Additional Current Floodplain Acreage:** 1.1 acres **Required Additional Historical Floodplain Acreage:** 0.1 acres **Required Additional Upland Acreage:** 0.2 acre **Required Additional Well:** One potential future well near HNWR-1. Well HNWR-1 was already constructed by the USFWS and lies within the 100-year floodplain of the Colorado River. Similarly, the Site B Well is also already constructed and lies within the floodplain. A future supply well near HNWR-1 would also be within the floodplain. The contingency pre-injection treatment facilities would be located within previously developed upland areas, if required. Estimate above is based on pipelines only.
Piping Corridors	-Belowground water pipes are made of plastic (high density polyethylene [HDPE]). Aboveground water pipes are made of steel (Schedule 40 steel with AWWA C205 cement mortar lining). [Note: Final details on belowground and aboveground segments still under consideration] **Conveyance Piping Associated with Remediation Wells** -The groundwater remedy includes approximately 26,000 feet of trenches and more than 100,000 linear feet of pipeline, with most being installed below ground either direct burial or in pre-cast concrete trenches. **Conveyance Piping Associated with Freshwater Supply** -Approximately 105,000 feet (ft) of water/liquid/utility pipes, and approximately 70,000 ft of electrical conduits and cables. Most of conveyance pipes/conduits will be below ground. -Approximately 2,200 feet of double-walled pipe.	**Required Additional Current Floodplain Acreage:** 1.7 acres **Required Additional Historical Floodplain Acreage:** 4.7 acres **Required Additional Upland Acreage:** 0.5 acre **Required Additional Wells:** None Portions of the freshwater pipeline along Oatman-Topock Highway in AZ will be within the 100-year floodplain of the Colorado River. There is another segment of freshwater conveyance line that crosses along the edge of the floodplain beneath the Interstate 40 bridge. No additional floodplain impacts because the pipeline will cross the Colorado River on an existing pipe bridge that spans the floodplain. These acreages are included in remediation and freshwater impacts above.
Supporting Facilities	The primary power supply source for remedy facilities in California will be power generated by the TCS. Secondary power supply will be power generated from small photovoltaic solar panels at various locations such as at the Central Maintenance Facility at the TW Bench and at select remote well locations. Power will be transmitted at 480 VAC to 12K VAC along pipeline corridor, six load centers are planned with a transformer/distribution equipment at each one (plus one future provisional load center to serve the future provisional well IRL-7 if this well is needed to be installed/operated). For the freshwater supply well (HNWR-1) in Arizona, the power supply source will be power provided by Mohave Electric Cooperative. Remedy-produced Water Conditioning System and associated tanks located at the Compressor Station One central maintenance building (approx. 10,000 sq. ft.) and one storage building (approx. 900 sq. ft.) at the TW Bench. A Supervisory Control and Data Acquisition (SCADA) and Human Machine Interface (HMI) system located at the central maintenance building at the TW Bench.	**Required Additional Current Floodplain Acreage:** None expected **Required Additional Historical Floodplain Acreage:** None expected **Required Additional Upland Acreage:** None expected **Required Additional Wells:** None One power transformer location north of Bat Cave Wash outlet is in the historical floodplain. Additional upland habitat needs are limited to the area needed for power facilities at or near HNWR-1 or at Site B well as well as other power transformer locations. Other facilities will be constructed in previously developed upland areas.
Access Pathways and Roadways	Reuse all existing access pathways and roadways (see Figure 7). Two new graded access roads will be needed in the upland area to allow for installation and maintenance of wells IRL-2 and IRL-4. To allow for shared use of the TW Bench by the Topock remediation project and Transwestern, one new access road east of the TW bench will be needed for access to Transwestern's gas transmission equipment.	**Required Additional Current Floodplain Acreage:** None expected **Required Additional Historical Floodplain Acreage:** None expected **Required Additional Upland Acreage:** 0.6 acre **Required Additional Wells:** None New roadway impacts estimated for new roadways to IRL-2 (estimated at 150 feet) and IRL-4 (estimated at 350 feet long). Assumes a 50-foot-wide disturbance corridor.

TABLE 2
Summary of Planned Activities for the Final Groundwater Remedy

Final Remedy Item	Planned Activity Description (refer to Figure 6 for locations of these features, unless otherwise noted)	Estimated Future Habitat Loss[c]
Other Ancillary Facilities	Upgrades to the evaporation ponds to address comments on the 60% Remedy Design Two aboveground pipe bridges for aerial crossing of Bat Cave Wash Small photovoltaic solar panels at various locations such as at the Central Maintenance Facility at the TW Bench and at select remote well locations. Small communication radios at select remote monitoring well locations to allow for remote data collection. Security equipment (e.g., fencing, gate, security cameras) for Transwestern bench and remote staging areas or other facilities. Concrete pads with sunshades for water supply wells to hold wellhead, pump, and electrical/control equipment.	**Required Additional Current Floodplain Acreage:** None expected **Required Additional Historical Floodplain Acreage:** None expected **Required Additional Upland Acreage:** 0.1 acre **Required Additional Wells:** None There will be no additional historical floodplain or upland acreage due to the remote communication installations because they will be located immediately adjacent to the wells within existing disturbed areas. The upland disturbance for the two aerial bridge crossings over Bat Cave Wash will consist of concrete anchor points at either end of the bridges estimated at 25 by 30 feet each.
Construction Yard/Temporary Material Staging and Soil Storage	Within the Action Area, twenty-five staging areas (totaling up to 35.40 acres) have been proposed in California and four staging areas (totaling up to 3.18 acres) have been proposed in Arizona (see Figure 7). Twenty areas (totaling up to 22.95 acres) in California will be for staging only while five areas (totaling up to 11.5 acres) near the northwest corner of the Action Area are proposed for combined staging and soil storage areas. Two of the twenty areas (total 0.95 acre) are under negotiation as potential combined staging and soil storage areas to the north of the west access route. A construction yard (to be located in Park Moabi) will also be required which will include at a minimum: multiple trailers serving as a work place for personnel, a central check-in/out location for site visitors, a place for daily briefings/project meetings, etc.	**Required Additional Current Floodplain Acreage:** None **Required Additional Historical Floodplain Acreage:** None **Required Additional Upland Acreage:** None **Required Additional Wells:** None None of the proposed construction staging and soil storage areas are located within the historical floodplain or in undisturbed areas within the uplands.
Operation and Maintenance		
Operation of Final Remedy Facilities	Normal operation of the previously described Final Remedy facilities which includes the groundwater extraction and recirculation wells and pipelines carbon substrate storage and deliveries; carbon substrate injections, and regularly scheduled maintenance and repairs of the remedy system. Normal operation and maintenance of the freshwater supply, conveyance, and storage system. Normal operation and maintenance of the Remedy Produced Water Treatment system. Normal operation and maintenance of the Pre-Injection Arsenic Treatment system (if required). Normal operation and maintenance of the power supply and distribution system.	**Required Additional Current Floodplain Acreage:** None expected **Required Additional Historical Floodplain Acreage:** None expected **Required Additional Upland Acreage:** None expected **Required Additional Wells:** None The operation of the IRZ facilities will not expand the project footprint beyond what has already been used during construction.
Well Maintenance and Decommissioning	Routine maintenance that can be conducted without intrusive modifications to the wellhead or well including regular surging and pumping techniques. A more aggressive routine maintenance technique uses AquaGard^{TM} that injects cryogenic liquid carbon dioxide (CO_2) into existing well access tubes and requires all or some of the following: a CO_2 injection trailer, CO_2 storage vessel, support truck, pump rig and/or crane (if a pump or pipe needs to be installed/removed), and a support truck. Non-routine maintenance are intrusive methods requiring removal of existing equipment from well and include drop-pipe replacement; submersible pump repair/replacement; and well repair and well rehabilitation methods. Depending on the specific plan for well rehabilitation, some or all of the following equipment may be required: a pump rig and/or crane, support or pipe truck, generator(s), air compressor, chemical trailer (mixing tanks and pumps), neutralization trailer (mixing tanks and pumps), support truck, video van, vacuum or tanker truck, forklift, and 20,000-gallon frac tanks. The general approach for well decommissioning is currently being developed by a subgroup that includes PG&E, DTSC, DOI, and Interested Tribes and will be provided in the 90% Design O&M manual.	**Required Additional Current Floodplain Acreage:** None expected **Required Additional Historical Floodplain Acreage:** None expected **Required Additional Upland Acreage:** None expected **Required Additional Wells:** None The operation of the IRZ facilities will not expand the project footprint beyond what will have already been used during construction.

TABLE 2
Summary of Planned Activities for the Final Groundwater Remedy

Final Remedy Item	Planned Activity Description (refer to Figure 6 for locations of these features, unless otherwise noted)	Estimated Future Habitat Loss[c]
Pipeline Maintenance and Repair	A Clean-In-Place (CIP) system will operate as a closed loop system to use approved chemicals to remove biological films and mineral scale deposits within remedy pipelines. Spent CIP solutions will be collected and managed as liquid wastes. Sections of direct burial HDPE pipe requiring repairs will need to be exposed by excavation; whereas, belowground pipe section inside precast concrete trench can be accessed via maintenance manhole(s). Aboveground pipeline repairs will be done according to manufacturer's recommendations. Aboveground pipeline will need to be periodically repainted for upkeep and aesthetic reasons.	**Required Additional Current Floodplain Acreage:** None expected **Required Additional Historical Floodplain Acreage:** None expected **Required Additional Upland Acreage:** None expected **Required Additional Wells:** None No additional habitat impacts are expected because repairs will occur along corridors and work zones that have already been already been used during the pipeline installation.
Waste Management Practices	Different waste streams include remedy produced water and CIP; displaced soil; solids and filters from remedy-produced water treatment system; dewatered sludge from contingency arsenic removal system; used PPE; miscellaneous waste; universal waste; recoverable materials; and sanitary waste. Liquid and solid wastes will be analyzed to determine if they are hazardous or not, and how the waste will be managed. Waste materials will be managed onsite in demarcated waste management areas that will be selected from the proposed staging areas shown in Figure 7. Wastes will be segregated, containerized and labeled before they are shipped off site in accordance with local, state, and federal transportation requirements. Recoverable materials will be recycled or re-used as feasible.	**Required Additional Current Floodplain Acreage:** None **Required Additional Historical Floodplain Acreage:** None **Required Additional Upland Acreage:** None **Required Additional Wells:** None Upland areas that will be used for waste management and temporary storage will be limited to previously disturbed and unvegetated locations.
Storm Water Pollution Prevention	Storm water pollution prevention has two major objectives: Identifying and evaluating sources of pollutants associated with industrial activities that may affect the quality of storm water discharges and authorized non-storm water discharges from the facility; and Identifying and implementing site-specific best management practices (BMP) to reduce or prevent pollutants from being released in storm water discharges and/or authorized non-storm water discharges that may affect receiving water quality. The O&M SWPPP identifies BMPs as required by law, and establish a monitoring and sampling plan (including visual inspections and an annual comprehensive review). The annual comprehensive review is required to evaluate the effectiveness of the BMPs and to determine whether modifying BMPs or implementing additional BMPs is required. A Draft O&M SWPPP will be included in the 90% Design submittal that will reflect the latest requirements of the Industrial General Permit.	**Required Additional Current Floodplain Acreage:** None expected **Required Additional Historical Floodplain Acreage:** None expected **Required Additional Upland Acreage:** None expected **Required Additional Wells:** None BMPs established by the O&M SWPPP are expected to be contained within existing project work areas or designated soil storage areas. SWPPP actions are not expected to expand the project footprint, except in the case of a possible response to a BMP failure during a storm event.
Fuel Storage and Fueling Practices	Two types of fuels are currently expected for use during the final Groundwater Remedy, diesel and gasoline, which shall meet the applicable California standards. There are existing diesel and gasoline bulk storage tank at the Topock Compressor Station that will be used by Final Remedy personnel. Alternate fuels, if used in the future, will comply will all local, state, or federal regulations related to their bulk storage and management. The Hazardous Materials Business Plan and SOPs will include procedures for properly storing and handling fuels on site; equipment and procedures for spill containment; required PPE; and measures to reduce the likelihood of spills during fueling or maintenance activities.	**Required Additional Current Floodplain Acreage:** None **Required Additional Historical Floodplain Acreage:** None **Required Additional Upland Acreage:** None **Required Additional Wells:** None Fueling practices are not expected to expand the project footprint, except in the case of an unlikely spill.
Access Road and Pathway Maintenance	Access roadway and footpath are expected to deteriorate over time, so maintenance activities will need to be tailored to the specific cause and repair need. For footpaths, pruning of overgrowth will be done using hand tools or mechanical-powered tools. Soil stabilization for disturbed areas may be accomplished by applying approved soil stabilizing agents (e.g., SoilTac), erosion control matting, silt fencing, etc. Access roadways can be loose or compact dirt; gravel; or paved surfaces. Manual or mechanical grading may be required; as well as filling and soil stabilization. Ditches and culverts will be inspected and cleaned but may require replacement or ditch reshaping to increase capacity. Erosion control measures; addition of base fill or gravel; or re-paving of the roadways are all activities that may be required depending on the need.	**Required Additional Current Floodplain Acreage:** To Be Determined **Required Additional Historical Floodplain Acreage:** To Be Determined **Required Additional Upland Acreage:** To Be Determined **Required Additional Wells:** None The project footprint may be expanded in cases where roadway repairs require modifications of ditches or placement of fill to address erosion or deterioration issues. The added habitat acreage for this activity cannot be reasonably estimated; however, it is expected to be negligible because the likely repair areas will be alongside roadways, which have already been disturbed,

TABLE 2
Summary of Planned Activities for the Final Groundwater Remedy

Final Remedy Item	Planned Activity Description (refer to Figure 6 for locations of these features, unless otherwise noted)	Estimated Future Habitat Loss[c]
Contingency Plans	Contingency Plans have been provided as part of the 60% Design Submittal in the form of the Draft Operation and Maintenance Manual – Volume 3 (CH2M HILL, 2012c) and consider the following unacceptable conditions: unacceptable remedy performance where the RAOs are not met; schedule failures where the time to cleanup is extended more than 5 to 15 years; cost failures; significant change to impact; and significant H&S or compliance incident. Contingency planning has been prepared for five key elements of the groundwater remedy: In-Situ Remediation System; Remedy-produced Water Management System; Freshwater Supply; Power Supply; and SCADA System. Various failures and corrective actions are considered.	**Required Additional Current Floodplain Acreage:** None **Required Additional Historical Floodplain Acreage:** None **Required Additional Upland Acreage:** None **Required Additional Wells:** None ESA consultation will be required for any unacceptable condition that leads to a longer time frame for achievement of the RAOs and continued activities for a longer period of time than contemplated in this consultation or results in potential impacts on any of the PBA-listed species not addressed here. However, should additional operational time be required, it will not expand the footprint of the Final Remedy beyond what was used during construction.
IM No. 3 Lay-up	Prior to startup of the Final Groundwater Remedy, the IM No. 3 system will be shut down and prepared for lay-up. When the IM No. 3 is in a lay-up condition, the system will be left in a safe, secure, and preserved state and will not operate again until agency approval is received for decommissioning and removal of the system. Procedures for shutting down IM No. 3 are included in the existing IM No. 3 Treatment and Extraction System Operations and Maintenance Plan (O&M) (CH2M HILL, 2006d). The IM No. 3 system will remain in a lay-up condition until PG&E receives approval for closure and decommissioning of IM No. 3, as appropriate. During the lay-up period, equipment maintenance is required to keep the equipment in good condition and under active equipment warranties, because most major equipment will likely be recovered for reuse. Electricity will be required for equipment maintenance. In addition, weekly inspections of the following equipment will be conducted: • Storage tanks that formerly contained hazardous materials. • Pressurized (compressed air) tank. • Onsite chemical storage areas. (Excess chemicals will be removed from site during lay-up preparation.) • Emergency shower and eye wash station and potable water cooling system. • Fire water tank. • Aboveground injection well pipeline and instrumentation conduit. Maintenance will also be conducted on the access road to the IM No. 3 Treatment Plant and injection wells as well as watering the road for dust control pursuant to EIR mitigation measures. Periodic filling of the potable water tank, and possibly the fire water tank at the IM No. 3 Treatment Plant, as well as regular pest control will also be required. Telecommunications and plant communications will continue to be maintained for safety, security, and maintenance requirements. Because personnel will be onsite during work days, the potable water system at the IM No. 3 Treatment Plant will stay in service to provide water to the sinks and toilet in the IM No. 3 Treatment Plant trailer. The sewage holding tank for the IM No. 3 Treatment Plant trailer will stay in service. The sewage holding tank will need to be serviced; the service frequency will be on an as needed basis.	**Required Additional Current Floodplain Acreage:** None **Required Additional Historical Floodplain Acreage:** None **Required Additional Upland Acreage:** None **Required Additional Wells:** None These actions are not expected to have impacts outside of the existing project footprint; however, ESA coverage would be additional inspection/maintenance site visits to the IM No. 3 facilities during the lay-up phase.

TABLE 2
Summary of Planned Activities for the Final Groundwater Remedy

Final Remedy Item	Planned Activity Description (refer to Figure 6 for locations of these features, unless otherwise noted)	Estimated Future Habitat Loss[c]
Sampling and Monitoring Plan		
Monitoring well sampling locations and frequency	Remedy Compliance Monitoring and Process Control Monitoring Plan (RCM/PCMP) will include the planned 19 monitoring wells (Designated as Wells A through S in Figure 6) as well as any existing monitoring wells and surface water samples from the current GMP that are deemed necessary during the Final Remedy operations. It also includes the additional future 25 contingency wells. The RCM/PCMP sample locations, analytes, and frequencies will be adapted in an ongoing manner to meet the needs of the Final Remedy. Current GMP samples include: • Thirteen (13) groundwater wells are sampled biennially; • Thirty-nine (39) groundwater wells are sampled annually; • Two (2) active supply wells are sampled annually; • Thirty-five (35) groundwater wells are sampled semi-annually; • Fifty-four (54) groundwater wells are sampled quarterly; • Two (2) groundwater wells on the floodplain are sampled monthly between November and February • Two (2) active extraction wells are sampled monthly; • Four (4) shoreline surface water stations along the Colorado River and two (2) other surface water monitoring locations were sampled quarterly (except during the winter low-river stage conditions, when the stations are sampled one additional time); and • Ten (10) depth-specific sampling stations within the Colorado River that were sampled quarterly (except during the winter low-river stage conditions, when the stations are sampled one additional time). An initial RCM/PCMP for groundwater and surface water sampling are provided in the 60% Design Draft O&M Manual (Volume 2).	**Required Additional Current Floodplain Acreage:** None **Required Additional Historical Floodplain Acreage:** None **Required Additional Upland Acreage:** None **Required Additional Wells:** None Well sampling activities will make use of existing routes established during the well installations so no additional habitat impacts are anticipated. Associated impacts to wildlife resources are related to the periodic visits for well sampling during operation of the Final Remedy, which will be a function of the well sampling frequency and well characteristics (e.g., required purge volumes). Additional wells may also be required but the additional impact for this is accounted for in the provisional monitoring wells in the Construction section of this table.
Sampling Methods	SOPs for groundwater and surface water sampling are provided in Appendix A of the 60% Design Draft O&M Manual (Volume 2) (CH2M HILL, 2012d). The SOPs provide detailed method descriptions for purging and sampling of groundwater monitoring wells by well-volume and modified well-volume methods; purging and sampling of active and inactive water supply wells; depth-specific surface water sampling; groundwater sampling from sonic drilling boreholes; sample field filtration and preservation for metals analyses; decontamination of water sampling equipment; spill prevention, containment, and control measures for monitoring well sampling; pore water sampling; access routes; process water sampling; and safe fueling and fuel handling procedures.	**Required Additional Current Floodplain Acreage:** None **Required Additional Historical Floodplain Acreage:** None **Required Additional Upland Acreage:** None **Required Additional Wells:** None Well sampling activities will make use of existing routes established during the well installations so no additional habitat impacts are anticipated. Associated impacts to wildlife resources are related to the periodic visits for well sampling during operation of the Final Remedy, which will be a function of the well sampling frequency and well characteristics (e.g., required purge volumes). The SOPs minimize potential impacts to sensitive biological resources.
Baseline Soil Sampling	A Baseline Soil Sampling and Analysis Plan is provided in Appendix A of the Draft O&M Manual (Volume 4) (CH2M HILL, 2012e). In areas where groundwater remedy infrastructure overlaps with any of the eighteen different Soil Investigation Areas, the approach presented in the SAP will be fully coordinated with the ongoing RFI/RI planning activities to minimize the total number of soil samples to be collected and associated ground disturbances, as well as to ensure consistency between the groundwater and soil programs associated with the Topock Remediation Project. The purpose of the baseline soil sampling will be to provide comparable data to evaluate potential impacts of the final remedy features at the time that they are being decommissioned. Baseline soil samples will be collected along the remedy pipelines/conduits alignments, which include direct burial pipelines/conduits, pipeline trenches, and the new remediation wells (i.e., injection and extraction wells) that are connected to those pipelines, as well as at the new remedy monitoring well locations. Baseline soil sampling will not occur along the alignment of the freshwater pipeline in Arizona, and on the California side, leading to the Compressor Station because the freshwater from HNWR-1 has very low concentrations of inorganic compounds so that potential risks to underlying soil from incidental releases, spills or leaks from the pipeline are negligible.	**Required Additional Current Floodplain Acreage:** None **Required Additional Historical Floodplain Acreage:** None **Required Additional Upland Acreage:** None **Required Additional Wells:** None The Baseline soil samples would be collected just prior to installation of Final Remedy facilities so the acreage for disturbance is already accounted for in the construction phase.

TABLE 2
Summary of Planned Activities for the Final Groundwater Remedy

Final Remedy Item	Planned Activity Description (refer to Figure 6 for locations of these features, unless otherwise noted)	Estimated Future Habitat Loss[c]
Soil Storage		
Locations and Storage Methods	The Baseline Soil Sampling and Analysis Plan (SAP) presented in Appendix A of the Soil Management Plan 60% Design Draft O&M Manual - Volume 4 (CH2M HILL, 2012e) describes the collection of data to assist with the management of materials displaced during construction activities. Screening of analytical test results will determine handling requirements for displaced soils project in accordance with the Soil Management Plan. Figure 7 shows five different proposed staging/soil storage areas that have been identified in California (totaling 11.50 acres). Two other areas to the north of the west access route (Historic Route 66) totaling 0.95 acre, are currently being negotiated for dual staging/soil storage use. Displaced soil that is non-hazardous but is unsuitable for final disposition onsite because contaminants are present above the interim screening level cannot be reused until project-specific soil cleanup goals are finalized and must be stored onsite. Storage area(s) will depend on the volume of soil, which will not be known until after the implementation of the Baseline SAP. Soil will be stored in 55-gallon drums/small containers, roll-off bins, and/or stockpiles that are managed in accordance with the O&M SWPPP. All containers will be properly labeled according to state and federal requirements. Only non-hazardous soil will be stored in stockpiles.	**Required Additional Current Floodplain Acreage:** None **Required Additional Historical Floodplain Acreage:** None **Required Additional Upland Acreage:** None **Required Additional Wells:** None Soil storage areas will be located within selected upland areas that have been previously disturbed. Application and maintenance of BMPs in accordance with the O&M SWPPP are expected to limit expansions of the storage area footprints.
Handling and Short-term Storage of Non-Hazardous Clean Soil	Non-hazardous clean displaced soil will be stockpiled at the work site. If feasible, clean soil that was removed from trenches or excavations will be reused as backfill into the same trench or excavation area. Clean soil that cannot be immediately used as backfill may be reused in other areas within the Action Area, or stockpiled for future reuse within the Action Area. Displaced soil that is stockpiled for future use will be managed following the BMPs Plan that will be part of the O&M SWPPP and included in Appendix E of the 90% design Draft Operation and Maintenance Manual – Volume 1 (CH2M HILL, 2012b). Storage area(s) for clean soil will depend on the volume of soil, which will not be known until after the implementation of the Baseline SAP (Appendix A). Once the volume of clean soil needing storage is determined, PG&E will coordinate with agencies, tribe(s), and affected land owners regarding the acceptable mode and location of storage. An addendum to the Soil Management Plan (SMP) will be prepared after the implementation of the Baseline SAP, to document sampling results and discuss implications on soil management. The volume of clean displaced soil from the decommissioning and removal of the IM No. 3 system requiring storage will not be known until after the system has been decommissioned and removed, which will not occur until after the start of implementation of the groundwater remedy. Since the amount of displaced soil from the decommissioning and removal of the IM No. 3 system is expected to be minimal and characterization of this displaced soil will not occur until after the SMP has been revised to include the Baseline SAP results, this displaced soil will be stored and managed following the same process as the soil displaced during the groundwater remedy installation and O&M as provided for in the revised SMP.	**Required Additional Current Floodplain Acreage:** None **Required Additional Historical Floodplain Acreage:** None **Required Additional Upland Acreage:** None **Required Additional Wells:** None Short-term soil storage areas will be located and operated within selected upland areas that have been previously disturbed. Application and maintenance of BMPs in accordance with the O&M SWPPP are expected to limit expansions of the storage area footprints.
Long-term Storage of Non-Hazardous Soil	Displaced soil that is non-hazardous but unsuitable for final disposition onsite because contaminants are present above the interim screening level cannot be reused must be stored onsite until project-specific soil cleanup goals are finalized. Once final project specific cleanup goals are established, the contamination will be re-assessed based on existing data, or additional data as determined necessary, to determine final disposition (i.e., transportation to offsite disposal facility or reuse within the Action Area). The long-term storage area(s) will depend on the volume of soil, which will not be known until after the implementation of the Baseline SAP. Once the volume of soil needing long-term storage is determined, PG&E will coordinate with agencies, Tribe(s), and affected land owners regarding the acceptable mode and location of long-term storage. An addendum to the SMP will be prepared after the implementation of the Baseline SAP to document sampling results and discuss implications on soil management, especially long-term storage of soil. The volume of displaced soil in and near Soil RFI/RI Areas from the decommissioning and removal of the IM No. 3 system requiring long-term storage will not be known until after the system has been decommissioned and removed, which will be after the start of implementation of the groundwater remedy. The amount of displaced soil within and near Soil RFI/RI Areas from the decommissioning and removal of the IM No. 3 system is expected to be minimal and characterization of this displaced soil will not occur until after the SMP has been revised to include the Baseline SAP results. For these reasons, this displaced soil will be stored and managed following the same process as the soil displaced during the groundwater remedy installation and O&M provided in the revised SMP.	**Required Additional Current Floodplain Acreage:** None **Required Additional Historical Floodplain Acreage:** None **Required Additional Upland Acreage:** None **Required Additional Wells:** None Long-term soil storage areas will be located and operated within selected upland areas that have been previously disturbed. Application and maintenance of BMPs in accordance with the O&M SWPPP are expected to limit expansions of the storage area footprints to these previously disturbed areas.

TABLE 2
Summary of Planned Activities for the Final Groundwater Remedy

Final Remedy Item	Planned Activity Description (refer to Figure 6 for locations of these features, unless otherwise noted)	Estimated Future Habitat Loss[c]
Handling, Short-term Storage, and Offsite Transport of Hazardous Waste Soil	Non-RCRA and RCRA hazardous wastes will be removed from the site within 90 days from date of generation.	**Required Additional Current Floodplain Acreage:** None **Required Additional Historical Floodplain Acreage:** None **Required Additional Upland Acreage:** None **Required Additional Wells:** None Hazardous waste soils will be contained in drums or roll-off bins and managed at waste storage areas will be located within selected upland areas that have been previously disturbed. Regular inspection of waste storage areas are expected to prevent releases of hazardous waste soil. There will be no hazardous soil storage or handling within the historical or current river floodplains.
Emergency Response	A barrier, such as temporary fencing, will be provided for hazardous waste accumulation areas that are otherwise accessible to the general public. Hazardous waste soil accumulation areas will also have signs that provide 24-hour emergency contacts and telephone numbers and will contain emergency response equipment appropriate to applicable waste hazards. The project-specific Health and Safety Plan will identify the project emergency response procedures and equipment, including emergency response contacts and phone numbers. In addition to the project-specific Health and Safety Plan procedures, hazardous waste accumulation areas will be provided with fire extinguishers, decontamination equipment including an eye wash station, and an alarm system (if radio equipment is not available to all staff working in accumulation area).	**Required Additional Current Floodplain Acreage:** None **Required Additional Historical Floodplain Acreage:** None **Required Additional Upland Acreage:** None **Required Additional Wells:** None Established procedures for management of hazardous soil storage areas located in upland areas will include properly trained personnel and equipment to handle emergency response situations. There will be no hazardous soil storage or handling within the historical or current river floodplains.
Post-Remediation Monitoring		
Post-Remediation Monitoring	After active remediation is completed, monitored natural attenuation will be implemented as a long-term component of the groundwater remedy to address residual chromium that may remain in recalcitrant portions of the aquifer following efforts to enhance and optimize in-situ treatment and flushing systems during the O&M phase. In addition, in compliance with the State Board directive dated November 20, 2013, monitoring of groundwater quality in the freshwater injection areas will be conducted to verify that the arsenic water quality objective in the receiving groundwater are met within the earlier of (i) 20 years after achieving the RAO for chromium or (ii) 20 years after ceasing injection of freshwater containing naturally occurring arsenic at concentrations above the water quality objective. It is currently assumed that there will be no need for additional monitoring wells (or replacements) as a part of the post-remediation monitoring program.	**Required Additional Current Floodplain Acreage:** None expected **Required Additional Historical Floodplain Acreage:** None expected **Required Additional Upland Acreage:** None expected **Required Additional Wells:** To Be Determined Well sampling activities will make use of existing routes established during the well installations so no additional habitat impacts are anticipated. Additional impact comes from the periodic visits for well sampling during operation of the Final Remedy, which will be a function of the well sampling frequency and well characteristics (e.g., required purge volumes). This assumes that no new wells will be needed other than those provisional wells already accounted for in the Construction section of this table.

TABLE 2
Summary of Planned Activities for the Final Groundwater Remedy

Final Remedy Item	Planned Activity Description (refer to Figure 6 for locations of these features, unless otherwise noted)	Estimated Future Habitat Loss[c]
Decommissioning		
IM No. 3	Once the Final Groundwater Remedy is brought on line and is determined by the agencies to be operating properly and successfully, PG&E will decommission and remove the IM No. 3 system after receipt of approval by DTSC, with concurrence from DOI. A draft work plan describing the IM No. 3 Decommissioning activities will be submitted for review with the 90% design. Once approved, the work plan will be implemented for the decommissioning and removal of IM No. 3 facilities. The scope of work will include the decommissioning and removal or abandonment in place of the following IM No. 3 system components: • Three extraction wells in the MW-20 Bench area of the site (TW-2S, TW-2D, and TW-3D) and one extraction well in the floodplain (PE-1), as well as ancillary well equipment and vaults. Two injection wells in the East Mesa area of the site (IW-2 and IW-3) and power supply structure located at this site. Prior to decommissioning the wells, submersible pumps in the extraction wells, air-lift tubing in the injection wells, and pipes, valves, and instruments in both the extraction and injection well vaults will be removed. Conduit, electrical panels, and other features within a well vault will also be removed. • Underground piping and vaults between the extraction wells and the treatment plant. After successful decontamination or cleaning, underground pipelines and conduits exiting PE-1, IW-2, and IW-3 well vaults will be cut and capped outside of the well vault and abandoned in place. The subsurface well vault will then be removed. • Entire treatment plant, including equipment, pipelines, valves, instrumentation, utilities, and infrastructure underneath the sunshade, the sunshade, mobile warehouse units, trailer, treatment plant foundation and secondary containment areas, underground pipelines and utilities within the footprint of the treatment plant fence line, and security fence and gate. • Underground and aboveground pipelines, and instrumentation conduit between treatment plant and injection well field. • Support facilities on the MW-20 Bench, including Valve Vault #1, pumps, valves, pipelines, electrical, and instrumentation associated with the extraction wells, parking areas, security fence and gates, security system, lighting, and other ancillary equipment. • Existing MWs and their instrumentation that are currently used to monitor IM No. 3 performance will be reused as part of the monitoring network associated with the Final Remedy, and therefore will not be decommissioned. Decommissioning of these existing MWs and their instrumentation will be addressed as part of the decommissioning of the groundwater remedy. The general approach for decommissioning wells is being developed by a subgroup that includes PG&E, DTSC, DOI, and Interested Tribes, and will be incorporated into the Groundwater Remedy O&M Manual, Volume 1, Section 4 (Well Maintenance and Decommissioning), as available. • No aboveground component of the existing IM No. 3 system located within the footprint of the existing IM No. 3 Treatment Plant building, or within the IM No. 3 Treatment Plant fence line will be reused in its current location as part of the Final Remedy. The brine storage and loading facility (three tanks, the truck lane, and associated pumps and piping) will be reused by the Final Groundwater Remedy in its existing location at the MW-20 Bench.	**Required Additional Current Floodplain Acreage:** None expected **Required Additional Historical Floodplain Acreage:** None expected **Required Additional Upland Acreage:** None expected **Required Additional Wells:** None The decommissioning process is not expected to expand beyond the footprint that was already created during construction and maintenance activities. It is recognized however; that there may be “re-disturbance” for limited areas where habitat has re-established on previously disturbed areas.
Final Remedy	In compliance with the 2013 Consent Decree (Appendix C, Item 9), PG&E will submit a decommissioning plan within 120 days of DOI’s certification of completion of the remedial action and a determination by DOI that removal of such facilities is protective of human health and the environment. The decommissioning plan will describe procedures for the removal of the remedy facilities and associated infrastructure. The plan will also describe the post-remedy restoration of the site to the conditions existing prior to the implementation of the remedy construction, to the extent practicable. In addition, in accordance with mitigation measure, biological surveys will be conducted prior to decommissioning, and during the breeding season, to inform the decommissioning planning process. The Final Remedy Decommissioning activities will be completed in accordance with the Bird Impact Avoidance and Mitigation Plan (BIAMP; CH2M HILL, 2013f) and other relevant documents (including this PBA). After decommissioning and removal of the remediation facilities, the areas will be restored using decompaction and grading techniques designed to decrease erosion and accelerate revegetation of native species. The decommissioning of monitoring wells will be after an appropriate time span following the decommissioning of the remediation facilities.	**Required Additional Current Floodplain Acreage:** To Be Determined **Required Additional Historical Floodplain Acreage:** To Be Determined **Required Additional Upland Acreage:** To Be Determined **Required Additional Wells:** None The decommissioning process is not expected to expand beyond the footprint that was already created during construction and maintenance activities. It is recognized; however, that there may be “re-disturbance” for limited areas where habitat has re-established on previously disturbed areas that have regrown during the Final Remedy operation (up to 50 years).

TABLE 2
Summary of Planned Activities for the Final Groundwater Remedy

Final Remedy Item	Planned Activity Description (refer to Figure 6 for locations of these features, unless otherwise noted)	Estimated Future Habitat Loss[c]
Restoration		
IM No. 3	The IM No. 3 restoration will provide a template after which, subsequent restoration efforts may be modeled or improved. Prior to conducting restoration activities, PG&E will prepare a Restoration Plan for review by regulatory agencies, stakeholders, landowners, and Tribal Nations. The focus of the Restoration Plan would be to outline the scope of restoration; the goals and objectives of the restoration; to promote native plant and habitat regeneration; and to prevent invasive plant establishment. Success criteria will be proposed along with a monitoring and reporting plan. Adaptive management will be used to evaluate the effectiveness of the restoration through monitoring, and adjust management of the site in the event of unforeseen circumstances. It should be recognized that the majority of the IM No. 3 decommissioned facilities are adjacent to ongoing Final Groundwater Remedy facilities. Similarly, previously used staging or soil storage may also be required for use in the Final Groundwater Remedy, or have ongoing activities (e.g., the Compressor Station, the Transwestern Metering Bench, the MW-24 Bench, the evaporation ponds area, the trailer park area in Moabi Regional Park, the parking areas off I-40, etc.). Even after the decommissioning of the IM No. 3 facilities, it is expected that restoration will not be feasible for many areas that are required for ongoing Final Remedy operations (e.g., MW-20 Bench). Rather, these areas will not be restored until after the Final Groundwater Remedy facilities have been closed and decommissioned. Instead, these locations will be maintained along with remaining facilities over the duration of the final remedy operation. Established roads and access pathways will be maintained during decommissioning and restoration activities. After demobilization, the condition of established roads and access pathways will be returned to pre-mobilization condition. The IM No. 3 treatment plant site may represent one area where restoration could proceed in advance of the closure of the Final Groundwater Remedy facilities, assuming it was not required as part of the Final Groundwater or Soil Remedies. Whether it is the former IM No. 3 Treatment Plant site or any other location, as previously mentioned, the IM No. 3 Restoration Plan will provide an excellent opportunity to develop the best methods and approaches that will help the Final Groundwater Remedy restoration efforts.	**Required Additional Current Floodplain Acreage:** None **Required Additional Historical Floodplain Acreage:** None **Required Additional Upland Acreage:** None **Required Additional Wells:** None No additional disturbance areas outside of those already used for prior construction or maintenance activities are expected during the restoration process.
Final Remedy	With the decommissioning and removal of the Final Groundwater Remedy facilities, it will be possible to restore many of the areas used by the Remediation Project. Prior to final decommissioning, a second Restoration Plan will be prepared for review by regulatory agencies, stakeholders and Tribal Nations. This Restoration Plan will encompass the remaining project areas used by groundwater remedy, including staging/storage areas. Similar to IM No. 3 Restoration, staging areas that have ongoing activities (e.g., the Compressor Station, the Transwestern Metering Bench, the MW-24 Bench, the evaporation ponds area, the trailer park area in Moabi Regional Park, the parking areas off I-40, etc.) will not be restored. Also, established roads and access pathways will be returned to pre-mobilization condition. The Restoration Plan for the remedy facilities will incorporate the approaches and feedback gathered from the previously prepared IM No. 3 Restoration Plan.	**Required Additional Current Floodplain Acreage:** None **Required Additional Historical Floodplain Acreage:** None **Required Additional Upland Acreage:** None **Required Additional Wells:** None No additional disturbance areas outside of those already used for prior construction or maintenance activities are expected during the restoration process.

Notes:

[a] The listed Final Groundwater Remedy features described in this table are based upon the 60% Design Submittal along with some modifications based on comments received. The 90% Design submittal is anticipated to be available in August 2014.

[b] The numbers of well locations and wells differs because of the need for dual well completions at certain individual locations (IRZ-11, -13, -15, -16, -17, -19, -20 and -21).

[c] The estimated habitat losses provided in this table may be modified based on discussions with Agencies. Habitat losses were estimated for planned well and pipeline locations as shown in the 60% Design and modified based on subsequent agency comments and a constructability review between April 7 and April 10, 2014. The habitat losses from the planned wells were used to estimate the additional habitat losses from future provisional wells, for which data is not currently available. Estimated impacts for the upland pipeline corridors used current design trench dimensions and assumed that a 25-foot construction corridor would be needed, recognizing that actual project impacts may be less as adaptations in the field are used to minimize impacts to potential sensitive resources or to avoid terrain constraints. In historical floodplain areas assumed pipeline construction corridors ranged between 50 and 75 feet based on anticipated design and construction conditions. In upland areas, the estimated new impact area was estimated by intersecting the GIS footprint with previous undisturbed areas. In the historical and current floodplains, the estimated new impact area was estimated by intersecting the GIS footprint with mapped vegetation polygons. It should be recognized that the vegetation unit intersections in the floodplain habitats overestimate impacts when the vegetation polygons contain significant bare ground (such as the native shrub and some arrow weed map units). In such units, it is expected that access routes will be able to avoid most (if not all) of the vegetation impacts.

[d] The current floodplain of the Colorado River includes those areas within the 100-year floodplain while the historical floodplain is comprised of the land in California that is outside of the 100-year floodplain and extends to the MW-20 Bench and National Trails Highway or adjacent upland area as shown on Figure 7.

Future Provisional Well for Freshwater Supply

650-151-03

650-151-04

COLORADO RIVER

Bureau of Reclamation (Managed by BLM) 650-151-05

Fort Mojave Indian Tribe 650-151-06

650-161-09

Caltrans Leased

650-161-12*

Havasu National Wildlife Refuge (Managed by USFWS) 650-161-09

PG&E 650-161-08

Metropolitan Water District of Southern California 650-141-04

Interstate 40

Northern Aerial Crossing

Southern Aerial Crossing

HNWR-1

Topock-2

Topock-3

Compressor Station

Chemical Storage

Process Tanks

Freshwater Pre-Injection Treatment System

Conditioned Water Storage Tanks

Remedy-Produced Water Conditioning Building

Influent Water Storage Tanks

TCS Freshwater Storage Tanks

Conditioned Water Storage Tank

Transwestern Bench

New Septic System

New Maintenance Facility

New Storage Building

New Carbon Amendment Storage Tank (3,000 gallons)

New Carbon Amendment Building

MW-20 Bench

New Carbon Amendment Storage Tank (15,000 gallons)

New Carbon Amendment Building

LEGEND

Existing Monitoring Well

Existing Freshwater Supply Well

Proposed Access Routes

Property Boundaries

PBA Update Action Area

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on fourth quarter 2011 sampling events. Dashed where based on limited data.

Remedy Wells

Contingent Freshwater Source

Freshwater Source

Remedy Monitoring Well

Extraction Well (East Ravine)

Extraction Well (NTH IRZ)

Extraction Well (Riverbank)

Extraction Well (Transwestern Bench)

Freshwater Injection Well

Injection Well (Inner Recirculation Loop)

Injection Well (NTH IRZ)

Injection Well (Topock Compressor Station)

Future Provisional Extraction Well

Future Provisional Injection Well

Pipeline Corridor for Remedy

Aboveground Pipe

Underground Pipe/Conduit

Future Provisional

Remedy Facilities

Proposed New Remedy Structure

Transformers

Notes:

1. Note that in compliance with EIR mitigation measure CUL-1a-9, as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Hwy is located in an existing, previously disturbed, access road. In addition, the location of the road and pipeline was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10, PA, and CHPMP mitigation measures .
2. Remedy features, as shown are based on 60% Design Submittal (CH2M HILL 2013a) as amended based on initial regulatory comments.

N

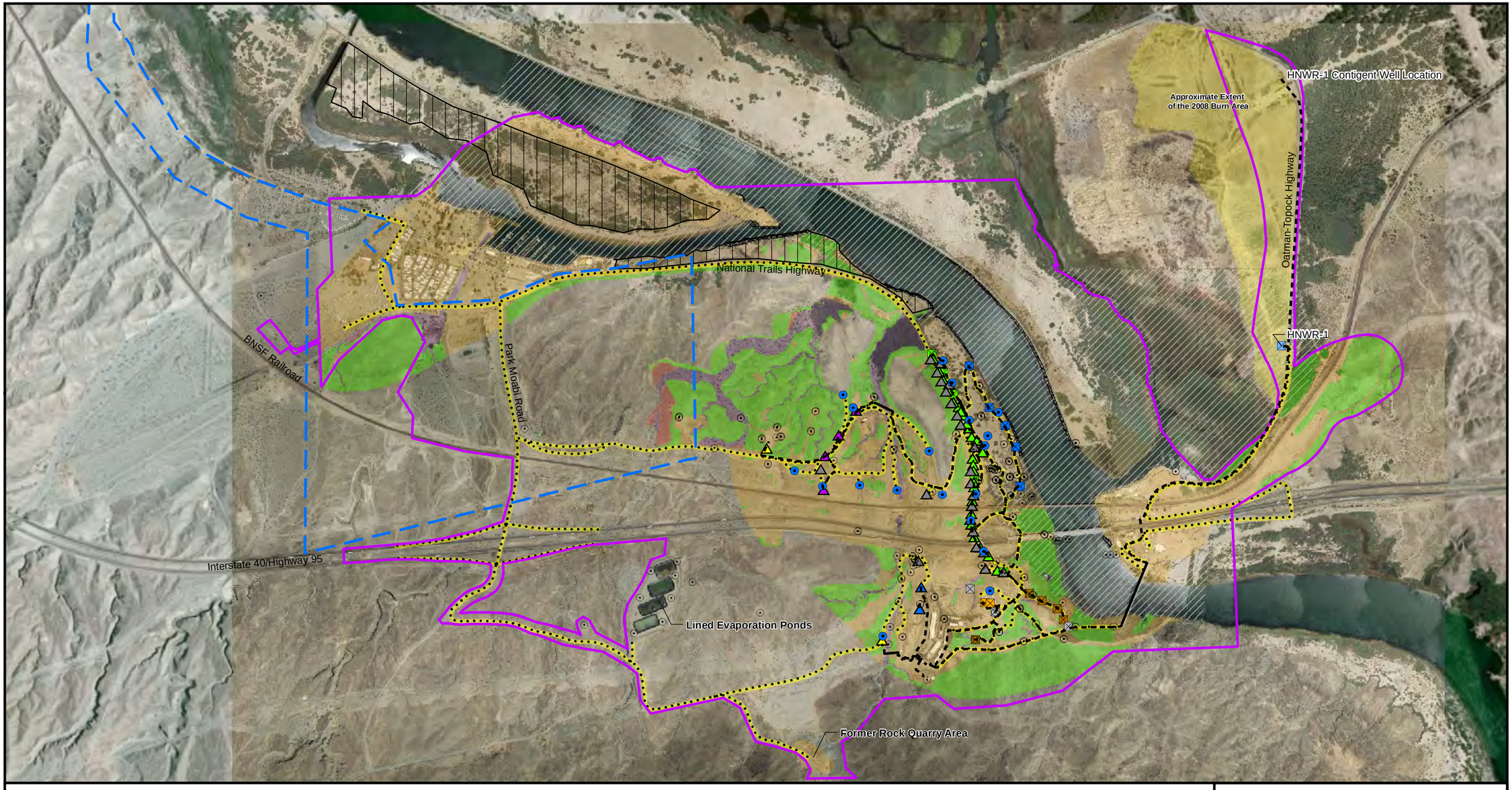
0 300 600 1,200 Feet

FIGURE 6
GENERAL REMEDY LAYOUT

FINAL GROUNDWATER REMEDY
PROGRAMMATIC BIOLOGICAL ASSESSMENT
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2013\PBA\2013Q4\FIG6_GeneralRemedyLayout.mxd



LEGEND

- Existing Monitoring Well
- Aboveground Pipe Route
- Underground Pipe Route
- Proposed Access Routes
- PBA Update Action Area

Remedy Features

- Future Provisional Extraction Well
- Future Provisional Injection Well
- Remedy Monitoring Well
- Freshwater Source

Surface Condition

- Mechanical Soil Surface Damage
- Dredged Sand
- Active Wash Channel
- Inactive Wash Channel
- Rip Rap
- Undisturbed and Archaeological/Historical Sites
- Mechanical Soil Surface Damage and 2008 Burn Area
- Open Riding Area (CTUC 2011)
- Vegetated Areas with ORV Trails
- Soil Storage and/or Staging Areas under Negotiation
- Combined Staging/ Soil Storage Area
- Staging Areas
- 100yr. Floodplain

Source Map:
Aerial Map of Disturbed Areas, November 2011
Note:
Access Routes and Surface Conditions are limited to the Project Area from the EIR.

FIGURE 7
PROPOSED CONSTRUCTION STAGING, SOIL STORAGE, AND ACCESS ROUTES

FINAL GROUNDWATER REMEDY
PROGRAMMATIC BIOLOGICAL ASSESSMENT
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2013\PBA\2013Q4\FIG7_AccessRoutes.mxd

TABLE 3
Summary of 2007 PBA and Final Groundwater Remedy Impacts in the Project Action Area[a]

Final Remedy Item	Additional Current Floodplain Acreage[b]	Additional Historical Floodplain Acreage[b]	Additional Upland Acreage
Activities Covered Under 2007 PBA (including the 2012 Re-initiation)			
CA Slant Wells	0.082	None	None
Upland ISPT	None	None	None
AZ Drill Program	None	None	None
East Ravine GW Investigations (1)	None	None	None
East Ravine GW Investigations (2)	None	None	None
AOC 4 removal Action	None	None	1.6
FWIP	None	None[d]	None
Subtotal Activities Covered under 2012 Reinitiation	**0.082**	**None**	**1.6**
Final Groundwater Remedy Construction			
Remediation Wells	0.1	1.6	0.2
Monitoring Wells	None	0.9	0.1
Freshwater Source	1.1	0.1	0.2
Piping Corridors	1.7	4.7	0.5
Access Roadways	None expected	None expected	0.6
Ancillary Facilities	None expected	None expected	0.1
Subtotal	2.9[c]	7.3[c]	1.7
Including 20% Design Change Contingency	3.5	8.8	2.0
Total Final Groundwater Remedy	3.5	8.8	3.6
Allowable Acreage Disturbance Carry-Over from 2012 Reinitiation	2.5		8.0
Current Cumulative Disturbance	0.082		1.6
Amount Requested for Soil Investigation to Remain in 2012 Reinitiation PBA	0.14		2.2
Balance Remaining from 2012 Reinitiation PBA	2.278		4.2
Total Requested for Final Groundwater Remedy Minus 2012 Carryover[e] and Soil Investigation Amount	**1.222**	**8.8**	**4.2**

Notes:

[a] This table includes only those features in Table 2 where acreage impacts or wells for the Final Groundwater Remedy were noted.

[b] The current floodplain of the Colorado River includes those areas within the 100-year floodplain while the historical floodplain is composed of the land in California that is outside of the 100-year floodplain and extends to the MW-20 Bench and National Trails Highway or adjacent upland area as shown on Figure 7.

[c.] The areal estimates of impacts within the current and historical floodplain are based on intersections of the project footprint with mapped vegetation units. However, the mapped vegetation units contain a significant proportion of bare ground that would not actually represent habitat loss. Additionally, final design, layout, and construction approaches may be able to further reduce habitat losses. As such, the impact acreages presented here are very conservative, especially with respect to the floodplain impacts. Project footprint includes all access routes, well and pipeline work areas, as well as IM-3 areas that will decommissioned.

[d] This is only an estimate as the final completion reports have yet to be completed.

[e] Difference between 2012 Reinitiation Carryover and Final Groundwater Remedy.

3.3.1.1.1 In situ Reactive Zone (IRZ) along the National Trails Highway

This line of wells will be installed primarily along the eastern margins of the National Trails Highway, extending from the outlet of Bat Cave Wash in the north to a few hundred feet south of the Interstate-40 alignment. Almost all the wells are located adjacent to the National Trails Highway with the southern-most three wells located within a graded area between the roadway and the Transwestern Bench.

The current (60%) design will include 24 new injection wells and four new extraction wells. As shown in Figure 6, the new injection well locations have the following designations: IRL-11, 13, 15, 16, 17, 19, 20, 21, 25, 27 ,29, 30, 31, 33, 35, 36, 37, and 39, while the four extraction wells are designated: IRZ-1, 5, 9, and 23. As determined by the remedy need, the additional six wells would be installed within a selection of these same locations (either as dual or multiple-well installations).

The 60% design also includes a contingency for an additional future 30 injection wells. Eighteen contingency well locations are shown in Figure 6 with the following designations: IRZ-02, 03, 04, 06, 07, 08, 10, 12, 14, 18, 22, 24, 26, 28, 32, 34, 38, and 40. As determined by the remedy need, the additional twelve wells would be installed within a selection of wells at these same locations (either as dual or multiple-well installations).

3.3.1.1.2 Inner Recirculation Loop (IRL)

As shown in Figure 6, the current (60%) design has planned for five new extraction wells near the western bank of the Colorado River. These wells are located at least 20 feet outside of the mapped ordinary high water mark. The five wells (RB-1 through RB-5) have been located outside of dense floodplain vegetation area and, especially, avoid any mapped adjacent emergent wetlands (CH2M HILL, 2013c). The wells extend from approximately 780 feet southeast of the Bat Cave Wash outlet to about 500 feet east of the southern portion of the MW-20 Bench.

Under the current (60%) design, the IRL will add four new injection wells (IRL-1 through IRL-4) in an arc to the west of the IM No. 3 Treatment facility (Figure 6). The 60% design also includes a contingency for an additional future three injection wells (IRL-5 through IRL-7). Depending on the quality of the extracted water, the riverbank extracted groundwater may or may not be amended with a carbon source to promote reduction of Cr(VI) to Cr(III).

Based on the 60% design shown in Figure 6, six of seven IRL injection wells (IRL-1 through IRL-5 and IRL-7) will be located to the west of the National Trails Highway north of the BNSF railroad. These injection wells and pipeline routes are located mostly on the upland sparsely vegetated plateau to the west of Bat Cave Wash, with the exception of IRL-4, which is located at the bottom of a ravine just north of the BNSF railroad. If needed, the future provisional well (IRL-6) would be located adjacent to east side of Bat Cave Wash just south of Interstate 40.

Existing access routes will be used to install, maintain, monitor, and decommission these wells, with the exception of IRL-2 and IRL-4. The details concerning those new access routes are provided in subsection 3.3.10.

3.3.1.1.3 Topock Compressor Station (TCS) Recirculation Loop

As shown in Figure 5, the East Ravine (ER) extraction wells will be located in a line across the eastern end of the East Ravine. The current (60%) design anticipates five new extraction wells with a future provisional extraction well. The extraction wells are designated as ER-1 through ER-4, with one of these wells constructed as a dual well completion based on the remedy need. The future provisional well location is at ER-5.

These wells and piping will be installed along the existing access roadway that crosses the highly disturbed East Ravine and provides access from the National Trails Highway to the three pipe bridges that are located downstream from the Interstate-40 bridge. The unpaved access roadway runs along the eastern edge of the terrace that slopes steeply down to the Colorado River floodplain.

The Transwestern Bench (TWB) extraction wells are located near the eastern edge of the TCS to provide hydraulic capture of contaminated groundwater. The current (60%) design anticipates two new extraction wells (TWB-1 and TWB-2) located within the developed Transwestern Bench parking area. The two future provisional extraction wells (TWB-3 and TWB-4) will be located outside of the Transwestern yard but within adjacent, previously graded areas to the northwest and southeast margin of the yard.

The TCS injection wells will be located in the northern half of the station for the re-injection of groundwater that has been extracted from the East Ravine and Transwestern Bench extraction wells and amended with an organic carbon source to promote reduction of Cr(VI) to Cr(III). As shown in Figure 6, the current (60%) design anticipates two new injection wells (TCS-1 and TCS-2) that will be installed within previously developed areas.

3.3.1.1.4 Freshwater Injection System

The Final Groundwater Remedy will include two freshwater injection wells that are located upgradient of both the IRL and the TCS injection wells, as shown in Figure 6. These wells will inject freshwater that has been conveyed from the Arizona supply well(s) into the groundwater aquifer upgradient of the recirculation loops and will assist with flushing the chromium plume through the National Trails Highway IRZ and to constrain the westward spread of carbon-amended water and in situ byproducts from the IRLs. The 90% design will have a contingency for potential pre-treatment of the freshwater supply to reduce naturally occurring arsenic concentrations before injection. Those contingency pre-injection treatment facilities are described in subsection 3.3.1.4.2.

The first freshwater injection well (FW-1) is located just north of the Historic Route 66 alignment and near the property line of the Fort Mojave Indian Tribe property. The freshwater supply pipeline route to this well is described in subsection 3.3.1.5.2.

The second freshwater injection well (FW-2) is located to the west of the TCS on HNWR land. The freshwater supply pipeline route to this well is described in subsection 3.3.1.5.2.

3.3.1.2 Monitoring Wells

The Final Groundwater Remedy will make use of all existing monitoring wells; however, the current (60%) design has planned for an additional 19 monitoring wells as shown in Figure 6. Six of these new monitoring wells (Wells A through D, H, and O) are located within unvegetated areas of the Colorado River floodplain north-northeast of the MW-20 Bench. Four new individual monitoring wells are located within developed or previously disturbed areas along the National Trails Highway south of the MW-20 Bench (Wells E and G), north of the Transwestern Bench (Well K), and in an undeveloped area within Bat Cave Wash (Well S).

The remaining nine new monitoring wells (Wells I, J, L through N, P through R) are located within the dry wash or upland habitats north and south of the western access route along the Historic Route 66. The type of monitoring well installed at any particular location will be based on an evaluation of the key uncertainties and constraints. Well installation will be conducted in a manner to minimize the well's footprint while considering factors such as hydrogeologic conditions at the well site, borehole quantity constraints, data collection needs, constructability, and longevity constraints.

3.3.1.3 Carbon Amendment and Carbon Storage Facilities

These facilities will include a carbon storage tank and a carbon amendment building at each of the MW-20 Bench and the Transwestern Bench, as shown in Figure 6. These facilities will be used to deliver the planned dose of carbon substrate to the IRZ and TCS injection wells to promote reduction of Cr(VI). The system will be designed to provide flexibility according to the requirements for system optimization.

The MW-20 Bench was chosen for placement of carbon amendment facilities because of its relatively proximity to the National Trails Highway IRZ wells. The proposed carbon amendment facilities will include a new 15,000-gallon, aboveground carbon storage tank located just south of the three existing temporary

storage ("frac") tanks. The carbon storage tank will be placed within a 50-foot by 35-foot concrete containment structure and will have an access walk-way. Also a new 55-foot by 25-foot carbon amendment building will be located just south of the carbon amendment tank containment structure to contain dosing, metering, and control equipment.

The Transwestern Bench was chosen for placement of carbon amendment facilities because of its proximity to the TCS and to the pipeline corridor that services the TCS injection wells. The proposed carbon amendment facilities will include a 3,000-gallon aboveground carbon storage tank in the southern portion of the Transwestern Bench. This horizontal saddle tank has double-walled construction and an interstitial zone outfitted with ports for leak detection monitoring devices and overfill protection. It will be placed on a 50-foot by 35-foot concrete pad. Also, a new 40-foot by 12-foot carbon amendment building will be constructed to contain dosing, metering, and control equipment and will be located immediately to the southeast of the carbon storage tank.

3.3.1.4 Freshwater Source

The Final Groundwater Remedy includes freshwater supplied from Arizona well(s) to be conveyed to a freshwater storage tank in California, as shown in Figure 6. The freshwater supply system has been designed to provide a separate, reliable water source for the Final Groundwater Remedy that uses previously disturbed areas wherever possible.

3.3.1.4.1 Supply Wells

At this time, field work is being conducted to determine the best location for a primary freshwater supply well in Arizona. It is anticipated that DTSC and DOI will provide direction to PG&E on freshwater supply by April 2014. In the meantime, two candidate locations are proposed for freshwater supply for the remedy: (1) at or near the existing HNWR-1 well site, and (2) at Site B (see Figure 6).

The first freshwater supply well being considered for Final Groundwater Remedy use is HNWR-1 (see Figure 6). This well was installed by the refuge itself in the fall of 2010 for the purpose of providing irrigation water for the vegetation restoration project associated with the 2008 Sacramento Wash Fire to the west of the Oatman-Topock Highway. With the conclusion of the restoration irrigation, HNWR-1 is now being considered as a potential freshwater supply well for the Final Groundwater Remedy, pending verification of the physical condition of the well and aquifer testing. The ability to use an existing well avoids the need for additional disturbance and uncertainties about water quantity and quality. In the event the HNWR-1 well is determined not to be suitable for remedy use over the anticipated decades-long operation or information from the Site B well below suggest that it is also not a suitable well site, a new supply well could be drilled in the vicinity of the HNWR-1 site, and would be located within a previously disturbed area.

The second location being considered for a supply well (Site B Well) is located approximately 3,200 feet to the north of HNWR-1, just north of the Sacramento Wash channel levee on the west side of the Oatman-Topock Highway (see Figure 6). Installation of the Site B Well was completed in January 2014 with the well testing completed in early March 2014. ESA consultation for the installation and testing of that freshwater supply well was evaluated in the 2012 Reinitiated PBA. However, evaluation of any impacts to listed species for future maintenance of that well, if chosen as the supply well, is considered in the current Final Groundwater Remedy PBA.

If additional freshwater is needed, the existing supply wells that supply water to the TCS (Topock-2/3) may be employed. This well was installed prior to and independent of the Topock Compressor Station RFI/RI.

3.3.1.4.2 Contingency Pre-Injection Treatment Facilities

Per DTSC's direction, a contingency pre-injection treatment facility to remove arsenic in the freshwater water supply from Arizona will be included in the 90% Design.

As shown in Figure 6, the contingency pre-injection treatment facilities would consist of a chemical storage tank, two smaller process tanks, and a building to house the treatment process controls. All of these facilities would be located within the TCS in an already disturbed area. Because the pre-injection treatment facilities are discussed here as a contingency, the final design parameters have not been established. These details will be made available in the 90% Design.

3.3.1.4.3 Freshwater Storage Tank

A storage tank is required to ensure that adequate supplies are available for freshwater injection. The water stored in this tank may be conditioned, if it is determined that pre-treatment to reduce arsenic is required. As shown in Figure 6, the 10,000-gallon freshwater storage tank is located inside the existing TCS.

3.3.1.5 Piping Corridors

Remediation wells (extraction and injection wells) will be connected to pumps, carbon amendment facilities, and to freshwater supply facilities through a system of aboveground and belowground pipelines as described in the following subsections. The pipeline alignments will be placed in previously disturbed areas to avoid known utilities and cultural, archaeological, and historical resources. The mapped limits of previously disturbed areas are only used as a guide for planning activities, especially given that consultation with the Tribes is ongoing, regardless of whether the land is categorized as previously disturbed or not. In addition, the pipelines will be placed along existing or new access routes to minimize the need for additional vegetation removal.

3.3.1.5.1 Conveyance Piping Associated with Remediation Wells

Above- and below-grade piping networks will be installed to convey extracted groundwater, carbon-amended water, freshwater, and/or water produced from routine O&M activities such as backwashing of the injection wells, as shown in Figure 6. At the 60% design stage, the groundwater remedy includes approximately 26,000 feet of trenches and more than 100,000 linear feet of pipeline, with most being installed below ground either direct burial or in pre-cast concrete trenches. As previously noted, the changes that result in the 90% design submittal due in August 2014 may slightly alter alignments and impacts.

In general, pipe materials will be selected to resist corrosion, climatic effects, soil loads, and/or other physical impacts. Groundwater in the floodplain, in particular, contains high levels of total dissolved solids, chlorides (greater than 2,000 mg/L), sulfate, and other minerals that cause significant corrosion to iron-based piping material from mild carbon steel to Type 316 stainless steel. Below-grade piping will be constructed with HDPE pipe in a standard construction trench. Short sections of piping will be constructed within pre-cast concrete trench systems to facilitate ease of operation and maintenance in select locations (e.g., road crossings, around the Bench facilities, etc.).

Piping will be designed and installed in accordance with best practices for O&M, including flanged or union joints for serviceability and isolation valves for systems requiring routine maintenance. Expansion loops or joints will be located in all necessary areas in accordance with good engineering practices. All valves, instruments, control devices, pumps, and other equipment will be installed in a manner such that they are easily accessible for O&M; and equipment and instruments with readout displays will be oriented to allow for ease of data collection. Cleanouts will be provided at nominal 400-foot intervals, minimum, unless this would be in conflict with biological constraints or mitigation measures.

3.3.1.5.2 Conveyance Piping Associated with Freshwater Supply Wells

Figure 6 shows the alignment of the freshwater piping network. The total length of freshwater pipe is approximately 18,400 feet with most below ground. For the most part, the pipeline alignment follows existing roadways and existing PG&E pipeline rights-of-way (ROW) (see Figures 6 and 7). The pipeline alignment will be placed in previously disturbed areas to avoid known utilities and cultural, archaeological, and historical resources. The mapped limits of previously disturbed areas are only used as a guide for

planning activities, especially given that and consultation with the Tribes is ongoing, regardless of whether the land is categorized as previously disturbed or not.

A 12-inch-diameter freshwater pipeline that connects to a supply well in Arizona (HNWR-1 or Site B well), will follow the western shoulder of the Topock-Oatman Highway (Mohave County Road 10) toward the south and southwest. As the pipeline nears the Topock Marsh in the south, it will cross from the west side to the southeast side of the roadway to avoid the marsh and wetland habitats. The pipeline will cross beneath the BNSF railroad track within the existing road and then cross beneath Interstate 40. The water pipeline will then cross privately owned parcels south of Interstate 40 and continue onto the existing arched pipeline bridge (co-owned by Kinder Morgan and PG&E) to cross the Colorado River.

After crossing the Colorado River into California, the water pipeline will follow PG&E's natural gas pipeline ROW to deliver freshwater to the injection wells. In the event that pre-injection treatment of freshwater supply (to remove arsenic) is needed, all freshwater would first be pumped to the freshwater storage tank and the treatment system inside the TCS.

After exiting the pre-injection treatment system, freshwater will be conveyed eastward along the TCS access road to the north. Freshwater will run along National Trails Highway and split down to the floodplain with a short leg crossing under Interstate 40 and the BNSF railroad bridges. The northern branch will connect to and serve the MW-20 Bench; and from the MW-20 Bench, fresh water piping will go north and south to connect to the remaining floodplain and National Trails Highway IRZ wells. A branch of the freshwater piping will cross underneath the National Trails Highway to the access road west of the National Trails Highway. This pipe will continue westward along the west access road and serve the westernmost freshwater injection well (FW-1) and the four IRL injection wells (IRL-1 through -4), as needed. The Bat Cave Wash crossing near the IM No. 3 treatment plant will be an aerial crossing with a steel support structure complete with access ladders for piping inspection.

The freshwater injection well, FW-2, located within Bat Cave Wash to the west of the TCS, will be directly served by a water line that connects to conditioned water storage tanks and traverses Bat Cave Wash on an aerial pipe support bridge (see Figure 6). Once it crosses the wash, the pipe will go underground until it reaches the injection well.

3.3.1.6 Supporting Facilities

A number of supporting systems and features are needed to allow the remedy to function properly and safely over its projected operational span of several decades. These supporting items include systems to supply power to pumps and control systems, treat remedy-produced water, and access routes to allow for installation, maintenance, monitoring, and eventual decommissioning of the final remedy facilities.

There are a number of other aspects related to the Final Groundwater Remedy that are discussed in the 60% Design Submittal (CH2M HILL, 2013c). While these items are associated with or located within remedy facilities, because they do not have any potential to directly or indirectly affect biological resources, they are not discussed in detail in this PBA. These items include institutional land controls to ensure protection of the remedy features; communications and data networks; remote control and monitoring equipment; an onsite laboratory; a document repository center; a training/conference room; fire water; and site safety and security (e.g., alarms, gates/fences, security cameras, etc.). Because these facilities occur primarily within existing developed areas, their effect on biological resources is expected to be negligible. The security fences, which may have the potential to interrupt wildlife movement, surround areas containing marginal habitat value and are small enough so that they do not constitute a significant wildlife concern.

3.3.1.6.1 Power Supply

The primary power supply source for remedy facilities in California will be generated by two dedicated, stand-alone generators (2 x 450 kW) located inside the TCS, by the TCS power system, and/or by small solar

panels. Underground power line conduits will follow existing pipeline alignments and be limited to previously disturbed areas.

Power will be transmitted at 480 VAC to 12K VAC along pipeline corridors. Six load centers are planned with transformer/distribution equipment at each location. One future provisional load center could be constructed to serve the future provisional well IRL-7, provided this well is required to be installed/operated.

For the freshwater supply well in Arizona, the power supply source will be power provided by Mohave Electric Cooperative.

Similar to other construction activities, the installation of transformer pads and electrical equipment and connections will follow the same procedures as employed for other parts of the remediation program in order to minimize impacts to perennial vegetation. The facilities will be located, to the extent possible, within previously disturbed or developed areas that are without perennial, native vegetation.

3.3.1.6.2 Management of Remedy-produced Water

Because the Final Groundwater Remedy relies on several dozen wells used for the IRZ, freshwater and carbon-amended injection, and groundwater extraction, regular maintenance such as backwashing and rehabilitation is vital to maintain efficient and effective operations during the 30-year projected life of the remedy. Well maintenance will also prevent or reduce the need for drilling new replacement wells. These maintenance activities will produce an ongoing water stream that must be managed as part of the remedial action. Other types of produced water with smaller volumes will also need to be managed, such as monitoring well sampling purge water, equipment decontamination wastewater, and rainfall that collects in remedy facility secondary containment. Collectively, these types of water are called remedy-produced water. The current estimated total volume of remedy-produced water is 7.6 million gallons per year. Of the 7.6 million gallons, it is estimated that 800,000 gallons will be consumptive use (i.e., will not be returned to the groundwater aquifer).

Providing a reliable means of managing this wastewater is a critical component of the overall remedy. It is desirable that the remedy include more than one wastewater management option in order to not constrain remedy operation. Different waste streams may also require different management options. The 60% design presents a management plan that includes the following management options:

- Well backwash and cleaner water (2nd flush) from well rehabilitation will be conditioned in a central facility located at the TCS. The remedy-produced water conditioning system will be located within a new building in a previously developed area, at the southern end of the TCS and near the contingency freshwater pre-injection treatment facilities (see Figure 6). The conditioning system removes (filters) solids and adjusts pH of the water prior to reuse as compressor station cooling tower make-up waters or for re-injection into the IRZ wells. At the 90% design, in response to Tribes' comment, contingency systems to remove high iron and manganese will also be evaluated. It is anticipated that the contingency system will fit in the existing proposed footprint of the conditioning building.
- Remedy-produced water (e.g., water at the beginning of the well rehabilitation process or 1st flush water) that has significantly higher concentrations of solids or dissolved constituents (e.g., byproducts) than what exists in the aquifer water will be sent to the TCS evaporation ponds, or transported offsite for disposal.
- In some cases during well rehabilitation, mobile equipment may be used to condition the produced water at the well location. In the event that the produced water is hazardous, permitted transportable treatment units could be used.

3.3.1.6.3 Support Buildings

The following criteria were used to identify candidate locations for building/structures to house major equipment and key supporting functions:

- Previously disturbed areas;
- Avoiding or minimizing adverse effects on cultural, archaeological, and historical resources to the maximum extent practicable;
- Avoiding or minimizing adverse effects on sensitive biological resources to the maximum extent practicable;
- Areas of adequate space;
- Proximity to existing asphalt access roads, the Compressor Station, electrical and other utility services, remedy components (for service), and reuse/disposal options for remedy-produced water;
- Limited interference with existing infrastructure (especially with major gas pipelines in the area);
- Limited interference with Compressor Station operations during construction and O&M of the remedy (health and safety concerns);
- Shared use of existing improvements to the extent practicable (except for buildings with potential historical significance); and
- Minimized footprint outside of PG&E property.

The Transwestern Bench area is currently used to support various field/IM activities, the ongoing groundwater and surface water sampling activities, well drilling activities, equipment decontamination activities, soil sampling activities, temporary waste management activities, and various field surveys to collect baseline data to support design. The Transwestern Bench houses a field trailer, a decontamination pad, and several conex boxes for temporary storage. These facilities are regularly used by the groundwater and surface water sampling crew, PG&E staff, and field personnel/staff onsite for ad-hoc field tasks. In addition to PG&E's use of the bench area, Transwestern has been operating its gas metering station on the easternmost portion of the bench since 1991.

One central maintenance building and one storage building will be constructed at the Transwestern Bench, as shown in Figure 6. The central maintenance building (approximately 100 by 50 feet) will be located within the developed Transwestern yard to the west of the existing trailer, which will be removed. The central maintenance building will require a new septic disposal system (approximately 35 by 20 feet) to the north of the building. The central maintenance facility will house the SCADA system and HMI screen that will be used to control the Final Groundwater Remedy facilities. The building will also include laboratories, offices, an employee break room, work areas, and equipment and document storage areas.

A 40-foot by 22.5-foot storage building will be constructed to the southeast of the central maintenance building and will contain spare parts and tools for repair of the Final Remedy System. The Transwestern Bench yard between the central maintenance building and the paved access roadway will also be paved after subsurface utility trenches and stormwater drainage have been installed.

3.3.1.7 Access Pathways and Roadways

In compliance with the directive to give priority to existing facilities, the Final Groundwater Remedy will reuse all existing routes that have been previously used or constructed during the investigation and remediation activities to date. In addition, two new graded access roads will be required within the upland area to allow for installation and maintenance of wells IRL-2 and IRL-4, as shown in Figure 6.

The IRL-2 roadway will connect directly to the Historic Route 66 and is estimated at 150 feet in length along the top of a plateau. The IRL-4 freshwater injection well is located at the bottom of a ravine, and a new

permanent, engineered road (estimated at 350 feet in length) has been designed to access and service this well, the nearby monitoring well, and associated piping. In addition to the roadway, a portion of the ravine bottom will be filled to create a sturdy, flat area with adequate work space install the wells, maintain and sample them during remedy operations, and perform future decommissioning activities.

To allow for shared use of the Transwestern Bench together with activities for the PG&E Topock Remediation Project, one new access road to the northeast of the bench will be needed for access to Transwestern's gas transmission equipment (see Figure 7).

3.3.1.8 Other Ancillary Facilities

As shown in Figure 6, the conveyance pipeline system will require two aboveground pipe bridges to allow for aerial crossings of Bat Cave Wash. The first of these bridges will be located just north of the west access routes (Historic Route 66) to the northeast of the IM No. 3 Treatment facility. This 200-foot-wide aerial pipe bridge will be part of the freshwater conveyance system delivering water to the injection well, FW-1. The second of these bridges is approximately 180 feet wide will be west-southwest of the TCS and will be part of the freshwater conveyance system delivering water to the injection well, FW-2.

Small photovoltaic solar panel installations will be installed at various locations to offset electric demands for the Final Groundwater Remedy and to power radio data communication equipment at remote well locations. The largest of the solar panel installations will be located on the roof of the central maintenance facility that will be constructed at the Transwestern Bench.

Individual solar panels will also be used at select remote well locations to power wireless data communication devices that are part of the monitoring and control system of the Final Groundwater Remedy. These devices will be attached to poles that are installed within the existing disturbed area around the well. It will be necessary to periodically trim vegetation to maintain direct line-of-sight to data receivers. The sites where such devices are located will be inspected on a periodic basis and overgrowth will be pruned or managed (e.g., tie back, bundle, etc.) to maintain clear lines of sight. Care will be taken to ensure that vegetation control measures are consistent with the project mitigation directives such as the protection of mature plants and the avoidance/protection of ethnobotanically sensitive plants

Currently, a portion of the MW-20 Bench is used to house IM equipment and to support IM operations (e.g., extraction wells, an electrical room, three portable tanks, and a truck loading/unloading facility). There is fencing around the equipment area and nighttime lighting for health and safety and security purposes. The remaining portion of the MW-20 Bench is used for vehicle parking and equipment staging, and provides an alternative access route around the fenced facility. Similarly, the new facilities at the Transwestern Bench and the proposed material storage areas will require fencing and gates and other security equipment such as remote cameras to provide for protection and surveillance of these facilities.

The freshwater supply system will also include two concrete pads at the freshwater supply well site (HNWR-1 or Site B Well). These small concrete pads, equipped with sunshades, will be used to support the wellhead, pump, and electrical/control equipment.

3.3.1.9 Construction Yard / Temporary Material Staging and Soil Storage

During the Final Groundwater Remedy construction phase, staging areas will be established for location of temporary facilities, laydown of equipment (including heavy equipment), refueling of vehicles or equipment, materials, supplies, and demolition tools. These areas will also be used for the staging of empty containers; staging of recoverable materials for recycle or reuse; and for management of construction wastes, as further described in subsection 3.3.2.4. All of the proposed equipment and material staging areas will be located on previously disturbed areas.

In addition, staging areas will be used for temporary storage of nonhazardous, clean soil collected during construction or decommissioning activities. These soils, which have been determined to meet the criteria for onsite re-use, would be used to restore and stabilize construction sites, as needed, within the Action Area.

Any activities conducted on the proposed staging areas, would be done in accordance with established plans to protect against potential adverse impacts to surface waters or air quality. Smaller, temporary equipment and materials staging areas will be set up within the authorized work zones at each primary work area, as necessary.

It is anticipated that a construction yard (to be located within Park Moabi) will also be required, which will include at a minimum: multiple trailers serving as a work place for personnel, a central check-in/out location for site visitors, a place for daily briefings/project meetings, etc.

As shown in Figure 7, 25 different proposed staging/soil storage areas have been identified in California (totaling up to 35.40 acres, note that the actual area available for use by PG&E will need to be verified) and four staging areas have been identified in Arizona (totaling 3.18 acres). Of the total 35.40 acres of the California staging areas, about 23.90 acres is proposed only for staging use (with 0.95 acre under negotiation for dual staging/soil storage use). To allow for efficient staging during construction, the staging areas in California are scattered throughout the Action Area and are found near Moabi Regional Park; along Park Moabi Road to north and south of Interstate 40; around the eastern side of the evaporation ponds; along the western access route (Historic Route 66); along the National Trails Highway near the Bat Cave Wash and MW-20 Bench; and along the turnoff to the Transwestern Bench and around the TCS. The largest single area (11.57) acres is around the TCS. The staging areas in Arizona are located in close proximity to the Oatman-Topock Highway exit off Interstate 40.

3.3.2 Operation and Maintenance

The Final Groundwater Remedy PBA will cover actions that will be required to operate the constructed facilities described above over the anticipated duration of the remedy that could extend up to 50 years. The planned activities associated with the operation of the remedy systems are described in the following subsections.

3.3.2.1 Operation of the Final Groundwater Remedy Features

Planned activities that will be associated with the operation of the Final Groundwater Remedy have been summarized here from the Draft Operation and Maintenance Manual – Volume 1 (CH2M HILL, 2012b). Normal operations of the final remedy will include groundwater extraction and recirculation, carbon substrate storage and deliveries; carbon substrate injections, and monitoring and control of the system. There will also be activities associated with freshwater supply, conveyance, and storage; remedy-produced water management; pre-injection water treatment (if required); power supply and distribution; and the SCADA and HMI screen. All of these systems will require regularly scheduled maintenance to keep the systems functioning in an efficient and optimal manner.

In general, normal operation of the Final Groundwater Remedy associated with optimization of the groundwater extraction and recirculation systems will be accomplished through use of the SCADA system housed at the Transwestern Bench. Carbon substrate will be delivered by tanker truck to the previously described carbon storage tanks at the MW-20 Bench and Transwestern Bench. Operation personnel will be present during all chemical transfer activities and will verify the liquid level in each tank prior to beginning the filling operation to prevent overfilling. The tanks themselves will have secondary containment and be outfitted with level detectors and alarms to prevent overfilling.

Carbon substrate dosing and injection into the National Trails Highway IRZ, IRL, and TCS injection wells will also be primarily controlled by the SCADA system. Carbon substrate will be delivered to individual injection wells by a system of distribution lines and manifolds. The design incorporates the flexibility that will also allow for the injection of carbon substrate directly to selected wells through connections in the well vaults. Those individual well injections will be accomplished by pulling a portable tank to the well on a trailer or in a smaller vehicle carried by an operator during work hours. The anticipated footprint of these operations will be similar to that for sampling or maintenance of a well. All carbon substrate delivery valves and controls will be tested before startup. There are system controls that are linked to the SCADA system including well

packer pressure sensors and process control features that would allow operators to detect leaks or flow problems in the carbon substrate delivery system.

Regularly scheduled equipment O&M activities will include regular record keeping on important information from the SCADA/HMI system, such as tank levels and flow data. It will also include regular visual inspections of aboveground storage tanks for signs of damage, leaks, or excessive deformation of tank walls. Vent pipes and screens will be inspected and cleaned as needed. Carbon substrate pumps, well maintenance reagent pumps, and submersible well pumps will be regularly maintained according to manufacturer's recommendations and as established in the O&M manual and standard operating procedures (SOP). Monitoring flow rates through the SCADA system will help identify potentially faulty well pumps that may require removal from the individual wells for servicing. Planned actions, therefore, include maintenance of all equipment or replacement of faulty devices to keep the final groundwater remedy systems operating.

The freshwater supply, conveyance, and storage system begins at the freshwater supply well, includes the freshwater storage tank at the Compressor Station, and ends at the freshwater injection wells, FW-1 and FW-2, IRL wells, and the two benches, MW-20 and Transwestern (see Figure 6). Regular planned activities will follow SOPs to guide the testing of the system startup and shutdown procedures; well maintenance (see subsection 3.3.2.2); and cleaning and maintenance of the instrumentation and control equipment. Anticipated equipment O&M manuals will include the instrumentation and control equipment; extraction well pump; and control systems operations manual.

The Remedy Produced Water Management system begins at the wells, includes the conveyance system to the Remedy Produced Water Treatment System, and ends at the disposal/reuse including re-injection locations (see Figure 6). Regular planned activities will follow SOPs to guide the testing of the system startup and shutdown procedures; automatic backwashing; batch and continuous conditioning processes; reuse of conditioned water in TCS Cooling Towers, re-injection of conditioned water into the IRZ injection wells; disposal of remedy produced water into the existing evaporation ponds; and if required, offsite trucking of remedy produced water.

Maintenance activities for the Remedy Produced Water Management system will follow SOPs for cartridge filter change-out; produced water storage tank cleaning and inspection; produced water conditioning system secondary containment inspection and operation; phase separator loading and removal; cleaning and maintenance of instrumentation and control equipment; and conveyance system and secondary containment inspection and maintenance. Anticipated equipment O&M manuals will include the following items: extraction well, centrifugal, metering, sump, air-operated diaphragm pumps; cartridge filters; flow control valves; and instrumentation and control equipment; and control systems operations manual.

Details on the contingency pre-injection freshwater treatment system will be developed between the 60% and 90% Final Remedy design submittals. Those details will be provided as they become available.

The normal operation of the power supply systems for the Final Groundwater Remedy will include planned activities that will be guided by SOPs related to transformer inspection and repair and transformer secondary containment inspections. Anticipated equipment O&M manuals will include the following items: transformers and motor control centers.

3.3.2.2 Well Maintenance and Decommissioning

The final groundwater remedy is reliant on several dozen wells used for the IRZ, freshwater and carbon-amended injection, and groundwater extraction. For each of these types of wells, especially for the injection and IRZ wells, regular maintenance such as backwashing and rehabilitation is vital to maintain efficient and effective operations during the decades-long projected life of the remedy. Well maintenance will also prevent or reduce the need for drilling new replacement wells. The frequency and methods for well maintenance will be identified through initial and long-term well performance tracking (e.g., specific capacity or specific injectivity, flow logging, aquifer testing). This information will be supplemented by well video surveys and water quality (biological and geochemical) sampling. Routine and non-routine well

maintenance activities will focus on individual wells and their elements (screen, casing, gravel pack, and the aquifer formation near the borehole wall, plus down-hole equipment and pumps).

Routine maintenance methods are conducted without intrusive modifications to the wellhead or well and do not require removing existing equipment from the well for access. Simple operational procedures are implemented in order to prevent clogging and maintain well capacity over the service life of the well. One non-invasive procedure for extraction wells involves surging and pumping to remove siltation or mineral encrustation, while tightening the filter pack. Backwashing of the injection wells involves a similar non-invasive procedure. Backwashing is conducted by stopping injection and pumping the well for a short period. Backwashing removes the solids which have accumulated in the well screen and gravel pack during injection.

Aqua Gard™ is another, somewhat more aggressive non-intrusive routine method that can be done on both extraction and injection wells. The method involves injecting cryogenic liquid CO_2 into existing well access tubes. During the injection, plugging and fouling deposits are dislodged and detached from the filter pack and formation through rapid gas expansion during the liquid/gas phase change. Once the injection is complete, pumping and surging (or backwashing for injection wells) is employed to agitate and remove the material that was loosened during the injection. Some of the necessary equipment needed to conduct Aqua Gard™ may include all or some of the following: a CO_2 injection trailer, CO_2 storage vessel, support truck, pump rig and/or crane (if a pump or pipe needs to be installed/removed), and a support truck.

Non-routine maintenance methods are more intrusive, requiring removal of existing equipment from the well prior to conducting maintenance. Non-routine maintenance methods include drop-pipe replacement; submersible pump repair/replacement; and well repair and well rehabilitation methods. Over time, the column pipe in extraction wells and drop-pipes in injection wells can corrode so they will be thoroughly inspected for corrosion and damage when equipment is removed from the well. If threads, rings, or seals are damaged, they will be replaced. In addition, the total depth of the well should be sounded to determine if sand or silt debris is accumulating in the well and those solids will be removed.

Over time, submersible pump components wear out. Based on site experience, submersible pumps have lasted for 5 to 7 years under normal operating conditions. Conditions that can reduce the life of a submersible pump include: wear to the pump from excessive sand related to the well, a well that is not plumb and straight, blocked or plugged pump intake, improper motor cooling, corrosion, extended cavitation, and poor electricity supply. Submersible pumps may provide some advanced warnings, such as decreased production due to impeller wear and electrical changes (amp draw), but may provide no advance warning of problems, other than failure to operate. As needed, submersible pumps will be replaced with spares kept onsite, if they cannot be repaired.

If well performance declines, and routine maintenance proves ineffective, then more extensive well rehabilitation measures will be required. The focus of well rehabilitation is to effectively remove the material that is plugging the well and restore capacity. Specific plans for well rehabilitation activities will be prepared at the time rehabilitation is required, as rehabilitation methods must be custom tailored for each well and rehabilitation method. Some of the necessary equipment needed to conduct well rehabilitation work may include all or some of the following: a pump rig and/or crane, support or pipe truck, generator(s), air compressor, chemical trailer (mixing tanks and pumps), neutralization trailer (mixing tanks and pumps), support truck, video van, vacuum or tanker truck, forklift, and 20,000-gallon frac tanks. The three existing IM No. 3 frac tanks at the MW-20 Bench will be kept on site to meet some of this need, as required.

The general approach for well decommissioning is currently being developed by a subgroup that includes PG&E, DTSC, DOI, and Interested Tribes. Detailed SOPs for conducting well decommissioning will be based on this general approach and be presented in the O&M Plan at the 90% design stage.

3.3.2.3 Pipeline Maintenance and Repair

The groundwater remedy includes approximately 26,000 feet of trenches and more than 100,000 linear feet of pipeline, with most being installed below ground either direct burial or in pre-cast concrete trenches.

Belowground water pipes are made of plastic (HDPE). Aboveground water pipes are made of steel (Schedule 40 steel with AWWA C205 cement mortar lining).

It is possible, during the operation of groundwater extraction wells for biological films and mineral scale depositions to accumulate within the pipelines. A CIP system has been included in the in-situ remediation design to be operated as a closed-loop system to facilitate the maintenance of the groundwater pipelines associated with the IRZ. The CIP systems located at the MW-20 bench and Transwestern Bench carbon amendment facilities allow for short duration addition of maintenance chemicals (approved for use in drinking water systems) to prevent the collection of materials in the pipelines that may impact remedy performance. After the CIP maintenance procedures have been completed, the spent CIP solution will be flushed from the groundwater force mains with freshwater and the spent solution will be transferred from the receiving tank to either the Remedy-produced water conditioning plant or shipped offsite by tanker truck for treatment. The total volume of spent CIP solution is expected to be between 10,000 and 40,000 gallons per maintenance event.

In general, properly handled and installed heat fused HDPE pipeline provides a maintenance free system with leak free joints at 40-foot intervals, except for infrequent unforeseen third party damage. If HDPE pipe is damaged or leaks, repair methods will be required to bring the piping system back into service as soon as practicable. Sections of direct burial pipe requiring repairs will need to be exposed by excavation; whereas, belowground pipe section inside precast concrete trench can be accessed via maintenance manhole(s).

For aboveground repairs, when the pipe can be moved, the damage can be cut out and replacement pipe can be butt-fused or electro-fused into the system. In case that the pipe cannot be moved, alternative repair techniques and fittings that do not require longitudinal movement can be used. For field repairs of small puncture damage, techniques involving saddle fusion, electro-fusion patch, mechanical fittings, etc. can be used depending on the location, nature, and extent of the damage.

Although most of the remedy piping system is belowground, there are three aboveground water pipe segments: **Segment 1** – Over 800 feet of 12-inch pipe conveying freshwater from the irrigation well HNWR-1 (or the well at Site B), across the Arched Bridge to the California side of the Colorado River; **Segment 2** – Approximately 200 feet of 3-inch pipe conveying freshwater and 4-inch pipe conveying remedy-produced water aerially across Bat Cave Wash to/from the Freshwater Injection Well FW-2. **Segment 3** – Approximately 180 feet of 6-inch pipe conveying freshwater, 8-inch pipe conveying remedy-produced water, and 6-inch pipe conveying carbon amended water aerially across Bat Cave Wash, north of the IM No. 3 treatment plant. In addition to the water pipes, the aerial crossing for Segment 2 and 3 will also have conduits for distribution of electricity and instrumentation circuits.

Overall, cement mortar lined pipe conveying treated or conditioned water has proven to have a long and maintenance free service life in the water services industry. Cement mortar lined pipe conveying raw or freshwater will require periodic inspection of the lining to see if thickness has reduced or if the cement mortar is corroding. Repair of the lining usually requires curing time that could take up to 24 hours. All inspection and repair work will be in accordance with manufacturer's recommendation. All aboveground pipe segments will be painted to be harmonious with the surrounding earth-tone color palette, except for the arch bridge crossing, which will painted to match the existing pipelines. The pipelines will need to be periodically repainted for maintenance reasons.

3.3.2.4 Waste Management Practices

The expected waste streams from O&M activities include: remedy produced water; spent CIP solutions; displaced soil from well drilling/replacement/decommissioning and O&M activities; precipitated solids/sludge and spent filters generated from the Remedy-produced Water Conditioning Process; used personal protective equipment; miscellaneous waste including trash, paper bags, cardboard boxes, empty drums/cans, unused chemicals/paints, used oil, used solvents, etc.; universal waste including batteries,

electronic devices, lamps, aerosol cans, and mercury-containing equipment; recoverable materials; and sanitary waste.

Characterization of displaced soils will be discussed below in subsection 3.3.4. Liquids will be classified as hazardous waste based on having conditions of corrosivity (pH of ≤2.0 or ≥12.5); dissolved Cr concentration equals or greater than 5 parts per million (ppm), and/or dissolved As concentration equals or greater than 5 ppm. Liquids will also be evaluated for the presence of metals having hazardous waste toxicity characteristic levels. Similarly, solid wastes will be analyzed for total and leachable metals to determine if the waste will be classified as non-RCRA hazardous waste; RCRA hazardous waste; or as nonhazardous waste.

Miscellaneous waste such as trash, paper bags, and cardboard boxes will be disposed of as nonhazardous solid waste, unless affected by potentially contaminated material or water. Potentially contaminated miscellaneous waste will be combined with other hazardous waste. Empty, used 55-gallon drums that formerly contained hazardous materials will be labeled with the word “empty” and the date emptied, and will be returned to the original chemical supplier or turned over to a drum re-conditioner. Drums being reconditioned will be removed from the site within one year.

Different types of remedy-produced water require different management approaches. Multiple options are maintained to provide operational flexibility and reliability. A major portion of the produced water will be conditioned at the remedy-produced water conditioning system located at the Compressor Station as well as the spent solutions from CIP system.

Waste materials will be managed onsite in demarcated waste management areas that will be selected from the proposed staging areas shown in Figure 7. Within the waste management areas, hazardous wastes will be segregated from nonhazardous wastes. Additionally, incompatible hazardous wastes (e.g., flammable and corrosives wastes) will be segregated. Wastes of the same matrix, contamination, and source may be aggregated to facilitate accumulation and disposal. Lined roll-off boxes will be used to contain solid wastes. Liquid wastes will be contained in drums, totes, or portable tanks. Cleaning and decontamination wastewater will be contained in portable tanks within secondary containment near the point of origin while the water is characterized for offsite disposal. Incidental trash, such as wooden pallets and food and beverage containers, will be contained in dumpsters located in staging areas near temporary facilities. Universal waste will be stored in containers or packages that will remain closed; are structurally sound; are adequate to prevent breakage; are compatible with contents of batteries, lamps, or thermostats; and lack evidence of leakage, spillage, or damage that could cause leakage under reasonably foreseeable conditions. When possible, containerized wastes will be direct-loaded onto a truck and removed from the site from the point of generation (e.g., potentially during a rehabilitation event at the well site).

Once the wastes are containerized and labeled, those wastes ready for offsite disposal will be loaded onto trucks for transport to preapproved disposal facilities. A designated transportation and disposal coordinator will be onsite during transportation and disposal activities. This individual will be responsible for coordinating and overseeing these activities. As truck loading is completed, the containers and trucks will be inspected and brushed as necessary to remove loose materials. Each load will be inspected to ensure that it is secure and that the truck has been properly cleaned and/or decontaminated as required. Appropriate documentation to include waste manifests will be completed and checked. In addition, a truck log will be maintained of loading and transportation information. Transport vehicle will proceed to the designated disposal facility in accordance with local, state, and federal transportation requirements.

Some waste streams generated from various maintenance activities such as piping and/or process equipment removal/replacement, electrical equipment refurbishment, secondary containment structure repair, etc. are potentially recoverable or salvageable for reuse or recycle. Efforts will be made to limit the amount of components and materials leaving the site by recovering nonhazardous equipment and materials. All recoverable materials must be nonhazardous. An evaluation of reuse and recycling options will be

conducted to determine the most appropriate and sustainable way to manage nonhazardous recoverable materials.

3.3.2.5 Stormwater Pollution Prevention

A Stormwater Pollution Prevention Plan (SWPPP) for O&M activities will be prepared to comply with the requirements of the California State Water Resources Control Board (SWRCB) National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS00001, Waste Discharge Requirements for Discharges of Storm Water Runoff Associated with Industrial Activity (General Permit). The TCS project site is under the regional jurisdiction of the Colorado River Basin Water Quality Control Board (Regional Water Board). In accordance with the General Permit, storm water pollution prevention has two major objectives:

- Identifying and evaluating sources of pollutants associated with industrial activities that may affect the quality of storm water discharges and authorized non-storm water discharges from the facility.
- Identifying and implementing site-specific BMPs to reduce or prevent pollutants from being released in storm water discharges and/or authorized non-storm water discharges that may affect receiving water quality.

The O&M SWPPP will cover all remedy facilities located inside and outside of the Compressor Station. The O&M SWPPP identify BMPs as required by law, and establish a monitoring and sampling plan (including visual inspections and an annual comprehensive review). The annual comprehensive review is required to evaluate the effectiveness of the BMPs and to determine whether modifying BMPs or implementing additional BMPs is required. Please note that the remedy design has and will continue to incorporate engineering elements to reduce or prevent pollutants from being released in storm water discharges.

An outline of the O&M SWPPP, is presented in Appendix E of the Draft Operation and Maintenance Manual – Volume 1 (CH2M HILL, 2012b). A draft O&M SWPPP will be included in the 90% design submittal that will reflect the latest requirements of the Industrial General Permit.

3.3.2.6 Fuel Storage and Fueling Practices

Types of fuel anticipated to be used onsite include diesel Fuel Number 2 and gasoline. The diesel fuel will meet California low-sulfur standards and regulations. There is a bulk diesel fuel tank in place at the TCS that will be used by PG&E and its contractors conducting remedy activities for re-fueling vehicles and equipment. Gasoline will meet California's reformulated gasoline (CaRFG) program standards and regulations. There is a bulk gasoline fuel tank in place at the TCS that will be used by PG&E and its contractors conducting remedy activities for re-fueling vehicles and equipment. It is anticipated that remote fueling activities (transporting small amounts of fuel to equipment in the field) will also be conducted to re-fuel equipment located at remote portions of the site.

Over the decades-long O&M period, it is anticipated that alternative fuels may be considered for onsite use including, but not limited to, bio fuels, ethanol, etc. In addition, bulk fuel storage methods may change to support future remedy needs, and fueling practices may change to capture best practices that may become available in the future. Regardless of the type of fuel used, the project will comply with local, state, and federal regulations related to their bulk storage and management. Specifically, the Hazardous Materials Business Plan presented in Appendix F of the Draft Operation and Maintenance Manual – Volume 1 (CH2M HILL, 2012b) and SOPs will include procedures for properly storing and handling fuel onsite, the required equipment and procedures for spill containment, required personal protective equipment, and the measures to be used to reduce the likelihood of releases or spills during fueling or vehicle maintenance activities.

3.3.2.7 Access Road and Pathway Maintenance

Over time, access roads and pathways are likely to exhibit deterioration and/or overgrowth, and will require maintenance for safety, and for ensuring access to as well as protection of remedy infrastructure and

facilities. Depending on the road or pathway surface and condition, the proper maintenance method(s) will be different. Typically, road maintenance consists of stabilizing disturbed areas, filling/re-grading, and pruning overgrowth.

Once it is determined that a road or pathway must be maintained, an assessment including a review of potential causes for deterioration will be completed. Based on the assessment, an appropriate method for maintenance will be conducted.

For footpaths, pruning of overgrowth will be done using hand tools or mechanical-powered tools. Soil stabilization for disturbed areas may be accomplished by applying approved soil stabilizing agents (e.g., SoilTac), erosion control matting, silt fencing, etc.

For loose or compact dirt access roads with erosion, subsidence, soft spots, or potholes, road surfaces may be re-established using manual shovel and rake. In more severe cases, a backhoe or grader may be required. Soil stabilization for disturbed areas may be accomplished by applying approved soil stabilizing agents (e.g., SoilTac), erosion control matting, silt fencing, or water bars. Ditches and culverts will be inspected and cleaned or rebuilt, as needed. If additional capacity is needed, the ditch may be reshaped or turnout/diversion berms may need to be installed. For gravel access roads, it may be necessary to add gravel and re-grade the road surface.

Paved asphalt or concrete access roads may require patching, additional base fill, or re-paving, in addition to erosion control and restoration measures. All of the techniques listed above may be appropriate.

3.3.2.8 Contingency Plans

Contingency Plans have been provided as part of the 60% Design Submittal in the form of the Draft Operation and Maintenance Manual – Volume 3 (CH2M HILL, 2012c). Contingency planning is being conducted as a part of the final groundwater remedy design process to anticipate potential risks and organize plans to mitigate these risks. The contingency plan is intended for use during the design phase as a tool to anticipate potential risks and to develop methods to mitigate these risks, either within the design, or as part of the future system operations.

The contingency planning process identifies possible failures that could cause unacceptable conditions in the groundwater remedy such as unacceptable remedy performance where the RAOs are not met; schedule failures where the time to cleanup is extended more than 5 to 15 years; cost failures; significant change to design parameters associated with the remedy; and significant H&S or compliance incident such as a health and safety incident that results in lost work time for remedy or Compressor Station staff or the public; an environmental compliance Notice of Violation (other than related to remedy performance); or violation of the requirements in the ARARs.

Contingency planning has been prepared for five key elements of the groundwater remedy: In-Situ Remediation System; Remedy-produced Water Management System; Freshwater Supply; Power Supply; and Supervisory Control and Data Acquisition (SCADA) System. In the 90% Design, per DTSC's direction, the freshwater pre-injection treatment system will be added as a contingency.

This section has been included in the PBA in order to seek ESA coverage in the event of the occurrence of any unacceptable condition that leads to a longer time frame for achievement of the RAOs or results in potential impacts on any of the PBA-listed species requiring reinitiation of consultation under 50 CFR 402.16.

3.3.2.9 IM No. 3 Lay-Up

Prior to startup of the Final Groundwater Remedy, the IM No. 3 system will be shut down and prepared for lay-up. When the IM No. 3 system is in a lay-up condition, the system will be left in a safe, secure, and preserved state and will not operate again until agency approval is received for decommissioning and removal of the system. Procedures for shutting down IM No. 3 are included in the existing IM No. 3 Treatment and Extraction System Operations and Maintenance Plan (CH2M HILL, 2006d). Procedures for

Lockout/Tagout of pipelines and mechanical and electrical equipment will be in accordance with existing IM No. 3 Treatment and Extraction System SOPs. Wastes generated during IM No. 3 lay-up will be handled in accordance with the Waste Management Plan under the IM No. 3 Treatment and Extraction System O&M Plan (CH2M HILL, 2006d). After the IM No. 3 system is in a lay-up condition, it is not currently expected to operate again because it will have met the goals of the IM and associated design parameters. The IM No. 3 system will remain in a lay-up condition until PG&E receives approval for closure and decommissioning of IM No. 3.

During the lay-up period, equipment maintenance is required to keep the equipment in good condition and under active equipment warranties, because most major equipment will likely be recovered for reuse. Electricity will be required for equipment maintenance. In addition, weekly inspections of the following equipment will be conducted:

- Storage tanks that formerly contained hazardous materials.
- Pressurized (compressed air) tank.
- Onsite chemical storage areas. (Excess chemicals will be removed from site during lay-up preparation.)
- Emergency shower and eye wash station and potable water cooling system.
- Fire water tank.
- Aboveground injection well pipeline and instrumentation conduit.

Maintenance will also be conducted on the access road to the IM No. 3 Treatment Plant and injection wells as well as watering the road for dust control pursuant to EIR mitigation measures. Periodic filling of the potable water tank, and possibly the fire water tank at the IM No. 3 Treatment Plant, as well as regular pest control will also be required.

During the lay-up period, PG&E's security system will continue to provide security monitoring of the IM No. 3 system facilities. During nighttime hours, existing lighting will continue to be used at the IM No. 3 Treatment Plant and at the MW-20 Bench Facility for security and safety. Even though the facility will not be routinely staffed at night, minimum lighting during nighttime hours is still required for safety in case PG&E personnel need to enter the facilities during these hours. Minimum lighting or minimum illumination intensities are defined by OSHA. For activities and areas not included under the OSHA standard, the American National Standards Institute has established recommended illumination levels under Recommended Practice RP-07-01.

Telecommunications and plant communications will continue to be maintained for safety, security, and maintenance requirements. Because personnel will be onsite during work days, the potable water system at the IM No. 3 Treatment Plant will stay in service to provide water to the sinks and toilet in the IM No. 3 Treatment Plant trailer. The sewage holding tank for the IM No. 3 Treatment Plant trailer will stay in service. The sewage holding tank will need to be serviced; the service frequency will be on an as needed basis.

3.3.3 Sampling and Monitoring Plan

When the Final Groundwater Remedy is implemented, the current groundwater monitoring programs will be replaced by a new Corrective Measure/ Remedial Action Monitoring Program with the focus of evaluating the performance of the remedy to attain the RAOs and to comply with ARARs. As described in the Draft Operation and Maintenance Manual – Volume 2 (CH2M HILL, 2012d), the monitoring program will have several components: compliance monitoring, process control monitoring, and constituents of potential concern monitoring.

In the field, variations in Cr(VI) concentration distributions, lithology, and hydrogeology will be encountered. To deal with the uncertainty in these parameters in implementation, the remedial system was designed to be flexible and the remedy will be implemented with an adaptive operational strategy. During system installation and baseline sampling, additional data will be collected that will refine the current conceptual

model. Where appropriate, the data may be used to refine the design, such as remedial well screen depths or well locations.

3.3.3.1 Monitoring Well Sampling Locations and Frequency.

As previously noted, the Corrective Measure/Remedial Action Monitoring Program (RCM/ PCMP) will make use of the existing monitoring well network wherever possible. That existing monitoring well network will be augmented by the planned 19 new monitoring wells (Designated as Wells A through S in Figure 6) that were previously described in subsection 3.3.1.2. The RCM/PCMP sample locations, analytes, and frequencies will be adapted in an ongoing manner to meet the monitoring needs of the Final Groundwater Remedy. Additional monitoring wells may be required in the future.

The current GMP network of monitoring wells in the Action Area (shown in Figure 5) consists of 146 groundwater monitoring wells, with an additional 17 wells that are associated with the CMP for the IM No. 3 injection area. The current GMP also includes surface water sampling in the Colorado River, so these samples are presented in the event that sampling will continue during operation of the Final Remedy and, are included in this evaluation. As of December 2013, monitoring occurs as follows:

- 13 groundwater wells are sampled biennially;
- 39 groundwater wells are sampled annually;
- 2 active supply wells are sampled annually;
- 35 groundwater wells are sampled semi-annually;
- 54 groundwater wells are sampled quarterly;
- 2 groundwater wells on the floodplain are sampled monthly between November and February
- 2 active extraction wells are sampled monthly;
- 4 shoreline surface water stations along the Colorado River and two (2) other surface water monitoring locations were sampled quarterly (except during the winter low-river stage conditions, when the stations are sampled one additional time); and
- 10 depth-specific sampling stations within the Colorado River that were sampled quarterly (except during the winter low-river stage conditions, when the stations are sampled one additional time).

The locations of the existing GMP/CMP wells are included in Figure 5.

3.3.3.2 Sampling Methods

As previously mentioned, analytes and monitoring frequencies for particular wells will be dictated by the location and well category and will be regularly evaluated by the PG&E, DOI, and DTSC to provide a flexible, adaptive program to meet the needs of the RCM/PCM program during remedy operations. An initial sampling program is presented in the Draft Operation and Maintenance Manual – Volume 2 (CH2M HILL, 2012d) for different well types (remediation, process control, monitoring, and freshwater supply wells). As data are collected during remedy installation and initial operations, the conceptual site model (CSM) will be updated. The monitoring program may be refined based on baseline data prior to remedy operation, and the sampling program will be revisited and refined after the first two years of operation.

All sampling events, regardless of the analytes being sampled, will also include collection of field parameters (pH, dissolved oxygen, oxidation-reduction potential, temperature, and specific conductance) and water level data to evaluate hydraulic control of the remedy system. Field sampling will follow the SOPs outlined in Section 7 and presented in Appendix A of the O&M manual (CH2M HILL, 2012d). The SOPs provide detailed method descriptions for purging and sampling of groundwater monitoring wells by well-volume and modified well-volume methods; purging and sampling of active and inactive water supply wells; depth-specific surface water sampling; groundwater sampling from sonic drilling boreholes; sample field filtration

and preservation for metals analyses; decontamination of water sampling equipment; spill prevention, containment, and control measures for monitoring well sampling; pore water sampling; access routes; process water sampling; and safe fueling and fuel handling procedures.

Access to monitoring wells will typically occur using via a pickup truck or all-terrain utility vehicle with a trailer. On average, two field personnel will be involved in sampling activities for each individual well. Sampling procedures require purging the wells before sampling can be conducted. Depending on the well characteristics, approximately 15 to 200 gallons of water are typically purged. This water will be either re-injected into the IRZ or transported to the Remedy-produced Water Treatment Facility. Pumping of purge water will typically involve the use of a portable generator unless the well pump has a dedicated (direct line) power source. For example, several wells on the Colorado River floodplain have dedicated pumps installed that are powered from an electrical power source taken from the PE-1 extraction well.

The time frame to complete field sampling activities at an individual well ranges from approximately 15 minutes to several hours. Several of the monitoring sites include clusters of two to three wells sampled at different groundwater depths. The total time frame to complete a sampling event ranges from one day for monthly events or two days for surface water/river sampling events, to seven or eight weeks for a biennial event. Existing and new access routes as shown in Figure 7 will be used to access any of these wells that are kept as part of the new Corrective Measure/Remedial Action Monitoring Program.

There will be ongoing RFI Soil Investigations as described in the work plan (CH2M HILL, 2013a) that will include sampling activities as shown in Figure 4. This work plan includes soil samples that will be distributed in locations around the Action Area but predominantly within Bat Cave Wash and East Ravine. It also includes sediment and pore water sampling that will be used as part of the East Ravine Investigation. All proposed sampling will follow existing SOPs.

3.3.3.3 Baseline Soil Sampling

In general, ongoing soil sampling through 2017 was evaluated in the 2012 Reinitiated PBA and included in the environmental baseline for this project. A brief description of baseline soil sampling is provided here since it will be accomplished in conjunction with the construction of the Final Groundwater Remedy facilities. To document baseline soil conditions prior to groundwater remedy implementation, a Baseline Soil SAP has been presented in Appendix A of the Soil Management Plan 60% Design Draft O&M Manual (Volume 4) (CH2M HILL, 2012e) to provide the approach and methods to collect and analyze soil samples in the areas used by the groundwater remedy.

In areas where groundwater remedy infrastructure overlaps with any of the eighteen different Soil Investigation Areas, the approach presented in the SAP will be fully coordinated with the ongoing RFI/RI planning activities to minimize the total number of soil samples to be collected and associated ground disturbances.

The purpose of the baseline soil sampling will be to provide comparable data to evaluate potential impacts of the final remedy at the time that they are being decommissioned. Baseline soil samples will be collected along the remedy pipelines/conduits alignments, which include direct burial pipelines/conduits, pipeline trenches, and the new remediation wells (i.e., injection and extraction wells) that are connected to those pipelines, as well as at the new remedy monitoring well locations. The exception is that baseline soil sampling will not occur along the alignment of the freshwater pipeline in Arizona, and on the California side, leading to the Compressor Station because the freshwater from HNWR-1 has inorganic compounds at such low concentrations, that soil underlying the pipeline would not be adversely impacted by inorganic compounds from incidental releases, spills or leaks from the pipeline.

3.3.4 Soil Storage

It is anticipated that excess soil will be generated from the construction of the Final Groundwater Remedy. The Soil Management Plan (60% Design Draft O&M Manual - Volume 4 [CH2M HILL, 2012e]) describes the

collection of data to assist with the management of displaced soils during construction activities. Analytical results from the Baseline SAP or other characterization of soil samples (i.e., drum or roll-off bins, or areas not pre-characterized) will be used to determine whether displaced soil is suitable for retention onsite for eventual return, reuse, or replacement, or if the soil must be removed from the site for disposal in accordance with applicable state and federal laws and regulations.

Analytes detected in the Baseline SAP or other characterization of soil samples above laboratory detection limits will be screened first against conservative values such as the background screening values (if available), or against the DTSC residential California Human Health Screening Level (CHHSL) or the ecological comparison value. If a CHHSL is not available, then the lesser of the U.S. Environmental Protection Agency residential regional screening level or the ecological comparison value will be used. It is assumed that the project-specific soil cleanup goals will be equal to or greater than these levels, so that soils below these levels will not be managed as wastes and would be suitable for re-use.

Soils not falling below these conservative screening levels will be further screened to determine if the soil should be classified as a nonhazardous waste, a state (non-RCRA California) hazardous waste, or a federal (RCRA) hazardous waste. The specific procedures are described in Section 2.3 of the Soil Management Plan, but are summarized here. Analytical results for total constituent concentrations (mg/kg), toxicity characteristic leaching procedure (TCLP) values, and California Waste Extraction Test (WET) values will be screened to determine how the soils should be classified. Based on the screening results, the displaced soil will be classified into 3 categories and will be managed as follows:

- RCRA and non-RCRA hazardous waste—the waste will be removed from the site within 90 days of generation and disposed of offsite in accordance with applicable laws and regulations. It will be imperative to coordinate with the waste hauler and disposal facility to ensure proper completion of the waste profile and to avoid unnecessary delays in acceptance of a waste to a specific facility.
- Non-hazardous clean soil—soil that is not classified as a hazardous waste, and is equal to or below the interim screening level, is suitable for immediate return, reuse, or replacement onsite. Based on initial estimates, roughly over 10,000 cubic yard of excess clean soil could be generated during remedy construction.
- Non-hazardous soil for long-term storage—soil that is not classified as a hazardous waste, and is greater than the interim screening level, will be stored onsite until the project-specific cleanup goals are established. Until these goals are established, soil that falls into this intermediate category will be retained onsite for long-term storage. For planning purposes, approximately 2,000 cubic yards of nonhazardous soil requiring long-term storage could be generated during remedy construction. Storage duration could be 3 to 5 years, or more, depending on establishment of site-specific cleanup goals and/or reuse scenario. Storage will be consistent with applicable requirements.

3.3.4.1 Locations and Storage Methods

As shown in Figure 7, five different proposed staging/soil storage areas have been identified in California (totaling 11.50 acres). Two other areas to the north of the west access route (Historic Route 66) totaling 0.95 acre, are currently being negotiated for dual staging/soil storage use.

Soil and material originating in or near Soil RFI/RI Investigation Areas (areas of known or suspected soil contamination) that is displaced as part of the groundwater remediation project will be handled and managed in accordance with the Soil Management Plan (CH2M HILL, 2012e). Uncontaminated soil that cannot be immediately used as backfill may be reused in other areas within the Action Area, or stockpiled for future reuse within the Action Area. The stockpiled uncontaminated soil will be managed following the BMPs Plan that will be part of the O&M SWPPP will be included in Appendix E of the 90% design Draft Operation and Maintenance Manual – Volume 1, which will reflect the latest requirements of the Industrial General Permit. It should be noted that the impacts for the Final Soil Remedy, if required by the agencies, will be evaluated prior to the conclusion of the re-Initiated 2007 PBA, which will expire in 2017.

Displaced soil that is nonhazardous but is unsuitable for final disposition onsite because contaminants are present above the interim screening level cannot be reused until project-specific soil cleanup goals are finalized and must be stored onsite. Once final project specific cleanup goals are established, the contamination will be re-assessed based on existing data, or additional data as determined necessary, to determine final disposition (i.e., transportation to offsite disposal facility or reuse within the Action Area).

Storage area(s) will depend on the volume of soil, which will not be known until after the implementation of the Baseline SAP. Soil will be stored in 55-gallon drums/small containers, roll-off bins, and/or stockpiles that are managed in accordance with the O&M SWPPP. All containers will be properly labeled according to state and federal requirements. Only nonhazardous soil will be stored in stockpiles.

3.3.4.2 Emergency Response

In compliance with 22 CCR 66264.14, a barrier, such as temporary fencing, will be provided for hazardous waste accumulation areas that are otherwise accessible to the general public. Hazardous waste soil accumulation areas will also have signs that provide 24-hour emergency contacts and telephone numbers. Hazardous waste accumulation areas will contain emergency response equipment appropriate to applicable waste hazards. The project-specific Health and Safety Plan will identify the project emergency response procedures and equipment, including emergency response contacts and phone numbers.

In addition to the project-specific Health and Safety Plan procedures, hazardous waste accumulation areas will be provided with fire extinguishers, decontamination equipment including an eye wash station, and an alarm system (if radio equipment is not available to all staff working in accumulation area).

3.3.5 Post-Remediation Monitoring

After active remediation ceases, monitored natural attenuation will be implemented as a long-term component of the groundwater remedy to address residual chromium that may remain in recalcitrant portions of the aquifer following efforts to enhance and optimize in-situ treatment and flushing systems during the O&M phase. In addition, in compliance with the State Board directive dated November 20, 2013, monitoring of groundwater quality in the freshwater injection areas will be conducted to verify that the arsenic water quality objective in the receiving groundwater are met within the earlier of (i) 20 years after achieving the RAO for chromium or (ii) 20 years after ceasing injection of freshwater containing naturally occurring arsenic at concentrations above the water quality objective. In other words, this long-term monitoring program could last up to 20 years after active remediation has ceased.

3.3.6 Decommissioning

Decommissioning of the project will occur in separate phases as described in the following subsections. Details on these items along with a consideration of their biological impacts are discussed in the following subsections.

3.3.6.1 IM No. 3 Facilities

Once the Final Groundwater Remedy is brought on line and is determined by the agencies to be operating properly and successfully, PG&E will decommission and remove the IM No. 3 system after receipt of approval for IM No. 3 decommissioning by DTSC, with concurrence from DOI. As required, a draft work plan describing the IM No. 3 Decommissioning activities will be submitted for review with the 90% design. Once approved, the work plan will be implemented for the decommissioning and removal of IM No. 3 facilities. The scope of work will include the decommissioning and removal or abandonment in place of the following IM No. 3 system components:

- Three extraction wells in the MW-20 Bench area of the site (TW-2S, TW-2D, and TW-3D) and one extraction well in the floodplain (PE-1), as well as ancillary well equipment and vaults. Two injection wells in the East Mesa area of the site (IW-2 and IW-3) and power supply structure located at this site. Prior to decommissioning the wells, submersible pumps in the extraction wells, air-lift tubing in the

injection wells, and pipes, valves, and instruments in both the extraction and injection well vaults will be removed. Conduit, electrical panels, and other features within a well vault will also be removed.

- Underground piping and vaults between the extraction wells and the treatment plant. After successful decontamination or cleaning, underground pipelines and conduits exiting PE-1, IW-2, and IW-3 well vaults will be cut and capped outside of the well vault and abandoned in place. The subsurface well vault will then be removed.
- The entire treatment plant, including equipment, pipelines, valves, instrumentation, utilities, and infrastructure underneath the sunshade, the sunshade, mobile warehouse units, trailer, treatment plant foundation and secondary containment areas, underground pipelines and utilities within the footprint of the treatment plant fence line, and security fence and gate.
- Underground and aboveground pipelines, and instrumentation conduit between treatment plant and injection well field.
- Support facilities on the MW-20 Bench, including Valve Vault #1, pumps, valves, pipelines, electrical, and instrumentation associated with the extraction wells, parking areas, security fence and gates, security system, lighting, and other ancillary equipment.

Existing monitoring wells and their instrumentation that are currently used to monitor IM No. 3 performance will be reused as part of the monitoring network associated with the Final Groundwater Remedy, and therefore will not be decommissioned. Decommissioning of these existing monitoring wells and their instrumentation will be addressed as part of the decommissioning of the groundwater remedy. The general approach for decommissioning wells is being developed by a subgroup that includes PG&E, DTSC, DOI, and Interested Tribes, and will be incorporated into the Groundwater Remedy O&M Manual, Volume 1, Section 4 (Well Maintenance and Decommissioning), as it becomes available.

The brine storage and loading facility (three tanks, the truck lane, and associated pumps and piping) also will be reused by the Final Groundwater Remedy in its existing location at the MW-20 Bench. No aboveground component of the existing IM No. 3 system located within the footprint of the existing IM No. 3 Treatment Plant building, or within the IM No. 3 Treatment Plant fence line will be reused in its current location as part of the Final Remedy.

3.3.6.2 Final Remedy Facilities

In compliance with the 2013 Consent Decree (Appendix C, Item 9), PG&E will submit a decommissioning plan within 120 days of DOI's certification of completion of the remedial action and a determination by DOI that removal of such facilities is protective of human health and the environment. The decommissioning plan will describe procedures for the removal of the remedy facilities and associated infrastructure. The plan will also describe the post-remedy restoration of the site to the conditions existing prior to the implementation of the remedy construction, to the extent practicable.

In addition, in accordance with mitigation measures, biological surveys will be conducted prior to decommissioning, and during the breeding season, to inform the decommissioning planning process. The Final Remedy Decommissioning activities will be completed in accordance with the BIAMP (CH2M HILL, 2013f) and other relevant documents (including this PBA).

3.3.7 Restoration

Upon completion of the decommissioning activities, the next step for the TCS Remediation Project will be to restore areas that were used in the course of the project, to conditions existing prior to construction to the maximum extent practicable.

After decommissioning and removal of the IM No. 3 treatment plant and final remediation facilities, the areas will be restored using decompaction and grading techniques designed to decrease erosion and

accelerate revegetation of native species. The decommissioning of monitoring wells will occur after an appropriate time span following the decommissioning of the remediation facilities.

3.3.7.1 IM No. 3 Facilities

The IM No. 3 restoration will provide a template after which, subsequent restoration efforts may be modeled or improved. Prior to conducting restoration activities, PG&E will prepare a Restoration Plan for review by regulatory agencies, stakeholders and Tribal Nations. The focus of the Restoration Plan would be to outline the scope of restoration; the goals and objectives of the restoration; to promote native plant and habitat regeneration; and to prevent invasive plant establishment. Success criteria will be proposed along with a monitoring and reporting plan. Adaptive management will be used to evaluate the effectiveness of the restoration through monitoring, and adjust management of the site in the event of unforeseen circumstances.

It should be recognized that the majority of the IM No. 3 decommissioned facilities are adjacent to ongoing Final Groundwater Remedy facilities. Similarly, previously used staging or soil storage may also be required for use in the Final Groundwater Remedy, or have ongoing activities (e.g. the Compressor Station, the Transwestern Metering Bench, the MW-24 Bench, the evaporation ponds area, the trailer park area in Moabi Regional Park, the parking areas off Interstate 40, etc.). Even after the decommissioning of the IM No. 3 facilities, it is expected that restoration will not be feasible for many areas that are required for ongoing Final Remedy operations (e.g., MW-20 Bench). Rather, these areas will not be restored until after the Final Groundwater Remedy facilities have been closed and decommissioned. Instead, these locations will be maintained along with remaining facilities over the duration of the final groundwater remedy operation. Established roads and access pathways will be maintained during decommissioning and restoration activities. After demobilization, the condition of established roads and access pathways will be returned to pre-mobilization condition.

The IM No. 3 treatment plant site may represent one area where restoration could proceed in advance of the closure of the Final Groundwater Remedy facilities, assuming it was not required as part of the Final Groundwater or Soil Remedies. Whether it is the former IM No. 3 Treatment Plant site or any other location, as previously mentioned, the IM No. 3 Restoration Plan will provide an excellent opportunity to develop the best methods and approaches that will help the Final Groundwater Remedy restoration efforts.

3.3.7.2 IM No. 3 Restoration Guidelines

After the aboveground IM No. 3 infrastructure and components have been decommissioned, the land within the work zone will be returned to a safe condition prior to commencing restoration activities. To return the land to a safe condition, excavated infrastructure, such as buried well and pipeline vaults, partially buried buildings, the IM No. 3 Treatment Plant foundation, and trenches excavated to remove utility lines, will be backfilled with displaced material or foreign fill and compacted. Excess displaced material from the Final Groundwater Remedy and displaced material from IM No. 3 Decommissioning activities may be used for backfill after the materials are tested and proven to be suitable for this use. Imported fill may be used if there is not enough displaced site material to backfill the excavated area or if the displaced material is not suitable for backfilling a particular area.

Backfilling and grading the decommissioned IM No. 3 infrastructure areas will be coordinated with the Soil cleanup process at the IM No. 3 site (AOC 29) and MW-20 Bench (AOC 30). If final remedial action at these areas is not known at the time of subsurface infrastructure decommissioning, temporary controls, such as barricades or gravel, may be placed at excavated areas to render the locations safe until the final remedial action for AOC 29 and AOC 30 is selected and implemented, and the final backfilling and grading is established.

Following backfill and compaction, light grading may be required to provide proper drainage and to control erosion. Grading, contouring, drainage, and erosion control plans for the identified areas to be restored will

be designed and included in the IM No. 3 Restoration Plan. Final grading and contouring will occur prior to revegetating the identified disturbed areas.

The following general steps will be conducted during restoration:

1. Verify that the above- and below-grade components, with the exception of any facilities associated with the final remedy, have been decommissioned.
2. Verify soil confirmation sampling is complete, and that remedial actions selected for AOC 29 and AOC 30 are implemented.
3. In coordination with the selected remedial action for AOC 29 and AOC 30, backfill holes or trenches created during the removal of IM No. 3 infrastructure or components with either displaced materials or with foreign fill.
4. Grade, contour, and compact the soil in accordance with the grading, drainage, and erosion control plans included in the IM No. 3 Restoration Plan.
5. Revegetate the area in accordance with the IM No. 3 Restoration Plan.

3.3.7.3 Final Remedy Facilities

With the decommissioning and removal of the Final Groundwater Remedy facilities, it will be possible to restore many of the areas used by the Remediation Project. Prior to final decommissioning, a second Restoration Plan will be prepared for review by regulatory agencies, stakeholders and Tribes. This Restoration Plan will encompass the remaining project areas used by groundwater remedy, including staging/storage areas. Similar to IM No. 3 Restoration, staging areas that have ongoing activities (e.g. the Compressor Station, the Transwestern Metering Bench, the MW-24 Bench, the evaporation ponds area, the trailer park area in Moabi Regional Park, the parking areas off Interstate 40, etc.) will not be restored. Also, established roads and access pathways will be returned to pre-mobilization condition.

The Restoration Plan for the remedy facilities will incorporate the approaches and feedback gathered from the previously prepared IM No. 3 Restoration Plan.

3.4 General Project Management Measures

Approval of ongoing and planned future activities are expected to be consistent with the substantive intent of current mitigation measures applied by BLM, USFWS, and DTSC to investigative and interim measures/removal actions that were required in the 2007 PBA. In addition to the measures noted below, project activities could also be subject to other regulatory requirements including, but not necessarily limited to, substantive requirements of the California Fish and Game Code Section 1600 et seq. and the California Endangered Species Act. Further, prior to the approval of implementation of the groundwater remedy, the BLM and/or USFWS will consult with the Native American community, which typically includes nine local tribes.

To clarify existing BLM mitigation measures, March 15 through September 30 was established as the date for the migratory bird nesting season and May 1 through September 30 was established to encompass the nesting period for the southwestern willow flycatcher and western yellow-billed cuckoo. During these periods, a qualified biological monitor would be required in the field to conduct pre-construction surveys for nesting birds, in addition to the USFWS-approved surveys that were being conducted annually, and then biennially, for the presence of southwestern willow flycatchers. In addition, February 1 through May 31 has been established as conservation dates to identify the up/down river migration and spawning period for razorback suckers and bonytail chubs. More recent agreements with the USFWS (2014a) have modified the southwestern willow flycatcher surveys to once every three years. Initially, two consecutive years of surveys for western yellow-billed cuckoo will be conducted in 2014 and 2015, and, thereafter, may also follow a triennial frequency depending on the results. Based on input from the USFWS (2005a, 2014b), it was

decided that there would be no project-specific surveys for Yuma clapper rail but that the status of this species in the Action Area would be assessed using the annual survey data from the USFWS. Should those data or onsite monitoring results indicate a need, future clapper surveys may become warranted.

Since 2005, there have been a number of focused protocol-level surveys for desert tortoise and southwestern willow flycatcher that have increased the knowledge of local biology. In addition, there have been many project-specific surveys, incidental wildlife observations, and habitat and plant surveys to help characterize the overall biological baseline within the Action Area. The BIAMP (CH2M HILL, 2013f) was drafted to identify and avoid project-related risks to avian wildlife that could result from the construction and operation of the Final Remedy, including decommissioning and restoration. Specific mitigation measures reflecting the latest agreements with the USFWS are included with the individual species descriptions in Section 5.0 of this PBA.

General management measures will apply to future field activities are listed below:

1. All project activities will be conducted in a manner that avoids take of a federally listed species. Take is defined to include any harm or harassment, including significant habitat modification or degradation that actually kills or injures listed wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Should a listed species enter the project site or become harmed or killed by project activities, the project shall be shut down and the USFWS, BLM, and CDFW shall be consulted. Impacts to habitat will also be minimized to the maximum possible extent.
2. PG&E shall designate a field contact representative (FCR) who will be responsible for overseeing compliance with the mitigation measures. The FCR must be onsite during all construction activities. The FCR shall have authority to halt activities that are in violation of the mitigation measures and/or pose a danger to listed species. The FCR will have a copy of the mitigation measures when work is being conducted on the site. The FCR may be a project manager, PG&E representative, or a biologist.
3. PG&E shall have a qualified biologist responsible for assisting crews in compliance with the mitigation measures, performing surveys in front of the crew as needed to locate and avoid listed species, and monitoring compliance. Preconstruction surveys by a biologist shall be implemented for special-status wildlife species in work areas immediately prior to initiation of ground-disturbing activities. The survey shall provide 100 percent coverage of the designated work area, to the extent practicable. Any desert tortoise burrows and pallets outside of, but near, the work area footprint shall be flagged at that time so that they may be avoided during work activities. At conclusion of work activities, all flagging shall be removed.
4. Listed species, including the desert tortoise, shall not be handled or harassed. Encounters with a listed species shall be reported to the project biologist and BLM Lake Havasu biologists. These biologists will maintain records of all listed species encountered during project activities. This information will include for each individual: the locations (narrative, vegetation type, and maps) and dates of observations; general conditions and health; any apparent injuries and state of healing; and diagnostic markings.
5. All PG&E employees and the contractors involved with the proposed project shall be required to attend PG&E's threatened and endangered species education program prior to initiation of activities. New employees and contractors shall receive training prior to working onsite.
6. To the maximum extent possible, facilities (treatment facility, pipelines, injection wells, and access routes) shall be sited within existing designated access routes and previously disturbed or barren areas to limit new surface disturbance.
7. Existing routes of travel to and from the proposed project site shall be used. Cross-country vehicle and equipment use shall be prohibited.

8. Trash and food items shall be contained in closed containers and removed daily to reduce attractiveness to opportunistic predators such as common ravens (*Corvus corax*), coyotes (*Canis latrans*), and feral dogs.
9. To minimize effects, lights shall be angled toward the ground, reduced in intensity to levels compatible with safety concerns, and limited in duration of usage. The hue of lighting shall be that which is most compatible with and least disturbing to wildlife.
10. Employees shall not bring pets to the project site.
11. Firearms shall be prohibited from the project site, except as required for security employees.
12. Employees shall be required to check under their equipment or vehicle before it is moved. If a desert tortoise or other wildlife is encountered under vehicles or equipment, the vehicle shall not be moved until the animal has voluntarily moved to another location, or to a safe distance from the parked vehicle.
13. Upon completion, all unused material and equipment shall be removed from the site. This condition does not apply to fenced areas.
14. Palo verde, ocotillo, mesquite, catclaw acacia, smoketree, and cacti species are considered sensitive by the BLM. To the extent practicable, these species shall be avoided. If complete avoidance is not possible, these species shall be transplanted when practical. Should any of the aforementioned plants be destroyed, they shall be replaced.
15. The area of disturbance shall be confined to the smallest practical area, considering topography, placement of facilities, location of burrows, nesting sites or dens, public health and safety, and other limiting factors. Designated work areas will be determined based on Remedy Design documents, as approved by the BLM, USFWS, and CDFW.
16. Activities shall be restricted to the designated work areas that are determined by the latest Remedy Design documents as approved by BLM, USFWS, and CDFW. If unforeseen circumstances require project expansion outside of the designated work area, the potential expanded work areas shall be surveyed for listed species prior to use of the area. All appropriate mitigation measures shall be implemented within the expanded work areas based on the judgment of the agencies and the project biologist. Work outside of the original designated work area shall proceed only after receiving written approval from the BLM, USFWS and CDFW describing the exact location of the expansion
17. All open holes and trenches shall be inspected for trapped desert tortoises at the beginning, middle, and end of the work day, at a minimum. During excavation of trenches or holes, earthen ramps shall be provided to facilitate the escape of any wildlife species that may inadvertently become entrapped. If desert tortoises are trapped, the project biologist shall be notified immediately. The desert tortoise shall be allowed to escape before work continues in that location. A final inspection of the open trench segment shall also be made immediately before back filling.
18. All open, vertical pipe segments (such as those used for fence support or other purposes) shall be capped or otherwise covered when work activity is not occurring at the site. The capping/covering of the pipes is needed to prevent birds from entering the pipes. Uncapped pipes represent a threat to birds who may enter them and then be unable to exit. Capping the vertical pipes will avoid unintended impacts to birds.
19. Handling of hazardous materials for the Final Remedy program will be managed under the Topock Compressor Station Hazardous Materials Business Plan and under specific standard operating procedures (SOP) that are included in the O&M Manual (Volume 1), which will include procedures for properly storing and handling fuel onsite, the required equipment and procedures for spill containment, required personal protective equipment, and the measures to be used to reduce the likelihood of releases or spills during fueling or vehicle maintenance activities. The BLM shall be informed of any hazardous spills within 48 hours.

20. Workers shall exercise caution when traveling to and from the Action Area. To minimize the likelihood for vehicle strikes of listed species, speed limits when commuting to project areas on designated access roads shall not exceed 20 miles per hour.
21. Intentional killing or collection of either plant or wildlife at construction sites and surrounding areas shall be prohibited. The BLM shall be notified of any such occurrences.
22. For emergency situations involving a pipeline leak or spill or any other immediate safety hazard, PG&E shall notify the BLM within 48 hours. As a part of this emergency response, the BLM may require specific measures to protect listed species. During cleanup and repair, the agencies may also require measures to recover damaged habitats.
23. Once remedy facilities are no longer needed, PG&E shall restore disturbed areas in a manner that will assist in the reestablishment of biological values within the disturbed areas. Methods of such restoration shall be consistent with the Topock Remediation Restoration Plans and include erosion control, planting with appropriate native shrubs, and restoration to pre-project conditions, to the extent practicable.
24. Within 60 days of completion of construction activities, the FCR and biologist shall prepare a brief report for the BLM documenting the effectiveness and practicality of the mitigation measure and making recommendations for modifying the measures to enhance species protection, as appropriate. The report will also provide information on survey and monitoring activities, observed listed species if encountered, and the actual acreage disturbed by the activities, if any.
25. Construction during the potential nesting season for most birds will require preconstruction surveys for nesting pairs, nests and eggs. These preconstruction surveys shall occur in areas proposed for any vegetation removal and active nesting areas flagged. If nesting birds are detected, vegetation removal will be avoided during the nesting season. All construction activity within 200 feet of active nesting areas will be prohibited until the nesting pair/young have vacated the nests, unless otherwise approved by the USFWS.
26. All areas within the proposed Action Area, subject to operations and maintenance activities, and within the potential impact of the action, shall be monitored during the active period for tortoise by a biologist knowledgeable of desert tortoise ecology. Surveys shall be completed throughout the duration of the activity to verify the presence or absence of desert tortoise and reports shall be provided to the biologists in the BLM Lake Havasu Field Office. Due to the lack of tortoise sightings in the Project area, the BLM has ended the program requirement for annual surveys.
27. Riparian areas surrounding the proposed Action Area and subject to influence of operations and maintenance activities shall be surveyed for southwestern willow flycatcher according to the protocol established by the USFWS. These surveys shall be completed every three years by a biologist permitted by the USFWS to carry out flycatcher surveys until the project has been completed and all facilities have been removed. Reports shall be provided to the biologists in the BLM Lake Havasu Field Office and the USFWS's Phoenix, Arizona Ecological Services Field (AESO) Office (2321 West Royal Palm Road, Suite 103, Phoenix, AZ 85021, 602-242-0210) at the end of the each survey period.
28. Upon locating an individual of a dead or injured listed species, PG&E shall make initial notification to the BLM and USFWS within three working days of its finding. The notification must be made by telephone and writing to the Lake Havasu BLM Office (2610 Sweetwater Avenue, Lake Havasu City, Arizona 86406, 928-505-1200) and the USFWS's Phoenix AESO Office. The report will include the date and time of the finding or incident (if known), location of the carcass, a photograph, cause of death (if known), and other pertinent information. Animals injured through PG&E activities shall be transported by a permitted biologist to a qualified veterinarian for treatment at the expense of PG&E. If an injured animal recovers, the CDFW and the BLM shall be contacted for final disposition of the animal.

29. PG&E will immediately notify the BLM Lake Havasu Field Manager (or his designated representative) of any cultural resources (prehistoric/historic sites or objects) and/or paleontological resources (fossils) encountered during permitted operations and will maintain the integrity of such resources pending subsequent investigation. All operations in the immediate area of the discovery must be suspended until written authorization from BLM to proceed is issued. An evaluation of the discovery shall be made by a qualified archaeologist or paleontologist to determine appropriate actions to prevent the loss of significant cultural or scientifically important paleontological values.
30. No permanent improvements that affect the integrity of the bridge/culvert over Bat Cave Wash on historic Route 66 shall be implemented.
31. Actions that result in impacts to archaeological or historical resources are subject to the provisions of the Archaeological Resources Protection Act of 1979, as amended, and the Federal Land Policy and Management Act of 1976.
32. To document existing conditions prior to construction, a photo documentation plan will be written for the project and reviewed by BLM and USFWS. The plan will include photo points and a methodology. The plan will be implemented prior to any disturbance on site.

Additional species-specific measures are provided in Section 5.0 of this document.

SECTION 4.0

Biological Setting and Environmental Baseline

This section describes the general biological setting and environmental baseline in the Action Area along with species-specific information. Interpretations and conclusions regarding biological resources within the Action Area were derived primarily from the results of various studies conducted between 2004 and the present including:

- *Final Environmental Impact Report for the PG&E Topock Compressor Station Groundwater Remediation Project, Volume 2* (AECOM, 2011)
- *Programmatic Biological Assessment for Pacific Gas and Electric Topock Compressor Station Remedial and Investigative Actions* (CH2M HILL, 2007a)
- Desert Tortoise Presence/Absence Surveys for the Topock Compressor Station (CH2M HILL 2004f, 2004g; Garcia and Associates (GANDA) 2005b, 2006b, 2007b, 2008b, and 2009b; and William Self Associates, Inc. [WSA] 2013)
- Southwestern Willow Flycatcher Presence/Absence Surveys for the PG&E Topock Compressor Station (GANDA 2005a, 2006a, 2007a, 2008a, 2009a, 2010, and 2012)
- Yuma Clapper Rail and Black Rail Surveys at the PG&E Topock Compressor Station Site (Konecny Biological Services (KBS), 2012)
- Instream Habitat Typing Survey, Topock Compressor Station, Colorado River (CH2M HILL, 2012f)
- *Revised Final Floristic Survey for the Topock Compressor Station Groundwater Remediation Project* (GANDA and CH2M HILL, 2013a)
- *Revised Final Ethnobotany Survey Report for the Topock Groundwater Remediation Project* (GANDA and CH2M HILL, 2013b)
- *Supplemental Ethnobotanical Plant Surveys for the Pacific Gas and Electric Company's Topock Compressor Station, San Bernardino County, California* (E2 Consulting Engineers, Inc., 2014)
- *Wetlands and Waters of the United States, Delineation for the Topock Compressor Station Groundwater Remediation Project* (CH2M HILL, 2013d)

4.1 Biological Setting

The Action Area is located approximately 12 miles southeast of Needles, California, and 2.5 miles south-southwest of Topock, Arizona, and is located in the easternmost portion of San Bernardino County, California, and the westernmost portion of Mohave County, Arizona. The Colorado River represents the boundary between California and Arizona (Figure 1).

Land use in the Action Area and vicinity consists of developed areas and open space (undeveloped) federal lands that are managed for multiple uses. Developed areas, described later in subsections 4.2.1 and 4.2.2, include the TCS, the BNSF railroad and Interstate 40 transportation corridor, existing paved roadways, Moabi Regional Park, Pirate's Cove Resort, and Topock Marina. The nearest significant concentration of irrigated agricultural lands can be found within the Colorado River floodplain approximately 9.4 miles or more to the north of the Action Area.

The channel banks along the Arizona side of the river north of the Topock Marina are characterized by steep slopes that have been armored with large boulders. The elevation at the top of the bank is approximately 466 feet amsl. The banks along the inlet to the Topock Marina are characterized by narrow sandy beaches and eroded sandy banks at elevations ranging from around 460 to 463 feet amsl. Low sandy beaches are

also present along the Arizona side of the river south of the Topock Marina and the BNSF railroad bridge (CH2M HILL, 2013d). The 100-year floodplain of the Colorado River is shown in Figure 7. The low terrace between MW-20 Bench and the floodplain is a former (historical) floodplain that has been colonized by riparian vegetation habitat.

The California side of the river channel is characterized by steep, sandy banks with dense vegetation with narrow sandy beaches occurring in scattered locations. Along the California side of the channel, north of the Park Moabi Slough, the banks have been modified to create elevated campgrounds and low sandy beaches (CH2M HILL, 2013d).

Within the Action Area, most of the northern banks of the Park Moabi Slough are characterized by open sandy beaches that are routinely maintained as part of the park operations. Vegetated areas along the north shoreline are limited to the low terrace at the western edge of the survey area. The south banks of Park Moabi Slough are characterized by developed beaches, vacation cabins, boat docks, and boat ramps associated with the Pirate's Cove Resort and Park Moabi. East of the developed areas, the south shore of the slough is characterized by relatively steep sandy and rocky banks with dense vegetation. As with the main channel of the Colorado River, patches of emergent vegetation occur in some locations along the edges of the slough. Park Moabi Slough is a direct tributary to the Colorado River and is also used for interstate commerce including recreational boating and fishing (CH2M HILL, 2013d). Open water associated with the Colorado River and Park Moabi Slough account for approximately 11 percent of Action Area.

4.1.1 Vegetation Communities and Land Cover Types

Most of the Action Area is located in the Piute Valley-Sacramento Mountains ecological subsection of Mojave Desert Ecological Section (Miles and Goudey, 1998). Approximately half of this subsection is characterized by steep mountains, moderately sloping piedmonts, and alluvial fans, with the remaining half of the subsection characterized by alluvial plains and a nearly level basin floor (Miles and Goudey, 1998).

An area approximately 50 acres in size within the HNWR was burned during the 2008 Sacramento Wash wildfire. In 2011, USFWS mechanically cleared this area of dead trees and much of the woody debris was chipped and spread over the site (Digital-Desert, 2013). This area was essentially devoid of vegetation at the time of the 2012 floristic survey (GANDA and CH2M HILL, 2013a). However, when this area was observed in December 2013, vegetative restoration with native plants (Digital-Desert, 2013) had been initiated to the west of the unpaved roadway. The restoration plantings of the area between the unpaved roadway and the Oatman-Topock Highway had not yet begun and this area was dominated by an invasive plant, Russian thistle (*Salsola tragus*).

Ten primary terrestrial plant community types and three major wetland communities occur within the Action Area. The primary terrestrial plant community types are creosote bush scrub, tamarisk thickets, arrow weed thickets, blue palo verde woodlands, catclaw acacia thorn scrub, hillside palo verde scrub, allscale scrub, quailbush scrub, western honey mesquite bosque, and screwbean mesquite bosque. The primary wetland communities include California bulrush marshes, cattail marshes, and common reed marshes. Descriptions of these primary plant communities are provided in the following subsections. A detailed vegetation map with additional community types found in the Action Area is provided in Figure 8.

2008
Burn Area

Reference:
[1] Sawyer, J. O., T. Keeler-Wolf, and J. M. Evens. 2009. A manual of California vegetation, 2nd ed. California Native Plant Society, Sacramento, CA.

Aerial Image Source:
Toponex Inc. aerial flyover, conducted August 2011

Note:
The vegetation community mapping was limited to the EIR Project Area and additional areas in Arizona that were evaluated as part of the Freshwater Implementation Plan.

N

0 700 1,400 2,800 Feet

LEGEND

PBA Update Action Area

Vegetation Types

- Desert Lilly
- Allscale Scrub (MCV2[1]: Allscale scrub) [1]
- Arrow Weed (MCV2: Arrow weed thickets)[2]
- Athel Tamarisk (MCV2: Tamarisk thickets)[3]
- Blue Paloverde (MCV2: Blue palo verde-Ironwood woodland)[4]
- Blue Paloverde/Catclaw Acacia (MCV2: Blue palo verde-Ironwood woodland)[5]
- Blue Paloverde/Honey Mesquite (MCV2: Blue palo verde woodland)[6]
- Broad-leaved Cattail (MCV2: Cattail marshes)[7]
- California Bullrush (MCV2: California bulrush marsh)[8]
- Catclaw Acacia (MCV2: Catclaw acacia thorn scrub)[9]
- Common Reed (MCV2: Common reed marshes)[10]
- Creosote bush scrub (MCV2:Creosote bush scrub)[11]
- Creosote Bush/Cattle Saltbush (MCV2: Allscale scrub)[12]
- Desert Smoke Tree (MCV2: Blue palo verde-Ironwood woodland)[13]
- Developed/Disturbed[14]
- Giant Reed (MCV2:Giant reed breaks)[15]
- Hillside Paloverde (MCV2: Foothill palo verde desert scrub)[16]
- Honey Mesquite (MCV2: Mesquite bosque)[17]
- Landscaped[18]
- Open Water [19]
- Quailbush Scrub (MCV2: Quailbush scrub)[20]
- Salt Cedar (MCV2: Tamarisk thickets)[21]
- Salt Cedar/Arrow Weed (MCV2: Tamarisk/Arrow weed thickets)[22]
- Salt Cedar/Athel Tamarisk (MCV2: Tamarisk thickets)[23]
- Salt Cedar/Honey Mesquite (MCV2: Tamarisk thickets/Mesquite bosque)[24]
- Salt Cedar/Honey Mesquite/Blue Paloverde (MCV2: Tamarisk thickets/Mesquite bosque/Blue palo verde-Ironwood woodland)[25]
- Salt Cedar/Screwbean Mesquite (MCV2: Tamarisk thickets/ Screwbean mesquite bosque)[26]
- Screwbean Mesquite (MCV2: Screwbean mesquite bosque)[27]
- Wetland [28]

FIGURE 8
VEGETATION COMMUNITIES
FINAL GROUNDWATER REMEDY
PROGRAMMATIC BIOLOGICAL ASSESSMENT
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2013\PBA\2013Q4\FIG8_VegCommunities.mxd Date Saved: 1/7/2014 10:45:13 AM

4.1.2 Terrestrial Communities

The following descriptions were summarized from the *Revised Final Floristic Survey Report* (GANDA and CH2M HILL, 2013a). It should be noted that the area surveyed for that report was limited to the portions of the Action Area in California and Arizona that were associated with proposed or existing investigative or remedial activities. The floristic survey area included additional areas outside of the Action Area that were associated with the Freshwater Implementation Plan.

4.1.2.1 Creosote Bush Scrub

The most common and widespread plant community in the Action Area is creosote bush scrub. This vegetation type is characterized by widely spaced creosote bush (*Larrea tridentata*) with associated species such as white bursage (*Ambrosia dumosa*), white rhatany (*Krameria bicolor*), brittlebush (*Encelia farinosa*), beavertail cactus (*Opuntia basilaris* var. *basilaris*), and silver cholla (*Cylindropuntia echinocarpa*). Creosote bush scrub occurs throughout the dissected alluvial terraces within the Action Area.

4.1.2.2 Tamarisk Thicket

Tamarisk thicket is found primarily on the east side of the Oatman-Topock Highway in the Sacramento Wash and along the low sandy terraces adjacent to the Colorado River and the inlet to Park Moabi Slough. This vegetation type is also found near the terminus of the larger ephemeral washes along the Colorado River and south of the National Trails Highway. Vegetation is characterized by open to dense stands of the non-native and invasive tamarisk (*Tamarix ramosissima*) and/or athel tamarisk (*Tamarix aphylla*). In many locations tamarisk or athel tamarisk occur as monospecific stands; in other areas associated trees and shrubs include western honey mesquite (*Prosopis glandulosa* var. *torreyana*), screwbean mesquite (*Prosopis pubescens*), blue palo verde (*Parkinsonia florida*), and arrow weed (*Pluchea sericea*). Herbaceous vegetation is absent within dense thickets of tamarisk and athel tamarisk, but scattered herbaceous species such as fanleaf crinklemat (*Tiquilia plicata*), Spanish needle (*Palafoxia arida*), and *Cryptantha* spp. are often present in the openings between the trees in some areas.

4.1.2.3 Arrow Weed Thicket

Arrow weed thicket is found on the low sandy terraces along the Colorado River and Park Moabi Slough. Arrow weed is the sole dominant shrub species with individuals widely scattered or aggregated into dense, nearly impenetrable stands. It is most common along the Colorado River in California north of Interstate 40 and in Arizona north of the Topock Marsh Inlet and often intermixes with tamarisk thickets and mesquite bosque. Associated species include tamarisk, smoke tree (*Psorothamnus spinosus*), western honey mesquite, brittlebush, and desert broom (*Baccharis sarothroides*). Scattered herbaceous vegetation in the more open areas includes fanleaf crinklemat, Spanish needle, *Cryptantha* spp., and Mediterranean grass (*Schismus barbatus*).

4.1.2.4 Blue Palo Verde Woodland

Blue palo verde woodland occurs along the edges and throughout the channel bottoms of the larger ephemeral washes in the dissected alluvial terraces south of the Colorado River. This vegetation type is also present in Arizona in the northern and eastern parts of the Action Area on the HNWR. Total vegetation cover is generally low, but species diversity is relatively high, especially in the larger washes, as compared to the other vegetation types in the project area. Blue palo verde is the dominant tree with scattered individuals of tamarisk, athel tamarisk, and smoke tree also present in some areas. Associated shrubs include catclaw acacia (*Senegalia greggii*), Anderson's desert thorn (*Lycium andersonii*), brittlebush, sweetbush (*Bebbia juncea* var. *aspera*), cheesebush (*Hymenoclea salsola*), climbing milkweed (*Funastrum hirtellum*), desert lavender (*Hyptis emoryi*), white bursage, white rhatany, and creosote bush. Common herbaceous species include small-seeded spurge (*Chamaesyce polycarpa*), small-flowered California poppy (*Eschscholzia minutiflora*), Emory rock daisy (*Perityle emoryi*), Spanish needle, and Arizona lupine (*Lupinus arizonicus*).

4.1.2.5 Catclaw Acacia Thorn Scrub

In the Action Area, catclaw acacia thorn scrub is limited to the bottoms of moderate-sized ephemeral washes in the dissected terraces south of the National Trails Highway. This vegetation type is characterized by widely scattered shrubs dominated by catclaw acacia. Common associated species include Anderson's desert thorn, brittlebush, sweetbush, cheesebush, desert lavender, white bursage, white rhatany, and creosote bush. Herbaceous species include small-seeded spurge, Arizona lupine, and Spanish needle.

4.1.2.6 Hillside Palo Verde Scrub

Hillside palo verde scrub is restricted to a small area east of the compressor station along the slopes of the Chemehuevi Mountains. Vegetation in this area is characterized by scattered hillside palo verde (*Parkinsonia microphylla*). Associated species in this area include creosote bush, pygmy-cedar (*Peucephyllum schottii*), brittlebush, white rhatany, beavertail cactus, buckhorn cholla (*Cylindropuntia acanthocarpa*), California barrel cactus (*Ferocactus cylindraceus* var*. cylindraceus*), and inflated desert trumpet (*Eriogonum inflatum* var*. inflatum*).

4.1.2.7 Quailbush Scrub

Quailbush scrub is dominated by big saltbush (*Atriplex lentiformis*) and occurs on low-lying alkaline or saline soils. This community is most common in Arizona, where it occurs in the HNWR west of the Oatman-Topock Highway. The only common associate at this site is bush seepweed (*Suaeda moquinii).* A small area of Quailbush scrub also occurs in Arizona near the Colorado River at the foot of the southernmost natural gas pipeline bridge.

4.1.2.8 Allscale Scrub

Allscale scrub is dominated by cattle saltbush (*Atriplex polycarpa*) and is the most common alkaline-tolerant shrubland alliance in the project area. In the Action Area, allscale scrub is most common along the National Trails Highway south of the Park Moabi Slough and Colorado River confluence. In Arizona, a small area of allscale shrub is also present south of the pipeline bridge and cattle saltbush is the characteristic shrub in a large open area on the east side of the BNSF railroad tracks.

4.1.2.9 Western Honey Mesquite Bosque

Western honey mesquite bosque is mostly found on the low sandy terraces along the Colorado River in California north of Interstate 40 and in Arizona north of the Topock Marsh Inlet, where it occurs intermixed with tamarisk thickets, but also occurs in a few scattered locations in the HNWR on the east side of the Oatman-Topock Highway in Arizona.

4.1.2.10 Screwbean Mesquite Bosque

Screwbean Mesquite bosque is almost entirely restricted to the low terraces along the California side of the Colorado River where it is concentrated in three relatively small areas from Moabi Regional Park to the Interstate-40 bridge. It is most abundant along the southwestern shoreline of Park Moabi Slough across from the marina. It is also a principal component of the screwbean/tamarisk thicket vegetation that covers the southern portion of the island to north of the slough. It is common on the California side of the Colorado River near the BNSF railroad bridge. Along the narrow inlet of Park Moabi Slough, it is locally common and near the cattail marshes. Screwbean mesquite was also planted as part of vegetation restoration between the Topock Marsh and the unpaved roadway on the HNWR following a 2008 Sacramento Wash wildfire.

4.1.3 Wetland Plant Communities

The following descriptions were summarized from the *Wetlands and Waters of the United States Delineation for the Topock Compressor Station Groundwater Remediation Project, San Bernardino County, California* (CH2M HILL, 2013d). Similar to the previously discussed Floristic Report, the area surveyed for the wetland delineation report included only the portions of the Action Area in California and Arizona that were associated with proposed or existing investigative or remedial activities.

The delineation mapped and characterized riverine (i.e., flowing water) and palustrine (i.e., ponded water) features with their own vegetation communities, as summarized in the following subsections.

4.1.3.1 Riverine Features

Under the classification system developed by Cowardin et al. (1979), riverine features include "all wetlands that are contained within a channel, with the exception of channelized wetlands dominated by over 30 percent cover of trees, shrubs, or persistent emergent vegetation and channels containing ocean-derived salts…" Under this classification system, a channel is defined as "an open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of water".

Riverine features identified in the Action Area include Lower Perennial features and Intermittent classes. The Lower Perennial Riverine features are non-tidal, low gradient rivers and streams with slow water velocity, sandy or muddy substrates, and at least some water flow throughout the year and are represented by the Colorado River and Park Moabi Slough. The Intermittent features are channels that contain flowing water for only part of the year and include the Sacramento Wash, Bat Cave Wash, and other ephemeral washes and drainages that occur throughout the dissected terraces within the Action Area (primarily west of the Colorado River).

Both the Colorado River and Park Moabi Slough were considered to be traditional navigable waters based on their use for recreational boating including the Pirate's Cove Resort Marina and the Topock Marina (USACE, 2007). Because the state line between California and Arizona is located near the center of the Colorado River, the river is also an interstate water body. Interstate commerce associated with the river includes recreational boating, camping, and fishing. Ephemeral washes that are direct tributaries to the Colorado River or the Topock Marsh are considered to be non-wetland waters of the United States.

The alluvial terraces located along the south side of the Colorado River and north of the Chemehuevi Mountains are characterized by numerous incised drainage channels and ephemeral washes. One of the largest ephemeral drainages within the Action Area is Bat Cave Wash, a primarily north-south-trending channel immediately west of the PG&E TCS. Bat Cave Wash is shown as an intermittent blue line stream on the USGS Topock topographic quadrangle map and is also shown as an intermittent stream in the National Hydrologic Dataset (NHD). Vegetation in the upper reaches is sparse consisting of scattered shrubs such as Cooper's box-thorn (*Lycium cooperii*), catclaw acacia, and desert lavender. As the wash continues down slope, the channel broadens to over 190 feet wide in some areas and multiple low-flow channels are present throughout the active floodplain. Vegetation cover also increases down slope with blue palo verde and tamarisk trees scattered throughout the active floodplain. Other common shrubs on or immediately adjacent to the active floodplain include brittlebush, creosote bush, white bur-sage, sweetbush, and white rhatany.

A second large ephemeral wash, located to the northwest of Bat Cave Wash, is not shown as a blue line stream on the USGS Topock quadrangle map or as a mapped feature in the NHD. The active floodplain of this channel ranges from approximately 100 feet to 240 feet wide and is characterized by a sandy-pebble-cobble substrate with multiple low-flow channels. Scattered perennial vegetation throughout the channel includes blue palo verde, catclaw acacia, Cooper's box-thorn, sweetbush, creosote bush, white rhatany, and cheesebush. Similar to Bat Cave Wash, there is a dense thicket of tamarisk and honey mesquite at the northern (down slope) end of the wash feature. Evidence of flow observed in this area included a defined

bed and bank, scouring, drift/debris deposits, benches and sand/silt deposits. A large earthen dam has been constructed near the downstream terminus of this feature and there is no longer a direct hydrologic connection to the Colorado River. A perennial pond is located immediately north of the dam that is connected to a small wetland adjacent to the Colorado River via a large culvert that passes under the National Trails Highway. This pond and the adjacent wetland are described in more detail in the following subsection under Palustrine wetlands.

Several additional smaller, incised tributary drainages flow directly into either Bat Cave Wash or into the unnamed western wash system within the Action Area. These channels are characterized by a single low-flow channel and generally have sandy-gravel, cobble, or rocky substrates. Most of the low-flow channels are devoid of vegetation or have only sparse scattered herbaceous species such as spurge, Spanish needle, ovate plantain (*Plantago ovata*), and needle gramma (*Bouteloua aristidoides* var. *aristidoides*). Common trees and shrubs along the lower slopes and channel edges in these areas include blue palo verde, catclaw acacia, Anderson's box-thorn, creosote bush, white bur-sage, white rhatany, and sweetbush.

The Sacramento Wash is located near the northern end of the Action Area east of the Topock Marsh. Within the Action Area, the Oatman-Topock Highway bisects the wash with an at-grade ("Arizona-type") crossing. The Sacramento Wash is shown as a blue line stream on the Topock USGS 7.5-minute quadrangle and as an NHD intermittent stream. Within the Action Area, the Sacramento Wash is a broad, open sandy channel that is largely confined within constructed levees. The channel ranges from approximately 50 to 70 feet wide and has a flat, generally uniform bed that lacks well-defined low-flow channels. There are minor benches and terraces along the channel in a few locations, but there is no active floodplain outside of the channel due to the constructed levees along this section of the wash. On the east side of the Oatman-Topock Highway, the main wash channel is devoid of vegetation with extensive athel tamarisk thickets along both sides of the wash channel. On the west side of the road, the wash continues to flow through a main channel that is confined by levees for approximately 950 feet to where it then broadens out along the floodplain adjacent to the Topock Marsh just west of the Action Area. Some blue palo verde trees are present along the levees on the west side of the road and a few small trees and shrubs including tamarisk, smoke tree, bush seepweed (*Suaeda nigra*), and creosote bush occur within the wash channel.

4.1.3.2 Palustrine Features

Palustrine (ponded) wetlands are nontidal, freshwater wetlands that are vegetated with over 30 percent cover of trees, shrubs, herbaceous vegetation or mosses, and lichens. Also included are wetlands lacking such vegetation but with all of the following four characteristics: 1) the total area is less than 20 acres; 2) there are no active wave-formed or bedrock shoreline features; 3) water depth in the deepest part of basin is less than 6 feet at low water; and 4) salinity due to ocean-derived salts is less than 0.5 parts per thousand (Cowardin et al., 1979). Palustrine wetlands identified in the Action Area included emergent, scrub-shrub, and unconsolidated bottom wetland classes. The Emergent class includes those wetlands that are characterized by erect, rooted, herbaceous plants adapted to grow under flooded and/or saturated conditions. The Scrub-Shrub class includes wetlands that are characterized by trees and shrubs less than 20 feet tall. Unconsolidated Bottom wetlands have sand, silt or mud substrates and less than 30 percent vegetative cover.

Shore zone emergent wetlands include scattered patches of southern cattail (*Typha domingensis*), California bulrush, common reed (*Phragmites australis*), and giant reed (*Arundo donax*) growing along the edges of the Colorado River and Park Moabi Slough, below the ordinary high water line. These shore zone wetlands are most common along the southern banks of the Park Moabi Slough, but are also found along the north banks of the slough in the westernmost part of the Action Area. Shore zone wetlands are less common along the Colorado River and occur in scattered locations along the south/west bank as well as in the vicinity of the Topock Marina. Also included are areas with California bulrush along the outlet of Bat Cave Wash and areas with broad-leaved cattail (*Typha latifolia*) in the outlet of the East Ravine near the southern boundary of the Action Area (CH2M HILL, 2013d).

Adjacent emergent wetlands include wetland features that are immediately adjacent to the Colorado River or Park Moabi Slough, but occur above the ordinary high water and inland of the shore zone wetlands. Four adjacent wetland areas were identified in the Action Area. The first and largest adjacent wetland is located on the south side of the Interstate 40 Bridge on the west side of the Colorado River. This wetland is characterized by a dense monoculture of common reed. Based on the location and elevation of this wetland surface water is likely present in the summer months (May–July) during higher flow levels and so was considered to be seasonally flooded (CH2M HILL, 2013d).

The second adjacent wetland is on the east side of the Colorado River, north of the Topock Marina. This wetland is characterized by a strip of emergent wetland immediately above the shore line and also includes a narrow band of low trees and shrubs further inland. Emergent vegetation is characterized by iris-leaved rush (*Juncus xiphioides*), dallis grass (*Paspalum dilatatum*), and marsh pennywort (*Hydrocotyle verticillata*) with scattered common reed and California bulrush. Given the low topographic position, this area is likely subject to some flooding during higher flows and appears to have saturated conditions in the upper part of the soil for most of the year (i.e., seasonally flooded). Immediately inland, the vegetation is characterized by small tamarisk trees and shrubs, arrow weed, broom baccharis and scattered narrow-leaved willow (*Salix exigua*), and sparse common reed. For these reasons, this area was classified as a scrub-shrub saturated wetlands (CH2M HILL, 2013d).

The third adjacent wetland is on the south bank of the Colorado River, approximately 600 feet downstream of the confluences of the Park Moabi Slough and the Colorado River. This low depressional area is filled with dense growth of southern cattail. A culvert connects this area to a pond on the south side of the National Trails Highway. Given the low topographic position, hydrologic connection to the pond south of the road, and shallow ground water noted at the time of the survey, it is likely that this area is subject to shallow seasonal flooding for part of the year (CH2M HILL, 2013d).

The fourth adjacent wetland occurs on the north side of Park Moabi Slough to the northwest of the Moabi Regional Park parking area and marina. This wetland is located on the landward side of shore zone and is characterized by iris leaved rush, marsh pennywort, and dallis grass with scattered southern cattail. This wetland area appears to be located just above the ordinary high water level, but it is at a low enough elevation that some flooding likely occurs during periods of higher flows and so was considered to be seasonally flooded (CH2M HILL, 2013d).

The Action Area includes a small piece of the southern Topock Marsh located to the north of Interstate 40 in Arizona. In this location the marsh is characterized by dense growth of California bulrush. Surface water to a depth of 7 inches was present at the sample location at the time of the February 2012 survey and the area was considered to be permanently flooded.

As previously mentioned, there is a pond on the south side of the National Trails Highway approximately 800 feet southeast of the confluence of Park Moabi Slough and the Colorado River. An earthen dam separates the pond from the ephemeral wash system that extends to the south. The pond is connected to an adjacent emergent wetland on the north side of the National Trails Highway via a large culvert. The southern half of the pond is characterized by dense growth of southern cattail, while the northern part is open water. Several feet of water was observed in the pond during both the February and July 2012 surveys and so this area was considered to be permanently flooded. A beaver lodge is present near the center of the pond at the edge of the cattails.

There is another small, square pond in the northeast corner of Moabi Regional Park between the boat ramp and the Pirate's Cove Marina, which was created as part of a water-supply project and is immediately adjacent to Park Moabi Slough. With the exception of sparse California bulrush the pond is characterized by open water with tamarisk, honey mesquite, and arrow weed surrounding the pond. Because of the lack of vegetation this feature was considered to be a non-wetland waters of the U.S. (CH2M HILL, 2013d).

Dense thickets of tamarisk are present at the northern ends of larger ephemeral washes south of the National Trails Highway. As previously noted, there is a dense thicket of tamarisk at the northern end of Bat Cave Wash and a dense thicket of tamarisk intermixed with honey mesquite is present at the terminus of the ephemeral wash system west of Bat Cave Wash. These areas are considered to be temporarily flooded wetlands because vegetative cover exceeds 30 percent.

The stormwater impoundment area in the western part of the Action Area, south of Moabi Regional Park, also supports relatively dense tamarisk and blue palo verde with scattered creosote bush and brittlebush. This feature collects water from three ephemeral drainages south of Moabi Regional Park. Evidence of flooding observed in this area during the survey included drainage patterns, drift deposits, large mud cracks and extensive debris at the 48-inch-diameter culverts in the northeast corner. This area was also considered to be temporarily flooded wetland (CH2M HILL, 2013d).

Based on the information above, the Action Area in California was divided into three primary habitat types as shown in Figure 9 that correspond to habitats that would be used by the PBA-listed species: uplands; historical river floodplain; and current river floodplain. Upland habitats include all undeveloped areas with upland vegetation that could be potentially suitable habitats for desert tortoise. Upland habitats include the ephemeral washes, but specifically exclude the historical and current river floodplains. The historical river floodplain is the zone with riparian vegetation including mesquite, tamarisk, and arrow weed patches. In the Action Area, the historical river floodplain is found between MW-20 Bench and National Trails Highway and the 100-year floodplain (see Figure 9) and has portions of dune-like habitat where dredge sands were deposited. This habitat may potentially suitable for use by southwestern willow flycatcher and western yellow-billed cuckoo. The current river floodplain includes all the area inside of the 100-year floodplain of the Colorado River. In general, these include adjacent (emergent marsh) wetlands such as that at the outlet of East Ravine and in smaller patches along the river's edge. The emergent marsh habitats are potentially suitable for Yuma clapper rail and the aquatic habitats are potentially suitable for the razorback sucker, and bonytail chub.

4.1.4 Special-Status Plants in the Action Area

Potential special-status plants in the Action Area were considered as part of the Environmental Impact Report (AECOM, 2011). Special-status plants that were identified within the Action Area are documented in the *Revised Final Floristic Survey Report* (GANDA and CH2M HILL, 2013a) and shown in Figure 9. It should be noted that the area surveyed for this report included only the portions of the Action Area in California and Arizona that were associated with proposed or existing investigative or remedial activities. The floristic survey area also included additional areas outside of the Action Area that were associated with the Freshwater Implementation Plan.

No federal or state listed endangered, threatened, or rare plants and no BLM sensitive species were found in the project area. Five species, including four plants with California Rare Plant Ranks (CRPR) of 2B and one plant with a rank of 4, were identified in the project area (Table 4). Two of these (mousetail suncup and hillside palo verde) were found in California and three (spiny-haired blazing star, small flowered androstephian, and gravel milkvetch) were found only in Arizona. A total of 14 plants that are protected under the California Desert Native Plants Act were identified in the project area (Table 4). No plants identified in the Arizona Rare Plant Field Guide were found in the Action Area.

TABLE 4
Summary of Special-Status Plants Identified in the Project Area

Common Name	Scientific Name	Status	Estimated Number in the Project Area
Trees			
Blue palo verde	*Parkinsonia florida*	CDNPA	700 +
Catclaw acacia	*Senegalia greggii*	CDNPA	250 +
Desert smoke tree	*Psorothamnus spinosus*	CDNPA	50
Hillside palo verde	*Parkinsonia microphylla*	CRPR 4.3 / CDNPA	100 -150
Screwbean mesquite	*Prosopis pubescens*	CDNPA	150 +
Western honey mesquite	*Prosopis glandulosa* var. *torreyana*	CDNPA	200
Shrubs			
Desert holly saltbush	*Atriplex hymenelytra*	CDNPA	3
Cacti			
Beavertail prickly pear	*Opuntia basilaris* ssp. *basilaris*	CDNPA	>500
Buckhorn cholla	*Cylindropuntia acanthocarpa* var. *coloradensis*	CDNPA	30
California Barrel Cactus	*Ferocactus cylindraceus* var. *cylindraceus*	CDNPA	65
Corkseed mammillaria	*Mammillaria tetrancistra*	CDNPA	50
Ocotillo	*Fouquieria splendens*	CDNPA	8
Teddy bear cholla	*Cylindropuntia bigelovii*	CDNPA	2
Silver cholla	*Cylindropuntia echinocarpa*	CDNPA	200
Herbs			
Mousetail suncup	*Chylismia arenaria*	CRPR 2.2	12
Small-flowered androstephium*	*Androstephium breviflorum*	CRPR 2.2	70 +
Spiny-hair blazing star*	*Mentzelia tricuspis*	CRPR 2.1	5
Gravel milkvetch*	*Astragalus sabulonum*	CRPR 2.2	1

*Species found only in Arizona within the limits of the project area.
CNDPA = California Desert Native Plants Act

4.1.5 Federal or State Listed Plants

No federal or state listed endangered, threatened, or rare plants or candidates for listing were found in the project area.

4.1.5.1 Bureau of Land Management Sensitive Plants

BLM has designated a category of special-status plants termed “sensitive.” Such plants are not federally endangered, threatened, or proposed, but are designated by the BLM State Director for special management consideration. In California this category includes all plants that are Federal Candidates for listing, all plants that are listed as Endangered, Threatened, or Rare by the State of California, and all plants that are ranked as 1B in the Inventory of Rare and Endangered Plants of California (CNPS, 2010), unless the State Director has determined that a particular taxon should be excluded from sensitive status. Based on the literature and database reviews, only four BLM sensitive species were considered to have the potential to occur in the project area: Harwood’s woolly star (*Eriastrum harwoodii*), Kofa Mountain barberry (*Berberis harrisoniana*), white-margined penstemmon (*Penstemmon albomarginatus*) and Howe's hedgehog cactus (*Eichenocereus engelmannii* var. *howei*). None of these species was found during the surveys within the Action Area.

4.1.5.2 California Rare Plant Ranked Species

CRPRs are used to define and categorizes degrees of concern regarding rarity in the California Flora. Plants that have been ranked as 2B are considered to be rare, threatened or endangered in California, but more common elsewhere (outside of the state). Plants assigned this ranking meet the definitions of a threatened or endangered species under sections 2062 and 2067 of the California Endangered Species Act and are eligible for listing.

Plants that have been ranked as 4 included species that have a limited distribution or have infrequent occurrences over a broad region in California. Plants assigned this rank are generally not eligible for listing under the California Endangered Species Act, but are uncommon enough that their status warrants monitoring. In general, however, many are locally important or represent populations that are at the periphery of the species range.

In addition to Rare Plant Ranks, plants are also assigned a Threat Rank to designate the degree in which the species is threatened. A threat rank of .1 indicates the species is seriously threatened, whereas a rank of .2 indicates a moderate threat level, and a rank of .3 indicates that a species is not very threatened in California.

Five CRPR plants were identified in the Action Area (Table 4). Two species, mousetail suncup (CPRP 2.2) and hillside palo verde (CRPR 4.3), were discovered in California and the other three species, spiny-haired blazing star (CRPR 2.1), small-flowered androstephium (CRPR 2.2), and gravel milkvetch (CRPR2.2) were found only in Arizona.

Mousetail suncup was found in Survey Segments C, D, and H. The largest population (with approximately nine individuals) is located on a vertical conglomerate rock wall above Bat Cave Wash (Figure 9). Single individuals also occur on a conglomerate rocks above the wash south of Interstate 40 and on a granitic rock face at the southern end of the wash. It also occurs on a steep rocky slope next to the BNSF railroad tracks (Figure 9). These populations represent a significant range extension for the species as they are over 90 miles northeast of previously recorded populations in California (Jepson Online Interchange, n.d.).

Hillside palo verde was found in areas to the south of Interstate 40 on the rocky north-facing slopes of the Chemehuevi Mountains (Figure 9). The number of individuals in this population is approximately 150 trees.

The other three species were all found in the Arizona portion of the Action Area to the south and east of the Topock Marsh. A few individuals of spiny-haired blazing star were identified on the rocky slopes just west of the BNSF railroad tracks. Approximately 70 individuals of small-flowered androstephium were observed in sandy soils on the west side of the BNSF railroad tracks and a single gravel milkvetch plant was found adjacent to the Sacramento Wash on the east side of the Oatman-Topock Highway (Figure 9). While listed as rare species in California these plants have no special-status ranking in Arizona. However, these plants may be locally important as they are likely near the western extent of their natural range.

4.1.5.3 Plants with Special Status in Arizona

The Arizona Rare Plant Field Guide includes over 125 species of plants that are considered rare in Arizona, including 26 species that occur in Mohave County (Arizona Rare Plant Committee, 2001). All but one of the rare plants listed for Mohave County are found in the northern and eastern parts of the county and were not considered likely to occur. The only Arizona rare plant that was considered to possibly occur in the project area is white-margined beardtongue, which was not found during multiple site surveys within the Action Area.

LEGEND

- PBA Update Action Area
- Vegetation Survey Area

Plant Species

Common Name:	Scientific Name:
Hillside Palo Verde	*Parkinsonia microphylla*
Small-flowered androstephium	*Androstephium breviflorum*
Mousetail suncup	*Chylismia arenaria*
Spiny-haired blazing-star	*Mentzelia tricuspis*
Gravel milkvetch	*Astragalus sabulonum*

Note: The rare/ranked plant mapping was limited to the EIR Project Area and additional areas in Arizona that were evaluated as part of the Freshwater Implementation Plan

N

0 1,000 2,000 4,000 Feet

FIGURE 9
CALIFORNIA RARE PLANTS/ RANKED PLANTS

Final Groundwater Remedy
Programmatic Biological Assessment
PG&E Topock Compressor Station
Needles, California

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2013\PBA\2013Q4\FIG9_RarePlants.mxd Date Saved: 3/10/2014 10:56:21 AM

4.1.6 Wildlife in the Action Area

The aquatic habitat of the Colorado River supports several game fish species including striped bass (*Morone saxatillis*), largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), white crappie (*Pomoxis annularis*), flathead catfish (*Pylodictis olivaris*), and channel catfish (*Ictalurus punctatus*) (AECOM, 2011).

The diversity and abundance of wildlife species encountered are influenced by the proximity of the Action Area to the creosote-dominated desert and the Topock Marsh, a large wetland with abundant wildlife (GANDA, 2012). Avian species commonly associated with the river include American coot (*Fulica americana*), mallard (*Anas platyrhynchos*), pied-billed grebe (*Podilymbus podiceps*), great egret (*Casmerodius albus*), great blue heron (*Ardea herodias*), northern rough-winged swallow (*Stegidopteryx serripennis*), and belted kingfisher (*Ceryle alcyon*). Other avian species found in the upland areas include red-tailed hawk (*Buteo jamencensis*), Gambel's quail (*Callipepla gambelii*), mourning dove (*Zenaida macroura*), white-winged dove (*Zenaida asiatica*), common raven (*Corvus corax*), song sparrow (*Melospiza melodia*), Canyon wren (*Catherpes mexicanus*), brewer's blackbird (*Euphagus cyanocephalus*), great-tailed grackle (*Quiscalus mexicanus*), turkey vulture (*Cathartes aura*), greater roadrunner (*Geococcyx californianus*), lesser nighthawk (*Chordeiles acutipennis*), rock dove (*Columba livia*), verdin (*Auriparus flaviceps*), and black-tailed gnatcatcher (*Polioptila melanura*) (AECOM, 2011; GANDA, 2012).

Observations during the 2012 avian surveys also included detections of Yuma clapper rail (*Rallus longirostris yumanensis*), Arizona Bell's vireo (*Vireo bellii arizonae*), brownheaded cowbird (*Molothrus ater*), and the discovery of a great blue heron nest (GANDA, 2012).

Mammals that may occur in the Action Area include deer mouse (*Peromyscus maniculatus*), Merriam kangaroo rat (*Dipodomys merriami*), whitetail antelope squirrel (*Ammospermophilus leucurus*), desert woodrat (*Neotoma lepida*), California ground squirrel (*Spermophilus beecheyi*), desert cottontail (*Sylvilagus audubonii*), Audubon's cottontail (*Sylvilagus audubonii)*, black-tailed hare (*Lepus californicus*), coyote (*Canis latrans*), desert kit fox (*Vulpes macrotis*), American badger (*Taxidea taxus*), bobcat (*Lynx rufus*), striped skunk (*Mephitis mephitis*), beaver (*Castor canadensis*), raccoon (*Procyon lotor*), burro (*Equus asinus*); and bighorn sheep (*Ovis canadensis nelsoni*) (AECOM, 2011; GANDA, 2012; CH2M HILL, 2013e).

Reptiles that may occur in the area include chuckwalla (*Sauromalus obesus*), side-blotched lizard (*Uta stansburiana*), western whiptail lizard (*Cnemidophorus tigris*), zebra-tailed lizard (*Callisaurus draconoides*), desert iguana (*Dipsosaurus dorsalis*), coachwhip (*Masticophis flagellum*), gopher snake (*Pituophis melanoleucus*), and western diamondback rattlesnake (*Crotalus atrox*) (AECOM, 2011; GANDA, 2012).

4.2 Environmental Baseline

The environmental baseline for the Action Area includes the past and present impacts of all federal, state, or private actions and other human activities, the anticipated impacts of all proposed federal projects that have already undergone formal or early Section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation process (50 CFR 402.02). The Action Area for the environmental baseline evaluated here includes the entire geographic area encompassed by both the 2007 PBA and the 2012 Reinitiated PBA (see Figure 2). For the purpose of this Final Groundwater Remedy PBA, the potential impacts to listed species that are related to planned activities that were discussed in Section 3.0, as well as current and ongoing activities, are included in this ESA consultation.

Over time, the Colorado River corridor within the Action Area has undergone many changes influenced by past and present federal, state, or private actions that constitute the environmental baseline.

Within California, the Action Area is irregularly shaped and includes land to the north and south of Interstate 40 for approximately 1.7 miles west of the Colorado River. To the south of the highway, it encompasses the PG&E TCS, a pipeline metering station (Transwestern), a rock quarry, and four lined evaporation ponds (see Figure 4).

On the Arizona side, the Action Area includes the area between the Colorado River and western margin of Topock Marsh (north of its inlet). To the south of Topock Marsh, it extends approximately 1,500 feet east of the Colorado River and includes land along the north and south side of the BNSF railroad for approximate 0.75 mile east of the river. It also includes land on the east side of the Oatman-Topock Highway for approximately 1 mile north of the point where it diverges east of the Topock Marsh (Figure 2). An unpaved roadway extends through this area in a north-northwest direction from the Oatman-Topock Highway. The Topock Marina operates a resort here and there are several private residences also located on the Arizona side of the river, near the BNSF railroad and Interstate 40 bridges.

As shown in Figure 3, land ownership in the Action Area includes parcels owned by PG&E, as well as lands owned and/or managed by federal and local government agencies such as BLM, USFWS (HNWR), USBR, and the Metropolitan Water District of Southern California. The Interstate 40 right-of-way in California is leased by the California Department of Transportation from USBR land that is managed by USFWS. The Moabi Regional Park and Pirate's Cove Resort is located on BLM land that is leased by San Bernardino County. The Action Area also includes the TCS site owned by PG&E and land owned by the Fort Mojave Indian Tribe, as well as privately owned parcels in Arizona.

BLM manages the federally owned land north of the BNSF railroad and west of the Colorado River. This includes lands managed on behalf of USBR. USFWS manages the HNWR located in California immediately north, south, west, and east of the TCS. The HNWR is also located in the southern and eastern portions of the Action Area and includes most lands located on the Arizona side of the Colorado River. Outside of the Action Area, the 37,515-acre HNWR extends for approximately 30 miles along the Colorado River, from Needles, California, to Lake Havasu City, Arizona.

The Action Area includes land within the HNWR. Recreational activities within the HNWR include sightseeing, boating, bird watching, fishing, and hunting. Prior damming and channelization of the Colorado River have significantly altered the aquatic, marsh, and riparian habitats associated with the river. These water control and diversion actions have also contributed to increased housing development along the river and facilitated an increase in the intensity of river-related recreation (including recreational boating, fishing, and hunting) (USBR, 2004).

The Colorado River has been stocked with various game fish that have been linked to predation of native, listed fish species (USBR, 2004). The invasion of tamarisk along the Colorado River has significantly altered riparian habitat. This exotic tree dominates and displaces native plant communities. USBR is responsible for managing the river and has consulted with USFWS on its actions. Several biological opinions have been issued to USBR (USFWS, 1997a; 1997b; 2002a; 2005a). The Lower Colorado River Multi-Species Conservation Plan was developed for the Colorado River (USBR, 2004).

4.2.1 Historical Setting and Activities within the Action Area

By 1852, the first steamboat traveled up the Colorado River to resupply Fort Yuma. This marked the beginning of the steamboat trade that would have profound effects on the mature riparian areas along the river. The Colorado River Gold Rush began in 1862 (Lingenfelter, 1978). The gold rush fueled steamboat trade along the lower Colorado River. Initially, downed, dried cottonwood, willow, and mesquite trees were used as fuel for the steamboats (Ives, 1861). Increased river traffic soon used all of the available wood debris, and crews began cutting down large quantities of cottonwoods, willows, and mesquites. By 1890, most of the large cottonwood-willow stands and mesquite bosques had been cut down (Ohmart et al., 1988; Grinnell, 1914). The railroad crossing at Needles by the Atlantic and Pacific Railroad in 1883 resulted in the end of steamboat trade along the lower Colorado River (LaRue, 1916).

Tamarisk was introduced as an ornamental tree into the United States in the late 1800s and soon escaped cultivation. Expansion of its range was rapid and by 1920 tamarisk had appeared along the mainstem of the Colorado River (DeLoach, 1989; Ohmart et al., 1988). This species adapted to the altered riverine ecosystem and displaced native riparian species throughout the lower Colorado River. Important wildlife habitats,

including the cottonwood-willow gallery forests, have all but disappeared from the mainstem of the Colorado River and have been replaced by the tamarisk (Anderson and Ohmart, 1984).

In 1910, Joseph Grinnell led a 3-month expedition from Needles to Yuma to collect data on mammals, birds, and associated habitats. The expedition provided one of first detailed accounts of the flora and fauna of the lower Colorado River. Grinnell documented the loss of riparian habitat to agriculture during his expedition (Grinnell, 1914).

Starting in the 1930s, federal actions included the channelization of the Colorado River and the construction of several dams, including the Hoover Dam, Parker Dam, and Davis Dam. The changes to the natural river flows significantly altered available fish habitats and reduced the river's ability to meander and create or destroy backwaters and marshes. Alleviating the threat of floods also allowed for conversion of riparian areas to agricultural uses. In addition, USBR implemented intermittent riverbank stabilization and dredging programs from 1951 to present. As part of the mitigation for the various river control projects, USBR has undertaken projects to improve and enhance backwater and marsh areas, including the Topock Marsh within and adjacent to the Action Area (USBR, 1996, 2000, 2002, 2004).

Significant changes to the Colorado River hydraulic regime have occurred in the vicinity of the Action Area. With the completion of Hoover Dam in 1936, annual spring floods and associated scouring events ended. With the closure of Parker Dam in 1938 and subsequent filling of Lake Havasu, the Colorado River channel between Needles and Topock rapidly aggraded (Metzger and Loeltz, 1973) and by 1944, this had caused elevated groundwater levels and flooding in low-lying areas. These issues required USBR to conduct an extensive program of dredging to maintain river channel geometry and to reduce flooding of adjacent areas.

USBR began emergency levee modifications around Needles in the mid- to late 1940s. Between 1949 and 1953, USBR implemented a formal program to dredge the Colorado River from Needles to the Topock area to open the channel. Between 1953 and 1960, USBR moved dredging operations upstream to remove additional sediments in the Big Bend to Needles river reach in order to prevent those sediments from moving downstream. Additional maintenance dredging of the river channel in the Topock area was continued until 1961 (CH2M HILL, 2013d).

Another major dredging program was completed by USBR in the Action Area between 1965 and 1968. Historical photographs from this period indicate that much of the present shoreline and bank stabilization features on both sides of the Colorado River were created at this time. The USBR program began with the construction of an active water management system that included a diversion structure and excavated inlet channel to divert water from the river into Topock Marsh. Jetties were then constructed upstream of the inlet (at a roughly right angles to the Arizona shoreline) to form a narrower channel and cause the river to flow faster past the inlet in order to scour the sand bar at the Topock Marsh inlet and keep it open.

Dredged river sands were placed on the east and west sides of the river that created the existing sand dune-like features. On the California side of the Colorado River, this area is outside of the 100-year floodplain and is referred to as the historical river floodplain. Boulder rip-rap, some of which was mined from the rock quarry in the south central portion of the Action Area (Figure 7), was also placed along the sides of the river to prevent erosion of the banks. The Park Moabi Slough was also excavated by USBR at this time. However, additional subsequent dredging by San Bernardino County is what rendered the Park Moabi Slough in its current configuration (CH2M HILL, 2013d).

Large-scale historical transportation projects have also been part of the Action Area. For example, Historic Route 66 originally traversed the Action Area in the 1920s and portions of its former alignment are evident just south of Interstate 40 alignment on both the Arizona and California sides of the Colorado River. Historic Route 66 formerly crossed the river on the white steel-arch bridge that is currently used as a pipe bridge. Within California, the Historic Route 66 ran along a terrace above the Colorado River from the bridge to the west and north to where it joined the current National Trails Highway alignment and followed a northward alignment beneath the current Interstate 40 and BNSF bridges. Approximately 0.25 mile north, the Historic

Route 66 alignment turns west, as it mounts the terrace hillside by way of a pair of broad switchbacks before taking a predominantly western track to where it intercepts Park Moabi Road. The historic highway's visible trace within the Action Area also ends at this point. By the 1970s, Historic Route 66's longest intact stretch was largely replaced by five different interstate highways. The last stretch in Arizona was decommissioned when Interstate 40 was completed in 1984, and the remnants of the route are protected under the 1999 Route 66 Preservation Bill (Crapanzo, 2010).

The current BNSF railroad alignment was originally part of a transcontinental railway system that first linked Chicago to Southern California. It was originally built by the Atchinson Topeka and Santa Fe Railroad (later to become BNSF) and dates back to the late 1880s. Both the Interstate 40 and the BNSF alignments traverse the Action Area on the east and west sides of the Colorado River. These transportation features roughly bisect the northern and southern halves of the Action Area (see Figures 3 and 4).

Two exits provide connections off Interstate 40 within the Action Area. In Arizona, just east of the Colorado River, the exit connects to the Oatman-Topock highway that runs north and northeast around Topock Marsh along the eastern edge of the Action Area. Short private roadway segments in this area also connect the exit to the Topock Marina on the north side and to private residences on the south side of the interstate. In California, the Park Moabi Road exit off of Interstate 40 provides access to the Moabi Regional Park/Pirate's Cove Resort, as well as the PG&E TCS, which is reached by heading east from Park Moabi Road along the National Trails Highway. An extensive system of unpaved roadways extending south from the Park Moabi Road exit provide access to the former rock quarry, lined evaporation ponds, and to the gas supply pipelines that extend west from the PG&E TCS (Figure 7).

4.2.2 More Recent Activities within the Action Area

Activities within the Action Area that are not related to the PG&E TCS environmental cleanup program include the development and ongoing operations associated within recreational facilities at the Moabi Regional Park and the Topock Marina. They also include restoration efforts on the HNWR that are associated with the 2008 Sacramento Wash Fire.

Moabi Regional Park occupies the northwestern portion of the Action Area (Figure 4). As previously mentioned, Park Moabi Slough was originally created by USBR between 1965 and 1968. However, the Moabi Regional Park was developed into its current configuration by San Bernardino County, which leases the land from BLM. Moabi Regional Park has recreational vehicle trailer, as well as day-use and recreational vehicle camping and parking facilities that are located primarily on the north side of the National Trails Highway to the west of Park Moabi Road. Moabi Regional Park also includes the island of land on the north side of the excavated Park Moabi Slough. The island is accessed via an unpaved roadway and bridge along the Colorado River from northwest of the Action Area. The island contains elevated, constructed camping sites along the Colorado River shoreline. The park also maintains wastewater infiltration ponds within an ephemeral wash to the south of the National Trails Highway and east of Park Moabi Road (Figure 4).

A private, commercial resort, Pirate's Cove, has also been developed within the Moabi Regional Park, mostly to the east of Park Moabi Road and north of the National Trails Highway. The resort has a developed marina, a restaurant, and separate lodging facilities along the southern bank of the excavated slough. Other recent constructed facilities include a motorized and non-motorized zip-line from the main Pirate's Cove resort buildings that cross over the slough north and northwest to the island.

On the Arizona side of the Colorado River, there is another commercial marina, the Topock Marina, and a resort located in the southern portion of the Topock Marsh, where several mobile home lodging facilities are rented out by the week.

The Moabi Regional Park facilities also include an extensive network of ORV trails on the island on the north side of Park Moabi Slough and along the north side of the National Trails Highway from the resort as far east as the outlet from Bat Cave Wash (Figures 4 and 6). It should be noted that the ORV trail portion along the north side of the National Trails Highway from the Pirate's Cove resort east to the outlet from Bat Cave

Wash is currently closed as part of a federal road closure (CFR 2006; BLM, 2011), although recent (2013) aerial photographs indicate continued ORV use of this area. The estimated total length of the ORV trails through vegetated areas is about 12,600 feet or 2.4 miles. Assuming that the ORV trails are, on average, 15 feet wide, the estimated total area represents about 4.34 acres that are associated with the park.

Directly south and west of Moabi Regional Park, there is another area of approximately 400 acres that has been designated as an "open riding area" for ORVs according to the California Trail Users Coalition (CTUC, 2011). Numerous ORV trails are present within this area, which extends nearly as far south as the BNSF railroad on the eastern edge and to Interstate 40 on the western edge of the open riding area. Within the Action Area, the portion of this ORV open riding area to the east of Park Moabi Road is currently closed as part of a federal road closure (CFR 2006; BLM, 2011), which has likely limited most of the ORV use in this area. However, the ORV trails are clearly visible to west of Park Moabi Road and the open riding status and relatively open nature of this area means that vehicular impacts can potentially occur over a relatively high proportion this part of the designated ORV area. It is also possible that ORV effects may extend even beyond the designated areas through uncontrolled access or trespass.

The Sacramento Wash Fire occurred in October 2008 as a result of arson and burned approximately 306 acres between the Oatman-Topock Highway and Topock Marsh. The burned area included about 240 acres of dense tamarisk and about 41 acres of emergent marsh vegetation consisting of southern cattails and California bulrush. The remaining land cover classes affected by the fire were characterized as either developed or mixed shrub-scrub habitat (Digital-Desert, 2013).

A revegetation plan by the HNWR focused on those areas previously dominated by the dense tamarisk, which were divided into management zones based on the results of soil analyses, public visibility, and proximity to available water. Due to high levels of salinity, it was necessary to leach the soils with fresh water prior to replanting with native vegetation. In the winter of 2010–2011, the restoration efforts began with a mechanical clearing of the downed woody debris. This permitted the planting of native vegetation seedlings in the spring of 2011 that included: honey mesquite; screwbean mesquite; blue palo verde; and desert broom. Seeding of native plants included big saltbush, four-wing saltbush (*Atriplex canescens*), needle gramma (*Bouteloua aristidoides*), alkali sacaton (*Sporobolus airoides*), James galleta (*Pleuraphis jamesii*), and desert globemallow (*Sphaeralcea ambigua*) (Digital-Desert, 2013).

The Sacramento Wash burn area restoration is being conducted in two phases. When the area was visited in December 2013, the restoration plantings and associated irrigation piping were observed in the area between the Topock Marsh and the unpaved access roadway that runs roughly north-northwest through the center of the burn area. The area between the roadway and the Oatman-Topock Highway to the south of the main wash channel had been cleared and graded, but not yet planted or irrigated.

4.2.3 Activities within the Action Area Related to the PG&E Remediation Program

As previously described, the PG&E TCS and associated gas transmission lines were constructed in the late 1940s and have been operating since 1951 in the southern portion of the Action Area. Just downhill from the PG&E TCS, is the Transwestern Bench that contains pipeline metering facilities. A biological opinion was obtained to cover the operations and maintenance of this facility and associated pipelines (USFWS, 2000).

The PG&E TCS RCRA site investigations began in 1996, when PG&E entered into a Corrective Action Consent Agreement with DTSC. Involvement of the federal agencies began in July 2005, when PG&E entered into a Consent Agreement that outlined the process by which PG&E would comply with CERCLA requirements. Subsequently, in December 2010, the DOI issued a Record of Decision (ROD) selecting the groundwater remedy for the site, and in January 2011, DTSC also adopted the Final Remedy for the groundwater contamination. PG&E and the United States then entered into a Consent Decree governing implementation of the groundwater remedy, which was approved by the United States District Court for the Central District of California in November 2013. Since those dates, the investigation and remediation activities within the

Action Area have proceeded with under the direction of DTSC and DOI as well as inputs from stakeholders and interested tribes, which have been facilitated through the Topock Consultative Work Group and the Technical Work Group.

Past and present investigation and remediation activities at the Topock site are included in the environmental baseline for this consultation. These include those activities evaluated in prior consultations and summarized in Section 3.2 and Table 1 and shown in Figures 4 and 5, including but not limited to soil investigation activities and Freshwater Implementation Plan activities evaluated in the reinitiated 2007 PBA (through 2017).

4.2.3.1 Planned Remediation Activities

Of concern to this Final Groundwater Remedy PBA are those activities that are related to the ongoing operation and maintenance of the remedy, and to the future shut-down/lay-up of IM No. 3 facilities, decommissioning of IM No. 3 and remedial facilities, and restoration activities that are related to the IM No. 3 groundwater pumping and treatment facilities and remedial facilities described in Section 3.3. They will also include ongoing periodic system performance and compliance monitoring activities for groundwater and surface water.

The planned activities related to the Final Groundwater Remedy are described in Section 3.3 and summarized in Table 2. In addition, General Project Management Measures were described in Section 3.4. Many of the planned activities that are the subject of this consultation are similar in type, and (in some cases) location, to those that have already been conducted for activities previously completed prior to and under the 2007 PBA. These planned Final Groundwater Remedy activities will occur throughout the Action Area. Where necessary, staging of equipment and materials, nonhazardous soil storage, and waste management activities will all occur at previously developed areas such as the PG&E TCS, the Transwestern Bench, the MW-20 Bench, the main construction headquarter at Moabi Regional Park, or other previously disturbed areas identified in Figure 7. The planned activities will include construction of the Final Groundwater Remedy facilities, operation and maintenance of the remedy over a decades-long remediation period, sampling and monitoring for compliance and process performance, soil storage, long-term monitoring (post active remediation), decommissioning, and restoration. The planned activities also include future decommissioning and restoration of the IM No. 3 facilities. Again these activities are described in Section 3.3 and summarized in Table 2.

4.2.3.2 Potential Effects of the Planned Final Groundwater Remedy Activities

The potential effects of planned Final Groundwater Remedy activities are summarized here but described in more detail in Section 5.0. The construction of additional wells for extraction, injection, or monitoring will require access to new sites. Similarly, although the pipelines to connect the wells to planned remedial facilities are located primarily on previously disturbed areas, their construction may expand the existing project footprint. The general remedy layout, shown in Figure 6, shows the anticipated locations of planned facilities while Figure 7 shows proposed staging and soil storage areas and access routes. Ongoing operation and maintenance of the Final Groundwater Remedy facilities, as well as system monitoring will also expand the timeframe in which potential impacts to sensitive receptors may occur.

As described in Section 3.4, these Final Groundwater Remedy construction activities will continue to follow existing program procedures to minimize disturbances in previously undisturbed areas and vegetation clearing will be kept to a minimum. The planning and timing of the construction, as well as operation and compliance/performance monitoring activities, will also be done in accordance with the Draft BIAMP (CH2M HILL, 2013f). Based on proximity to potential sensitive habitats, the BIAMP establishes limitations on the timing of these activities to avoid disturbances to receptors, such as nesting and resident listed bird species.

A draft Decommissioning, Removal, and Restoration Work Plan has been prepared and submitted for review for the IM No. 3 facilities. The draft plan provides details about the process for decommissioning and

removal of the physical IM No. 3 Treatment Plant facilities. It also describes the areas that will be restored, as well as the process (guidelines) by which, restoration will occur. Elements of habitat restoration are also described, including revegetation methods (transplantation, planting, seed mix), performance criteria, maintenance monitoring, reporting, and adaptive management. It also lists demobilization activities and describes the process for the development of the future Detailed IM No. 3 Restoration Plan.

SECTION 5.0

Species and Habitat Description, Effects of the Action, and Relevant Reports

5.1 Introduction

This section describes the status, natural history, distribution, and abundance of federally listed and proposed species that may occur or are known to occur within or near the Action Area. This section also analyzes the potential effects to each species and its critical habitat resulting from on-going and planned activities described in Section 3.3 and Table 2.

A background search of available documents and databases was performed in preparation for this Final Groundwater Remedy PBA and the information in this section was obtained from several sources that are listed below. In addition, there were prior biological assessments and consultations, as documented in Section 1.1, which informed the baseline analysis presented in this section.

- Arizona Game and Fish Natural Heritage Program (AGFD, 2013)
- California Natural Diversity Data Base (2013)
- California Wildlife Habitat Relationships System (CDFW, n.d.)
- *Programmatic Biological Assessment for Pacific Gas and Electric Topock Compressor Station Remedial and Investigative Actions* (CH2M HILL, 2007a)
- Desert Tortoise Presence/Absence Surveys for the Topock Compressor Station (GANDA, 2005b, 2006b, 2007b, 2008b, and 2009b; CH2M HILL, 2004a, 2004f, 2004g, 2004h, 2004i, 2010a; and WSA, 2013)
- Southwestern Willow Flycatcher Presence/Absence Surveys for the PG&E Topock Compressor Station (GANDA, 2005a; 2006a; 2007a; 2008a; 2009a; 2010; and 2012)
- *Wetlands and Waters of the United States, Delineation for the Topock Compressor Station Groundwater Remediation Project* (CH2M HILL, 2013d)
- *Revised Final Floristic Survey Report for the Topock Compressor Station Groundwater Remediation Project* (GANDA and CH2M HILL, 2013a)
- *Revised Final Ethnobotany Survey for the Topock Compressor Station Groundwater Remediation Project* (GANDA and CH2M HILL, 2013b)
- Yuma Clapper Rail and Black Rail Surveys for the Topock Compressor Station Groundwater Remediation Project (KBS, 2012)
- *Instream Habitat Typing Survey Technical Memorandum, Topock Compressor Station, Colorado River.* May 21. CH2M HILL. 2012f.

Overall, the general management measures identified in Section 3.4 are intended to avoid, reduce, or mitigate potential direct, indirect, and cumulative effects to these species and habitats.

5.2 Terrestrial

5.2.1 Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

5.2.1.1 Status

The southwestern willow flycatcher (*Empidonax traillii extimus*) was listed as federally endangered on February 27, 1995 (USFWS, 1995). Critical habitat was first designated on October 19, 2005 and revised January 3, 2013 (USFWS, 2013b). The Southwestern Willow Flycatcher Recovery Plan was released on August 30, 2002 (USFWS, 2002b). The southwestern willow flycatcher was listed as endangered by the state of California in 1991.

Several factors have caused the decline in southwestern willow flycatcher populations. Extensive areas of suitable riparian habitat have been lost due to river regulation and channelization, agricultural and urban development, mining, road construction, and overgrazing (Tibbitts et al., 1994). As a result of habitat fragmentation, cowbird (*Molothrus ater*) nest parasitism has increased. Historical alterations of the river corridor in the Southwest by water management actions (i.e., damming, water diversions, and groundwater pumping) and by land management actions (e.g., grazing, recreation, levee construction, and agriculture) have facilitated the establishment, spread, and persistence of tamarisk along rivers. These human-caused changes have favored the invasion of the exotic tamarisk in the riparian ecosystems. Willow flycatcher nesting and foraging has been widely documented in tamarisk stands along the Colorado River so that tamarisk represents about 50% of the known breeding sites. Tamarisk is considered as a primary constituent element and is also a component within existing designated critical habitat for willow flycatchers. Many of the observations of southwestern willow flycatcher since 1993 have occurred in habitat dominated by tamarisk (Koronkiewicz et al., 2013). Successful breeding is known to occur in tamarisk on the Lower Colorado River. Because of low population numbers rangewide, identifying and conserving southwestern willow flycatcher breeding sites is thought to be crucial to the recovery of the species (USFWS, 2010d; Koronkiewicz et al., 2013).

5.2.1.2 Natural History, Distribution, Abundance and Habitat

Southwestern willow flycatcher is one of four subspecies of willow flycatcher. *Empidonax* flycatchers are noted for their physical similarities and the difficulty in identifying individuals in the field. This species is a small bird, approximately 14.6 centimeters (5.75 inches) long, with a grayish-green back and wings, whitish throat, light grey-olive breast, and pale yellowish body. Two white wing bars are visible. The upper mandible is dark, the lower is light. The most distinguishable taxonomic characteristic of the southwestern willow flycatcher is the absent or faintly visible eye ring. This willow flycatcher can be differentiated from other species by its distinctive “fitz-bew” song. As an insectivore, it forages within and above dense riparian vegetation taking insects on the wing and gleaning them from the foliage. It also forages along water edges, backwaters, and sandbars adjacent to nest sites (Tibbitts et al., 1994). From 2008 to 2012, breeding populations of southwestern willow flycatcher were studied at 113 study areas along the Virgin and Lower Colorado rivers and tributaries, and residents were detected at 33 sites in 9 study areas (Koronkiewicz et al., 2013).

The southwestern willow flycatcher breeds in dense riparian habitats in all or part of six southwestern states, from sea level in California to over 2,600 meters (8,550 feet) in Arizona and southwestern Colorado (Sogge et al., 1997). This particular species nests only in dense riparian vegetation near surface water or saturated soil; however, the surrounding portions of the territories are often comprised of a mosaic of vegetation that is not uniformly dense. Along the Colorado River they may typically nest in riparian habitat characterized by a dense stand of intermediate-sized shrubs or trees, such as willows (especially *Salix gooddingii*), *Baccharis*, or arrow weed, usually with an overstory of scattered larger trees, such as cottonwoods. Along the Lower Colorado River (downstream of the Hoover Dam), willow flycatcher nests have only been detected in tamarisk. Occupied habitat always has dense vegetation in the patch interior regardless of the plant composition and height. These dense patches are often interspersed with small

openings, open water, or sparser vegetation, creating a mosaic that is not uniformly dense (Sogge et al., 1997).

Riparian patches used by breeding flycatchers vary in size and may be a relatively dense, linear, contiguous stand or an irregularly shaped mosaic of dense vegetation with open areas. Southwestern willow flycatchers are known to nest in patches as small as 0.8 hectare (2 acres) to as large as several hundred hectares (Sogge et al, 1997). The mean size of flycatcher breeding habitat patches is 8.5 hectares (21.2 acres) (Sogge et al, 1997). Habitat patches as small as 0.5 hectare (1.23 acres) may support one or two nesting pairs (USFWS, 1995). Sogge et al. (1993) found territorial flycatchers in habitat patches ranging from 0.5 to 1.2 hectares (1.23 to 2.96 acres). However, this species has not been observed nesting in narrow, linear riparian habitats that are less than 10 meters (30 feet) wide, although they may use such linear habitats during migration (Sogge et al., 1997; USFWS, 2003). In the Southwest, most willow flycatcher breeding territories are found within small breeding sites containing five or fewer territories; only four sites are known to have 50 or more territories (Gila, Rio Grande, San Pedro River, and San Luis Rey River). The Hoover to Parker Management Unit that includes the Topock Marsh contains approximately 14 territories (Durst et al., 2008). The overall recovery objective for the flycatcher is to attain a population level and an amount and distribution of habitat sufficient to provide for the long-term persistence of metapopulations, even in the face of local losses (e.g., extirpation) so that the species may be downlisted. Management unit recovery criteria (goals) for the management unit are to increase viable territories and to hold at least 50% to 80% of the minimum population target for that unit (USFWS, 2002b).

Nesting habitat almost always contains or is adjacent to water or saturated soil. With the loss of habitats that are more dominated by native species throughout the Southwest, southwestern willow flycatchers have been observed using tamarisk thickets for nesting. Nearly 50 percent of willow flycatcher territories occur in mixed native/exotic habitat, and 25 percent are at sites where tamarisk is dominant (Durst et al., 2008). Flycatchers nest in tamarisk at many river sites and, in many cases, use tamarisk even if native willows are present. Tamarisk eradication can be detrimental to willow flycatchers in mixed and exotic habitats, especially in or near occupied habitat or where restoration is unlikely to be successful. Risks to the flycatcher increase if the tamarisk control projects are implemented in the absence of a plan to restore suitable native riparian plant species or if site conditions preclude the reestablishment of native plant species of equal or higher functional value. Threats also increase if the eradication projects are large-scale, possibly setting the stage for large-scale habitat loss (USFWS, 2005b).

Migrant southwestern willow flycatchers may occur in nonriparian habitats and riparian habitats unsuitable for breeding. These migration stopover areas, even though not used for breeding, may be critically important sites affecting local and regional flycatcher productivity and survival (Sogge et al., 1997). One of the last long-distance, neo-tropical migrants to arrive in North America during spring migration, willow flycatchers have a short (approximately 100-day) breeding season, with individuals typically arriving in May or June and departing in late August. All four subspecies of willow flycatchers spend the non-breeding season in portions of southern Mexico, Central America, and northwestern South America. Willow flycatchers have been recorded on the wintering grounds from central Mexico to southern Central America as early as mid-August, and wintering resident individuals have been recorded in southern Central America as late as the end of May.

5.2.1.3 Status of the Species in the Action Area

The Action Area is located in the vicinity of two southwestern willow flycatcher study areas—the Topock Marsh (a portion of which is within the Action Area) and Topock Gorge (south of the Action Area). GANDA (2005a, 2006a, 2007a, 2008a, 2009a, 2010, and 2012) has conducted protocol-level surveys of the suitable southwestern willow flycatcher habitats within and adjacent to the Action Area annually from 2005 to 2010 and again in 2012.

In 2005, 2007, 2008, 2009, and 2012, biologists detected the bird, primarily by song, in varying locations but primarily in Arizona. No detections were made during the 2006 and 2010 surveys. All detections have been

determined to be migratory or transient birds and no nests, or nesting activity, have been observed (GANDA, 2009a).

During the 2012 surveys, auditory and visual observations of single birds only on June 5 and June 7 were detected. The June 5 detection was at a newly added call point, CA4-V, along the Colorado River near the confluence with Bat Cave Wash. The June 7 detection was at call point AZ5-8 to the east of Topock Bay. These single sightings were not replicated in other survey events and so, were also considered to be indicative of transient, rather than breeding, individuals (GANDA, 2012).

Nesting territories do occur within the general area as documented nesting activities have been reported along the northeastern portion of Topock Marsh. This area supported 34 territories and 29 nesting pairs in 2004 and all nest locations are documented within tamarisk thickets. These areas are approximately 2,900 feet west-southwest from the northeast portion of the Action Area where planned actions associated with the Site B well may occur and are approximately 1,900 feet north of the Action Area along the Arizona shoreline. The nesting habitat occurred on the eastern side of the peninsula within the mixed tamarisk/willow thickets before they transition to the Topock Marsh. In nearby areas of the Topock Marsh that are outside of the Action Area, more recent survey data (McLeod and Pellegrini, 2013) have demonstrated a decline in nesting pairs between 2004 and 2008. Only one nesting pair was detected in 2011 and, for the first time since surveys began in 1996, no nesting pairs were detected in 2012. The decline was attributed to low water levels in the Topock Marsh (corresponding in time to repairs of the inlet structures) which led to a decline in the amount of inundated vegetation that correlated with the decline in flycatcher populations.

Nesting and migratory habitat for the southwestern willow flycatcher exists within and adjacent to the Action Area. The nesting and migratory period for southwestern willow flycatchers begins with arrival around mid-May and ends with departure around late September (Sogge et al., 2010). Tamarisk and arrow weed are the dominant vegetation types within the portion of the Action Area that are associated with the Colorado River floodplain. The dense tamarisk thickets are considered potentially suitable nesting, roosting, and foraging habitat for willow flycatchers. They may also serve as suitable perching and foraging habitats during migration periods (arrival/departure).

East of the river, potentially suitable nesting habitat exists along the western margin of the Topock Marsh within dense tamarisk stands where nesting pairs of southwestern willow flycatchers have been documented within the Action Area. Additionally, other less desirable, but potentially suitable nesting habitat exists within dense tamarisk stands associated with Sacramento Wash to the east of the Oatman-Topock Highway.

The potential nesting areas on the west side of Topock Marsh are included within the Action Area but range from more than 1,000 feet in the southern portion (near Topock Marina) to greater than 3,000 feet in the northern portion from proposed activities associated with the Freshwater Implementation Plan (i.e., well and pipeline construction activities). The potential tamarisk nesting areas on the east side of the Oatman-Topock Highway are adjacent to the Action Area. Both of these habitats are subject to regular human disturbances including recreational boating within Topock Marsh, ORV traffic within Sacramento Wash, and vehicular traffic along Oatman-Topock Highway.

The 2008 Sacramento Wash Fire destroyed the dense tamarisk along the west side of Oatman-Topock Highway and the burned area was subsequently cleared in late 2010 / early 2011. The fire reduced much of the potential southwestern willow flycatcher habitat within the northeastern portion of the Action Area. Annual protocol surveys that have been conducted between 2005 and 2010 and in 2012 have not documented southwestern willow flycatchers nesting in the area along the northeastern edge of the Action Area since the 2008 fire (GANDA, 2012). The burned tamarisk area is part of a planned restoration effort that seeks to re-establish native vegetation (Digital-Desert, 2013), so the nesting and foraging suitability within these habitats is expected to improve over time as the native plants mature. The 2008 Sacramento

Wash Fire did not affect the dense tamarisk thicket to the east of the Oatman-Topock Highway, which remains as potentially suitable, though marginal, southwestern willow flycatcher nesting habitat.

Within the Action Area to the west of the Colorado River, there is generally less suitable southwestern willow flycatcher nesting habitat than in Arizona. However, the existing habitats may be used for southwestern willow flycatcher roosting and foraging during migration. The tamarisk thickets in California are found below the BNSF Railway and Interstate 40 bridges (approximately 6 acres); near Bat Cave Wash at its confluence with the Colorado River (approximately 5 acres); near the unnamed western wash, which has its confluence with the Colorado River directly northwest of Bat Cave Wash (approximately 3 acres); and near the Park Moabi Marina (approximately 7 acres) as shown in Figure 10. These tamarisk thickets represent less than 1.5 percent of the total Action Area. The patches tend to be fragmented and are subject to regular human disturbance; two factors that may decrease the habitat value for the species (GANDA, 2005b). The habitats near the Park Moabi Slough are subject to regular recreational boating traffic and the adjacent habitats on the island north of the slough and north of the National Trails Highway between the Pirate's Cove Resort and the Bat Cave Wash outlet have an extensive network of ORV trails that were mostly added only in the past few years (i.e., post-2010).

While tamarisk occurs in and adjacent to the Action Area, the quality of this vegetation for nesting flycatchers is not nearly as suitable compared to other locations along the Lower Colorado River. USBR annual surveys indicate that nesting flycatchers are being found in higher-quality tamarisk vegetation compared to what is found in the Action Area (McLeod and Pellegrini, 2013). The higher-quality tamarisk vegetation was associated with higher soil moisture and more moderate temperatures, which would indicate that the tamarisk stands near the margin of the Topock Marsh are more suitable for nesting than what is found in the California portions of the Action Area. It should also be noted that this study documented a decline in nesting pairs in the Topock Marsh from 2004 (29 pairs) to 2008 and in 2011 (one pair only) and 2012 (no pairs detected). This decline in nesting pairs was attributed to lower water levels that led to drier, less suitable nesting conditions.

Although tamarisk habitat exists within the Action Area in California, the vegetation density, habitat structure, and patch-size of thickets are sparser, smaller, and more fragmented in comparison to observed/known breeding habitat within the Topock Marsh. Additionally, southwestern willow flycatchers are very rarely nest in mesquite, palo verde, and acacia trees (Sogge et al., 1997), which are the associated tree species in this part of the Action Area. Furthermore, there is no known breeding habitat within the Action Area

Additionally, biological monitors have logged several hundred hours performing pre-activity surveys on the California floodplain as part of compliance with the mitigation measures associated with the 2007 PBA and 2012 Reinitiated PBA and with revised well sampling procedures (CH2M HILL, 2005b), that require monitoring for any migratory bird nests by a qualified biologist within a 200-foot work area prior to construction-related activities that occur between March 15 and September 30. To date, no active nests of any migratory birds have been documented during these surveys or by protocol-level surveys conducted up to 2012.

5.2.1.4 Direct Effects

Direct effects are those that are caused by the proposed action and occur at the same time and place. Details of the Final Groundwater Remedy were previously described in Section 3.3 and Table 2 and are shown in Figures 6 and 7. The Final Groundwater Remedy actions are summarized here as only they relate to potential direct effects to southwestern willow flycatcher.

Beginning in Arizona, the Freshwater Implementation Plan has the potential to have a direct effect on southwestern willow flycatcher due to anticipated activities in the northeastern portion of the Action Area. The Freshwater Implementation Plan is currently evaluating options for the freshwater supply well in Arizona. The first well being considered is HNWR-1, a well that has already been constructed by the refuge

along the west side of the Oatman-Topock Highway. A second potential supply well (Site B well) is located to the north of HNWR-1 on the northern margin of the Sacramento Wash channel and was completed in January 2014 with well testing finishing in March 2014. If these two wells are determined to be unsuitable for the freshwater source well, then a third location for a new well near the existing HNWR-1 would then be considered.

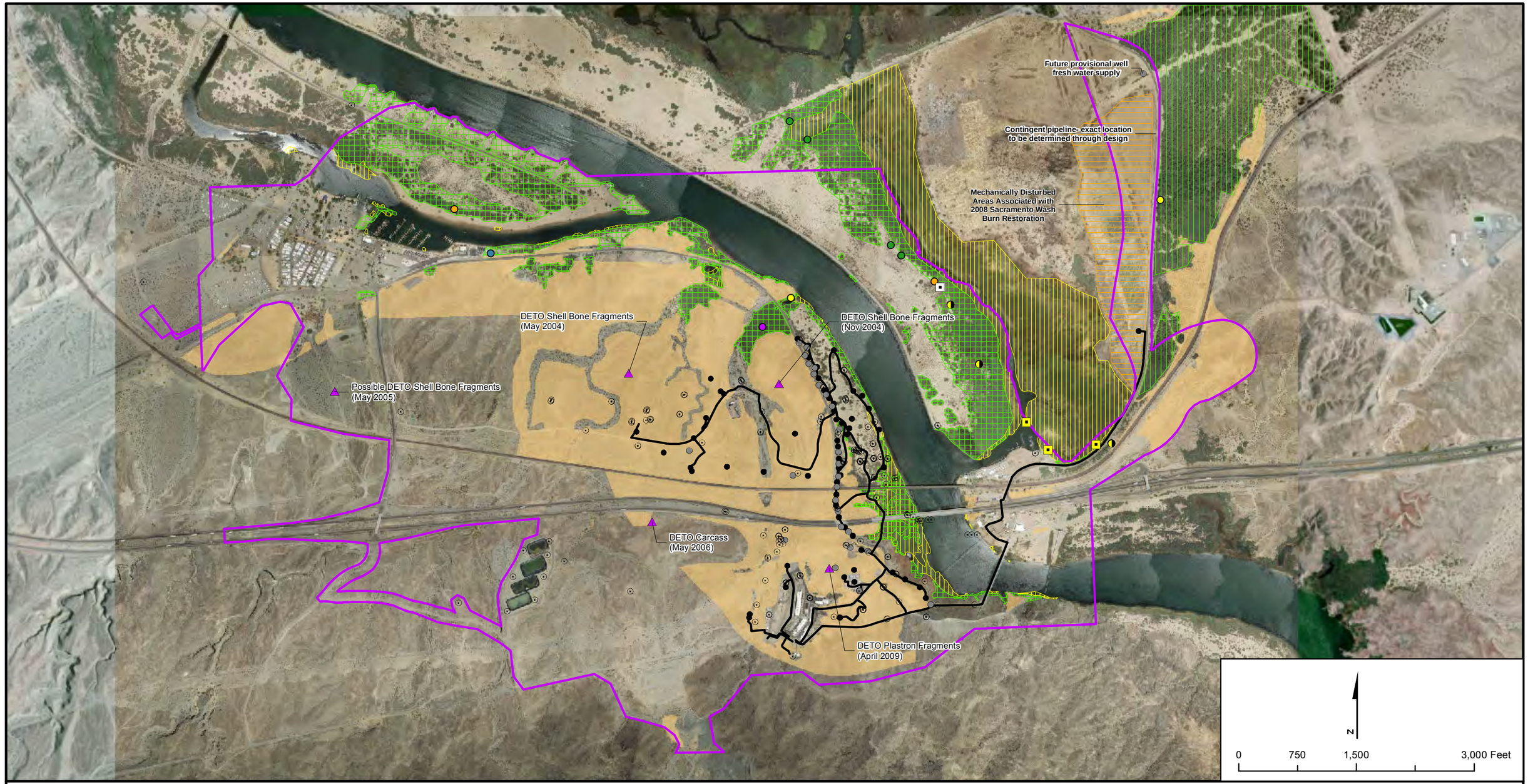
The Freshwater Implementation Plan activities are being completed under the 2012 Reinitiated PBA. The evaluations of HNWR-1 and the Site B well are expected to be completed prior to the March 15 date associated with southwestern willow flycatcher in-migration and nesting season in 2014, so that these activities are expected to have no effect on this species. Additional actions with impacts that would be related to the planned Final Groundwater Remedy may occur at whichever of these locations is chosen as the freshwater supply well because there could be other activities that could extend into the southwestern willow flycatcher nesting season. The additional Final Groundwater Remedy activities would include the construction of the pump and electronic control facilities, as well as security fence in proximity to the chosen supply well and the installation of the conveyance pipeline.

The tamarisk habitats near these well locations to the east of the Oatman-Topock Highway are marginal, but potentially suitable southwestern willow flycatcher nesting habitats. While annual protocol surveys that have been conducted between 2005 and 2010 and in 2012 have not documented southwestern willow flycatchers nesting in this area since the 2008 fire (GANDA, 2012), it is possible that birds could use this area for nesting in the future. The potential for direct impacts to southwestern willow flycatcher only exists if the freshwater supply pipeline construction occurred between March 15 and September 30. In accordance with established procedures, coordination of biological monitoring with BLM and USFWS would occur for this activity, and a qualified biological monitor would conduct pre-activity surveys for nesting birds as well as monitoring during construction.

To the maximum extent practicable, the water supply pipeline will be installed within the previously disturbed areas on the shoulder of the Oatman-Topock Highway. The underground pipeline will connect the supply wells to each other and to the conveyance pipeline that will convey the water to the Final Groundwater Remedy facilities in California (Figures 6 and 7). In proximity to HNWR-1 well, the underground pipeline will cross beneath the Oatman-Topock Highway from the west to the east side to avoid direct impacts to Topock Marsh, which is adjacent to the roadway at the marsh's southern margin. It is while pipeline construction is occurring along the northeastern edge of the Action Area along the Oatman-Topock Highway that potential direct impacts to southwestern willow flycatcher may occur because of the presence of the dense tamarisk that represents potentially suitable nesting habitat immediately adjacent to the east side of the Oatman-Topock Highway.

As the freshwater conveyance pipeline alignment extends south of the Topock Marsh, it will travel within the Oatman-Topock Highway roadbed and then cross beneath Interstate 40. The underground pipeline alignment will continue in a southeastern direction along the elevated river terrace to the existing pipe bridge (i.e., the former Route 66 bridge) upon which, it will cross above ground over the Colorado River (Figures 6 and 7). This alignment for the freshwater conveyance pipeline will avoid any direct impacts to the Colorado River floodplain, associated with the freshwater supply pipeline within the Action Area in Arizona or California.

Specific actions associated with construction of the Final Groundwater Remedy that will occur within or adjacent to suitable habitat in the floodplain in California have the potential to affect this species. This will include the activities that would be associated with the installation of remediation wells and pipelines for the in situ reduction zone, installation of monitoring wells, installation of remote wireless communications, and the use of two construction staging areas near the Bat Cave Wash outlet.



LEGEND

- PBA Update Action Area
- Existing Monitoring Well
- Future Provisional Wells
- Remediation Wells
- Pipeline For Remedy

- Western yellow-billed cuckoo 2008-2010 (GANDA 2012a)
- Desert Tortoise Findings (GANDA 2009a)
- YUCR Detection 2012 (GANDA 2012a)
- YUCR Detection (Konecny Biological Services 2012)

SWFL Detection Year (GANDA, 2012a)

- 2005
- 2007
- 2008
- 2009
- 2012

Habitat Areas

- Agassiz's Desert Tortoise
- Morafkai's Desert Tortoise
- Mechanical Soil Surfce Damage
- Southwestern willow flycatcher
- Western yellow-billed cuckoo
- Yuma clapper rail/California Black Rail

Notes:
1. Habitats are shown within the areas surveyed for the EIR and the Freshwater Implementation Plan in Arizona.
2. YUCR habitat areas are based upon data collected by Konency Biological Services 2012.

FIGURE 10
DESERT TORTOISE AND PBA-LISTED BIRD HABITATS
Final Groundwater Remedy
Programmatic Biological Assessment
PG&E Topock Compressor Station
Needles, California

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2013\PBA\2013Q4\FIG10_DT_Habitat.mxd Date Saved: 4/22/2014 11:14:05 AM

Activities related to the construction of the Final Groundwater Remedy in upland areas will include the construction of carbon amendment storage and injection facilities, remedy-produced water conditioning system; and conditioned water storage facilities. It would also include a pre-injection freshwater treatment system if it is determined that such a system will be required. These activities will also include the installation of upland remediation wells and pipelines, installation of monitoring wells, and the use of construction staging/soil storage areas. These sites are located within the upland area that does not support riparian vegetation and other characteristics commonly associated with flycatcher habitat. For this reason, these activities are not expected to have any effect to this species due to unsuitable habitat at the specific project locations.

The Final Groundwater Remedy construction activities will involve the use of heavy equipment including, but not limited to, graders, backhoes and drill rigs that may be used to remove vegetation, grade the ground surface, and install remediation or monitoring wells or pipelines within the floodplain. Heavy equipment can create substantial ground disturbance and noise. Recognizing the potential for these impacts to occur, the General Project Measures presented in Section 3.4 were intended to minimize them.

The Colorado River may function as a migration corridor for southwestern willow flycatcher. During migration periods, this species may briefly stop to roost and/or forage within or adjacent to potentially suitable roosting and foraging habitats within the fragmented tamarisk patches in the Action Area located at Bat Cave Wash and the unnamed wash to the west; under the BNSF railroad and Interstate 40 overpasses; near Moabi Regional Park; and the eastern edge of the Action Area (Figure 10) (CH2M HILL, 2005b, 2005c).

Because flycatchers may potentially use the habitat in the Action Area for roosting and foraging during the spring and fall migration seasons, it is possible that construction and operational activities could alter the behavior of migrating individuals, but as discussed, the potential for impact is considered low. The greatest potential for direct effects to southwestern willow flycatcher would be within the short migratory period during arrival (mid-May through June) and departure (July through late September) when individuals could be passing through the Action Area to and from more suitable nesting locations.

Habitat elements such as patch size, shrub density, and the presence and/or location of water provide the appropriate habitat structure and features to allow for this behavior. However, annual surveys conducted from 2005 through 2010 and in 2012 have not documented any southwestern willow flycatcher nesting or presence (other than transients) using this habitat patch within the Action Area. Five riverbank remediation wells and associated water conveyance pipelines, as well as several monitoring wells would be constructed within or near the tamarisk thickets along the floodplain on the California side of the project. It is possible that future provisional wells may be installed if operational data indicate that they are needed. As previously explained, the regular disturbances by recreational boating and ORV traffic reduce the potential suitability of these areas for southwestern willow flycatcher use. Based on recent input from USFWS (2014a), it was determined that continuing protocol surveys for the southwestern willow flycatcher could be conducted based on the possibility for project work to occur in or near flycatcher habitat, with at least one protocol surveys occurring every 3 years. PG&E will supplement the flycatcher survey information in the Action Area with data being collected for ongoing flycatcher surveys by the USFWS in the HNWR. These survey results indicate that the likelihood of direct impacts to nesting birds is very low and discountable. They also indicate that any potential severity of direct impacts would occur primarily to migrating birds and, therefore, the effect would also be very low and insignificant. Given the application of conservation measures (pre-activity surveys and construction monitoring when working in or near flycatcher habitat during the nesting season), the effect of any direct impacts effects to nesting or migratory southwestern willow flycatchers is expected to be low to negligible.

Over time, tamarisk acreage resulting from human population growth (i.e., damming, water diversions, groundwater pumping) in the Colorado River corridor has significantly increased along the Lower Colorado River. These activities have altered the riparian hydrology and, by consequence, have created conditions that have favored the establishment of larger tamarisk thickets that are known to serve as southwestern

willow flycatcher breeding habitat. While several fragmented, small stands of tamarisk could be peripherally affected as a result of the proposed actions, most of the work will occur within sparsely vegetated areas within the floodplain in order to avoid and minimize habitat disturbance. Design efforts have and will continue to avoid dense contiguous stands of tamarisk greater than 1 acre and any associated vegetation as practicable. Limited riparian vegetation, primarily smaller patches or individual plants of tamarisk and arrow weed, may be crushed or trimmed as a result of the proposed actions. An 8.8-acre disturbance threshold within the historical floodplain will be followed in an attempt to lessen the potential effects to the species and habitat. Exceeding the 8.8-acre threshold will require consultation with USFWS and may require possible mitigation.

Project-related construction and operational activities will not occur within cottonwood-willow stands and, therefore, will have no direct effect upon the Colorado River's overall balance of remaining cottonwood-willow riparian stands that historically were the native habitat for this species.

5.2.1.5 Indirect Effects

Indirect effects are those that are caused by the proposed action and are later in time, but reasonably certain to occur. The possible actions that may occur are related to the long-term operation and maintenance of the Final Groundwater Remedy facilities after construction plus possible installation of future provisional wells or other contingency actions. They also include the decommissioning and restoration of IM No. 3 and the Final Groundwater Remedy.

The Final Groundwater Remedy activities related to operation and maintenance of the freshwater supply system would also include periodic maintenance and repair of well, pump, and electrical control equipment, pipeline maintenance and repair; stormwater pollution prevention; access roadway maintenance; well sampling; and eventual decommissioning of the well and pumping facilities. After decommissioning, these areas would be restored in accordance with the Remedy Decommissioning Plan, including a restoration plan that will be submitted by PG&E to DOI after receipt of DOI's certification of Remedial Action completion, and the Habitat Restoration Plan, where applicable, that will be submitted to the agencies with the Remedial Action Work Plan.

The Final Groundwater Remedy activities related to operation and maintenance of the remediation facilities and supporting systems would also include periodic maintenance and repair of well, pump, and electrical control equipment, pipeline maintenance and repair; stormwater pollution prevention; access roadway maintenance (include vegetation trimming); well sampling; and eventual decommissioning of the wells, pipelines, and pumping facilities. After decommissioning, these areas would be restored in accordance with the Remedy Decommissioning Plan, including a restoration plan that will be submitted by PG&E to DOI after receipt of DOI's certification of Remedial Action completion, and the Habitat Restoration Plan, where applicable, that will be submitted to the agencies with the Remedial Action Work Plan. Planned activities will also include the decommissioning of the IM No. 3 treatment facilities, and upland restoration including the areas on MW-20 Bench and IM No. 3 facilities.

Sampling of remediation or monitoring wells will occur more frequently in the initial years of operations and will likely require the use of off-road utility vehicles and possibly a small generator for power to activate the submersible pumps during water collection. The generators' noise output is minimal enough that a conversation can easily occur. These activities, happening within or adjacent to suitable SFWL habitat, may lead to alterations of southwestern willow flycatcher behavior. However, the lack of evidence of southwestern willow flycatcher nesting within this portion of the Action Area suggests that the probability of negatively altering southwestern willow flycatcher behavior during normal well sampling, carbon substrate injection, or equipment maintenance activities would be considered as a discountable effect. Further, the magnitude of project effects may be difficult to discern from other potentially impacting transportation activities (i.e., the Interstate 40 and the BNSF railroad) and recreational activities (e.g., watercraft) that occur with regularity within the Action Area.

More aggressive activities associated with certain non-routine well maintenance, pipeline repair, road repair; decommissioning and removal of facilities; and restoration activities would require the use of heavy equipment, trucks, materials, and crews to implement. However, the potential effects of these activities would be reduced by the application of general project management measures discussed in Section 3.4 and species-specific mitigation measures discussed in subsection 5.2.1.8, so that the potential for indirect effects on southwestern willow flycatcher are considered to be insignificant.

5.2.1.6 Cumulative Effects

Cumulative effects include future state and private activities, excluding federal activities that are reasonably certain to occur within the Action Area. Continued operation of the TCS will occur. It is reasonably certain that soil remedial activities will also occur within the Action Area. The final soil remedy, if required, will include heavy equipment and personnel with minor activities in the floodplain. Habitat loss would likely not be enough to reduce the habitat value and thereby, alter southwestern willow flycatcher use and behavior. Habitat loss is defined as the removal of trees and perennial shrubs. The trimming of vegetation is not considered habitat loss.

Future state and private actions separate from PG&E that are reasonably certain to occur within the project vicinity include continued recreational activities associated with the Colorado River and the HNWR, such as boating, fishing, and ORV use of the floodplain and surrounding areas. Examples of recent actions that have occurred within the Action Area in California since the 2007 PBA include the expansion of private commercial recreation facilities at the Moabi Regional Park (Pirate's Cove restaurant, individual lodging, motorized and non-motorized zip-line rides, as well as expanded ORV trail networks on the island north of the slough and north of the National Trails Highway east to the Bat Cave Slough outlet). Other actions include ongoing use of the open riding ORV areas to the south of Moabi Regional Park, although an official 2006 BLM road closure to the east of Park Moabi Road would be expected to limit this effect within the Action Area.

Within the Action Area in Arizona, ongoing and future actions include renovations at the Topock Marina (including current rental lodging, and a proposed hotel and new restaurant) and HNWR restoration efforts associated with the 2008 Sacramento Wash Fire. The HNWR restoration efforts are expected to have an overall positive effect on southwestern willow flycatcher habitat in the Action Area as those native plantings mature and the habitats are restored; however, the restoration plantings will not create additional southwestern willow flycatcher habitat. Additionally, operations and maintenance of existing infrastructure such as the gas pipelines, railroad, Interstate 40, bridges, and other nearby roads and utilities are anticipated.

5.2.1.7 Critical Habitat Effects Determination

The nearest critical habitat for the southwestern willow flycatcher is located on the Big Sandy River located about 50 miles east of the Action Area (USFWS, 2013b). PG&E's activities are located outside designated critical habitat for the southwestern willow flycatcher. An effects determination of "no effect" to critical habitat is concluded.

5.2.1.8 Effects Determination

Although no southwestern willow flycatcher were detected in 2006 and 2010, in other surveys migrant southwestern willow flycatcher were detected at various locations within the Action Area (GANDA, 2005a; 2006a; 2007a; 2008a; 2009a; 2010; and 2012). The 2008 fire that destroyed much of the potential southwestern willow flycatcher habitat along the northeastern edge of the Action Area, along with vegetation clearance in the area, reduced the available southwestern willow flycatcher habitat (GANDA, 2012). Given the cumulative detections of southwestern willow flycatcher over the years, the presence of potentially suitable habitat, and the presence of nearby breeding populations, there is a potential for southwestern willow flycatcher to breed in the Action Area in the future (GANDA, 2012). To date, no incidental take of southwestern willow flycatcher (or any other migratory birds) has occurred within the Action Area from project activities.

Based on the results of previous protocol-level surveys conducted between 2005 and 2012, there has been no evidence of nesting flycatchers within the Action Area, although transient birds have been occasionally detected by auditory methods at several call stations in CA and AZ. The survey information suggests that it is unlikely that Final Remedy activities within the Action Area will affect nesting flycatchers, even if those activities were conducted between March 15 and September 30. For that reason, it is proposed that construction activities not be limited during this period. However, to ensure that no inadvertent impacts to southwestern willow flycatchers will occur during this period, pre-activity surveys will continue to be required to ensure that no nesting birds are present in or within 200 feet of proposed work areas. If nesting flycatchers are found to occur, construction activities would be halted, unless otherwise approved by the USFWS. The USFWS immediately consulted to determine an appropriate response to avoid the impact. Protocol-level surveys will be continued every 3 years with the next survey period in 2014 to document base conditions prior to the beginning of construction of the Final Groundwater Remedy.

Nesting of southwestern willow flycatchers is considered unlikely west of the Colorado River within the California portion of the Action Area. This can be attributed to the lack of appropriate vegetation composition, habitat structure, microclimate, and presence of water or moist soils. Negative effects to nesting southwestern willow flycatchers are not anticipated to occur.

Seasonal migratory use of habitat on the floodplains of California and Arizona can be anticipated to occur along the Colorado River as southwestern willow flycatchers move to and from other known breeding locations. Project activities, therefore, could influence activity during this period. To augment the understanding of southwestern willow flycatchers within the Action Area and to help guide in the conservation of this species, triennial protocol surveys (beginning in 2014) will continue to determine presence or absence of southwestern willow flycatcher. Similarly, pre-construction surveys and construction monitoring will also be conducted during the migratory/nesting season by qualified biological monitors to ensure that project effects on this species will be avoided.

The following mitigation measures will be applied to all actions associated with the Final Groundwater Remedy that will occur in or near potential southwestern willow flycatcher habitat, as shown in Figure 10.

1. Minimize the net increase of disturbed habitat in the Action Area.
2. Riparian areas surrounding the designated work areas and subject to influence of operations and maintenance activities shall be surveyed for southwestern willow flycatcher according to the protocol established by the USFWS. These surveys shall be completed every 3 years by a biologist permitted by the USFWS to carry out flycatcher surveys until the action has been completed and all facilities have been removed. Reports shall be provided to the biologists in the BLM Lake Havasu Field Office and USFWS's Phoenix AESO on a triennial basis.
3. Construction and well development or rehabilitation activities that use heavy equipment should be completed prior to March 15, to the extent practicable. The use of any heavy equipment in or near southwestern willow flycatcher habitat after March 15 will be reassessed and additional conservation measures considered, including pre-activity surveys and construction monitoring by a qualified biologist. Preferably such activities would occur from October 1 to March 15.
4. Because protocol-level surveys within the Action Area have not indicated the presence of nesting willow flycatchers, work limitations between March 15 and September 30, do not appear warranted. However, pre-activity surveys will continued to be required during this period whenever activities are being conducted within the sensitive areas identified in Figure 10. If nesting flycatchers are found to occur, construction activities would be halted and the USFWS immediately consulted to determine an appropriate response to avoid the impact. If greater than 8.8 acres of historical floodplain habitat is lost or manipulated, specific project consultation with USFWS will be required and possible mitigation may be required. Habitat loss is defined as the removal of trees and perennial shrubs. The trimming of vegetation is not considered habitat loss.

5. Minimization measures outlined in the BIAMP for southwestern willow flycatcher will be implemented including preconstruction surveys during the nesting season, awareness training, pre-activity surveys, compliance monitoring, and reporting during field activities.

Future project activities, conducted in accordance with species-specific mitigation measures presented above and established mitigation measures (CH2M HILL, 2013f) will help to avoid, reduce, and mitigate operational and construction impacts to the biological environment within the Action Area. It is recognized that future minor additional tamarisk habitat may be lost, removed, or manipulated to conduct planned activities, which could potentially reduce overall habitat value and alter southwestern willow flycatcher behavior. Southwestern willow flycatchers have been documented in several areas in Arizona within the Action Area. Future project activities are anticipated to occur on the California floodplain in or near potentially suitable nesting/migratory habitat along the Colorado River and near the southern portion of the Topock Marsh on the HNWR. In general, these activities will be near marginal southwestern willow flycatcher habitats and of relatively short duration.

However, based on the location of project activities and distance from documented southwestern willow flycatcher nesting habitat; the fragmented distribution, composition and structure of habitat conditions in or adjacent to the Action Area; and the continued implementation of conservation measures identified in Section 3.0, the effects of planned project activities to the southwestern willow flycatcher are not expected to occur. For these reasons, any potential direct or indirect effects from project activities are likely to be either negligible or avoidable. An effects determination of "not likely to adversely affect" is concluded for this species.

5.2.2 Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)

5.2.2.1 Status

The western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) was proposed for federal listing as threatened on October 3, 2013 [78 Fed. Reg. 61622], is a California State Endangered species, and is considered threatened on the list of Wildlife of Special Concern in Arizona. It is associated with large blocks of riparian woodland primarily composed of cottonwood and willow.

Although yellow-billed cuckoos are common in the east, the western population represents a distinct population segment (DPS) that has different habitat requirements than the eastern population. Major declines in the western populations are due to habitat loss and habitat fragmentation, local extinctions, and low colonization rates (Hughes, 1999).

5.2.2.2 Natural History, Distribution, Abundance and Habitat

The yellow-billed cuckoo is a medium-sized bird, about 30 centimeters (12 inches) long, with wings that are grayish-brown on top and white below and with reddish primary flight feathers. Tail feathers are grayish-brown above and black tipped with white below. The distinctive tail pattern is visible in flight and while perched. This species has a somewhat elongated body and a moderate to heavy bill that is moderately long and curved down with a hook at the tip. The upper mandible is black and the lower is yellow to orange yellow at the base with a dark tip. This species has a zygodactyl foot with two toes pointing forward and two toes pointing backwards (Hughes, 1999).

Two subspecies (western and eastern with the Pecos River, Texas, as the boundary between the two subspecies) have been recognized since the late 1880s; however, scientific studies to date have not conclusively determined whether western and eastern subspecies exist (Hughes, 1999). USFWS evaluated the available scientific evidence and determined that the recognition of the subspecies is not justified at this time (USFWS, 2013c). Instead, USFWS determined that the population segment of yellow-billed cuckoo nesting west of the Continental Divide is a DPS under the ESA.

The yellow-billed cuckoo is a neotropical migrant bird that breeds in North America and winters in South America. The breeding range historically included most of North America, from southeastern and western

Canada to the Greater Antilles and northern Mexico. Western yellow-billed cuckoo were once widespread and locally common in California and Arizona, locally common in a few river reaches of New Mexico and in portions of Oregon and Washington, and local and uncommon in western Colorado, western Wyoming, Idaho, Nevada, Utah, and southern British Columbia, Canada (Hughes, 1999). Over the last 90 years, the range has been reduced such that the northern limit of breeding is Sacramento Valley, California (though a small, potentially breeding population has been observed in northern California) and southeastern Idaho in the western interior states (USFWS, 2013c).

These birds were once considered widespread and locally common nesters in Arizona river bottoms, but the state population has declined sharply from an estimated 180 pairs present on the Arizona side of the lower Colorado River in 1976/1978 to 8 to 18 pairs estimated from surveys in 2010 (USFWS, 2013c). California once supported an estimated 15,000 pairs in the late 1800s, but massive declines have been documented into the 1980s due to loss of riparian gallery forest (less than 1 percent of original forest remaining) and egg-shell thinning from pesticide exposures (Hughes, 1999). The California population of western yellow-billed cuckoo today is less than one percent of its estimated historical population size and only three areas of the state have been identified as supporting more than a few breeding pairs on a regular basis. These include the Sacramento River (between Colusa and Red Bluff), South Fork of the Kern River upstream of Lake Isabella, and the lower Colorado River. In 2006, only one individual was detected on the California side of the lower Colorado River; however, 10 to 19 pairs were found in 2011 at a restored habitat area (USFWS, 2013c).

As an insectivore, yellow-billed cuckoo forages in open areas, woodland, orchards, and adjacent streams, gleaning grasshoppers, cicadas, caterpillars and other larger insects from the foliage. Occasionally it also forages on frogs or lizards and rarely on fruit during the breeding season (CDFW, 2013b; Hughes, 1999).

The onset of breeding is apparently correlated with an abundant local food supply or periods of greatest rainfall. Cuckoos may not breed if local food supply is inadequate on breeding grounds following spring migration. The breeding cycle is extremely rapid and requires only 17 days from egg-laying to fledging of young. Nesting activities take place between late June and late July, but may begin as early as late May and continue into September. Nest building typically takes 2 to 4 days. One brood of two to three young is raised per season. Cuckoos will occasionally double-brood in western populations if abundant food resources exist. Incubation begins with initiation of the first egg laying, known as asynchronous hatching, resulting in eggs and nestlings at different developmental stages in the same nest. Asynchronous hatching permits survival of the oldest nestlings in the event of a food shortage. The incubation period for yellow-billed cuckoos is 10 to 12 days. The young are fed large food items for the 5 to 8 day nestling period. Most young cuckoos leave the nest on day 6. After fledging, the young are dependent on the adults for at least 2 weeks (Hughes, 1999).

Western yellow-billed cuckoo occupy extensive deciduous riparian thickets or forests with dense, low-level or understory foliage and that are adjacent to slow-moving waterways, backwaters or seeps (CDFW, 2013b). In Arizona and southern California, western yellow-billed cuckoo prefer desert riparian woodlands comprised of willow, Fremont cottonwood, and dense mesquite (*Prosopis* spp). Nests are placed in willows, but cottonwood is used extensively for foraging (Hughes, 1999). Western yellow-billed cuckoo nest almost exclusively in low to moderate elevation riparian woodlands that cover 20 hectares (50 acres) or more within arid to semiarid landscapes. Western yellow-billed cuckoo may be restricted to the extensive, moist habitats because of humidity requirements for successful hatching and rearing of the young (Hughes, 1999; USFWS, 2013c).

Willow is almost always a dominant component of the vegetation. Along the Colorado River, western yellow-billed cuckoo may inhabit mesquite thickets where willow is absent, but nests are usually located in thickets with at least some willow, dense low-level or under-story foliage, high humidity, and wooded foraging spaces in excess of 93 meters (300 feet) in width and 10 hectares (25 acres) in area (CDFW, 2013b). Although breeding pairs have been observed in tamarisk, they are not found in areas that are totally dominated by tamarisk with a complete lack of willows or cottonwoods (USFWS, 2013c).

5.2.2.3 Status of the Species in the Area

The Action Area contains potentially suitable, though not preferred, nesting habitat for the species. The Action Area is located in the vicinity of two western yellow-billed cuckoo study areas (Lower Colorado River Multi-Species Conservation Program [LCMSCP], 2013)—the Topock Marsh (a portion of which is within the Action Area) and Topock Gorge (south of the Action Area). Potential nesting, foraging, and migratory habitat for the western yellow-billed cuckoo exists within and near the Action Area. The nesting and migratory period for western yellow-billed cuckoo occurs around late May (arrival) through late September (departure).

While not the particular focus of protocol surveys within the Action Area, incidental observations of western yellow-billed cuckoo have been made as part of annual protocol surveys that were conducted for southwestern willow flycatcher between 2005 through 2010 and in 2012 (GANDA, 2005a, 2006a, 2007a, 2008a, 2009a, 2010, and 2012). Throughout these surveys, a single western yellow-billed cuckoo individual was detected in three consecutive years between 2008 and 2010 (but not in 2012) at the same call point location (Figure 9) within the western portion of Topock Marsh in Arizona (GANDA, 2012).

These incidental sighting results at the same location seem to indicate that, even though no western yellow-billed cuckoo pairs were observed, there is potentially suitable nesting habitat in AZ along the western margin of the Topock Marsh. The topography along this peninsula from west to east consists of rolling sand dunes increasing in elevation from the levee road to an additional 20 feet and decreasing to tamarisk thicket and eventually to marsh habitat. Presumably, these areas may also contain sufficient willow shrubs (and, perhaps, even cottonwood trees) in addition to the tamarisk, which could support the nesting by western yellow-billed cuckoo. The recent floristic survey (GANDA and CH2M HILL, 2013a) indicated the presence of sand-bar willow in the southern portions of Topock Marsh that were surveyed within the Action Area. Based on this information, potentially suitable western yellow-billed cuckoo nesting habitat is presumed to occur along the western and southern margin of Topock Marsh.

Potentially suitable nesting habitat exists along the western margin of the Topock Marsh within dense tamarisk stands where an individual western yellow-billed cuckoo was documented at the same location for three consecutive years between 2008 and 2010. The potential nesting areas on the west side of Topock Marsh are included within the Action Area but range in distance from about 1,000 feet in the southern portion to greater than 3,000 feet in the northern portion from proposed activities associated with the Freshwater Implementation Plan (i.e., well and pipeline construction and operation and maintenance activities not already otherwise included in the environmental baseline). The burned tamarisk area to the east of the Oatman-Topock Highway is part of a planned restoration effort that seeks to re-establish native vegetation (Digital-Desert, 2013), so the potential suitability for western yellow-billed cuckoo foraging (and potentially nesting) in these habitats is expected to improve over time.

Conversely, the vegetation in the dense tamarisk stands associated with the Sacramento Wash to the east of the Oatman-Topock Highway was floristically surveyed and did not contain willow or cottonwood. For this reason, these areas would not be considered to be potentially suitable nesting western yellow-billed cuckoo habitat. Also, given the distance of these areas from the Colorado River (and associated cottonwood trees), the western yellow-billed cuckoo is not expected to make significant use of the Sacramento Wash tamarisk areas for roosting or feeding.

Within the CA portion Action Area to the west of the Colorado River, there is generally less suitable western yellow-billed cuckoo habitat than what is available in Arizona. Areas closer to the Colorado River are expected to be more suitable for migratory habitat as the birds migrate into and from suitable nesting habitats; however, the existing tamarisk habitats in California are still likely to have very limited use for roosting or feeding due to the nearly complete lack of willow and cottonwood. A single Gooding's willow was mapped on the island north of Park Moabi Slough and the presence of cottonwood was noted north and south of the slough only within Moabi Regional Park. The presence of sand-bar willow was noted in survey areas on both sides of the Colorado River throughout the Action Area and in the southern portion of

Topock Marsh (GANDA and CH2M HILL, 2013a), but was not considered sufficient to support western yellow-billed cuckoo.

In addition, the fragmented tamarisk thickets in California are too small to support western yellow-billed cuckoo. These thickets are found below the BNSF Railway and Interstate 40 bridges (approximately 6 acres); near the Bat Cave Wash at its confluence with the Colorado River (approximately 5 acres); near the unnamed western wash, which has its confluence with the Colorado River directly northwest of Bat Cave Wash (approximately 3 acres); and near the Park Moabi Marina (approximately 7 acres) as shown in Figure 10. These tamarisk thickets represent less than 1.5 percent of the total Action Area.

The tamarisk patches are also subject to regular human disturbance. The thickets near the Park Moabi Slough are subject to regular recreational boating traffic and the adjacent habitats on the island north of the slough and north of the National Trails Highway between the Pirate's Cove Resort and the Bat Cave Wash outlet have an extensive network of ORV trails.

Within the Action Area to the west of the Colorado River, there is generally less suitable western yellow-billed cuckoo nesting habitat than in Arizona. Tamarisk and arrow weed are the dominant vegetation types within the portion of the Action Area associated with the Colorado River floodplain. However, given the small size and relatively limited amount of sand-bar willow and nearly complete lack of cottonwood (except within Moabi Regional Park), the dense tamarisk thickets to the west of the Colorado River are not considered to be suitable nesting, or roosting and foraging habitat for western yellow-billed cuckoo. However, these habitats may still be used for western yellow-billed cuckoo roosting and foraging during migration. These tamarisk thickets represent less than 1.5 percent of the total Action Area. The patches tend to be fragmented and are subject to regular human disturbance; two factors that may decrease the habitat value for the species (GANDA, 2005a). The habitats near the Park Moabi Slough are subject to regular disturbance by recreational boat traffic and the adjacent habitats on the island north of the slough and north of the National Trails Highway between the Pirate's Cove Resort and the Bat Cave Wash outlet have an extensive network of ORV trails.

Although tamarisk habitat exists within the Action Area in California, the vegetation density, habitat structure, and patch-size of thickets are sparser, smaller, and more fragmented in comparison to observed potential breeding habitat within the Topock Marsh. While western yellow-billed cuckoo may inhabit mesquite thickets where willow is absent, nests are usually located in thickets with at least some willow, dense low-level or under-story foliage, high humidity, and wooded foraging spaces in excess of 93 meters (300 feet) in width and 10 hectare (25 acres) in area (CDFW, 2013b).

Additionally, biological monitors have logged several hundred hours performing pre-activity surveys on the California floodplain as part of compliance with the mitigation measures associated with the 2007 PBA and with revised well sampling procedures (CH2M HILL, 2005d) that require monitoring for any migratory bird nests by a qualified biologist within a 200-foot work area prior to construction-related activities that occur between March 15 and September 30. To date, no active nests of any migratory birds have been documented during these surveys.

5.2.2.4 Direct Effects

Direct effects are those that are caused by the proposed action and occur at the same time and place. Details of the Final Groundwater Remedy were previously described in Sections 3.3 and Table 2 and shown in Figures 6 and 7. The Final Groundwater Remedy actions are summarized here as only they relate to potential direct effects to western yellow-billed cuckoo.

Beginning in Arizona, the Freshwater Implementation Plan would have no direct effect on western yellow-billed cuckoo from anticipated activities in the northeastern portion of the Action Area because of the lack of suitable habitat near the areas where planned activities associated with the water conveyance pipeline construction (Figure 10) would occur from either the HNWR-1 location and Site B well location. Nonetheless, pre-activity surveys and construction monitoring by a qualified biologist would still be conducted, especially

when the conveyance pipeline work is near the southern margin of Topock Marsh, in order to avoid potential project impacts to this species.

As the freshwater conveyance pipeline alignment extends south of the Topock Marsh, it will travel in the Oatman-Topock Highway and then cross beneath Interstate 40. The underground pipeline alignment will continue in a southeastern direction along the elevated river terrace to the existing pipe bridge (i.e., the former Route 66 bridge) upon which, it will cross above ground over the Colorado River (Figures 6 and 7). This alignment for the freshwater conveyance pipeline will avoid any direct impacts to the Colorado River floodplain within the Action Area in Arizona or California. However, the pipe bridge crosses over marginal, but potential western yellow-billed cuckoo habitat along the California shore of the river. Pre-construction surveys and construction monitoring by a qualified biologist would be conducted when the conveyance pipeline activities were traversing this area.

Specific actions occurring within or adjacent to potentially suitable habitat in the floodplain in California have the potential to affect this species. This will include the activities that would be associated with the installation of remediation wells and pipelines for the in situ reduction zone, installation of monitoring wells, installation of remote wireless communications, and the use of a construction staging area near the Bat Cave Wash outlet.

Activities related to the construction of the Final Groundwater Remedy in upland areas will include the construction of carbon amendment storage and injection facilities, remedy-produced water treatment system; a pre-injection freshwater treatment system (if required), and conditioned water storage facilities. These activities will also include the installation of upland remediation wells and pipelines, installation of monitoring wells, and the use of construction staging/soil storage areas. These sites are located within the upland that does not support riparian vegetation and other characteristics commonly associated with western yellow-billed cuckoo habitat. For this reason, these activities are not expected to have any effect to this species due to unsuitable habitat at the specific project locations.

The Final Groundwater Remedy construction activities proposed by PG&E will involve the use of heavy equipment including, but not limited to, backhoes and drill rigs that may be used to remove vegetation, grade the ground surface, and install remediation or groundwater monitoring wells or pipelines within the floodplain. This equipment can create substantial ground disturbance and noise.

The Colorado River may function as a migration corridor for the western yellow-billed cuckoo. During migration periods, this species may briefly stop to roost and/or forage within or adjacent to potentially suitable roosting and foraging habitats within the fragmented tamarisk patches in the Action Area that are located at Bat Cave Wash and the unnamed wash to the west; under the BNSF railroad and Interstate 40 overpasses; near Park Moabi Regional Park; and the eastern edge of the Action Area (Figure 10) (CH2M HILL, 2005a; 2005b; 2005c).

Because western yellow-billed cuckoo may potentially use the habitat in the Action Area for roosting and foraging during the spring and fall migration seasons, it is possible that operational activities could alter the behavior of migrating individuals, but as discussed, the potential for impact is considered low. The greatest potential for direct effects to western yellow-billed cuckoo would be within the short migratory period during arrival (late May through June) and departure (July through late September) when individuals could be passing through the Action Area to and from more suitable nesting locations.

Habitat elements such as patch size, shrub density and the presence and/or location of water provide the appropriate habitat structure and features to allow for this behavior. However, annual surveys conducted from 2005 through 2010 and in 2012 have not documented any western yellow-billed cuckoo nesting or presence (other than transients) using the habitat patches in the historical or current Colorado River floodplain within the Action Area. Five riverbank remediation wells and associated water conveyance pipelines, as well as several monitoring wells would be constructed within or near the tamarisk thickets along the floodplain on the California side of the project. As previously explained, the regular disturbances

by recreational boating and ORV traffic reduce the potential suitability of these areas for western yellow-billed cuckoo use. Also, based on the combination of biennial survey results and the application of conservation measures, any direct effects to nesting or migratory western yellow-billed cuckoos is expected to be low to negligible.

Over time, tamarisk acreage may significantly increase along the Colorado River corridor and the larger thickets may serve as western yellow-billed cuckoo breeding habitat when they are found in conjunction with willow and cottonwood. While several fragmented, small stands of tamarisk could be peripherally affected as a result of the proposed actions, most of the work will occur within sparsely vegetated areas within the floodplain in order to avoid and minimize habitat disturbance. Design efforts will avoid dense contiguous stands of tamarisk greater than 1.0 acre and any associated vegetation as practicable. Limited riparian vegetation, primarily smaller patches or individual plants of tamarisk and arrow weed, may be crushed or trimmed as a result of the proposed actions. An 8.8-acre disturbance threshold will be followed in an attempt to lessen the potential effects to the species and habitat. Exceeding the 8.8-acre threshold will require consultation with USFWS and may require possible mitigation.

Project-related construction and operational activities will not occur within cottonwood-willow stands and; therefore, will have no direct effect upon the Colorado River's overall balance of remaining cottonwood-willow riparian stands that historically were the native habitat for this species.

5.2.2.5 Indirect Effects

Indirect effects are those that are caused by the proposed action and are later in time, but reasonably certain to occur. The possible actions that may occur are related to the long-term operation and maintenance of the Final Groundwater Remedy facilities after construction and the decommissioning and restoration of IM No. 3 and the Final Groundwater Remedy.

The Final Groundwater Remedy activities related to operation and maintenance of the freshwater supply system would also include periodic maintenance and repair of well, pump, and electrical control equipment, pipeline maintenance and repair; stormwater pollution prevention; access roadway maintenance; well sampling; and eventual decommissioning of the well and pumping facilities once remedial objectives were achieved. After decommissioning, these areas would be restored in accordance with the Remedy Decommissioning Plan, including a restoration plan that will be submitted by PG&E to DOI after receipt of DOI's certification of Remedial Action completion, and the Habitat Restoration Plan, where applicable, that will be submitted to the agencies with the Remedial Action Work Plan. As previously mentioned, these activities will occur in areas that are not within or nearby suitable western yellow-billed cuckoo habitat, so the effect of these activities is expected to be negligible.

The Final Groundwater Remedy activities related to operation and maintenance of the remediation facilities and supporting systems would also include periodic maintenance and repair of well, pump, and electrical control equipment, pipeline maintenance and repair; stormwater pollution prevention; access roadway maintenance; well sampling; and eventual decommissioning of the wells, pipelines, and pumping facilities once remedial objectives were achieved. After decommissioning, these areas would be restored in accordance with the Remedy Decommissioning Plan, including a restoration plan, which will be submitted by PG&E to DOI after receipt of DOI's certification of Remedial Action completion, and the Habitat Restoration Plan, where applicable, that will be submitted to the agencies with the Remedial Action Work Plan. Planned activities will also include the decommissioning of the IM No. 3 treatment facilities, and upland restoration including the areas on MW-20 Bench and IM No. 3 facilities.

Regular sampling of remediation or monitoring wells may occur on a weekly, biweekly, or monthly basis and will likely require the use of off-road utility vehicles and possibly a small generator for power to activate the submersible pumps during water collection. The generators' noise output is minimal enough that a conversation can easily occur. These activities happening within or adjacent to suitable western yellow-billed cuckoo habitat may lead to alterations of western yellow-billed cuckoo behavior. However, the lack of

evidence of western yellow-billed cuckoo nesting within this portion of the Action Area suggests that the probability of negatively altering western yellow-billed cuckoo behavior during normal well sampling, carbon substrate injection, or equipment maintenance activities would be relatively low. Further, the magnitude of project effects may be difficult to discern from other potentially impacting transportation activities (i.e., the Interstate 40 and the BNSF Railroad) and recreational activities (e.g., watercraft) that occur with regularity within the Action Area.

More aggressive activities associated with non-routine well maintenance, pipeline repair, certain road repair; decommissioning and removal of facilities; and restoration activities would require the use of heavy equipment, trucks, materials, and crews to implement. However, the potential effects of these activities would be reduced by the application of general project management measures discussed in Section 3.4 and species-specific mitigation measures discussed below in subsection 5.2.2.8, so that the potential for indirect effects on western yellow-billed cuckoo are considered to be low.

5.2.2.6 Cumulative Effects

Cumulative effects include future state and private activities, excluding federal activities that are reasonably certain to occur within the Action Area. Continued operation of the TCS will occur. It is reasonably certain that remedial activities will also occur within the Action Area. The final soil remedy, if required, will include heavy equipment and personnel with minor activities in the floodplain. Habitat loss would likely not be sufficient enough to reduce the habitat value and thereby, alter western yellow-billed cuckoo use and behavior. Habitat loss is defined as the removal of trees and perennial shrubs. The trimming of vegetation is not considered habitat loss.

Future state and private actions separate from PG&E that are reasonably certain to occur within the project vicinity include continued recreational activities associated with the Colorado River and the HNWR, such as boating, fishing, and ORV use of the floodplain and surrounding areas. Examples of recent actions that have occurred within the Action Area in California since the 2007 PBA include the expansion of private commercial recreation facilities at the Moabi Regional Park (Pirate's Cove restaurant, individual lodging, motorized and non-motorized zip-line rides, as well as expanded ORV trail networks on the island north of the slough and north of the National Trails Highway east to the Bat Cave Slough outlet). Other actions include ongoing use of the 'open riding' ORV areas to the south of Moabi Regional Park, although an official 2006 BLM road closure to the east of Park Moabi Road would be expected to limit this effect within the Action Area.

Within the Action Area in Arizona, ongoing and future actions include renovations at the Topock Marina (including current rental lodging, and a proposed hotel and new restaurant) and HNWR restoration efforts associated with the 2008 Sacramento Wash Fire. The HNWR restoration efforts are expected to have an overall positive effect on western yellow-billed cuckoo habitat in the Action Area as those native plantings mature and replace lost native habitats; however, the restoration plantings will not create additional western yellow-billed cuckoo habitat. Additionally, operations and maintenance of existing infrastructure such as the gas pipelines, railroad, Interstate 40, bridges, and other nearby roads and utilities are anticipated.

5.2.2.7 Critical Habitat Effects Determination

Because western yellow-billed cuckoo is not a current federal listed species, critical habitat for this species has not been identified. Constituent elements that will be part of any future critical habitat designation would be expected to include dense riparian areas that are dominated by willow, cottonwood, and mesquite. These areas would have to have shallow groundwater levels that would support the trees and create humid conditions. They would also need to have a suitable prey base of large insects. These particular conditions are not present within the Action Area and, given the current hydrological management of the Colorado River, they are unlikely to become present. Because the proposed activities for the Final Groundwater Remedy would not affect these resources, the potential for adversely affecting constituent elements or future critical habitat is considered discountable.

5.2.2.8 Effects Determination

As shown in Figure 10, individual western yellow-billed cuckoos were detected at a single call location in Arizona in three consecutive years between 2008 and 2010 (GANDA, 2012). It was presumed that this could indicate the presence of suitable nesting habitat within the Action Area on the western side of Topock Marsh. Given the multiple detections of western yellow-billed cuckoo over several years, the presence of potentially suitable habitat, and the presence of nearby breeding populations, there is a potential for western yellow-billed cuckoo to breed in the Action Area in the future. However, nesting of western yellow-billed cuckoo is considered unlikely in other portions of the Action Area along the western shore of the Colorado River due to the lack of appropriate vegetation composition, habitat structure, and size. Furthermore, due to the regular disturbances from recreational boating and ORV traffic, especially on the western side of the Colorado River near the Park Moabi Slough, the potential for negative effects to western yellow-billed cuckoo are very low and would therefore be considered insignificant. To date, no take of western yellow-billed cuckoos (or any other migratory birds) has occurred within the Action Area from project activities.

Protocol-level surveys for western yellow-billed cuckoos will be conducted for two consecutive years (2014 and 2015). Depending on the findings of those surveys, the subsequent surveys may follow a similar frequency (triennial) as the southwestern willow flycatcher (USFWS, 2014a). In addition, pre-project surveys by qualified biologists will be conducted to identify the presence of western yellow-billed cuckoos and adapt operations to minimize any potential for effects. Further, it is expected that project activities (especially those involving heavy equipment for the construction, development, or maintenance of wells in proximity to potentially suitable western yellow-billed cuckoo nesting habitat) will occur before May 15 or after September 30 (the migratory/nesting season) within the Action Area, where practicable, any potential effects would be a non-issue.

Nesting of western yellow-billed cuckoo on the floodplain is considered unlikely west of the Colorado River within the California portion of the Action Area. However, seasonal migratory use of habitat on the floodplains of California and Arizona can be anticipated to occur along the Colorado River as western yellow-billed cuckoos move to and from other known breeding locations. Project activities, therefore, could influence western yellow-billed cuckoo activity during this period.

The following mitigation measures will be applied to all actions associated with the Final Groundwater Remedy that will occur in or near potential western yellow-billed cuckoo habitat, as shown in Figure 10.

1. Minimize the net increase of disturbed habitat in the Action Area.
2. Riparian areas surrounding the designated work areas and subject to influence of operations and maintenance activities shall be surveyed by a USFWS permitted biologist for western yellow-billed cuckoo according to the protocol established by the USFWS. After the initial 2 years of surveys, ongoing surveys shall be performed according to USFWS's recommendations until the action has been completed and all facilities have been removed. Reports shall be provided to the biologists in the BLM Lake Havasu Field Office and to the USFWS's Phoenix AESO each time they are performed.
3. Construction and development activities that use heavy equipment should be completed prior to May 15. The use of any heavy equipment in or near western yellow-billed cuckoo habitat after May 15 will be required to be reassessed and additional conservation measures may be considered. Preferably such activities would occur from September 30 to May 15.
4. To the extent feasible, future project activities within the sensitive areas identified in Figure 10 (i.e., potential western yellow-billed cuckoo habitat, wetlands, 100-year floodplain, and a 60-foot buffer from the Colorado River) should be avoided. Further, if greater than 8.8 acres of floodplain habitat is lost or manipulated, specific project consultation with USFWS will be required and possible mitigation may be required. Habitat loss is defined as the removal of trees and perennial shrubs. The trimming of vegetation is not considered habitat loss.

5. A biologist will be assigned to field teams for remediation activities within western yellow-billed cuckoo habitat during the period of May 15 through September 30.
6. Minimization measures outlined in the BIAMP will be implemented including preconstruction surveys during the nesting season, awareness training, pre-activity surveys, compliance monitoring, and reporting during field activities.

Future project activities, conducted in accordance with species-specific mitigation measures presented above and other established mitigation measures (CH2M HILL, 2012a) will help to avoid, reduce, and mitigate operational and construction impacts to the biological environment within the Action Area. It is recognized that additional minor amounts of tamarisk habitat may be lost, removed, or manipulated to conduct planned activities, which are not expected to significantly reduce overall habitat value and alter western yellow-billed cuckoo behavior. Western yellow-billed cuckoos have been documented in several areas throughout the Action Area and future project activities are anticipated to occur on the California floodplains in or near potentially suitable nesting/migratory habitat along the Colorado River. In general, these activities will be near marginal yellow-billed cuckoo habitats and of relatively short duration. However, no impacts are expected within the Topock Marsh on the HNWR where the suitable western yellow-billed cuckoo habitat occurs.

Based on the location of project activities and distance from potential suitable western yellow-billed cuckoo nesting habitat; the fragmented distribution, composition, and structure of habitat conditions in or adjacent to the Action Area; and the continued implementation of conservation measures identified in Section 3.4, adverse effects from the planned project activities to the western yellow-billed cuckoo are not expected to occur. For these reasons, any potential direct or indirect effects from project activities are likely to be either negligible or avoidable. An effects determination of "not likely to jeopardize" is concluded for this species.

5.2.3 Agassiz's Desert Tortoise (*Gopherus agassizii*)

5.2.3.1 Status

The desert tortoise was listed as federally threatened on April 2, 1990 (USFWS, 1990a). Critical habitat was designated on February 8, 1994 (USFWS, 1994a). The Desert Tortoise Recovery Plan was released on June 28, 1994 (USFWS, 1994b). The desert tortoise was listed as threatened by the state of California in 1989.

The decline in the desert tortoise population is primarily due to habitat loss, degradation, and fragmentation resulting from increased human population and urbanization in the desert and arid regions of the southwestern United States. The increase in urbanization, collection of tortoises for pets, overgrazing, landfills, subsidized predation, highway mortality, vandalism, agriculture, fire, drought, and ORV use have all contributed to the decline of the tortoise in the wild. Another important reason for the tortoise decline in the western Mojave Desert is the introduction of an upper respiratory tract disease into many of the wild populations (USFWS, 1990a; 1994b).

5.2.3.2 Natural History, Distribution, Abundance, and Habitat

The desert tortoise is a large, herbivorous terrestrial reptile. The Agassiz's desert tortoise has a high-domed shell that can reach a length of 36 centimeters (14 inches). The animal has stocky, elephant-like limbs and a short tail. The carapace (upper shell) is brown, and the plastron (lower shell) is yellow—both exhibiting prominent growth lines. Adult males can be distinguished from females by the concavity toward the rear of their plastron. Adult males also have larger chin glands and a longer tail and gular horn than females (Stebbins, 1985).

The adult desert tortoise is active from mid-March or April to November and, during the winter months, is dormant in underground burrows (Luckenbach, 1982). Desert tortoises will congregate in winter dens during colder weather, and then spread out to nearby areas during moderate weather in the spring and fall and retreat into short, individual burrows or beneath shrubs during more extreme heat in summer (Woodbury

and Hardy, 1940). During the summer active period, desert tortoises have home ranges from 12.7 to 72.1 hectares (5 to 29 acres) (O'Conner et al., 1994). During active periods, tortoises feed on a wide variety of herbaceous plants, including cactus, grasses, and annual flowering plants (USFWS, 1994a).

Desert tortoises may live beyond 80 years and have a relatively slow rate of reproduction. Sexual maturity is reached at the age of 15 to 20 years. Mating generally occurs in the spring (mid-March to late-May), with nesting and egg-laying occurring from April to mid-July (Rostral et al., 1994). The female tortoise lays her eggs in a hole, approximately 7 to 10 centimeters (2.7 to 3.9 inches) deep, dug near the mouth of a burrow (Woodbury and Hardy, 1948). Following egg-laying, the female covers the eggs with soil. Clutch size ranges from 2 to 14 eggs, with an average of 5 to 6 eggs (Luckenbach, 1982). Desert tortoise eggs typically hatch from August through October. These hatchlings are provided a food source in the form of an egg yolk that is assimilated into the underside of the shell. This yolk sac will sustain the animal for up to 6 months. The hatchling desert tortoise will go into hibernation in the late fall but can be active on warm sunny or rainy days (Luckenbach, 1982).

The Agassiz's desert tortoise can be found in desert and arid regions west and north of the Colorado River in Nevada, Arizona, and Utah (Stebbins, 1985). This species is primarily associated with flats and bajadas (shallow slopes that lie at the base of rocky hills), with soils ranging from sand to sandy-gravel but firm enough for the tortoise to construct burrows. In California, this desert tortoise is most commonly found in association with creosote bush scrub, with inter-shrub space for growth of herbaceous plants (USFWS, 1994a).

5.2.3.3 Status of the Species in the Area

From 2004 through 2013, PG&E contracted with CH2M HILL (2004i, 2010a), GANDA, 2005b; 2006b; 2007b; 2008b; and 2009b), and WSA (2013) to perform protocol-level presence/absence surveys for the desert tortoise in the Action Area. The majority of the desert tortoise studies (2004 through 2009) were conducted in the Action Area portions within California. The 2010 (CH2M HILL, 2010a) biological survey looked at three areas that were added to the Action Area, two of which, were in California.

Since desert tortoise surveys have been conducted within the Action Area, there have been no observed live tortoises or sign of active use. There have been, however, findings of desert tortoise bone fragments, disarticulated carcasses, and potential burrows, as described below. The location of the bone and carcass findings are all shown in Figure 10. The potential burrows were not included on this figure because subsequent interpretations determined that the burrows were likely created or maintained by mammals.

The first significant finding related to desert tortoise was on November 5, 2004. That finding was documented in a technical memorandum (CH2M HILL, 2004i) that was published as an addendum (No. 4) to the *Final Biological Resources Investigations for Interim Measures No. 3: Topock Compressor Station Expanded Groundwater Extraction and Treatment System* (CH2M HILL, 2004a). The desert tortoise carcass was discovered on an elevated terrace in a Creosote Bush scrub 'badlands' with signs of previous vehicular traffic. The disarticulated carcass consisted of a plastron and a few portions of the carapace that were partially buried in the substrate or exposed at the ground surface. The bones showed signs of mineralization and were tan so that they blended with the color of the surrounding substrate. It was concluded, due to the condition of the bones, that the desert tortoise may have been entombed within a burrow which was subsequently eroded away. The age of the desert tortoise carcass was estimated be several decades (CH2M HILL, 2004i).

Another desert tortoise carcass was discovered within the Action Area in May 2006. This adult male carcass consisted of 14 scattered plastron and carapace bone fragments, which had serrated edges and were white. The external scutes had peeled off and were not present. This finding occurred to the south of Interstate 40 and to the northwest of the PG&E TCS (Figure 10). One additional set of disarticulated, scattered tortoise shell bone fragments was documented during the 2009 survey with the finding originally made on September 24, 2008 and reported to the USFWS and BLM on October 2, 2008. The set of bone fragments

was located to the northeast of the TCS near a wood post on the eastern edge of a wash (Figure 10). It was not possible to accurately determine the age of the bone fragments using available keys, however, it was confirmed that all of the tortoise remains were at least four years old. Later conclusions, taken in consultation with other experts, estimated that the remains were at least ten years old; and that, judging by their appearance, condition, and location, they were probably much older (GANDA, 2009b).

In addition to the carcasses documented above, two other sets of highly deteriorated bone shell fragments were discovered between May 2004 and April 2009. The bone fragments were estimated to be more than 4 years old. Two sets of bone shell fragments were associated with ephemeral drainages, indicating that they may have washed in from outside the Action Area during a rainstorm. This interpretation was based on the location of the finds, surrounding topography, and the lack of any other desert tortoise sign within the survey area. Burrows with entrances large enough to accommodate a desert tortoise were also observed during the multiple surveys. However, after repeated visits these possible desert tortoise burrows had no scat, tracks, or other signs within or surrounding the burrows. For these reasons, it was concluded that the burrow were likely created and maintained by a black-tailed jackrabbit or other burrowing mammal species (GANDA, 2009b).

It was concluded that the desert tortoise remains indicated historical use of the area but that no recent use was occurring. The survey area has been highly disturbed by numerous uses and is fragmented by the BNSF Railroad and Interstate 40, which are known to cause desert tortoise mortality. Linear transportation features contribute to habitat degradation for desert tortoise related to the increased dispersal of invasive weeds; increased populations of the common raven (*Corvus corax*) that prey on young tortoises; alter the dynamics of rainwater runoff; and provide additional human access and use. It was also hypothesized that the Interstate 40, BNSF Railroad, Highway 95, and Oatman-Topock Highway have effectively fragmented and isolated the habitats within the Action Area and surrounding vicinity. Given the dates when these roadways were constructed, it is likely that they have negatively affected desert tortoise populations within the Action Area for decades (GANDA, 2009b). Based on the survey findings above, the USFWS concurred with a PG&E request that regular protocol-level surveys for desert tortoise be stopped, while pre-activity surveys and construction monitoring would continue (USFWS, 2010a).

In 2010, three additional areas outside of the Action Area were surveyed for desert tortoise. As shown in Figures 2 and 10, two of the three survey areas were located on the California side of the river to the northeast and west of Park Moabi. No desert tortoises or other potential sign were documented within these survey areas (CH2M HILL, 2010a). These three areas were added to the Action Area based on consultations with the tribes. Based on the survey results described above, desert tortoises were concluded to be absent throughout the California portion of the Action Area.

Despite the absence of live or recent tortoise observations, there is a possibility; however, that desert tortoises could enter the Action Area from the west. The probability of this occurring is very low, owing to the relatively poor quality of the creosote bush scrub habitat in the Action Area, which typically lacks annual vegetation for forage and adequate burrowing environments for shelter. Combined with the presence of steep rocky slopes of the Chemehuevi Mountains and associated deeply incised drainages, along with the presence of major linear transportation facilities such as the Interstate 40 and BNSF railroad, the probability of permanent occupation by desert tortoises within the Action Area is unlikely.

5.2.3.4 Direct Effects

Direct effects are those that are caused by the proposed action and occur at the same time and place. Details of the Final Groundwater Remedy were previously described in Sections 3.3 and Table 2 and shown in Figures 6 and 7. The Final Groundwater Remedy actions are summarized here as only they relate to potential direct effects to Agassiz's desert tortoise.

The Freshwater Implementation Plan activities within Arizona will have no direct effects on Agassiz's desert tortoise because this species occur only occurs to the west and north of the Colorado River.

Specific actions occurring within suitable habitat in upland areas within California have the potential to affect this species. Activities related to the construction of the Final Groundwater Remedy in upland areas will include the construction of carbon amendment storage and injection facilities, remedy-produced water treatment system; a pre-injection freshwater treatment system (if required); and conditioned water storage facilities. These activities will also include the installation of upland remediation wells and pipelines; installation of monitoring wells; and the use of construction staging/soil storage areas. These sites are located within the upland areas that could be potential desert tortoise habitats.

A large portion of the Action Area (approximately 988 acres) is located on the uplands within desert habitat that is referred to as creosote bush scrub (Figure 8). Protocol-level surveys that were conducted between 2005 and 2009 by GANDA did not indicate that desert tortoise was currently occupying the Action Area. Although the area is considered poor desert tortoise habitat, a transient could potentially enter the site. By conducting proposed construction and operational activities in accordance with established access routes (CH2M HILL, 2005e), as well as mitigation measures presented in Section 3.4 and noted below in subsection 5.2.3.8, it is expected that impacts within the creosote bush scrub habitat will be kept to a minimum.

The project activities proposed by PG&E on the uplands will occasionally involve the use of heavy equipment including but not limited to graders, backhoes, drill rigs, and water trucks that may be used to remove vegetation, grade the ground surface including dirt roads, extract soil samples, drill or maintain remediation or monitoring wells, and install other facilities. This equipment can create substantial ground disturbance and noise. The planned activities project also includes the continued operations of IM No. 3 involving vehicles traveling on unpaved roads to access sites and associated human activity until such time as the Final Groundwater Remedy is constructed and the IM No. 3 is put into a lay-up condition prior to decommissioning. Existing access routes (Figure 6) will be used wherever possible, so that direct effects to the creosote bush scrub habitat would be very low.

5.2.3.5 Indirect Effects

Indirect effects are those that are caused by the proposed action and are later in time, but reasonably certain to occur. The possible actions that may occur are related to the long-term operation and maintenance of the Final Groundwater Remedy facilities after construction and the decommissioning and restoration of IM No. 3 and the Final Groundwater Remedy.

The Final Groundwater Remedy activities related to operation and maintenance of the remediation facilities and supporting systems would also include periodic maintenance and repair of well, pump, and electrical control equipment, pipeline maintenance and repair; storm water pollution prevention; access roadway maintenance; well sampling; and eventual decommissioning of the wells, pipelines, and pumping facilities once remedial objectives were achieved. After decommissioning, these areas would be restored in accordance with the Remedy Decommissioning Plan, including a restoration plan, which will be submitted by PG&E to DOI after receipt of DOI's certification of Remedial Action completion, and the Habitat Restoration Plan, where applicable, that will be submitted to the agencies with the Remedial Action Work Plan. Planned activities will also include the decommissioning of the IM No. 3 treatment facilities, and upland restoration including the areas on MW-20 Bench and IM No. 3 facilities.

Regular sampling of remediation or monitoring the wells may occur on a weekly, biweekly, or monthly basis and will likely require the use of a pickup truck or in some cases an off-road utility vehicles and possibly a small generator for power to activate the submersible pumps during water collection. The generators' noise output is minimal enough that a conversation can easily occur. These activities happening within or adjacent to suitable desert tortoise habitat may lead to alterations of desert tortoise behavior, if they are present. Additionally, activities associated with non-routine well maintenance; pipeline repair; certain road repair; decommissioning and removal of facilities; and restoration activities would require the use of heavy equipment, trucks, materials, and crews to implement.

However, the lack of evidence of desert tortoise within this portion of the Action Area suggests that the probability of negatively altering desert tortoise behavior during normal well sampling, non-routine well maintenance, carbon substrate injection, or equipment maintenance activities would be relatively low. Further, the magnitude of project effects may be difficult to discern from other potentially impacting transportation activities (i.e., the Interstate 40 and the BNSF Railroad).

The potential for indirect effects to the desert tortoise is related to the possibility of a transient entering the Action Area during the proposed activities. However, based on past survey findings and a full-time biological monitor onsite to conduct pre-activity surveys, the probability of potential impact is considered low to negligible. Additionally, negative effects to tortoises may be further complicated by nearby natural and man-made barriers such as the Chemehuevi Mountains, Colorado River, BNSF railroad, Interstate 40, and other paved and unpaved roadways, which have fragmented and isolated the landscapes within the Action Area. In particular, indirect effects associated resulting from operational activities are expected to be negligible or avoidable.

As with other construction and maintenance actions, there is a risk of altering individual tortoise behavior from the restoration of degraded sites. This will involve recontouring, removing structures, driving trucks, using bobcats, and replanting native vegetation, for example. Once established, the restoration will presumably improve the quality of the Creosote Bush Scrub habitat for this species and other wildlife species. Any indirect effects associated with restoration of this habitat are expected to be beneficial to this species and habitat.

Overall, the potential effects of these activities would be reduced by the application of general project management measures discussed in Section 3.4 and species-specific mitigation measures discussed below in subsection 5.2.3.8, so that the potential for indirect effects to desert tortoises are considered to be low.

5.2.3.6 Cumulative Effects

Cumulative effects include future state and private activities, excluding federal activities that are reasonably certain to occur within the Action Area. Continued operation of the TCS will occur. It is reasonably certain that remedial activities could occur within the Action Area. The final soil remedy, if required, will include heavy equipment and personnel with minor activities in upland areas. Habitat loss would not likely be enough to reduce the habitat value and thereby, alter desert tortoise use and behavior. Habitat loss is defined as the removal of trees and perennial shrubs. The trimming of vegetation is not considered habitat loss.

Future state and private actions separate from PG&E that are reasonably certain to occur within the project vicinity include continued recreational activities along the Colorado River and the HNWR, as well as ongoing use of the ‘open riding’ ORV areas to the south of Moabi Regional Park. These ORV activities are particularly significant to desert tortoise within the Action Area because ORV traffic may impact established trails or previously undisturbed habitat areas, or result in desert tortoise mortality within the designated ‘open riding’ areas (CTUC, 2011). Furthermore, it is possible that ORV traffic may extend well beyond the designated areas through trespass. Open access to unpaved roadways south of the Park Moabi Road exit off Interstate 40, also offers ORV access to the these portions of the Action Area. It is expected that the official 2006 BLM road closure to the east of Park Moabi Road would limit this adverse effect within the Action Area.

Additionally, operations and maintenance of existing infrastructure such as the gas pipelines, railroad, Interstate 40 and other nearby roads and utilities are anticipated.

5.2.3.7 Critical Habitat Effects Determination

The nearest critical habitat for Agassiz’s desert tortoise is located within the Chemehuevi Valley located approximately 9 miles west of the Action Area (USFWS, 1994a). PG&E’s activities are located outside designated critical habitat for the Agassiz’s desert tortoise. An effects determination of “no effect” to critical habitat is concluded.

5.2.3.8 Effects Determination

Recent evidence of desert tortoise presence was not detected during the protocol surveys of the Action Area from 2004 through 2010 (CH2M HILL, 2004i, 2005c, 2010a; and GANDA, 2005b, 2006b, 2007b, 2008b, and 2009b). However, remains of desert tortoises have been documented within the Action Area. These remains were highly degraded and of an older, undetermined age, and so, were not considered to be indicative of recent occupation by the desert tortoise. There has been no reported take of this species resulting from investigative and remedial activities to date.

The upland landscape is considered poor habitat for the desert tortoise. It is estimated that no more than 3.6 acres of new upland habitat would be affected by future proposed actions. The intent of PG&E will be to use those areas already disturbed by project activities so as to minimize the net increase of affected habitat. It should also be noted that this PBA does not imply the approval of actions and/or the degradation of the landscape at the expense of risk to other resources (e.g., cultural resources).

The following mitigation measures will be applied to all actions associated with the Final Groundwater Remedy that will occur in or near potential Agassiz' desert tortoise habitat, as shown in Figure 10.

1. PG&E will minimize the net increase of disturbed habitat in the Action Area.
2. If future activities require the loss or manipulation of greater than 3.6 acres of upland habitat, specific project consultation with the USFWS will need to occur and possible mitigation may be required. Habitat loss is defined as the removal of trees and perennial shrubs. The trimming of vegetation is not considered habitat loss.
3. PG&E is to have a USFWS-approved desert tortoise handler available if and when a tortoise is found within the Action Area and requires relocation.

The documentation of aged desert tortoise remains and the presence of two possible burrows within the Action Area, although difficult to interpret, do indicate that individuals have been present within the Action Area in the past, and could potentially do so in the future. However, 7 years of protocol-level surveys within the Action Area have concluded that this species is currently absent. The Action Area has relatively low quality habitat that has been isolated and fragmented by several large, busy transportation features including highways and a railroad grade. The Action Area is also relatively distant from known suitable habitat and tortoise populations.

For these reasons, taken together with the implementation of mitigation measures presented above, the effects from proposed project activities to the Agassiz's desert tortoise are not expected to occur. Therefore any potential direct or indirect effects from project activities are either negligible or avoidable. An effects determination of "not likely to adversely affect" is concluded for this species.

5.2.4 Morafkai's Desert Tortoise (*Gopherus morafkai*)

5.2.4.1 Status

In December 2010, the USFWS determined the Sonoran population of desert tortoise warranted protection under the ESA, but that listing was precluded by higher priority listing needs, placing them as a candidate for listing. In June 2011, the USGS conducted a study confirming that the desert tortoise, thought to be one species for the past 150 years, now includes two separate and distinct species. The newly recognized species, Morafkai's desert tortoise, was formerly considered the Sonoran population of the desert tortoise. The study's finding that the Morafkai's desert tortoise is a new species confirms the USFWS's decision to evaluate this population independently from the Agassiz's desert tortoise, and will not change the status of the species under the ESA or change existing recovery plans. Morafkai's desert tortoise is currently considered as a Candidate species for listing.

The causes contributing to the decline in the Morafkai's desert tortoise population are similar to those listed for the Agassiz's desert tortoise in Section 5.2.2.1.

5.2.4.2 Natural History, Distribution, Abundance, and Habitat

Morafkai's desert tortoise has a flatter, pear-shaped shell compared to the high-domed shell of the Agassiz's desert tortoise. The animal has stocky, elephant-like limbs and a short tail. The carapace (upper shell) is brown, and the plastron (lower shell) is yellow—both exhibiting prominent growth lines. Adult males can be distinguished from females by the concavity toward the rear of their plastron. Adult males also have larger chin glands and a longer tail and gular horn than females (Stebbins, 1985).

The adult desert tortoise is active from mid-March or April to November and, during the winter months, is dormant in underground burrows (Luckenbach, 1982). Desert tortoises will congregate in winter dens during colder weather, and then spread out to nearby areas during moderate weather in the spring and fall and retreat into short individual burrows or under shrubs during more extreme heat in summer (Woodbury and Hardy, 1940). During the summer active period, desert tortoises have home ranges from 12.7 to 72.1 hectares (5 to 29 acres) (O'Conner et al., 1994). During active periods, tortoises feed on a wide variety of herbaceous plants, including cactus, grasses, and annual flowering plants (USFWS, 1994b).

Desert tortoises may live beyond 80 years and have a relatively slow rate of reproduction. Sexual maturity is reached at 15 to 20 years of age. Mating generally occurs in the spring (mid-March to late-May), with nesting and egg-laying occurring from June to early August (Rostral et al., 1994). The female tortoise lays her eggs in a hole, approximately 7 to 10 centimeters (2.7 to 3.9 inches) deep, dug near the mouth of a burrow (Woodbury and Hardy, 1948). Following egg-laying, the female covers the eggs with soil. Clutch size ranges from 2 to 14 eggs, with an average of 5 to 6 eggs (Luckenbach, 1982). Desert tortoise eggs typically hatch from August through October. These hatchlings are provided a food source in the form of an egg yolk that is assimilated into the underside of the shell. This yolk sac will sustain the animal for up to 6 months. The hatchling desert tortoise will go into hibernation in the late fall but can be active on warm sunny or rainy days (Luckenbach, 1982).

This species of tortoise inhabits rugged uplands such as rocky bajadas, hillsides, mountain slopes, and canyons. Populations in northwestern Arizona inhabit more moderate terrain such as gentle bajadas and low valleys. It shelters and hibernates in self constructed burrows that are often excavated under large rocks as well as in naturally occurring cavities under rocks or in the banks of washes (USFWS, 1990a).

5.2.4.3 Status of the Species in the Area

In 2010, a protocol-level desert tortoise survey was conducted in one area on the Arizona side of the project as part of a detailed biological resources survey of three areas initially outside of the Action Area, as shown on Figures 2 and 10 (CH2M HILL, 2010a). This area was evaluated for the Freshwater Implementation Plan as part of the Final Groundwater Remedy.

Two potential desert tortoise burrows were documented during the 2010 surveys in Arizona; however, these were considered to be mammal burrows that had taken on the appearance of tortoise burrows through weathering/erosion. No desert tortoises or other potential sign were documented during the surveys (CH2M HILL, 2010a). In 2013, the area being investigated for the Freshwater Implementation Plan were expanded as shown Figure 2 and these additional areas (including the original 2010 survey area) were surveyed for desert tortoise in May 2013 (WSA, 2013). No individual tortoises or tortoise sign were observed during the surveys and the survey concluded that desert tortoise were absent within the Arizona freshwater investigation area.

Almost the entire survey area, with the exception of a limited portion in the sparsely vegetated hills to the east of the BNSF alignment, was determined to lack suitable desert tortoise habitat. The relatively level survey areas were previously disturbed; had some level of recent human disturbance; or had loose soils that were considered as unstable for burrowing. In addition, the low-lying level areas around the Sacramento Wash were subject to periodic flooding. The findings of this desert tortoise survey were deemed consistent with past surveys conducted around the PG&E TCS (WSA, 2013).

While GANDA (2009b) conducted their protocol-level surveys of the Action Area on the west side of the Colorado River, several of the conclusions related to habitat suitability are also applicable to the Action Area on the east side of the Colorado River within Arizona. In particular, this portion of the Action Area has also been highly disturbed by numerous uses and is fragmented by the BNSF Railroad and Interstate 40, known to be causes of desert tortoise mortality. Linear transportation features contribute to habitat degradation for desert tortoise related to the increased dispersal of invasive weeds; increased populations of the common raven that prey on young tortoises; alter the dynamics of rainwater runoff; and provide additional human access and use. It is possible that the Interstate 40, BNSF railroad, Highway 95, and Oatman-Topock Highway have effectively fragmented and isolated the habitats within the Action Area and surrounding vicinity. Given these roadways and other linear facilities were constructed between 40 and more than 100 years ago, it is likely that they have negatively affected desert tortoise populations within the Action Area for decades (GANDA, 2009b). Based on the protocol-level survey results, it was concluded that Morafkai's desert tortoises were absent within the Arizona portions of the Action Area. Only a small portion of the Action Area along the east side of the BNSF railroad alignment was considered to be marginally suitable desert tortoise habitat; however, there will be no activities associated with the Freshwater Implementation Plan (such as the water supply pipeline) that will intercept pass through or near this potentially suitable habitat.

5.2.4.4 Direct Effects

Direct effects are those that are caused by the proposed action and occur at the same time and place. Details of the Final Groundwater Remedy were previously described in Sections 3.3 and Table 2 and shown in Figures 6 and 7.

Project-related construction and operational activities proposed for the Arizona side of the project are related only to the Freshwater supply system. However, none of these activities will occur within habitat used by Morafkai's desert tortoise. Additionally, with the implementation of mitigation measures presented in Section 3.4 for Morafkai's desert tortoise and used again in subsection 5.2.4.8, the effects of proposed project activities to the Morafkai's desert tortoise are not expected to occur.

5.2.4.5 Indirect Effects

Indirect effects are those that are caused by the proposed action and are later in time, but reasonably certain to occur. The possible actions that may occur within the Arizona portion of the Action Area will include the maintenance of freshwater conveyance facilities (i.e., well, pump, electrical controls, and pipeline) after construction; the decommissioning of those facilities once the remedial objectives have been met; and eventual restoration of the areas once the facilities have been removed or suitably abandoned in place.

These activities would require heavy equipment, trucks, materials and crews to implement. Because these activities would occur outside of the Morafkai's desert habitat and would be completed in conjunction with pre-activity surveys and construction monitoring by a qualified biologist, any indirect effects are considered to be negligible or avoidable.

5.2.4.6 Cumulative Effects

Cumulative effects include future state and private activities, excluding federal activities that are reasonably certain to occur within the Action Area. Continued operation of the TCS will occur. The interim and remedial actions that may occur within the Action Area are focused on the supply of freshwater to support groundwater cleanup actions in the Action Area to the east of the Colorado River. It is reasonably certain that additional freshwater supply activities and investigations similar to the actions that have already been implemented to date will occur. The level and use of equipment, materials and personnel will be similar as well. There would be no tortoise habitat loss that would reduce the habitat value and thereby, alter desert tortoise use and behavior.

Future state and private actions separate from PG&E that are reasonably certain to occur within the project vicinity include continued recreational activities associated with the Colorado River and the HNWR, such as boating, and fishing at the Topock Marina. A new Topock Marina restaurant was constructed in 2013 and other improvement of those facilities (i.e., hotel and new restaurant) may occur in the future. Nearby federal ongoing and future actions include the restoration of the Sacramento Wash Burn area on the north and west sides of the Oatman-Topock Highway. These activities are outside of the potentially suitable habitat for Morafkai's desert tortoise.

Additionally, operations and maintenance of existing infrastructure such as the gas pipelines, railroad, Interstate 40 and other nearby roads and utilities are anticipated. Those activities have the potential to affect Morafkai's desert tortoise only in the south-easternmost portion of the Action Area.

5.2.4.7 Critical Habitat Effects Determination

As a candidate species, critical habitat has not been designated for Morafkai's desert tortoise. An effect determination of "no effect" for critical habitat is concluded for this species.

5.2.4.8 Effects Determination

Recent protocol-level surveys did not reveal evidence of the presence of Morafkai's desert tortoise within the Arizona portion of the Action Area in 2010 or in 2013 (CH2M HILL, 2010a; WSA, 2013). These studies also did not indicate the presence of suitable desert tortoise habitat in the portion of the Action Area where Final Groundwater Remedy actions will occur that are associated with the freshwater supply system. There has been no reported take of this species resulting from investigative and remedial activities to date.

The intent of PG&E will be to use areas that are already disturbed for project activities so as to minimize the net increase of affected, undisturbed habitat.

The following mitigation measures will be applied to all actions associated with the Final Groundwater Remedy that will occur in or near potential Morafkai's desert tortoise habitat, as shown in Figure 10.

1. PG&E will minimize the net increase of disturbed habitat in the Action Area.
2. If future activities require the loss or manipulation of greater than 3.6 acres of new upland habitats, specific project consultation with the USFWS will need to occur and possible mitigation may be required. Habitat loss is defined as the removal of trees and perennial shrubs. The trimming of vegetation is not considered habitat loss.
3. PG&E is to have a USFWS-certified desert tortoise handler available if and when a tortoise is found within the Action Area and requires relocation.

It is possible for a transient individual to enter the Action Area in Arizona. The Action Area has relatively low quality habitat that has been isolated and fragmented by several large, busy transportation features including highways and a railroad grade. The Action Area is also relatively distant from known suitable habitat and tortoise populations. These reasons, taken together with the implementation of mitigation measures presented above, indicate that any adverse effects from proposed project activities to the Morafkai's desert tortoise are not expected to occur.

Therefore any potential direct or indirect effects from project activities are either negligible or avoidable. An effects determination of "not likely to adversely affect" is concluded for this species.

5.3 Marsh Species

5.3.1 Yuma Clapper Rail (*Rallus longirostris yumanensis*)

5.3.1.1 Status

The Yuma clapper rail was listed as a federally endangered species on March 11, 1967, under endangered species legislation enacted in 1966. Critical habitat has not been designated for this species. The Yuma Clapper Rail Recovery Plan was released on February 4, 1983 (USFWS, 1983) with a draft revised plan released in 2010 (USFWS, 2010d). The Yuma clapper rail is a fully protected species in California and was listed as threatened by California in 1978.

Much of the decline of the Yuma clapper rail can be attributed to altered seasonal flow regimes and lost marsh habitat due to the construction of hydro facilities and dredging on the Lower Colorado River. Population changes on a local level have been documented, but these changes may be based on changes in habitat quality. In turn, a decline in habitat quality may be the result of the aging of existing cattail stands to a less suitable condition for rail occupancy. Historically, the marshes seldom accumulated large amounts of dead vegetative material because of floods and changes to the river channel, which washed away cattail stands on a repeating cycle (USBR, 2004).

5.3.1.2 Natural History, Distribution, and Abundance and Habitat

The Yuma clapper rail is a chicken-sized marsh bird with a long down-curved beak. Both sexes are slate brown above, with light cinnamon underparts and barred flanks. This subspecies is slightly lighter in color and slightly thinner than other clapper rails. The bird measures 14 to 16 inches long once it is fully grown (Eddleman, 1989).

Yuma clapper rails are found in emergent wetland vegetation such as dense or moderately dense stands of cattails (*Typha latifolia* and *T. domingensis*) and California bulrush (Eddleman, 1989; Todd, 1986). They can also occur, in lesser numbers, in sparse cattail-bulrush stands or in dense reed (*Phragmites australis*) stands (Rosenberg et al., 1991). The most productive clapper rail areas consist of a mosaic of uneven-aged marsh vegetation interspersed with open water of variable depths (Conway et al., 1993). Annual fluctuation in water depth and residual marsh vegetation are important factors in determining habitat use by Yuma clapper rails (Eddleman, 1989).

Yuma clapper rails may begin exhibiting courtship and pairing behavior as early as February. Nest building and incubation can begin by mid-March, with the majority of nests being initiated between late April and late May (Eddleman, 1989). The rails build their nests on dry hummocks, on or under dead emergent vegetation and at the bases of cattail or bulrush. Sometimes they weave nests in the forks of small shrubs that lie just above moist soil or above water that is up to about 2 feet deep. The incubation period is approximately 28 days so the majority of clapper rail chicks should be fledged by August (Eddleman, 1989). Yuma clapper rails nest in a variety of different micro habitats within the emergent wetland vegetation type, with the only common denominator being a stable substrate. Nests can be found in shallow water near shore or in the interior of marshes over deep water. Nests usually do not have a canopy overhead as surrounding marsh vegetation provides protective cover (Eddleman, 1989).

Crayfish (*Procambarus clarki*) are the preferred prey of Yuma clapper rails. Crayfish comprise as much as 95 percent of the diet of some Yuma clapper rail populations (Ohmart and Tomlinson, 1977). Availability of crayfish may be a limiting factor in clapper rail populations and is believed to be a factor in the migratory habits of the rail (Rosenberg et al., 1991). However, Eddleman (1989) found that crayfish populations in some areas remain high enough to support clapper rails all year and that seasonal movement of clapper rails cannot be correlated to crayfish availability. However, due to the species' secretive nature, nests are difficult to find and reproductive effects are difficult to assess (USFWS, 2005b).

5.3.1.3 Status of the Species in the Area

The Topock Marsh near the Topock Marina is located within a USFWS study site and is also within the Action Area. Several call stations have been surveyed annually for Yuma clapper rail by the USFWS along the South Dike that is located within the HNWR. In past years, this species has been detected south of the new South Dike and north of the Topock Marina (USFWS, 2005e). In 2005, seven Yuma clapper rails were detected along the South Dike transect (Fitzpatrick, 2006). More recent surveys by USFWS along the South Dike transect documented 21 rails in 2012 and 13 rails in 2013 (Fitzpatrick, 2014).

In addition to the USFWS detections, Yuma clapper rails were detected as incidental observations in annual southwestern willow flycatcher surveys during the 2008, 2009, 2010, and again in 2012 along the western edge of Topock Marsh and east of the Topock Marina within the Action Area in Arizona (GANDA, 2012), as shown in Figure 9.

Based on prior discussions, PG&E received a letter from USFWS Havasu National Wildlife Refuge (HNWR) staff in January 2005 requesting that protocol surveys for the Yuma clapper rail not be performed because HNWR staff were interested in avoiding duplication of existing USFWS survey efforts and were concerned with potential added stress to the Yuma clapper rail (USFWS, 2005a).

A focused survey for Yuma clapper rail was also conducted within the Action Area in 2012 by KBS. While no Yuma clapper rails were discovered within California, a pair of birds was observed in Arizona on five of six survey events. Two individual, advertising (kekking) male birds were also observed during all six of the surveys events. These Yuma clapper rail sightings were located within the marsh immediately east and northeast of the Topock Marina (KBS, 2012).

The suitable emergent habitat includes the entire Topock Marsh (Figure 9). The western portion of the Topock Marsh, north- northeast of the Topock Marina, is located within the Action Area and extends to the northern Action Area boundary. While the eastern portion of the Topock Marsh is not included within the Action Area, suitable emergent habitat is located approximately 530 feet west of freshwater supply well, HNWR-1, and is located approximately 2,300 feet west of the Site B supply well.

Within the Action Area on the California side of the Colorado River, there are twelve small, fragmented shoreline wetlands that are potentially suitable emergent wetlands (Figure 9). Four of these small emergent marsh habitats are located within the Park Moabi Slough to the west of the marina and another emergent marsh habitat along the southern shoreline of the Park Moabi Slough inlet. There are two additional habitats on the north side of the National Trails Highway at the outlets of the unnamed wash and Bat Cave Wash. The small pond to the south of the National Trails Highway within the unnamed wash is also an emergent marsh habitat. There is another single emergent wetland north of the BNSF bridge. Beneath and south of the Interstate 40 Bridge is the largest emergent marsh on the California side of the river. There are also two small emergent marshes further south of this area. All of these areas were surveyed in 2012 and, as previously mentioned, no rails were detected in California (KBS, 2012).

5.3.1.4 Direct Effects

Direct effects are those that are caused by the proposed action and occur at the same time and place. Details of the Final Groundwater Remedy were previously described in Section 3.3 and Table 2 and are shown in Figures 6 and 7. The Final Groundwater Remedy actions are summarized here as only they relate to potential direct effects to Yuma clapper rail.

Beginning in the eastern portion of the Action Area in Arizona, the Freshwater Implementation Plan has the potential to have a direct effect on Yuma clapper rail due to anticipated activities in the eastern portion of the Action Area near the southern margin of the Topock Marsh. The planned activities could include the installation of a new freshwater supply well; construction of pumping facilities in proximity to the supply well; and installation of the conveyance pipeline, as well as the periodic maintenance and eventual decommissioning of the well, pumping, and pipeline facilities once remedial objectives were achieved, followed by restoration of the affected areas. With respect to the Yuma clapper rail, it will be the activities

related to the conveyance pipeline, maintenance, decommissioning, and restoration that are most relevant because they occur closest to the suitable Yuma clapper rail along the southern margin of the Topock Marsh.

The Freshwater Implementation Plan is currently evaluating options for the freshwater supply well in Arizona. The first well being considered is HNWR-1, a well that has already been constructed by the refuge along the west side of the Oatman-Topock Highway. A second supply well (Site B well) is located to the north of HNWR-1 on the northern margin of the Sacramento Wash channel and was completed in March 2014. Based on current evaluations, the Site B well may not be suitable as a primary supply well; however, it may still serve as a backup supply well or be used for blending freshwater with another primary supply well. A third location for a new well near the existing HNWR-1 is also being considered. That new well installation is addressed in the 2007 PBA (as re-initiated in 2012). Because these well locations are not near suitable Yuma clapper rail habitat, none of the planned activities associated with construction, operation, decommissioning, or restoration of these sites will have any effect on this species.

The water supply pipeline will be installed within the previously disturbed areas on the shoulder of the Oatman-Topock Highway. The underground conveyance pipeline will connect the chosen supply well to the Final Groundwater Remedy facilities in California (Figures 6 and 7). The conveyance pipeline alignment will not directly impact suitable emergent marsh habitat but will occur close enough to represent a noise disturbance when the pipeline passes along the southern portion of Topock Marsh. For this reason, construction in this area will be completed outside of the time period when nesting young may not be mobile (March 15 to May 31). Work in this area that is conducted after this period will be completed in the shortest timeframe possible, so that it is expected that the effect on Yuma clapper rail will be negligible and discountable.

The dense tamarisk that was present near the southern Topock Marsh margin prior to being burned in the 2008 Sacramento Wash Fire, may have once provided a marginal buffer for the Oatman-Topock Highway for the Yuma clapper rail habitat north of the southern limits of Topock Marsh. However, without the tamarisk, the pipeline installation activities will no longer benefit from this marginal buffer. While the Oatman-Topock Highway and nearby Topock Marina are sources for relatively frequent (but short) year-round disturbances from vehicular and boating traffic, the pipeline installation activities represent a more sustained disturbance. For this reason, pre-construction surveys and the timing of the activities to avoid clapper rail nesting periods will be especially important to avoid disturbing nesting birds within the nearby Topock Marsh. In accordance with established procedures, a qualified biological monitor would conduct pre-activity surveys and construction monitoring for nesting birds if the work was occurring within the nesting season (mid-March to late May). If nesting birds are determined to be present, then there would be no construction activities within 200 feet of suitable nesting habitat during the period when young may be present but not mobile (mid-March to late May), unless otherwise approved by the USFWS. Construction activities could occur after this period but would need to minimize in terms of total duration (7 to 10 days at any one event, unless otherwise approved by the USFWS). It is expected that mobile adults and young birds may be able to move away from the temporary disturbance but could move back when the disturbance abated.

As the freshwater conveyance pipeline alignment extends south of the Topock Marsh, it will travel in the Oatman-Topock Highway and then cross beneath Interstate 40. The underground pipeline alignment will continue in a southeastern direction along the elevated river terrace to the existing pipe bridge (i.e., the former Route 66 bridge) upon which, it will cross above ground over the Colorado River (Figures 5 and 6). This alignment for the freshwater conveyance pipeline will avoid any direct impacts to the Colorado River floodplain, associated with the freshwater supply pipeline within the Action Area in Arizona or California.

Specific actions occurring within or adjacent to potentially suitable habitat (emergent marsh) along the margins of the floodplain in California have the potential to affect this species. This will include the activities that would be associated with the installation of remediation wells and pipelines for the *in situ* reduction zone; installation of monitoring wells; installation of remote wireless communications; and the use of a construction staging area near the Bat Cave Wash outlet.

The Final Groundwater Remedy activities proposed by PG&E will involve the use of heavy equipment including, but not limited to, backhoes and drill rigs that may be used to remove vegetation, grade the ground surface, and install remediation or groundwater monitoring wells or pipelines within the floodplain. This equipment can create substantial ground disturbance and noise.

The Colorado River may function as a seasonal movement or dispersal corridor for the Yuma clapper rail. During these movements, this species may briefly stop to shelter and/or forage within or adjacent to potentially suitable sheltering and foraging habitats within the fragmented emergent marsh patches in the Action Area that are located at Bat Cave Wash and the unnamed wash to the west; north of the BNSF railroad and beneath the Interstate 40 overpasses; and within the Park Moabi Slough (Figure 10) (CH2M HILL, 2005a; 2005b).

Because Yuma clapper rail may potentially use the habitat in the Action Area for sheltering and foraging during the year, it is possible that construction and operational activities could alter the behavior of dispersing or seasonally moving, but as discussed, the potential for impact is considered low because actions within the suitable habitat are not planned and activities adjacent to suitable habitats have limited effects (noise, duration, etc.).

Habitat elements such as patch size, shrub density and the presence and/or location of water provide the appropriate habitat structure and features to allow for movements among and between marsh areas in and adjacent to the Action Area. It should be noted; however, that seasonal bird surveys are not likely to detect dispersal of young or movement of adults. However, annual surveys conducted from 2005 through 2010 and in 2012 have not documented any nesting or transient Yuma clapper rail using the habitat patches within these portions of the Action Area. As previously explained, the regular disturbances by recreational boating and ORV traffic also lower the potential suitability of these areas for Yuma clapper rail use.

Activities related to the Final Groundwater Remedy will occur in upland areas that do not support the marsh vegetation and other characteristics commonly associated with Yuma clapper rail habitat. For this reason, these activities are not expected to have an effect to this species due to unsuitable habitat at the specific project location.

None of the proposed remediation wells or associated water conveyance pipelines would be constructed within the emergent marsh habitats along the floodplain on the California side of the Action Area. Based on the application of pre-activity surveys and construction monitoring and lack of evidence of suitable nesting sites, any direct effects to Yuma clapper rail is expected to be negligible or avoidable.

5.3.1.5 Indirect Effects

Indirect effects are those that are caused by the proposed action and are later in time, but reasonably certain to occur. The possible actions that may occur are related to the long-term operation and maintenance of the Final Groundwater Remedy facilities after construction and the decommissioning and restoration of IM No. 3 and the Final Groundwater Remedy.

The Final Groundwater Remedy activities related to operation and maintenance of the freshwater supply system would also include periodic maintenance and repair of well, pump, and electrical control equipment, pipeline maintenance and repair; storm water pollution prevention; access roadway maintenance; well sampling; and eventual decommissioning of the well and pumping facilities once remedial objectives were achieved. After decommissioning, these areas would be restored in accordance with the Remedy Decommissioning Plan, including a restoration plan, which will be submitted by PG&E to DOI after receipt of DOI's certification of Remedial Action completion, and the Habitat Restoration Plan, where applicable, that will be submitted to the agencies with the Remedial Action Work Plan.

The Final Groundwater Remedy activities related to operation and maintenance of the remediation facilities and supporting systems would also include periodic maintenance and repair of well, pump, and electrical control equipment, pipeline maintenance and repair; storm water pollution prevention; access roadway

maintenance; well sampling; and eventual decommissioning of the wells, pipelines, and pumping facilities once remedial objectives were achieved. After decommissioning, these areas would be restored in accordance with the restoration plan that will be developed prior to the achievement of the Final Groundwater Remedy RAOs. Planned activities will also include the decommissioning of the IM No. 3 treatment facilities, and floodplain restoration for those areas.

Regular sampling of remediation or monitoring the wells may occur on a weekly, biweekly, or monthly basis and will likely require the use of off-road utility vehicles and possibly a small generator for power to activate the submersible pumps during water collection. The generators' noise output is minimal enough that a conversation can easily occur. These activities happening within or adjacent to suitable Yuma clapper rail habitat may lead to alterations of Yuma clapper rail behavior.

However, the lack of evidence of Yuma clapper rail nesting within this portion of the Action Area suggests that the probability of negatively altering Yuma clapper rail behavior during normal well sampling, carbon substrate injection, or equipment maintenance activities would be relatively low. Further, the magnitude of project effects may be difficult to discern from other potentially impacting transportation activities (i.e., the Interstate 40 and the BNSF Railroad) and recreational activities (e.g., watercraft) that occur with regularity within the Action Area. Activities associated with non-routine well maintenance, pipeline repair, certain road repair; decommissioning and removal of facilities; and restoration activities would require the use of heavy equipment, trucks, materials, and crews to implement.

However, the potential effects of these activities would be reduced by the application of general project management measures discussed in Section 3.4 and species-specific mitigation measures discussed below in subsection 5.3.1.8, so that the potential for indirect effects on Yuma clapper rail are considered to be low.

5.3.1.6 Cumulative Effects

Cumulative effects include future state and private activities, excluding federal activities that are reasonably certain to occur within the Action Area. Continued operation of the TCS will occur. It is reasonably certain that soil remedial activities could occur within the Action Area. The final soil remedy, if required, will include heavy equipment and personnel with minor activities in the floodplain. There will be no loss of emergent marsh habitat loss that would reduce the habitat value and thereby, alter Yuma clapper rail use and behavior.

Future state and private actions separate from PG&E that are reasonably certain to occur within the project vicinity include continued recreational activities associated with the Colorado River and the HNWR, such as boating, fishing, and ORV use of the floodplain and surrounding areas. Examples of recent actions that have occurred within the Action Area in California since the 2007 PBA include the expansion of private commercial recreation facilities at the Moabi Regional Park (Pirate's Cove restaurant; individual lodging; motorized and non-motorized zip-line rides; as well as expanded ORV trail networks on the island north of the slough and north of the National Trails Highway east to the Bat Cave Slough outlet).

Within the Action Area in Arizona, ongoing and future actions include a renovations at the Topock Marina (including current rental lodging, and a proposed hotel and new restaurant) and HNWR restoration efforts associated with the 2008 Sacramento Wash Fire. The fire restoration efforts are expected to have an overall positive effect on Yuma clapper rail habitat in the Action Area by improving foraging opportunities as the native plantings mature through greater species diversity; however, the restoration plantings will not create additional Yuma clapper rail habitat. Additionally, operations and maintenance of existing infrastructure such as the gas pipelines, railroad, Interstate 40 and other nearby roads and utilities are anticipated.

5.3.1.7 Critical Habitat Effects Determination

Critical habitat has not been designated for the Yuma clapper rail. An effects determination of "no effect" for critical habitat is concluded for this species.

5.3.1.8 Effects Determination

Yuma clapper rails have been documented in suitable nesting habitat along the western and southern edge of the Topock Marsh on the HNWR near the eastern boundary of the Action Area in Arizona. Suitable emergent wetland habitats are approximately 530 feet west of the water supply well HNWR-1 and approximately 2,300 feet west of the Site B supply well. Well construction was completed before the Yuma clapper rail nesting period before April 2014 so they had no effect on Yuma clapper rail. Installation and testing activities for those wells were covered under the 2007 PBA (as re-initiated in 2012).

Potential disturbances to Yuma clapper rail habitats could occur during the water conveyance pipeline installation along the Oatman-Topock Highway near the southern portion of the Topock Marsh. However, adverse effects for work being conducted in this area can be avoided by implementing bird impact avoidance measures, as described in Section 3.4 and the BIAMP (CH2M HILL, 2013f), and by conducting pre-activity surveys and construction monitoring to avoid inadvertent impacts to Yuma clapper rail. Furthermore, the regular disturbances from recreational boating at Topock Marina and from traffic along the Oatman-Topock Highway make the potential for negative effects to Yuma clapper rail very low. To date, no take of Yuma clapper rails (or any other migratory birds) has occurred within the Action Area from project activities.

Pre-project surveys will be conducted by qualified biologist during the nesting/molting season (March 15 and September 15) to identify the presence of Yuma clapper rails and adapt operations to minimize any potential for effects. Further, it is expected that project activities (especially those involving heavy equipment for the construction of the freshwater pipeline in proximity to potentially suitable Yuma clapper rail nesting habitat) will occur outside of the March 15 to end of May time period when resident clapper rail nests may be occupied by immobile young. Beginning in June, it is expected that mobile adults and young may be able to temporarily move away from short-term (7 to 10 days) impacts that would be associated with the noise from the pipeline construction activities.

Seasonal use of habitat on the floodplains of California and Arizona can be anticipated to occur along the Colorado River as Yuma clapper rails move within existing habitat areas outside of the breeding season. Project activities; therefore, could influence activity during this period. To track clapper rail activity in the Action Area, PG&E will coordinate with USFWS to obtain the results of ongoing clapper rail survey results within the Action Area on the Arizona side of the Colorado River. At this point PG&E will not be conducting focused clapper rail surveys on the California side of the Colorado River; however, should future information from existing and pre-activity surveys indicate that clapper rails are actually using those habitats, focused surveys between February 15 and May 30 could be required at some appropriate interval (e.g., every 3 years).

The following mitigation measures will be applied to all actions associated with the Final Groundwater Remedy that will occur in or near potential Yuma clapper rail habitat, as shown in Figure 10.

1. To further minimize potential impacts to the Yuma clapper rail as a result of project activities on the Arizona side of the project, PG&E will coordinate with USFWS to obtain clapper rail survey results within the Action Area on the Arizona side of the Colorado River.
2. Minimization measures outlined in the BIAMP will be implemented including preconstruction surveys during the nesting season, awareness training, pre-activity surveys, compliance monitoring, and reporting during field activities throughout the year.
3. Specific to the Arizona portion of the Action Area, all construction and development activities should be completed prior to March 15. Preferably, such activities would occur from June 1 to March 15 in order to avoid nesting periods when immobile young may be present. Any construction or repair activities within 200 feet of potentially suitable nesting habitat during this time will be kept to the minimum duration possible.

Future project activities, conducted in accordance with established mitigation measures presented in Section 3 and other relevant documents (CH2M HILL, 2005a, 2013f) will help to avoid, reduce, and mitigate operational and construction impacts to the biological environment within the Action Area. It is expected that no emergent marsh habitats will be lost, removed, or manipulated to conduct planned activities, especially those within the Topock Marsh on the HNWR.

However, based on the location of project activities and the fragmented distribution, composition and structure of habitat conditions in or adjacent to the Action Area; and the continued implementation of conservation measures identified in Section 3.4 and as listed above, adverse effects of planned project activities to the Yuma clapper rail are not expected to occur.

For these reasons, any potential direct or indirect effects from project activities are likely to be either negligible or avoidable. An effects determination of "not likely to adversely affect" is concluded for this species.

5.4 Aquatic

5.4.1 Razorback Sucker (*Xyrauchen texanus*)

5.4.1.1 Status

The razorback sucker was listed as a federally endangered species on October 23, 1991, with an effective date of November 22, 1991. The Razorback Sucker Recovery Plan was released in 1998 (USFWS, 1998). The recovery plan was supplemented with the Upper Colorado River Endangered Fish Recovery Program (USFWS, 2001a) and the Razorback Sucker Recovery Goals (USFWS, 2001b). The razorback sucker is a fully protected species in California and was listed as endangered by the State of California in 1974.

Critical habitat was designated in 15 river reaches within the historic range of the razorback sucker on March 21, 1994, with an effective date of April 20, 1994 (USFWS, 1994c). This includes Lake Mead to its full pool elevation, the Colorado River and its 100-year floodplain between Hoover Dam and Davis Dam (including Lake Mohave to its full pool elevation), and the Colorado River and its 100-year floodplain from Parker Dam to Imperial Dam (USFWS, 1994c).

The trend for the razorback sucker is for a continued rangewide decrease in wild populations due to lack of sufficient recruitment of young adults, with the loss of old adults due to natural mortality. The primary limiting factor for the razorback sucker appears to be non-native fish predation of the early life stages (USFWS, 2005b).

5.4.1.2 Natural History, Distribution, Abundance and Habitat

The razorback sucker is a large fish, measuring over 2 feet long and weighing 8 pounds. Sexual dimorphism is present, with males being smaller, slimmer, and having larger fins than females. During the breeding season males have nuptial tubercles covering posterior fins and portions of the body. Females tend to be larger, heavier-bodied, and have fins that are somewhat smaller in proportion to their body size (Minckley, 1973).

The razorback sucker is endemic to large rivers of the Colorado River Basin from Wyoming to Mexico. Present distribution of natural populations is limited to Lake Mohave, Green River Basin, and the Upper Colorado River Basin. Historically razorback suckers inhabited the Colorado, Gila, Salt, Verde, and San Pedro rivers.

Presently, natural adult populations exist only in Lake Mohave, Lake Mead, and Lake Havasu. This species uses a variety of habitat types from mainstem channels to slow backwaters of medium and large streams and rivers, sometimes around cover. In impoundments they prefer depths of 1 meter or more over sand, mud, or gravel substrates. (AGFD, 2002). Early explorers report the fish as extremely abundant (Gilbert and Scofield, 1898). In central Arizona it was abundant enough to be commercially harvested for human and animal food and for fertilizer in the late 1800s. Similar abundances have been noted for the upper basin (Bestgen, 1990). Today the species occupies only a small portion of its historical range, and most occupied areas have very low

numbers of fish. Between Davis Dam and Lake Havasu, observations of razorback suckers were extremely rare (USBR, 2004) until more recent stocking efforts in the Colorado River main stem.

Spawning occurs from late winter through spring along gravelly shorelines or bays. Evidence suggests that suckers migrate from larger rivers to smaller tributaries prior to spawning. A single female is attended by 2 to 12 males, and the group moves in tight circles over the bottom. The eggs are adhesive and attach to the interstitial spaces within the gravel substrate. The young hatch in a few days and live along the shoreline for a time. Females will spawn repeatedly with several males. Hatching success is highly dependent on water temperature with complete mortality in temperatures less than 10 degrees Celsius (50 degrees Fahrenheit) (AGFD, 2002).

5.4.1.3 Status of the Species in the Area

The Lower Colorado River supports the largest remaining populations of razorback sucker. The population consists primarily of subadults. In 2005, razorback suckers were documented near Needles, California. In 2006, 236 suckers were captured and released at that spawning site. The likelihood of this species being in the area around Park Moabi and Topock Marina is very high (Fitzpatrick, 2006).

Stocking efforts in the Upper Colorado River Basin and in Lakes Mohave and Havasu and the Lower Colorado River below Parker Dam are ongoing, with the 30,000-fish requirement for Lake Havasu completed in 2001. The most critical of these efforts is the replacement of the Lake Mohave population using wild-caught larvae from the lake. By the end of 2001, the initial goal to stock 50,000 subadult fish into Lake Mohave was achieved. The Lake Mohave efforts will continue towards the second goal, which is to establish a population of 50,000 adults. The ongoing stocking and habitat improvement programs continue to add fish to this reach of the river (USFWS, 2008a, 2011). To date, from 2005 through 2012, the LCRMSCP Native Fish Augmentation Program has been responsible for stocking over 54,000 razorback sucker to Reach 3 of the river (encompassing the Topock Site and Havasu National Wildlife Refuge) (LCRMSCP, 2014).

Specific studies, focusing on spawning habitat, numbers of adult spawners, and juvenile success in specific backwater habitats, are being used to focus the stocking efforts and habitat conservation plans for both razorback sucker and bonytail chub (LCRMSCP, 2011).

5.4.1.4 Direct Effects

Direct effects are those that are caused by the proposed action and occur at the same time and place. Details of the Final Groundwater Remedy were previously described in Sections 3.3 and Table 2 and shown in Figures 6 and 7. All activities will occur outside of the Colorado River, therefore, no direct effects are anticipated.

Activities that may occur within the 100-year floodplain include the construction of a freshwater supply pipeline beneath the Interstate 40 and BNSF bridges. This pipeline will follow an existing access roadway through the western edge of the 100-year floodplain. No other Final Groundwater remedy facilities will occur within the 100-year floodplain. While the pipeline construction normally involves the use of heavy equipment such as a backhoe, smaller equipment such as a bobcat and/or quad-runners will be used if work is required directly within the 100-year floodplain. However, the magnitude of riparian function that may be reduced by the proposed action is not expected to impact the razorback sucker due to very limited project-related activities and associated minor footprints that are adjacent to the Colorado River floodplain.

Additionally, a 3.7-acre current floodplain vegetation removal threshold has been established to minimize any reduced function of the riparian zone.

5.4.1.5 Indirect effects

Indirect effects are those that are caused by the proposed action and are later in time, but reasonably certain to occur. The possible actions that may occur are related to the long-term operation and

maintenance of the Final Groundwater Remedy facilities after construction and the decommissioning and restoration of the Final Groundwater Remedy.

Because these activities will occur at the edge of the 100-year floodplain, it is expected that the work can be completed from the adjacent upland area; by using hand tools; or within minimal incursion into the 100-year floodplain, so that the effect on the floodplain itself would be minimal. For this reason, the indirect effects of the planned activities on razorback suckers are expected to be negligible or avoidable.

5.4.1.6 Cumulative Effects

Cumulative effects are of those future state and private activities, excluding federal activities that are reasonably certain to occur within the Action Area. Continued operation of the TCS will occur. It is reasonably certain that soil remedial activities could occur within the California portion of the Action Area.

Future state and private actions separate from PG&E that are reasonably certain to occur within the project vicinity include continued recreational activities associated with the Colorado River such as boating, camping, and fishing. Examples of recent actions that have occurred within the Action Area in California since the 2007 PBA include the expansion of private commercial recreation facilities at the Moabi Regional Park (Pirate's Cove restaurant; individual lodging; motorized and non-motorized zip-line rides; as well as expanded ORV trail networks on the island north of the slough and north of the National Trails Highway east to the Bat Cave Slough outlet). As previously noted, the Moabi Regional Park island to the north of the slough that could extend to within the 100-year floodplain. The restaurant building at the Topock Marina was also upgraded in 2013 and proposed projects include a new hotel and restaurant.

No other changes in land use or water use of the Colorado River within the Action Area are foreseen.

5.4.1.7 Critical Habitat Effects Determination

Critical habitat for the razorback sucker does not occur within the Action Area. An effect determination of "no effect" for critical habitat is concluded for this species.

5.4.1.8 Effects Determination

Razorback suckers have been documented north of the Action Area in Park Moabi Lagoon and near Needles, California. There is a high likelihood for this species to use the mainstem Colorado River upstream and downstream of the Action Area as well as the backwater areas of Park Moabi and the Topock Marina. No future project activities are anticipated to occur in the Colorado River; however, there will be additional remediation activities within the 100-year floodplain, although the amount of riparian habitat altered within the 100-year floodplain is expected to be minimal.

The following mitigation measures will be applied to all actions associated with the Final Groundwater Remedy that will occur in or near the mainstem Colorado River, as well as the backwater areas of Park Moabi and the Topock Marina.

1. Consideration was given to minimize the net increase of habitat disturbance that may affect riparian areas and the project altogether. If greater than 8.0 acres of habitat within the general and 100-year floodplain is destroyed or manipulated, specific project consultation with the USFWS will be required and possible mitigation may be required.
2. Proposed project activities that differ from surface water sampling, within the Colorado River should preferably occur between June 1 and January 31.
3. In the event an emergency situation (e.g., a spill into the Colorado River), where actions to abate the problem are to occur along the shoreline/river interface or in the water, a negative impact to this species may occur. Those actions which may adversely affect this species and constitute a 'take', are not covered within this scope of this determination in this Final Groundwater Remedy PBA. If an emergency situation occurs, immediate consultation with the USFWS will be required.

However, because no direct or indirect impacts are expected from planned activities within the Colorado River and the implementation of habitat avoidance and conservation measures described above, negative effects of the proposed project activities to the razorback sucker are unlikely to occur. Therefore, an effects determination of "not likely to adversely affect" is concluded for this species.

5.4.2 Bonytail Chub (*Gila elegans*)

5.4.2.1 Status

The bonytail chub was listed as a federally endangered species on April 24, 1980, with an effective date of May 23, 1980. The Bonytail Chub Recovery Plan was updated in 1990 (USFWS, 1990b). The recovery plan was supplemented with the Upper Colorado River Endangered Fish Recovery Program (USFWS, 2001a) and the Bonytail Chub Recovery goals (SWCA, 2001). The bonytail chub was listed as endangered by the State of California in 1974.

Critical habitat was designated in six river reaches in the historical range of the bonytail chub on March 21, 1994, with an effective date of April 20, 1994, in designated portions of the Colorado, Green, and Yampa Rivers in the Upper Basin and the Colorado River in the Lower Basin (USFWS, 1994c). In relation to the Action Area, critical habitat includes the Colorado River and the 100-year floodplain from Parker Dam to the northern boundary of the HNWR just south of Needles, California.

The trend for the bonytail chub is for a continued rangewide decrease in wild populations due to lack of sufficient recruitment of young adults with the loss of old adults due to natural mortality. Like the razorback sucker, the primary limiting factor for bonytail appears to be nonnative fish predation of the early life stages (USFWS, 2005b).

5.4.2.2 Natural History, Distribution, Abundance and Habitat

In appearance, bonytail are gray to gray-green on the dorsal, with silvery sides fading to a white ventral surface. The fish is elongated and somewhat laterally compressed with a narrow caudal peduncle. Adults are from 11 to 13 inches in length, although larger individuals (up to 24 inches) are occasionally identified. A smooth pre-dorsal hump is present in the adult form. Breeding males can be distinguished by reddish marks on the paired fins and the presence of tubercles anterior on the body (Vanicek, 1967).

In Lake Mohave, spawning has been observed during the month of May, while in the upper Green River, spawning occurs in June and July at water temperatures of about 18 degrees Celsius (64 degrees Fahrenheit) (Minckley, 1973). Eggs are scattered over the bottom; no parental care occurs. Cold water released below dams precludes successful hatching of eggs (Bagley, 1989).

The bonytail was once widely distributed throughout the Colorado River and its main tributaries, to include the Green River in Utah and Wyoming, and the Colorado, Gila, Salt, and Verde rivers in Arizona. Currently, this species is found only in isolated populations in the Yampa River, Green River, Colorado River at the Colorado/Utah border, and at the confluence of the Green and Colorado Rivers. In the lower basin, the bony tail is found only in Lake Mohave with possible individuals between Parker Dam and Davis Dam (AGFD, 2001). They were still abundant in Lake Mead after the completion of Hoover Dam; however, by 1950 they were considered rare. By the time concern was raised for this fish, it had disappeared from much of its range. Loss of the extant wild populations is expected.

Extinction of this fish in the wild throughout its historic range is being forestalled by the stocking of subadult fish into the Upper Colorado River Basin and Lakes Mohave and Havasu in the Lower Colorado River (USFWS, 2005a). These stockings are intended to create populations of young adults that may be expected to persist for 40 to 50 years. While it is expected that these young adults will reproduce, the successful recruitment of wild born young fish to the population may not occur without additional management of habitat and biological factors. Management and research on these populations will be critical to provide for the survival and recovery of the species. Of vital importance to the stocking program is maintenance and enhancement of the existing bonytail broodstock (USFWS, 2005b).

5.4.2.3 Status of the Species in the Area

A portion of Action Area is within the 100-year floodplain of the Colorado River that delineates critical habitat for the bonytail chub. From south to north, this area extends from a river-associated wetland (as described for the Yuma clapper rail) to a deep sand and drier environment of dredge spoils deposited by the Army Corps of Engineers from excavating the river channel. The gradient ranges from river level to possibly 20 feet created by the dredge spoils. The dredge spoils environment can be described as sand, tamarisk, and arrow weed. The mouths of the washes have channels and bridges that would allow water to flood these areas if a larger event was to occur. The lower ends of the washes are vegetated primarily of tamarisk. Normally, except for isolated rain events, there is no overland flow connectivity to the river.

The Lower Colorado River supports populations of bonytail chub. The populations consist primarily of sub-adults. In 2005, eight individuals were captured and released near Park Moabi (Fitzpatrick, 2006). However, long-term survival rates from past stocking efforts have not been very successful for a number of reasons related to the age and size of stocked fish, handling practices at the rearing and stocking locations, and conditions in the receiving waters (LCRMSCP, 2008). Nevertheless, there is an active and ongoing stocking and monitoring program and habitat enhancement efforts (USFWS, 2008b, 2011) To date, from 2005 through 2012, the LCRMSCP Native Fish Augmentation Program has been responsible for stocking over 30,000 bonytail chub to Reach 3 of the river (encompassing the Topock Site and Havasu National Wildlife Refuge)(LCRMSCP, 2014). The species restoration efforts have benefited from recent spawning studies in riverine backwater areas (LCRMSCP, 2011).

5.4.2.4 Direct Effects

Direct effects are those that are caused by the proposed action and occur at the same time and place. Details of the Final Groundwater Remedy were previously described in Sections 3.3 and Table 2 and shown in Figures 6 and 7. All activities will occur outside of the Colorado River; therefore, no direct effects are anticipated.

Activities that may occur within the 100-year floodplain include the construction of a freshwater supply pipeline beneath the Interstate 40 and BNSF bridges. This pipeline will follow an existing access roadway through the western edge of the 100-year floodplain. No other Final Groundwater remedy facilities will occur within the 100-year floodplain. While the pipeline construction normally involves the use of heavy equipment such as a backhoe, smaller equipment such as a bobcat and/or quad-runners will be used if work is required directly within the 100-year floodplain. However, the magnitude of riparian function that may be reduced by the proposed action is not expected to impact the razorback sucker due to very limited project-related activities and associated minor footprints that are adjacent to the Colorado River floodplain.

Additionally, a 3.7-acre floodplain vegetation removal threshold has been established to minimize any reduced function of the riparian zone.

5.4.2.5 Indirect Effects

Indirect effects are those that are caused by the proposed action and are later in time, but reasonably certain to occur. The possible actions that may occur are related to the long-term operation and maintenance of the Final Groundwater Remedy facilities after construction and the decommissioning and restoration of the Final Groundwater Remedy.

The Final Groundwater Remedy activities related to operation and maintenance of the freshwater conveyance pipeline; and eventual decommissioning of the pipeline once remedial objectives were achieved. After decommissioning, these areas would be restored in accordance with the Remedy Decommissioning Plan, including a restoration plan, which will be submitted by PG&E to DOI after receipt of DOI's certification of Remedial Action completion, and the Habitat Restoration Plan, where applicable, that will be submitted to the agencies with the Remedial Action Work Plan. Because these activities will occur near the edge of the 100-year floodplain, it is expected that the work can be completed from the adjacent upland area or by using hand tools, so that the effect on the floodplain itself would be minimal.

For this reason, the indirect effects of the planned activities on bonytail chub are expected to be negligible or avoidable.

5.4.2.6 Cumulative Effects

Cumulative effects are of those future state and private activities, excluding federal activities that are reasonably certain to occur within the Action Area. Continued operation of the TCS will occur. It is reasonably certain that soil remedial activities may occur within the California portion of the Action Area. The final soil remedy, if required, will include heavy equipment and personnel with minor activities in the floodplain.

Future state and private actions separate from PG&E that are reasonably certain to occur within the project vicinity include continued recreational activities associated with the Colorado River and HNWR, such as boating, camping, and fishing. As previously noted there, the Topock Marina has recent and proposed upgrade projects (i.e., hotel and restaurant). There is also a system of ORV trails on the island to the north of the slough at the Moabi Regional Park that could extend to within the 100-year floodplain.

No other changes in land use or water use of the Colorado River within the Action Area are foreseen.

5.4.2.7 Critical Habitat Effects Determination

Critical habitat in relationship to the Action Area includes the 100-year floodplain of the Colorado River from Parker Dam to the northern boundary of the HNWR south of Needles, California. Project activities will be occurring within this designation. However, based on the small footprint of project activities; the limited amount of vegetation removal within the 100-year floodplain that will not have an adverse effect on the physical and biological factors or on their associated primary constituent elements. Furthermore, the proposed impacts will occur closer to the upland edge of the floodplain, well away from the river, so the effects would be mitigated by a broad swath of undisturbed vegetation between the facilities and the river. Accompanied by the conservation measures listed below in subsection 5.4.3.8, the reduction of critical habitat function is likely to be unmeasurable or undetectable.

Therefore, any potential direct or indirect effects of planned project activities to critical habitat for the bonytail chub will be either negligible or avoidable. An effects determination of “not likely to destroy or adversely modify” is concluded for critical habitat of this species.

5.4.2.8 Effects Determination

Bonytail chubs have been captured and released near Park Moabi making the likelihood for this species to use the mainstem Colorado River and backwater areas (near Park Moabi and Topock Marina) within and near the Action Area a possibility. Future project activities are anticipated to occur along the margins or just within the 100-year floodplain of the Colorado River.

The following mitigation measures will be applied to all actions associated with the Final Groundwater Remedy that will occur in or near the mainstem Colorado River, as well as the backwater areas of Park Moabi and the Topock Marina.

1. Consideration was given to minimize the net increase of habitat disturbance that may affect riparian areas and the project altogether. If greater than 8.0 acres of habitat within the general and 100-year floodplain is destroyed or manipulated, specific project consultation with the USFWS will be required and possible mitigation may be required.
2. Proposed project activities that differ from surface water sampling within the Colorado River should preferably occur between June 1 and January 31.

3. In the event an emergency situation (e.g., a spill into the Colorado River), where actions to abate the problem are to occur along the shoreline/river interface or in the water, a negative impact to this species may occur. Those actions which may adversely affect this species and constitute a take, are not covered within this scope of this determination in this Final Groundwater Remedy PBA. If an emergency situation occurs, immediate consultation with the USFWS will be required.

However, because no direct impacts are expected from planned activities within the River; the minimal amount of riparian habitat that would be altered within the 100-year floodplain; and accompanied by the conservation measures described above, the effects of project activities to the bonytail chub could not be meaningfully measured, detected, or evaluated and are not expected to occur.

Therefore, any potential direct or indirect effects from project activities are either negligible or avoidable. An effects determination of “not likely to adversely affect” is concluded for this species.

SECTION 6.0

Effects Determination Summary

6.1 Southwestern Willow Flycatcher

An effects determination of “not likely to adversely affect” is concluded for the southwestern willow flycatcher.

A critical habitat effects determination of “no effect” is concluded for this species due to no designated critical habitat in the Action Area.

6.2 Western Yellow-Billed Cuckoo

An effects determination of “not likely to adversely affect” is concluded for the Western yellow-billed cuckoo.

Because critical habitat has not yet been designated for this species, a determination of no effect is concluded for this species. However, an evaluation of the constituent elements that would be expected to be part of any future critical habitat was considered. These constituent elements include dense riparian areas that are dominated by willow, cottonwood, and mesquite with shallow groundwater levels that would support the trees and create humid conditions, as well as a suitable prey base of large insects. These particular conditions are not present within the Action Area and, given the current hydrological management of the Colorado River, they are unlikely to become present. Because the proposed activities for the Final Groundwater Remedy would not affect these resources, the potential for adversely affecting likely constituent elements or future critical habitat is considered discountable.

6.3 Agassiz’s Desert Tortoise

An effects determination of “not likely to adversely affect” is concluded for the Agassiz’s desert tortoise.

A critical habitat effects determination of “no effect” is concluded for this species due to no designated critical habitat in the Action Area.

6.4 Morafkai’s Desert Tortoise

An effects determination of “not likely to adversely affect” is concluded for the Morafkai’s desert tortoise.

A critical habitat effects determination of “no effect” is concluded for this species since there is no designated critical habitat for candidate species.

6.5 Yuma Clapper Rail

An effects determination of “not likely to adversely affect” is concluded for the Yuma clapper rail.

A critical habitat effects determination of “no effect” is concluded for this species due to no designated critical habitat in the Action Area.

6.6 Razorback Sucker

An effects determination of “not likely to adversely affect” is concluded for the razorback sucker.

A critical habitat effects determination of “no effect” is concluded for this species due to no designated critical habitat in the Action Area.

6.7 Bonytail Chub

An effects determination of “not likely to adversely affect” is concluded for the bonytail chub.

A critical habitat effects determination of “not likely to destroy or adversely modify” is concluded for this species.

SECTION 7.0

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Appendix V
Technical Memorandum: Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California
(On CD-ROM Only)

Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California

PREPARED FOR: Virginia Strohl/PG&E

PREPARED BY: Steve Long and Russell Huddleston/CH2M HILL

COPIES: Marjorie Eisert/CH2M HILL

DATE: November 18, 2015

PROJECT NUMBER: 657421.TM.10

Introduction

As part of the Final Design Submittal for the Final Groundwater Remedy, three restoration plans were submitted to address impacts to plants that cannot be avoided during construction. Additionally, a separate plan was prepared to address ethnobotanically significant plants (CH2M HILL, 2013), which was submitted in compliance with the Cultural and Historic Properties Management Plan that also required mitigation for plant impacts. These plans specifically addressed plant impacts on Havasu National Wildlife Refuge (HNWR) lands (CH2M HILL, 2014a), within jurisdictional areas associated with waters of the U.S. and the State of California (CH2M HILL, 2014b); for mature plants (CH2M HILL, 2014c); and for ethnobotanically significant plants (CH2M HILL, 2013). Each of these plans describes the specific mitigation measure or regulatory requirement driving the restoration needs, as well as the general approaches that would be implemented.

This technical memorandum supplements the restoration plan submittals by providing preliminary information on the conditions within fourteen proposed mitigation planting areas in the project area in California (see Figure 1). These fourteen mitigation planting areas have been grouped into two upland habitat revegetation (UHR) units, six riparian habitat revegetation (RHR) units, and six historical floodplain revegetation (HFR) units. The historical floodplain term refers to the areas between the National Trails Highway and the ordinary high water mark of the Colorado River where dredged sands were historically deposited. The historical floodplain no longer functions as a riparian habitat with hydrologic connectivity to the river.

The purpose of this memorandum is to provide information to project stakeholders on the currently proposed revegetation areas that Pacific Gas and Electric Company (PG&E) is assessing for final design. It also evaluates the expected impacts to plants and mitigation planting area needs. Revegetation in the project area is expected to take place in two phases: the first phase occurring concurrently with and immediately after construction, and the second phase occurring after the system has been decommissioned and removed. This memorandum is associated with the first phase just as the final groundwater remedy system is brought on line and begins operation.

The revegetation and restoration to be conducted pursuant to these plans includes several aspects. Some of the disturbed area within the construction footprint will be replanted with new plantings where those plants will not interfere with system operation, maintenance, or future decommissioning. Some plants, such as arrow weed, are expected to regenerate largely on their own after having been cut or trimmed to allow for construction. Some disturbed areas (such as the remedy pipeline corridors) will not be replanted until the remedy is decommissioned to allow access for operation, maintenance, and decommissioning. It will also be important to avoid placing mitigation plants in an area where their roots may adversely affect the installed underground infrastructure. In those areas where such access must be maintained in the riparian corridors, revegetation will be accomplished in the first phase by planting new plants in areas immediately adjacent to

the pipeline area that must be maintained; then, in the second phase, the entire area will be revegetated after the completion of the remedy system operation, when the decommissioning and removal activities have been completed. It is recognized that the future system decommissioning and removal activities may adversely affect mitigation plantings as well as natural regeneration that has occurred within the original construction footprint. These plant impacts will be addressed in the second phase of revegetation and restoration.

The planting areas were selected along existing or proposed access routes to facilitate future planting, monitoring, and maintenance. They are also located outside of the groundwater remedy construction footprint and away from existing/planned infrastructure in order to avoid future impacts during decommissioning and removal of the remedy infrastructure. Further, it is intended that mitigation plantings would mimic the natural spacing and patterns of the surrounding vegetation, therefore, mitigation plantings are located within the sparsely vegetated areas between existing perennial vegetation. The existing vegetation would not be affected during mitigation planting and maintenance and use of mechanical equipment in these areas will be kept to a minimum. Having consolidated areas for the mitigation plantings is important for controlling initial costs and for simplifying ongoing maintenance throughout the monitoring period.

Analysis of the Final Groundwater Remedy footprint within Arizona indicated only three instances where native shrubs or trees requiring mitigation would be affected. In two of those locations—between the southern portion of the Topock Marsh and the Oatman-Topock Highway—it is likely that the three honey mesquite (*Prosopis glandulosa*) shrubs (note that one location has two trees) can be avoided completely or require only minor trimming. The third location, a blue palo verde (*Parkinsonia florida*) shrub near the eastern shore of the Colorado River northwest of the Topock Marina, may also be possible to avoid by shifting the construction zone around a proposed well. However, if avoidance of this sole palo verde shrub is not possible, it would be more cost effective to add the few mitigation plants to the existing areas within California, rather than to create a single mitigation planting site in Arizona.

Methods

Initially, the proposed planting areas were identified in the field during an August 8, 2014, site visit with PG&E site manager Curt Russell and CH2M HILL plant ecologist Russell Huddleston. These preliminary proposed planting areas were captured using a hand-held global positioning system (GPS) unit (Model Trimble GeoXH). The mapped units were rendered onto an overview aerial photograph map and the individual mapped units were rendered onto separate detail maps that could be taken into the field. Representative photographs of the proposed planting areas are provided as an attachment to this memorandum.

A second site visit to the proposed planting areas was completed by CH2M HILL's Russell Huddleston and biologist Steve Long on November 20, 2014, in order to collect the preliminary information presented in this memorandum.

There was a wildfire on July 14, 2015 that was accidentally started by a BNSF work crew that was grinding welds on the BNSF bridge. This wildfire burned a small area of the Colorado River floodplain in California between the BNSF and Interstate 40 bridges. This burn area was visited on October 30, 2015 by PG&E biologist Virginia Strohl and by Steve Long to collect additional information on the suitability of this site for use in the groundwater remedy's mitigation plantings.

A list of factors was developed to provide a consistent basis for assessing the proposed planting areas. This list of factors included unit size, land ownership, habitat type (upland or riparian), surface soil texture, presence of sensitive resources (for example, burrows or biotic crusts), evidence of wildlife use, existing plants (species and percent cover), accessibility, visibility, nearby infrastructure, and cultural issues (as provided from the PG&E cultural resources team). These factors were then used to develop a comparison matrix for each of the proposed planting areas.

While in the field, high-resolution aerial photographic base maps were used to record trees and shrubs within each unit and note the presence of sensitive resources. Where it was apparent that there was additional plantable area associated with the proposed unit than was originally mapped, the GPS was used to re-map the boundaries. Other field-observable factors (for example, surface soil type, evidence of disturbance, wildlife use, dominant plant height range, accessibility, and visibility) were also recorded for each unit. Factors such as unit size, land ownership, and existing infrastructure, were determined using the geographical information system (GIS) data for the Topock Program. Information on cultural resources was provided by PG&E cultural resource specialists.

It should be noted that the reconnaissance site visits in November 2014 and in October 2015 were not conducted at a time when many annual plants would be in bloom. However, it was considered that the preliminary assessment of vegetative conditions based on the tree and shrubs would be sufficient for the purposes of this memorandum. With the exception of planting area RHR-5, all of the proposed locations were included in the protocol-level floristic surveys (GANDA and CH2M HILL, 2013).

Because the planting areas already have existing vegetation that will be preserved, the total revegetation area is not entirely available to receive mitigation plantings. The percent vegetation cover was estimated in the office using the aerial photographic base maps showing the final planting areas boundaries. Tree and shrub cover visible on the aerial photographs within each unit was then compared to visual graphics for different cover classes provided in the *Field Book for Describing and Sampling Soils*, Version 3.0 (NRCS, 2012). The estimated cover percent was increased by 50 percent and this augmented cover percentage area was subtracted from the total area of the revegetation unit to give an estimate of the total plantable area in each unit.

The preliminary assessment data were then input into a matrix table for comparison of each of the proposed units. For six selected factors (size, surface soil type, biotic soils, disturbance, accessibility, and visibility), a three-point rating system was adopted with 1 representing the lowest and 3 the highest values.
A preliminary overall ranking is provided by simply totaling all six factors for all the proposed planting area with the planting areas with the highest value considered to represent the highest priority for use.

A detailed assessment of the number of plants (including ethnobotanical trees and shrubs and their seedlings, riparian vegetation, mature plants, and cacti) requiring mitigation was completed using GIS to intersect the Final design construction footprint with mapped plant information from various field plant surveys within the project area. Mature plants on the historical floodplain (27 individual plants) were primarily composed of non-native tamarisk (*Tamarix ramosissima*) but also included two creosote bush (*Larrea tridentata*) plants. Arrow weed impacts were not included in the impact assessment because the areas that would be subjected to temporary disturbance are expected to naturally recover in a relatively short amount of time. Other common species such as smaller (less than 6 feet) creosote bush, sweetbush (*Bebbia juncea* var. *aspera*), brittlebush (*Encelia farinosa*), and cheesebush (*Ambrosia salsola*), among others, were not included in the impact assessment because no special mitigation is required for these species.

Complete map books showing these data were reviewed to determine which of the plants as indicated by GIS were within the construction footprint, were near the edge of the construction footprint, or were outside of it and could likely be saved. The map book review was used to estimate the actual plant mitigation needs by determining a more accurate number for each plant species located entirely within the construction footprint and which would, therefore, likely be removed. The appropriate mitigation ratios were then applied to estimate how many mitigation plants would be required.

The amount of plantable area required to accommodate the mitigation plants was estimated by assuming a required spacing for the plants. A spacing of 20 to 30 feet was indicated for blue palo verde (Dave's Garden, 2014). The lower end of this range (20-foot spacing) was considered adequate because of the intent to irrigate the mitigation plantings for blue palo verde, honey mesquite, and desert smoke tree. A 10-foot spacing was adopted for smaller native perennials such as Anderson's desert thorn (*Lycium andersonii*),

catclaw acacia (*Senegalia greggii*), and creosote bush. A 5-foot spacing was applied to cattle salt bush (*Atriplex polycarpa*) and various cacti.

Additionally, the issue of potential uptake of hexavalent chromium by plants in the proposed planting areas was considered. This included reviewing the conclusions of a technical memorandum addressing the potential for chromium uptake by arrow weed and potential exposure pathways (ARCADIS, 2013) and consideration of the locations of the proposed planting areas relative to the groundwater plume. Information on plant uptake of hexavalent chromium and other byproducts (arsenic and manganese) from a similar project (CH2M HILL 2015) was also considered as it applied to mitigation planting areas above the known contaminant plume.

Results and Discussions

The proposed mitigation planting areas included two previously disturbed upland locations along the National Trails Highway (UHR-1 and UHR-2), five locations (RHR-1 through RHR-5) associated with the western drainage including portions of the flow channel and the adjacent low terraces, six locations on the historical floodplain (HFR-1 through HFR-6), and one recently burned location (RHR-6) on the 100-year floodplain of the Colorado River (see Figures 2 through 15). These figures show the proposed planting areas in the center of the figure along with a 100-foot buffer and any proposed or existing infrastructure. The purpose of showing the buffer and infrastructure around each planting unit is to assess the context of the planting unit relative to its immediate surroundings or infrastructure that could potentially affect the replanting areas in the future (for example, during demolition and removal).

The approximate extent of the hexavalent chromium groundwater plume (areas where the groundwater contains hexavalent chromium above background levels) is shown with a blue line in Figure 1. Based on that mapping, every proposed planting area, except the southern portions of HFR-3 and HFR-4 and the entire units of HFR-5 and HFR-6, are located well outside the known hexavalent chromium plume. The potential for uptake of hexavalent chromium by plants in these areas is considered negligible for the following reasons. Under current conditions, fresh water overlies the contaminated groundwater in these areas. The groundwater remedy is designed to reduce hexavalent chromium along the National Trails Highway IRZ to prevent its migration into the floodplain. Furthermore, there is a shallow naturally occurring organic rind that is present in the shallow floodplain. This organic rind creates a reducing environment that makes it highly unlikely that elevated hexavalent chromium concentrations in the shallow floodplain groundwater will occur. This shallow groundwater is what would be utilized by shrubs planted in the revegetation units.

Arsenic and manganese are already present within groundwater in the shallow floodplain and it is possible that the concentration of these elements may increase as byproducts of the groundwater remedy. However, geochemical and solute transport modeling of the proposed groundwater remedial strategy indicate that the simulated arsenic and manganese byproducts already present in the shallow floodplain groundwater will remain within the range of the naturally occurring average observed manganese and arsenic concentrations in the shallow floodplain groundwater. For this reason, it is anticipated that the proposed groundwater remedy will not significantly increase the average arsenic or manganese concentrations in the shallow floodplain groundwater. During remedy implementation, these byproduct concentrations will be monitored within the floodplain groundwater to confirm the magnitude and extent of changes in the byproduct concentrations. If these byproduct concentrations are observed to increase beyond existing maximum observed concentrations, further evaluation of plant uptake of these byproducts will be considered as part of the upcoming risk assessment activities.

In addition, PG&E is in the process of remediating the groundwater plume associated with historic hexavalent chromium releases at the Hinkley Compressor Station. A current treatment is in-situ remediation of groundwater followed by extracting and applying contaminated groundwater to agricultural fields where soil microbial action reduces dissolved hexavalent chromium to the less toxic trivalent chromium form. Temporary increases in groundwater concentrations of arsenic and manganese have been observed in pilot and extended studies. Results of a draft Updated Ecological Risk Assessment (CH2M HILL 2015) indicate that

no adverse effects are predicted for risks to terrestrial plants from exposure to total chromium, arsenic, and manganese.

All of the proposed planting areas contain at least some trees and/or shrubs (see Figures 2 through 15). Creosote bush is the most common species, sometimes representing nearly all of the plant cover. Other native plants observed in the proposed planting area included blue palo verde, catclaw acacia, and Anderson's desert thorn. While none of the existing species would be affected by the proposed planting activities, all of the aforementioned plants are considered to be ethnobotanically significant plants. Scattered individuals of beavertail cactus and cholla cactus (*Cylindropuntia echinocarpa*) were also observed in some of the proposed planting areas. A partial list of the perennial plants observed at each of the proposed planting areas is included in Table 1.

Screening Assessment

Table 1 provides a matrix that summarizes the various assessment factors that PG&E is using for each of the proposed planting areas. In addition, it provides a rating for the six selected factors that were totaled to provide an overall score for each of the areas. It should be recognized that the preliminary screening based on the overall score provides a basis for comparison among the different units. With six different factors, there is a potential for certain limitations (for example, small unit size) to be offset by higher scores in other factors. Because of this, the overall score ratings have a relatively narrow range.

For the upland habitat revegetation areas, both UHR-1 and UHR-2 have the same rank (score of 14), despite the fact that those planting areas have coarse-textured substrate and will require significant preparation to make them suitable for planting and irrigation.

For the riparian habitat revegetation areas, there was relatively little variation among the rankings (ranged from 12 to 15). RHR-5 had the highest overall score (15) with the burn area (RHR-6) having the second highest score (14). Important limitations for the remaining units include small unit size and coarse-textured soils within the units. RHR-6 would probably require suppression of the arrow weed resprouts to create space for new native tree plantings.

For the historical floodplain revegetation areas, there was little variation in the overall ranking. The limitations related to HFR-4 were mainly due to small size, while HFR-6 was deemed to be of lower value due to visibility and access issues.

Mitigation Plantings

During the design phases of the remediation activities, efforts have been made to avoid impacts to natural vegetation and sensitive habitats. To the extent possible, work activities have been designed to use existing roadways and previously disturbed areas. In the final design for the remedial action, efforts were made to minimize disturbance to the extent possible. These efforts have made it possible to minimize the need for mitigation planting. Preconstruction surveys of work areas, staging areas, and access routes will identify species that could be adversely affected and determine which plants are to be salvaged or removed. All sensitive habitats in the immediate vicinity of the work areas or access routes that are not directly affected but could be indirectly affected by project activities will be identified and clearly marked with flagging, fencing, and/or signage prior to the start of construction.

According to the restoration plans (CH2M HILL, 2014a and 2014b), where plant impacts cannot be avoided, mitigation plantings will be required using a ratio of 6:1 replacement plants. The intent of this ratio is to account for potential mortality and still achieve the minimum 2:1 replacement ratio that is required in the Environmental Impact Report mitigation measure CUL-1a-5 (DTSC, 2011) without requiring subsequent planting. This same replacement ratio would be applied for all impacts to sensitive plants that cannot be avoided.

Mitigation plantings are anticipated to include various native trees and shrubs including blue palo verde, honey mesquite, catclaw acacia, Anderson's desert thorn, and cattle saltbush. It is anticipated that most of

the impacts to these species would occur in upland habitats, although in some cases (such as Bat Cave Wash) riparian plants could be affected. Because avoidance efforts will prioritize avoidance of large, mature vegetation that provides greater habitat value, it is anticipated that most vegetation impacts would occur to smaller trees (saplings and seedlings) and shrubs.

Based on the GIS intersection of mapped plants and the Final Groundwater Remedy Final construction footprint, and subsequent review of mapped vegetation data, Table 2 provides a summary of the expected number of plants and planting areas that will be needed. These plant impacts have been separated for the general impacts to plants within HNWR or riparian areas and ethnobotanically significant plants and those that are associated with mature plants within the key view from the Topock Maze B location out over the historical floodplain. The mitigation plants for the general plant impacts would be distributed among the proposed revegetation areas; however, the mature plant impacts on the historical floodplain would be mitigated by planting only within the historical floodplain.

Based on this GIS analysis summarized in Table 2, the estimated area needed for the plant impacts not associated with the historical floodplain is about 239,550 square feet (or 5.50 acres). The amount of plantable acreages in the upland habitat revegetation areas is estimated at 1.98 acres, and 1.45 acre in the riparian habitat revegetation areas. The estimated area needed for the mature plant impacts associated with the historical floodplain is about 34,800 square feet (or 0.80 acre). Almost all of those impacts are associated with removals of 13 salt cedar trees, one blue palo verde, and 2 creosote bushes. The amount of plantable area in the historical floodplain revegetation areas is estimated at 3.99 acres, some of which may also be used to mitigate plants from the riparian and upland habitats.

All proposed historical floodplain revegetation units have been kept for consideration because of the potential difficulty of establishing honey mesquite and palo verde to offset the salt cedar removals. These plants currently exist on the historical floodplain but are primarily limited to areas where the sand deposits are apparently shallower. In order for the mitigation plantings to be sustainable, it will be necessary for irrigation to be regulated in such a manner as to create a wetted connection from the root zone to the static groundwater table that can be as much as 15 to 25 feet below ground surface. The intent would be to use the irrigation water to entrain plant roots downward so that they are able to reach into the static groundwater table. It may also be possible to add fertilizer amendments (such as potassium) to the irrigation water to promote root growth.

Irrigation

The preferred method of irrigation for mitigation plantings would be the use of deep irrigation pipes (Bainbridge, 2006; Bainbridge et al., 2001). Deep pipe irrigation has been shown to produce much better survival rates and require less water than other irrigation methods (Bainbridge et al., 2001). The method for using deep irrigation is described in Bainbridge (2006). For each transplanted tree or shrub, a hole is drilled to a depth of 20 to 30 inches with a soil auger. A polyvinyl chloride pipe (2 inches in diameter and 20 inches long with a series of 1/16-inch holes drilled 2 to 3 inches down one side beginning 7 inches below the top) is inserted to the bottom of the hole such that the side with holes faces the seedling or shrub with about 4 inches protruding above the ground surface for easy filling. The pipe is situated about 3 to 4 inches from the seedling. Two or three pipes can be situated around the root ball for transplanting shrubs or small trees.

Water (1 quart) will be directly applied to seedlings once every week for the first 8 weeks. Then irrigation pipes will be filled with 2 quarts every other week for at least 3 months after the initial watering. Watering will be continued at least until the end of August each year and will be done for the first 2 years after planting. Water will be brought into the irrigation pipes according to a defined watering schedule using a truck-mounted tank equipped with a hose that can extend into the revegetation areas. The truck would be driven on the access road to a point adjacent to the revegetation units to permit the water to be distributed appropriately.

A gravity feed drip irrigation system is possible alternative for areas where it is determined that a large number of replacement trees and shrubs are needed. Under this method water would be supplied from an

aboveground 1,500-gallon storage tank. The tank would be light brown in color and would measure approximately 8 feet in diameter by 5 feet tall. Although all of the proposed mitigation planting sites are located near existing roads or access routes to monitoring wells, the use of the above ground water tank will depend on the trade-off between accessibility to the tank by a water truck and the visual and aesthetic impacts of the tank.

Conclusions

Based on this GIS analysis summarized in Table 2, the estimated area needed for the plant impacts not associated with the historical floodplain is about 239,550 square feet (or 5.5 acres). The amount of plantable acreages in the upland habitat revegetation and in the riparian habitat revegetation areas is estimated at 1.98 acres and 1.45 acre, respectively, for a total of 3.43 acres.

The estimated area needed for the mature plant impacts associated with the historical floodplain is about 34,800 square feet (or 0.80 acres). The amount of plantable area in the historical floodplain revegetation areas is estimated at 3.99 acres. Given the excess acreage on the historical floodplain, some of the mitigation for non-riparian plants will need to occur in these areas. Almost all of the historical floodplain impacts are associated with potential removal of 27 salt cedar trees that would be replanted with native tree species.

Based on the data provided in this technical memorandum, our recommendation is to use UHR-1 and UHR-2 for upland vegetation plantings. Preparation of the individual planting locations could be accomplished simply by screening out the rock material and supplementing with clean soil from onsite stockpiles that have been deemed suitable for re-use.

Among the riparian sites, RHR-5 and RHR-6 are the highest-ranking candidate locations. The remaining locations, RHR-1 through RHR-4, would all be required given the relative shortage of these riparian areas. Additional areas needed for non-riparian plants will have to be accommodated on the historical floodplain planting units.

Because of the potential difficulty in establishing native trees such as honey mesquite and blue palo verde on the historical floodplain dredge sands, all proposed planting areas are kept for consideration. The intent is to focus mitigation plantings in areas where the sand deposits are thinnest and to provide an irrigation regime that favors deep root penetration. It is believed that survival success and sustainability of the mitigation plantings will require these plants to have roots that are able to reach the underlying static groundwater table. It is expected that the planting site limitations due to sand thickness may be overcome by sufficient irrigation to foster root growth through the unsaturated sands above the groundwater table.

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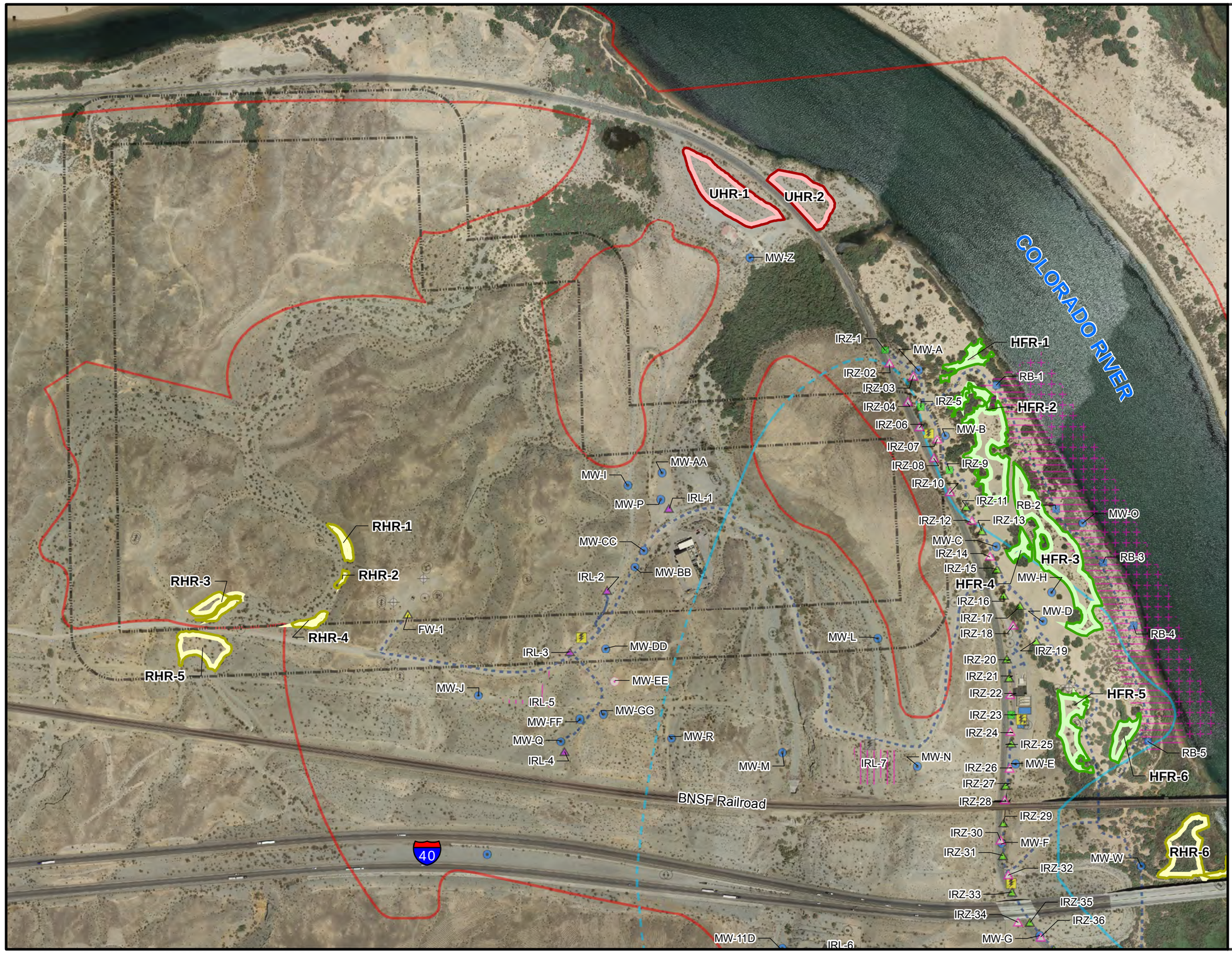
Figures



LEGEND

Proposed Revegetation Area
- Historical Floodplain Revegetation
- Riparian Habitat Revegetation
- Upland Habitat Revegetation
- Property Boundaries
- EIR Project Area

Existing Wells:
- Extraction Well
- Injection Well
- Monitoring Well

Provisional Wells:
(Items in Pink are Provisional)
- Injection Well
- Monitoring Well (MW-EE is a pending/future provisional monitoring well)
- Area for Potential Slant Well Screens
- Area for Inner Recirculation Loop (IRL) Wells
- Area for River Bank Extraction Wells

Planned Wells:
- Extraction, NTH IRZ
- Extraction, Riverbank
- Injection, Freshwater
- Injection, Inner Recirculation Loop
- Injection, NTH IRZ
- Injection, Topock Compressor Station
- Remedy Monitoring Well
- Recirculation Well
- Area for Monitoring Well MW-T

Pipeline Corridor for Remedy
- Underground Pipe/Conduit

Remedy Facilities
- Planned Transformer
- Future Provisional Transformer
- Proposed Remedy Structure

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

Note:
1. Note that in compliance with EIR mitigation measure CUL-1a-9, as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Hwy is located in an existing, previously disturbed, access road. In addition, the location of the road and pipeline was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10, PA, and CHPMP mitigation measures.
2. All well and structure locations are approximate.

0 150 300 600
Feet

N

FIGURE 1
POTENTIAL REVEGETATION AND MITIGATION PLANTING AREAS

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
FINAL 100% DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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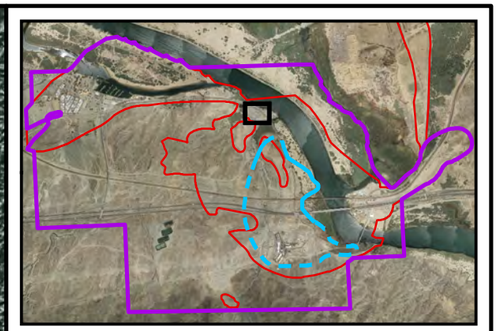

LEGEND

- Blue Palo Verde
- Honey Mesquite
- Staghorn Cholla

Proposed Revegetation Area

- Upland Habitat Revegetation
- CDFW Ephemeral Stream
- 100-ft. Buffer around Planting Area
- Area of Potential Effects (APE)
- EIR Project Area

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

0 30 60
Feet

N

FIGURE 2
PROPOSED REVEGETATION AREAS - UHR-1
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
FINAL 100% DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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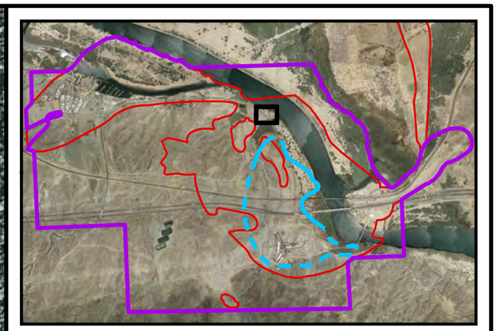

LEGEND

- Blue Palo Verde
- Honey Mesquite

Proposed Revegetation Area

- Upland Habitat Revegetation
- CDFW Ephemeral Stream
- 100-ft. Buffer around Planting Area
- Remedy Monitoring Well
- Area of Potential Effects (APE)
- EIR Project Area

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

0 30 60
Feet

N

FIGURE 3
PROPOSED REVEGETATION AREAS - UHR-2
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
FINAL 100% DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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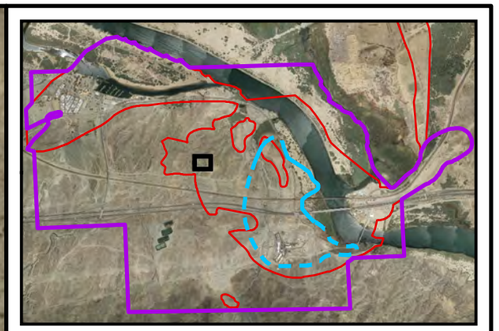

LEGEND

- Catclaw Acacia
- Silver Cholla

Proposed Revegetation Area

- Riparian Habitat Revegetation
- CDFW Ephemeral Stream
- 100-ft. Buffer around Planting Area

Existing Wells:

- Monitoring Well
- Area of Potential Effects (APE)
- EIR Project Area

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

0 20 40
Feet

N

FIGURE 4
PROPOSED REVEGETATION AREAS - RHR-1
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
FINAL 100% DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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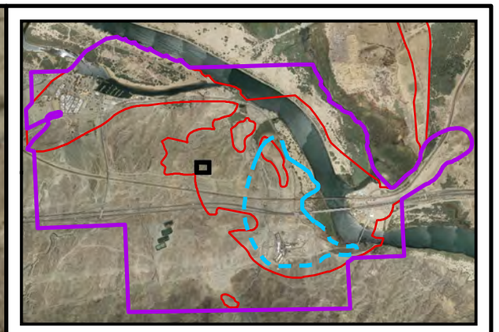

LEGEND

- Catclaw Acacia
- Silver Cholla

Proposed Revegetation Area

- Riparian Habitat Revegetation
- CDFW Ephemeral Stream
- 100-ft. Buffer around Planting Area

Existing Wells:

- Monitoring Well
- Area of Potential Effects (APE)
- EIR Project Area

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

0 10 20
Feet

N

FIGURE 5
PROPOSED REVEGETATION AREAS - RHR-2
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
FINAL 100% DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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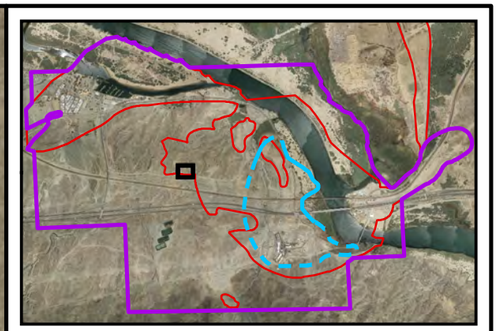

LEGEND

- Blue Palo Verde
- Catclaw Acacia
- White Rhatany

Proposed Revegetation Area

- Riparian Habitat Revegetation
- Active Flow Channel
- CDFW Ephemeral Stream
- 100-ft. Buffer around Planting Area

Existing Wells:

- Monitoring Well
- Area of Potential Effects (APE)
- EIR Project Area

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

0 20 40
Feet

N

FIGURE 6
PROPOSED REVEGETATION AREAS - RHR-3
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
FINAL 100% DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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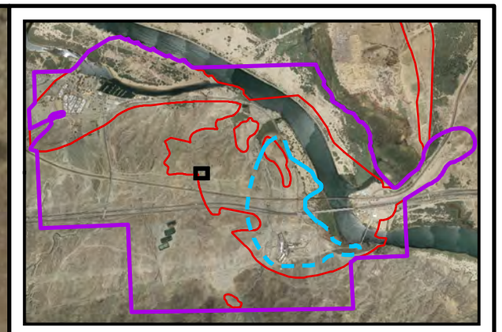

LEGEND

- Andersons Desert Thorn
- Blue Palo Verde
- Catclaw Acacia

Proposed Revegetation Area

- Riparian Habitat Revegetation
- CDFW Ephemeral Stream
- 100-ft. Buffer around Planting Area
- Area of Potential Effects (APE)
- EIR Project Area

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

0 10 20
Feet

N

FIGURE 7
PROPOSED REVEGETATION AREAS - RHR-4

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
FINAL 100% DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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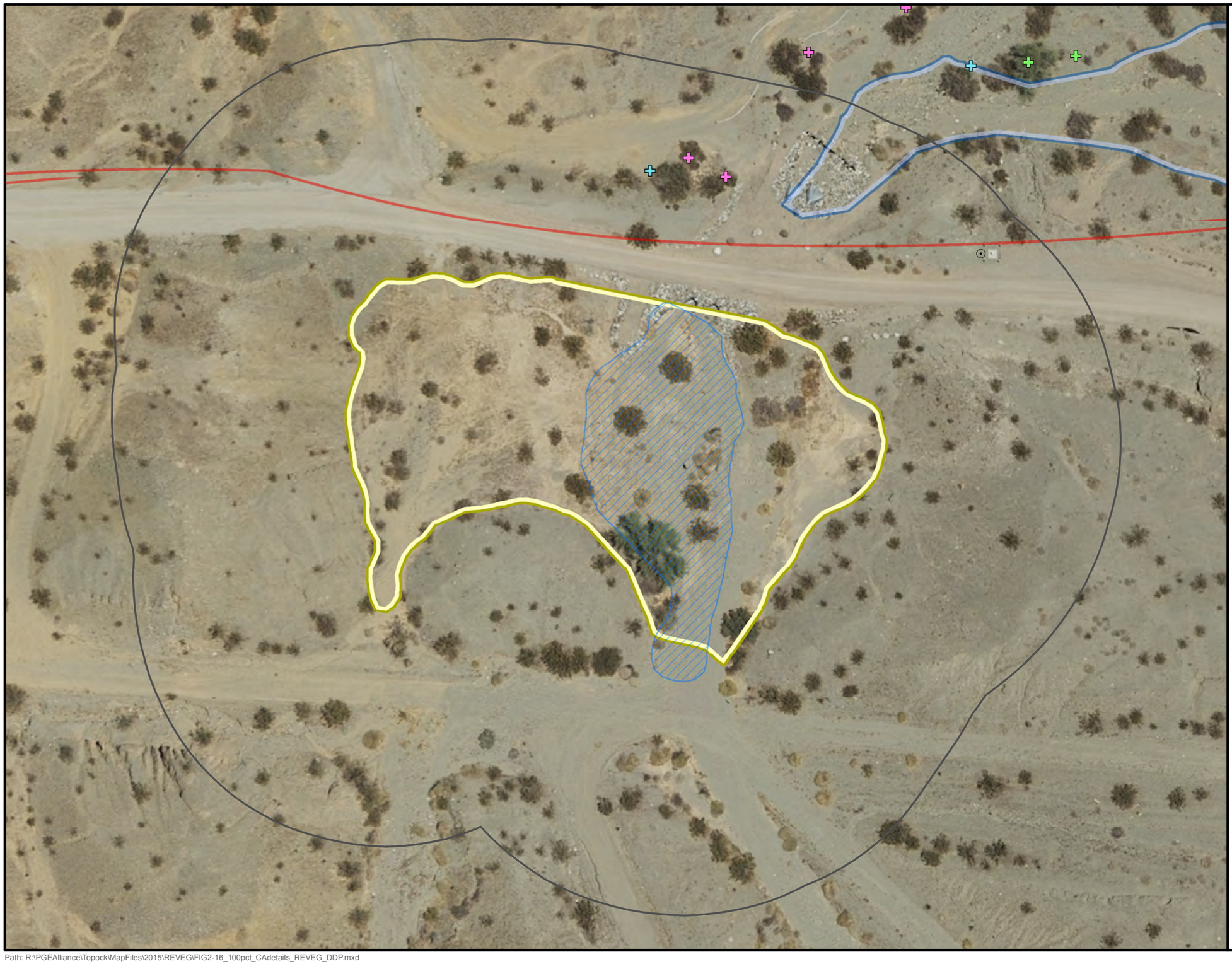

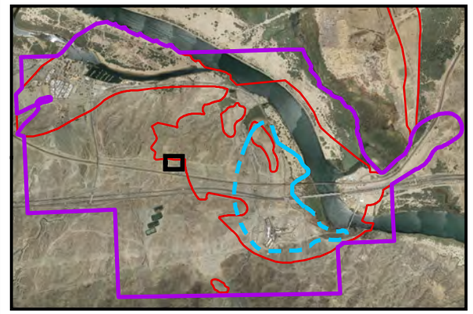

LEGEND

- Blue Palo Verde
- Catclaw Acacia
- White Rhatany

Proposed Revegetation Area

- Riparian Habitat Revegetation
- Active Flow Channel
- CDFW Ephemeral Stream
- 100-ft. Buffer around Planting Area

Existing Wells:

- Monitoring Well
- Area of Potential Effects (APE)
- EIR Project Area

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

0 25 50
Feet

N

FIGURE 8
PROPOSED REVEGETATION AREAS - RHR-5
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
FINAL 100% DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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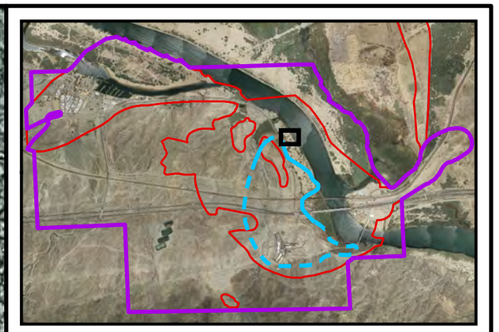

LEGEND

Proposed Revegetation Area

- Historical Floodplain Revegetation
- 100-ft. Buffer around Planting Area

Provisional Wells:

- Injection Well
- Area for River Bank Extraction Wells (RB-6 to RB-9)

Planned Wells:

- Extraction, National Trails Highway (NTH) In-situ Reactive Zone (IRZ)
- Extraction, Riverbank
- Injection, NTH IRZ
- Remedy Monitoring Well

Pipeline Corridor for Remedy

- Underground Pipe/Conduit
- Area of Potential Effects (APE)
- EIR Project Area

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

0 25 50
Feet

N

FIGURE 9
PROPOSED REVEGETATION AREAS - HFR-1

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
FINAL 100% DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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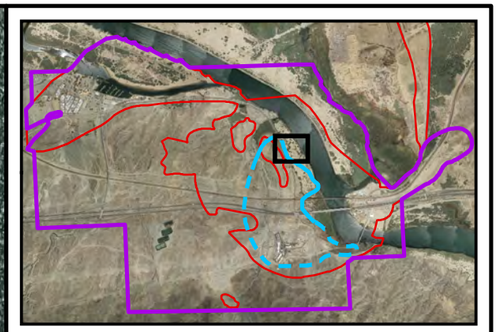

LEGEND

- Creosote Bush

Proposed Revegetation Area

- Historical Floodplain Revegetation
- 100-ft. Buffer around Planting Area

Provisional Wells:

- Injection Well
- Area for River Bank Extraction Wells (RB-6 to RB-9)

Existing Wells:

- Monitoring Well

Planned Wells:

- Extraction, National Trails Highway (NTH) In-situ Reactive Zone (IRZ)
- Extraction, Riverbank
- Injection, NTH IRZ
- Remedy Monitoring Well

Transformers

- Planned Transformer

Pipeline Corridor for Remedy

- Underground Pipe/Conduit
- Area of Potential Effects (APE)
- EIR Project Area

- Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

0 40 80
Feet

N

FIGURE 10
PROPOSED REVEGETATION AREAS - HFR-2
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
FINAL 100% DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

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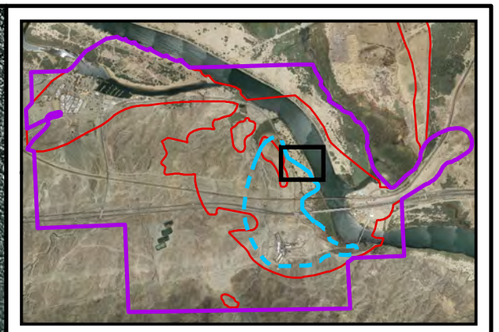

LEGEND

- Creosote Bush
- Honey Mesquite

Proposed Revegetation Area

- Historical Floodplain Revegetation
- 100-ft. Buffer around Planting Area

Provisional Wells:

- Injection Well
- Area for River Bank Extraction Wells (RB-6 to RB-9)

Existing Wells:

- Monitoring Well

Planned Wells:

- Extraction, National Trails Highway (NTH) In-situ Reactive Zone (IRZ)
- Extraction, Riverbank
- Injection, NTH IRZ
- Remedy Monitoring Well

Transformers

- Planned Transformer

Pipeline Corridor for Remedy

- Underground Pipe/Conduit
- Area of Potential Effects (APE)
- EIR Project Area

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

0 60 120
Feet

N

FIGURE 11
PROPOSED REVEGETATION AREAS - HFR-3
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
FINAL 100% DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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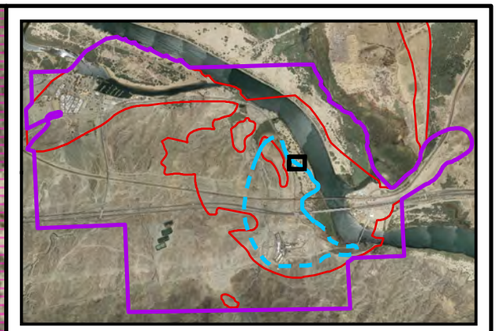

LEGEND

- Creosote Bush

Proposed Revegetation Area

- Historical Floodplain Revegetation
- 100-ft. Buffer around Planting Area

Provisional Wells:

- Injection Well
- Area for River Bank Extraction Wells (RB-6 to RB-9)

Existing Wells:

- Monitoring Well

Planned Wells:

- Extraction, Riverbank
- Injection, NTH IRZ
- Remedy Monitoring Well

Pipeline Corridor for Remedy

- Underground Pipe/Conduit
- Area of Potential Effects (APE)
- EIR Project Area

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

0 20 40
Feet

N

FIGURE 12
PROPOSED REVEGETATION AREAS - HFR-4
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
FINAL 100% DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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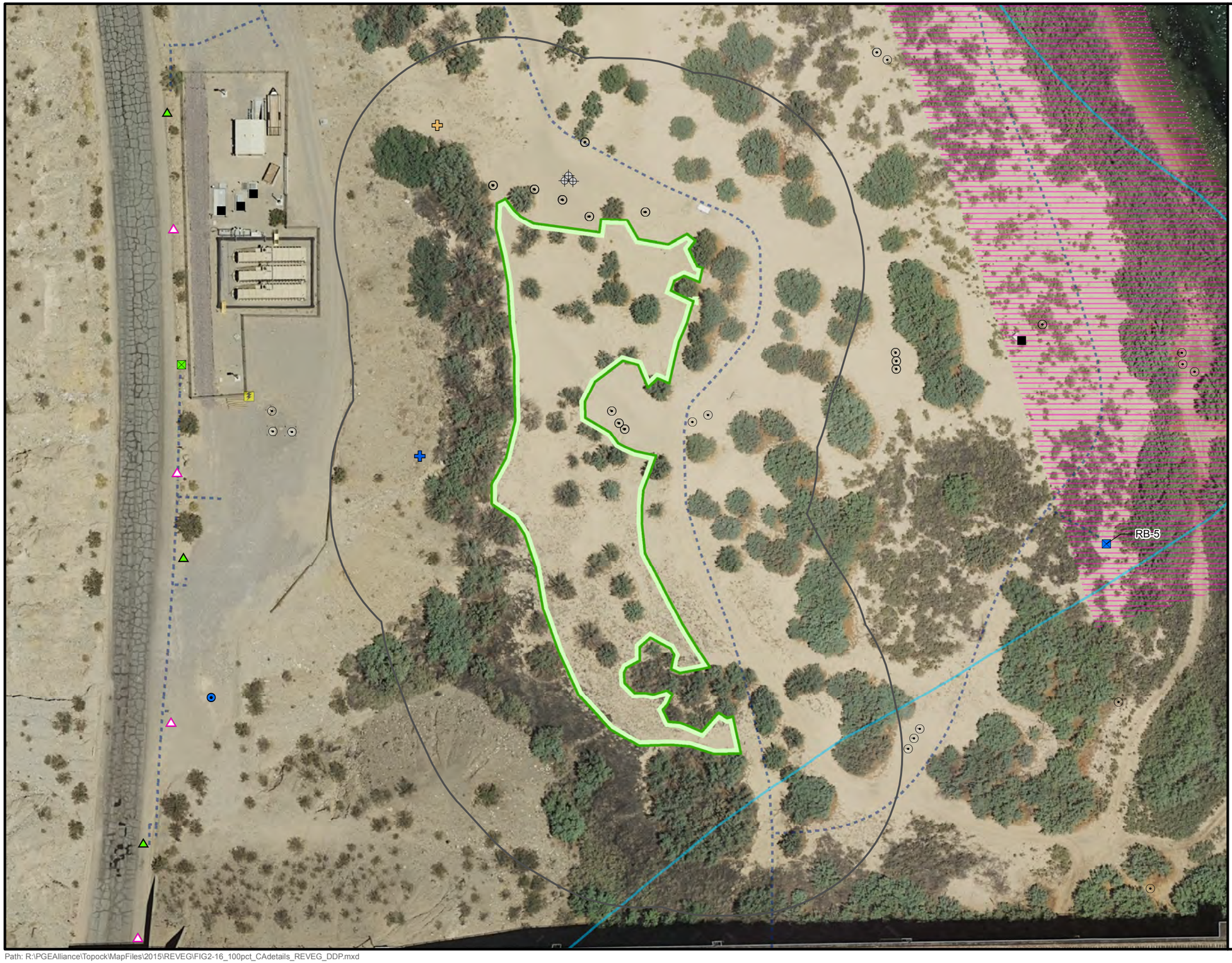

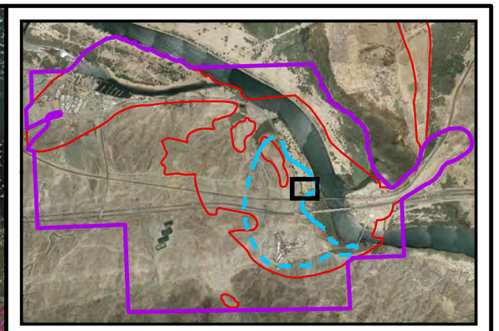

LEGEND

- Creosote Bush
- Honey Mesquite

Proposed Revegetation Area

- Historical Floodplain Revegetation
- 100-ft. Buffer around Planting Area

Provisional Wells:

- Injection Well
- Area for River Bank Extraction Wells (RB-6 to RB-9)

Existing Wells:

- Extraction Well
- Injection Well
- Monitoring Well

Planned Wells:

- Extraction, National Trails Highway (NTH) In-situ Reactive Zone (IRZ)
- Extraction, Riverbank
- Injection, NTH IRZ
- Remedy Monitoring Well

Transformers

- Planned Transformer

Pipeline Corridor for Remedy

- Underground Pipe/Conduit
- Area of Potential Effects (APE)
- EIR Project Area
- Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

0 30 60
Feet

N

FIGURE 13
PROPOSED REVEGETATION AREAS - HFR-5
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
FINAL 100% DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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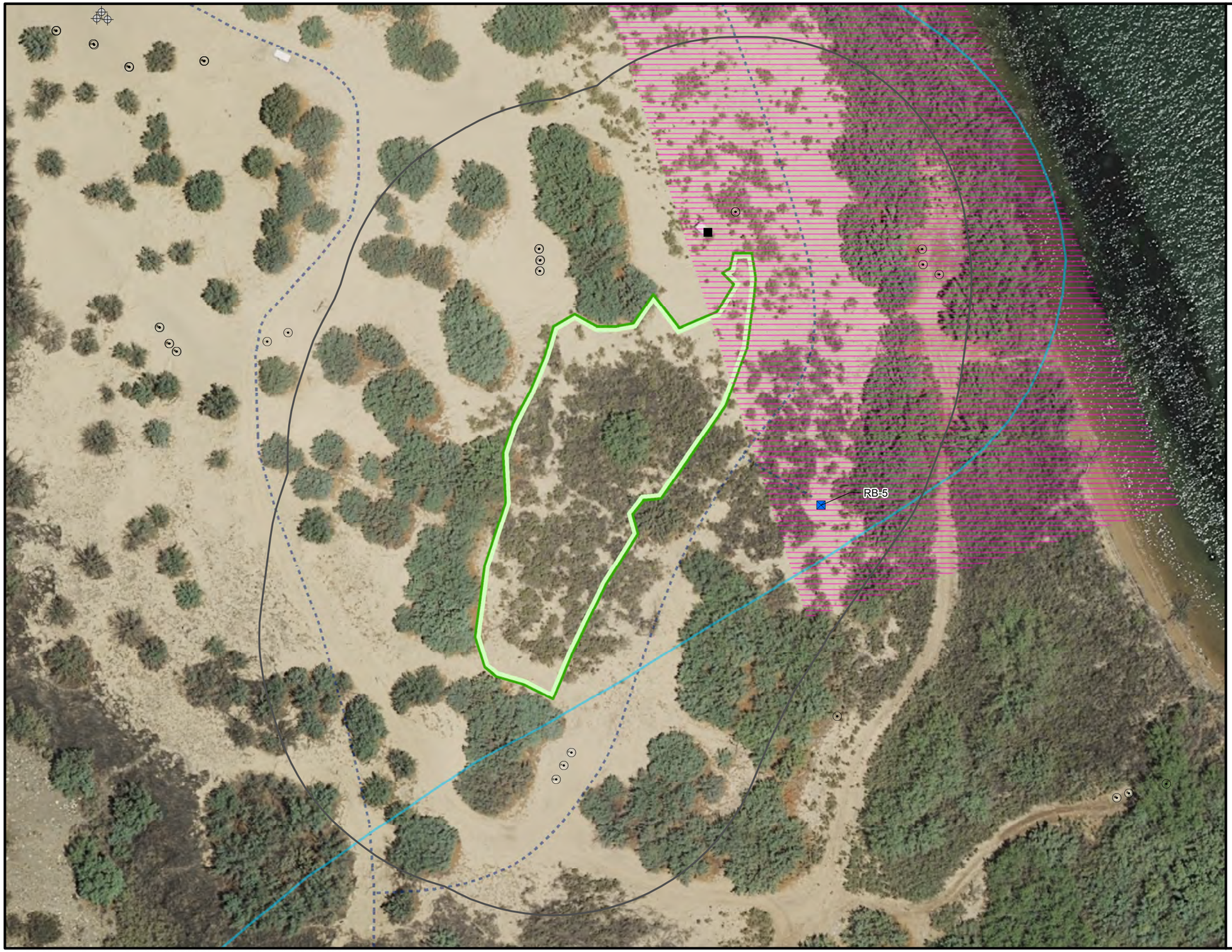

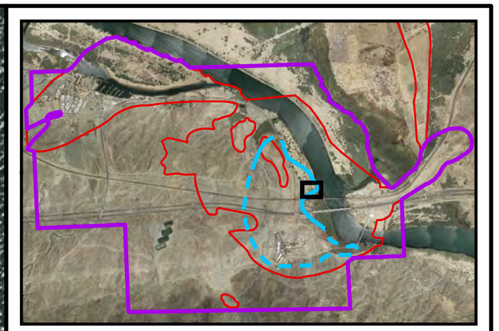

LEGEND

Proposed Revegetation Area

- Historical Floodplain Revegetation
- 100-ft. Buffer around Planting Area
- Area for River Bank Extraction Wells (RB-6 to RB-9)

Existing Wells:

- Extraction Well
- Injection Well
- Monitoring Well

Planned Wells:

- Extraction, Riverbank

Pipeline Corridor for Remedy

- Underground Pipe/Conduit
- Area of Potential Effects (APE)
- EIR Project Area

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

0 25 50
Feet

N

FIGURE 14
PROPOSED REVEGETATION AREAS - HFR-6

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
FINAL 100% DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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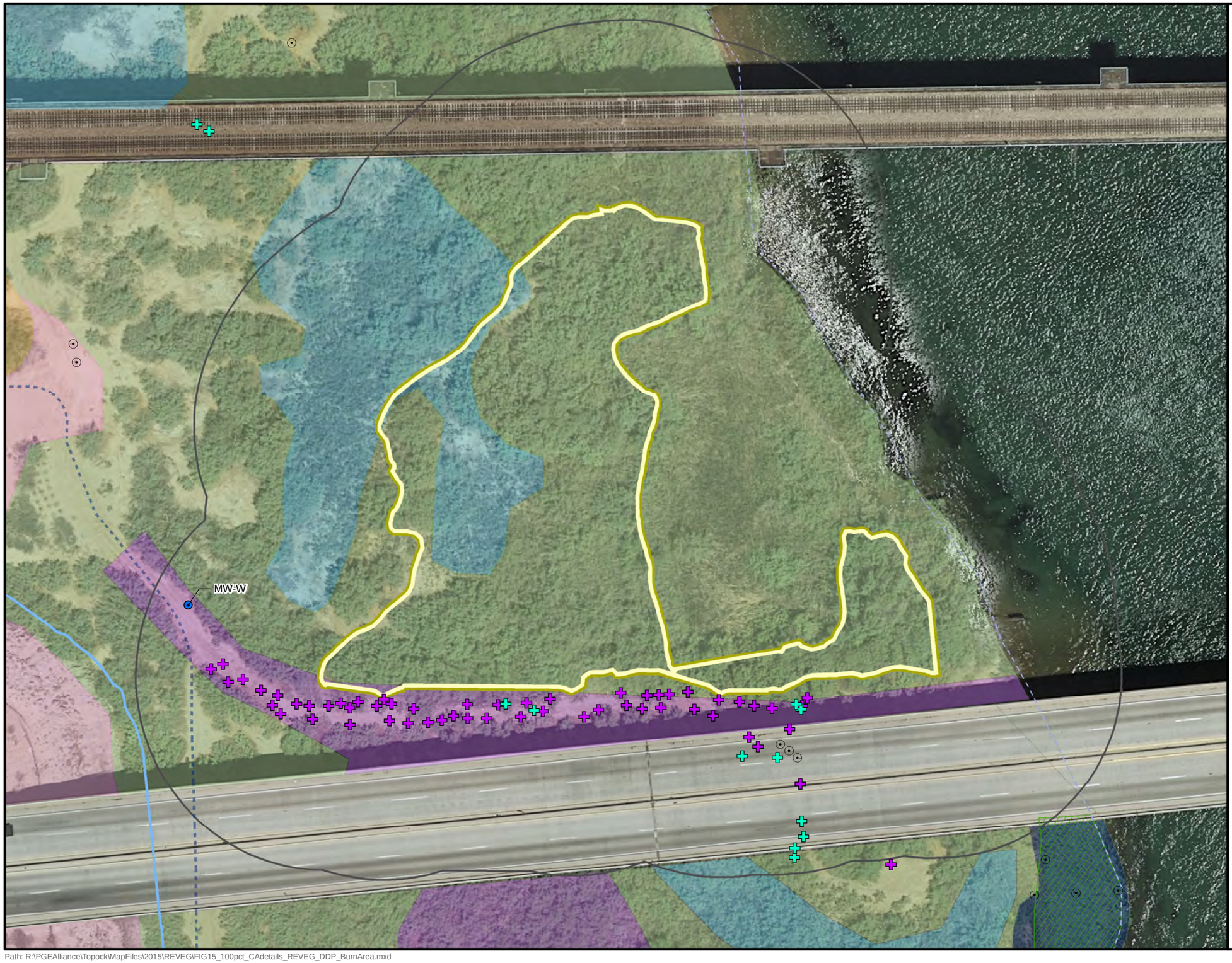

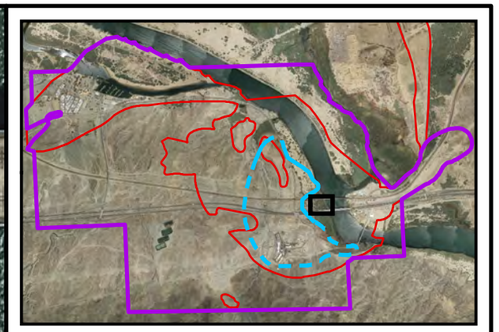

LEGEND

- Arrowweed
- Screwbean
- Arrow Weed
- Common Reed
- Creosote Bush Scrub
- Developed\Disturbed
- Honey Mesquite
- Salt Cedar
- Screwbean Mesquite

Water Types

- Palustrine, Emergent, Seasonally Flooded (PEMC)
- Riverine Lower Perennial Unconsolidated Bottom Sand (R2UB2)
- 100yr Flood Plain

Proposed Revegetation Area

- Riparian Habitat Revegetation (Burn Area)

Existing Wells:

- Monitoring Well
- Remedy Monitoring Well

Pipeline Corridor for Remedy

- Underground Pipe/Conduit
- Area of Potential Effects (APE)
- EIR Project Area

0 30 60
Feet

N

FIGURE 15
PROPOSED REVEGETATION AREAS - RHR-6 (BURN AREA)
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
FINAL 100% DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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Tables

TABLE 1

Matrix of Factors Considered for Ranking Revegetation Sites

Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California

Revegetation Area	Description	Habitat Type	Size (ac.)	Size Factor	Ownership	Surface Soil Texture	Soil Factor	Biotic Soils?	BioSoil Factor	Site Preparation Needs?	Previous Disturbance?	Disturbance Factor	Wildlife Use	Dominant Plants	Estimated Height (ft)	Sub-dominant Plants	Estimated Percent Cover	Accessibility	Accessibility Factor	Visibility	Visibility Factor	Nearby Infrastructure	Cultural Issues?	Rank (Sum of shaded factors)
UHR-1	Former levelled campground area to west of NTH	Upland	1.277	3	BLM	coarse sandy gravel and cobble	1	No	3	High, sieve soils or import	All, graded/terraced	3	wild burrow scat	LATR	2 to 5	PAFL; few cactii: OPBA & CY	3	Easy, on existing unpaved roadway from adjacent NTH	3	From NTH and Colorado River (site is above). Unlikely to be visible from Maze (site is below ridge line)	1	Former Campground/Roadhouse building slabs	Possible data collection need for trash behind old concrete slabs	14
UHR-2	Levelled and filled area to east of NTH	Upland	0.822	3	BLM	coarse sandy gravel and cobble	1	No	3	High, sieve soils or import	All, fill piles & ORV use	3	None observed	LATR	1 to 6	PAFL (up to 13 ft); few OPBA	5	Easy, on existing unpaved roadway from adjacent NTH	3	From NTH (site is below) and Colorado River. Possibly visible from nearby portion of Maze.	1	Underground phone line along NTH	No	14
RHR-1	Margin of wash to east of wells at end of access route within western drainage	Riparian	0.147	1	FMIT	fine sand with increasing gravel near slope base and along wash channel	3	Yes, limite	2	Low	96%	2	wild burrow scat & small mammal burrows	LATR	3 to 9	SEGR	5	Moderate, near end of existing well access roadway	1	Not visible except from adjacent mesas	3	Within 70 ft of well cluster but can be easily avoided	No	12
RHR-2	Portion of the wash and margin of the western drainage	Riparian	0.042	1	FMIT	predominantly medium to fine sand with very gravelly coarse to medium sand within wash	3	No	3	Low	67%	2	wild burrow scat	LATR and LYCO	3 to 8	SEGR	25	Moderate, along existing unpaved roadway from former Route 66	1	Visible from adjacent mesa and from old Route 66.	3	Unpaved access route	No	13
RHR-3	Margin of western drainage just north of unpaved roadway that was former Route 66. Bisected by exising access route.	Riparian	0.298	2	FMIT	extremely gravelly coarse to fine sand with pockets of very fine sandy loam and silt (mostly as pedestals beneath LATR)	2	No	3	Moderate	46%	2	wild burro scat	LATR	3 to 9	SEGR	15	Easy, adjacent to former Route 66	2	From adjacent former Route 66	2	Former Route 66 and unpaved access route	No	13
RHR-4	Portion of wash and margin of western drainage just north of unpaved roadway that was former Route 66	Riparian	0.115	1	BLM/FMIT	extremely gravelly coarse to fine sand	2	No	3	Moderate	All	3	None observed	LATR and LYCO	4 to 6	Large PAFL (~23 ft); SEGR	15	Moderate, along existing unpaved roadway from former Route 66	1	Visible from adjacent former Route 66 but not readily	3	Unpaved access route	No	13
RHR-5	Portion of wash and margin of western drainage just south of unpaved roadway that was former Route 66	Riparian	0.559	2	BLM	silt and fine sand with bands of very gravelly coarse sand	3	No	3	Low	All	3	None observed	LATR	3 to 8	PAFL (< 7 ft)	20	Easy, adjacent to former Route 66	2	From adjacent former Route 66	2	Underground pipe line along south side of Old Route 66	No	15
RHR-6	Recent burn area on Colorado River Floodplain between BSNF and I-40 bridges	Riparian	0.914	3	AT&SF HNWR Caltrans Lease	fine sand at surface; interbedded alluvium of mixed textures at depth	3	No	2	Moderate, will need to clear arrowweed sprouts	All, burned in October 2015	3	None observed	PLSE	less than 3 (resprouts)	TARA	25	Moderate, will use existing access roadway to monitoring wells	1	Visible from adjacent bridges and limited view from river	2	Nearby slant wells to southeast	No	14
HFR-1	Northern outside margin of construction footprint for pipeline loop	Historical floodplain	0.231	2	BLM	fine to medium sand (dredge sand) of variable depths	3	No	3	Low	All	3	None observed	TARA	3 to 9	PLSE	2	Moderate, will use access roadway along future pipeline route	2	Visible from NTH and adjacent mesas	1	Future underground pipe line ring and wells	No	14
HFR-2	Northern inside portion of construction footprint for pipeline loop	Historical floodplain	1.279	3	BLM	fine to medium sand (dredge sand from Colorado River)	3	No	3	Low	All	3	None observed	TARA and PLSE	3 to 6	None	2	Moderate, will use access roadway along future pipeline route	1	Visible from NTH and adjacent mesas	1	Future underground pipe line ring and wells	No	14
HFR-3	Central east inside portion of construction footprint for pipeline loop	Historical floodplain	1.815	3	BLM	fine to medium sand (dredge sand from Colorado River)	3	No	3	Low	All	3	None observed	TARA and PLSE	3 to 8	None	10	Moderate, will use access roadway along future pipeline route	1	Visible from NTH and adjacent mesas	1	Future underground pipe line ring and wells	No	14
HFR-4	Central west inside portion of construction footprint for pipeline loop	Historical floodplain	0.164	1	BLM	fine to medium sand (dredge sand from Colorado River)	3	No	3	Low	All	3	None observed	PLSE	~ 4	None	5	Moderate, will use access roadway along future pipeline route	2	Visible from NTH and adjacent mesas	1	Future underground pipe line ring and wells	No	13
HFR-5	Southwestern outside margin of construction footprint for pipeline loop	Historical floodplain	0.596	2	BLM	fine to medium sand (dredge sand from Colorado River)	3	No	3	Low	All	3	None observed	TARA	2 to 7	PLSE	5	Moderate, will use access roadway along future pipeline route	2	Visible from NTH and adjacent mesas	1	Future underground pipe line ring and wells	No	14
HFR-6	Southeastern inside portion of construction footprint for pipeline loop	Historical floodplain	0.286	2	BLM	fine to medium sand (dredge sand from Colorado River)	3	No	3	Low	All	3	None observed	PLSE	~ 4	TARA	2	Moderate, will use access roadway along future pipeline route	1	Visible from NTH and adjacent mesas	1	Future underground pipe line ring and wells	No	13

NOTES:

UHR = Upland Habitat Revegetation Area; **RHR** = Riparian Habitat Revegetation Area; **HFR** = Historical Floodplain Revegetation Area

Land Ownership

BLM = Bureau of Land Management; FMIT - Fort Mohave Indian Tribes; AT&SF = Atchison Topeka and Santa Fe Railroad;

NTH = National Trails Highway

Surface soil texture based on field observation. No soil pits were dug and no digital soil mapping information was availableon NRCS site for CA portion of the project area.

Site preparation needs: Presence of large proportion gravel and cobble = High; presence of lesser amounts of gravel = moderate; presence of adequate fine materials = low. This was not used as a separate factor since it parallels the soil factor.

Plant Names: LATR: Larrea tridentata; LYCO: Lycium cooperi; PAFL: Parkinsonia florida: SEGR: Senegalia greggi; HYEM: Hyptis emoryi; OPBA: Opuntia basilaris; CYEC: Cylindropuntia echinocarpa; PLSE: Pluchea sericea

Estimated percent cover developed by comparing aerial photograph to visual graphics for estimating percent cover (in Field Book for Describing and Smapling Soils ver. 3.0, NRCS Sept 2012). It may be possible to adjust total acreage for plantable acreage by reducing the exiting coverage amount.

FACTOR Scaling:

Size: 0 to 0.2 acre = 1; 0.21 to 0.8 acre = 2; >0.8 = 3

Soil Factor: Presence of large proportion gravel and cobble = 1; presence of lesser amounts of gravel = 2; presence of adequate fine materials = 3

BioSoil Factor: biotic soils over large portion of unit = 1; biotic soils present but avoidable = 2; no biotic soils = 3

Disturbance factor: Not previously disturbed = 1; portion not previously disturbed = 2; all previously disturbed = 3

Accessibility Factor: site accessed by longer unpaved access route = 1; site accessed from adjacent unpaved route = 2; site easily accessed from adjacent paved roadway = 3.

Visibility Factor: easily viewed from roadway open to public = 1; viewable from old Route 66 = 2; only viewable from adjacent mesa summits = 3

TABLE 2

Summary of Expected Plant Impacts and Revegetation Areas Needed

Assessment of Proposed Mitigation Planting Areas for Final Groundwater Remedy Impacts, Topock Compressor Station, California

Scientific Name	Common Name	Number of Plants Impacted	Visual	Ethnobotanical	HNWR	Riparian	Mitigation	Trees/shrubs for Planting	Spacing (ft.)	Area per plant (sq.ft.)	Area for all plants (sq.ft.)	Area for all plants (acres)
Trees, shrubs, and cactii not located on the Historical Floodplain where dredge sands were deposited												
Atriplex polycarpa	Cattle saltbush	10	NA	10	9	NA	6:1[1]	60	5	25	1,500	
Atriplex lentiformis	Big saltbush	3	NA	3	3	NA	6:1	18	5	25	450	
Lycium andersonii	Anderson's desert thorn	4	NA	4	4	4	6:1	24	10	100	2,400	
Parkinsonia florida	Blue Palo Verde	63	1	63	18	2	6:1	378	20	400	151,200	
Parkinsonia florida (seedlings/saplings)	Blue Palo Verde	52	NA	52	NA	NA	2:1[2]	104	20	400	41,600	
Prosopis pubescens	Honey mesquite	6	NA	6	4	1	6:1	36	20	400	14,400	
Prosopis pubescens (seedlings/sapling)	Honey Mesquite	11	NA	11	NA	NA	2:1[2]	22	20	400	8,800	
Psorothamnus spinosus	Desert smoke tree	2	NA	NA	1	1	6:1	12	20	400	4,800	
Senegalli greggii	Catclaw acacia	23	NA	NA	22	21	6:1	138	10	100	13,800	
Opuntia basilaris var. *basilaris*	Beavertail cactus	14	NA	NA	14	NA	1:1	14	5	25	350	
Cylindropuntia acanthacarpa	Buckthorn cholla	1	NA	NA	NA	NA	1:1	1	5	25	25	
Cylindropuntia sp.	Cholla	3	NA	NA	NA	NA	1:1	3	5	25	75	
Cylindropuntia echinocarpa	Silver cholla	3	NA	NA	1	NA	1:1	3	5	25	75	
Coryphantha alversonii	Foxtail cactus	1	NA	NA	NA	NA	1:1	1	5	25	25	
Cylindropuntia bigelovii	Teddy bear cholla	2	NA	NA	NA	NA	1:1	2	5	25	50	
										Subtotal Area	**239,550**	**5.50**
Trees and shrubs located on the Historical Floodplain where dredge sands were deposited												
Parkinsonia florida	Blue Palo Verde	1	1	1	NA	NA	6:1	6	20	400	2,400	
Tamarix ramosissima	Saltcedar	13	13	NA	1	NA	6:1	78	20	400	31,200	
Larrea tridentata	Creosote bush	2	2	NA	NA	NA	6:1	12	10	100	1,200	
										Subtotal area	**34,800**	**0.80**
										Total area	**274,350**	**6.30**

Notes:

NA = Not Applicable

[1] This ratio assumes a 3:1 mitigation ratio that is doubled to account for potential mortality that can be as high as 50 percent over the 5 year monitoring period.

[2] This ratio assumes that impacted seedlings/saplings will be relocated to designated planting areas and one additional mitigation tree will be planted.

[3] This ratio assumes the the impacted seedlings/saplings or cactii will be relocated to desginated plantings areas with no additional plantings.

Attachment
Representative Planting Site Photographs



Photo A-1. UHR-1: View southeast showing levelled areas of former campground.



Photo A-2. UHR-1: View southwest from National Trails Highway showing terracing.



Photo A-3. UHR-2: View southeast showing existing access and soil pile to left.



Photo A-4. UHR-2: View northwest showing access route and soil pile.



Photo A-5. RHR-1: View south-southeast showing wash and margin.



Photo A-6. RHR-1: View north-northwest showing wash.



Photo A-7. RHR-2: View north-northeast showing wash and margin. Old roadway into wash from southern mesa can be at northern end of this unit.



Photo A-8. RHR-2: View south-southwest showing old Route 66 in background.



Photo A-9. RHR-3: View east showing access route that bisects the site.



Photo A-10. RHR-3: View west showing old Route 66 in background.



Photo A-11. RHR-4: View east showing slight slope at based of old Route 66 to right.



Photo A-12. RHR-4: View west showing old Route 66 access where vehicle is located.



Photo A-13. RHR-5: View southeast showing rip rap near wash and ORV tracks.



Photo A-14. RHR-5: View southwest showing rip rap near wash and culvert.

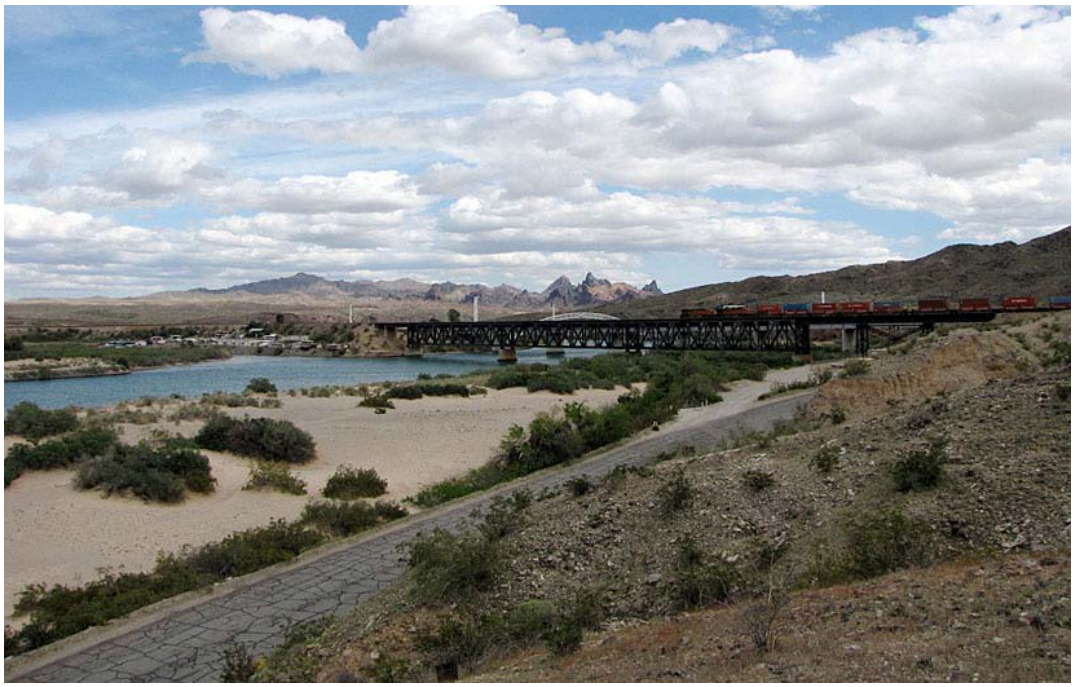

Photo A-15. Key View 5 from EIR—View southeast from Topock Maze Locus B over the historical floodplain toward the Colorado River, BNSF railroad bridge and the "Needles." HFR-4 and southern portion of HFR-3 to left and HFR-5 and -6 out of sight and nearer bridge to right.



Photo A-16. Key View 11 from EIR—View west toward the historical floodplain, IM-3, and compressor station. Portions of HFR-1, -2, and -3 are located just out of sight on the elevated sand deposits beyond the line of large tamarisks.



Photo A-17. View north-northeast across southern portion of historical floodplain in direction of southern portion of HFR-3.



Photo A-18. View north-northwest across northern portion of historical floodplain to the west of southern portion of HFR-2 showing variable depth of dredge sands.



Photo A-19. View north-northeast across eastern portion of historical floodplain showing mixed arrow weed and tamarisk.



Photo A-20. View north across eastern portion of historical floodplain showing variable depth of dredge sands.



Photo A-21. View southwest across central portion of RHR-6 burn area on floodplain showing active sprouting of arrow weed and tamarisk.



Photo A-22. View northeast from southern margin of RHR-6 burn area showing active sprouting of arrow weed within unit and from base of scorched screwbean mesquite.

Appendix W
Technical Memorandum: Proposed Use of Certain Areas for Construction, Staging, and Soil Storage at PG&E Topock Compressor Station
(On CD-ROM Only)

Proposed Use of Certain Areas for Construction, Staging, and Soil Storage at PG&E Topock Compressor Station

PREPARED FOR: Topock File

PREPARED BY: CH2M HILL on behalf of PG&E

DATE: January 26, 2015

Pacific Gas and Electric Company (PG&E) is implementing the selected groundwater remedy for chromium in groundwater at the PG&E Topock Compressor Station (TCS, or the Compressor Station) in San Bernardino County, California. This technical memorandum (TM) was prepared in response to the California Department of Toxic Substances Control (DTSC) and the U.S. Department of the Interior (DOI) direction to PG&E dated December 23, 2014 to (1) further examine and consider the Tribal input provided in the tables attached to the directive letter, (2) provide clarification on the construction/staging/soil storage terminology used in the Construction/Remedial Action Work Plan (C/RAWP; CH2M HILL 2014a), and (3) provide detailed descriptions of the proposed use of the areas still in discussion with the Tribes as well as justification for the necessity of using these areas during construction and remedy implementation.

Section 1 of this TM addresses the construction/staging/soil storage terminology used in the C/RAWP. The attachments to the Agencies' December 23, 2014 letter (DOI and DTSC 2014a) identified eleven areas (Areas 6, 7, 11, 12, 13, 15, 16, 17, 19, 20, and 25) whose use for project activities is still being discussed with the Tribes. These areas are depicted on Figure 4.3-2 (attached to this TM) of the C/RAWP. Of these eleven areas, seven (Areas 6, 7, 12, 13, 16, 17, and 19) are in the Upland area of the site and are discussed in Section 3. The remaining four Non-Upland areas (Areas 11, 15, 20, and 25) are addressed in Section 2.

1.0 Construction/Staging/Soil Storage Terminology

Sections 4.2.2 and 4.2.3 of the C/RAWP present the following definitions and descriptions:

- **Primary Work Zones (also called Construction Areas) –** These zones are defined as the immediate area where actual construction will occur for a given component of remedy infrastructure. For example, the primary work zone for the construction of a well will consist of a defined area around the well location, while the zone for the construction of a pipeline will consist of an area on one or both sides along the length of the pipeline. To the extent feasible, primary work zones will be limited to previously disturbed areas (that is, minimizing use of undisturbed areas and those potentially exposed to differential compaction).
- **Support Zones (also called Staging Areas) –** Most of the staging areas will be located adjacent to or near primary work zones to support construction. Staging areas are existing open areas (that is, minimizing use of undisturbed areas and those potentially exposed to differential compaction) that are used to minimize the size of the primary work zones by centrally placing temporary facilities (such as portable toilets and break areas), and for laydown of construction equipment, materials, supplies, and tools. Displaced soil, material (e.g., asphalt), and water generated in the primary work zones might also be temporarily staged in staging areas en route to the designed storage or disposition area so that the size of the primary work zones can be minimized. Staging areas will also be used to coordinate transportation activities—for example, a staging area for the management of wastewater generated during well construction and development on the floodplain will be set up at the centrally located MW-20 Bench. This central wastewater management area will include a series of portable frac tanks for temporary storage of wastewater, a truck haul station for hauling of wastewater, and pumping facilities

to pump the wastewater to the IM-3 treatment plant, as appropriate, thereby limiting the need for these activities in the primary work zones on the flood plain.

- **Soil staging/processing area (Area 5 on C/RAWP Figure 4.3-2)** – This area is located in Moabi Regional Park, and is where soil and material displaced during construction activities will be brought for staging, processing and potential reuse at the project site. Imported material for use in construction may also be temporarily staged here.
- **Soil container storage area (Area 4 on C/RAWP Figure 4.3-2)** – This area is located in Moabi Regional Park, and will serve as the primary storage and management area for containerized soil displaced from the site during construction that is pending final disposition in accordance with the Soil Management Plan (Volume 4 of the Operation and Maintenance [O&M] Manual, which is Appendix L of the Basis of Design Report/Pre-Final (90%) Design Submittal for the Final Groundwater Remedy [90% BOD; CH2M HILL 2014b]).

2.0 Description and Proposed Use of the Four Non-Upland Areas Still Being Discussed with the Tribes

This section describes and discusses the proposed use of the four non-Upland areas (Areas 11, 15, 20, and 25) still being discussed with the Tribes. These areas are depicted in the attached C/RAWP Figure 4.3-2.

Area 11 – Based on Tribal inputs provided in the tables attached to the Agencies' December 23, 2014 directive letter and received during resolution of the 60% design comments, PG&E has limited the area to be used during remedy construction to the western side of the fenced area, as shown in C/RAWP Figure 4.3-2. With the exception of installing a natural gas pipe from PG&E Line 300B to supply natural gas to the new generators, construction activities will be inside the ponds fenced area. It is anticipated that ongoing O&M activities at the ponds will continue to occur during remedy construction. After remedy construction is complete, the entire fenced area will continue to be used for O&M of the ponds (as is currently done) and O&M of the additional pond improvement features.

Regarding the Tribes' comment about tortoise habitat and tortoise activity in the pond area, PG&E asked for further clarification from the Tribes during the Technical Work Group (TWG) meeting on December 10, 2014. PG&E conducted multiple protocol-level tortoise surveys from 2004 to 2010 and identified tortoise remains in the project limits. In consultation with U.S. Fish and Wildlife Services (USFWS), the entire upland area of the project was deemed habitat for desert tortoise which resulted in concurrence from USFWS on avoidance and minimization measures that were proposed in the 2007 Programmatic Biological Assessment (PBA; CH2M HILL 2007) and most recently the 2014 Final Groundwater Remedy PBA (CH2M HILL 2014c). Measures within the PBA to protect desert tortoises that could potentially occur within the project limits and Groundwater Remedy Environmental Impact Report (DTSC 2011) Mitigation Measure BIO-2b will be implemented prior to and during construction of the remedy (e.g., preconstruction tortoise surveys and biological monitoring during construction to avoid impacts to this species).

Area 15 – In compliance with the Agencies' direction in its April 4, 2014 letter (DOI and DTSC 2014b), PG&E did not propose using this area for staging during remedy construction, as noted in Footnote 3 of C/RAWP Figure 4.3-2. Since there is no proposed remedy infrastructure in this area, PG&E also did not propose using the area as a primary work zone. The potential use for this area is for planting native plants to mitigate potential impacts to plants that may occur during remedy construction in the Upland (see Section 5.4 of the C/RAWP). Whether this area will ultimately be used for mitigation planting will depend on the actual plant impacts that may occur during construction and the associated requirements for mitigation plantings. Appendix V of this Supplemental 90% submittal contains additional details regarding the rationale and planned use of this area.

Area 20 – PG&E did not propose to use this area during remedy construction. This area is currently used to access the existing wells on the MW-24 Bench for well monitoring and maintenance. This area is also an

Area of Concern (AOC), No. 27, in the current soil remedial investigation effort. It is important to note that if it is later determined that the future provisional well IRL-6 needs to be installed, this area will need to be used as a primary work zone to install the well and associated vaults/piping/conduits, and after installation is completed, to access the well and associated equipment during remedy O&M. Access would be needed for ongoing monitoring and O&M of the existing wells at the MW-24 bench to occur during construction of the provisional well IRL-6. After construction of IRL-6 is complete, this area would continue to be used for access and O&M of remedy infrastructure in this area.

Area 25 – This flat area is where construction vehicles and water trucks will obtain construction water for use during remedy construction (see Drawing C-07-200 in Appendix D2 of the 90% BOD [CH2M HILL 2014b]). This area was selected because of its central location relative to all construction areas, its close proximity to the existing pipe that supplies fresh water to the Compressor Station, its relatively flat surface (requires no grading), and its convenient access off the paved National Trails Highway. While construction water is also available offsite such as from Needles or Golden Shores, each such round trip would be over 20 miles, which would add to the already expected busy traffic on National Trails Highway during construction along with the associated potential traffic-related safety hazards (e.g., vehicle accidents) and environmental impacts (e.g., dust, noise, greenhouse gas [GHG] emissions). It is anticipated that limited staging of construction materials/equipment and temporary parking of construction-related vehicles will also occur in this central area. After remedy construction is complete, this area will be restored to its pre-construction condition.

Regarding the Tribes' comment on a direct impact to a historic site, based on PG&E's preliminary discussions with the U.S. Bureau of Land Management and the California State Historic Preservation Office, the location of this area is adjacent to a non-significant segment of Route 66, and therefore use of that area during construction will not cause an adverse effect/significant impact to the road (Mead & Hunt, 2013).

However, the Route 66 sign located adjacent to Area 25 is significant and its protection as a historic property/historical resource during construction is addressed in the Cultural and Historical Property Treatment Plan (Hanes and Price 2014). The sign is considered a key component of the Route 66 interpretation program outlined in the Treatment Plan. Any potential direct impacts to the sign will be avoided and, if deemed necessary, the sign will be protected with barriers during construction. New interpretive signage may be added to the area around the existing sign as part of Treatment Plan implementation. The Treatment Plan also specifies that PG&E will develop a restoration plan for the sign, subject to the approval of the relevant landowner. The proposed use of the area adjacent to the Route 66 sign is temporary in duration and therefore will not permanently diminish the integrity of the sign's setting. With avoidance of direct physical impacts to the sign, as well as the temporary nature of the use of the area adjacent to the sign, project activities would not meet the criteria for adverse effects to historic Route 66.

3.0 Description and Proposed Use of the Seven Upland Areas Still Being Discussed with Tribes

This section describes and discusses the proposed use of the seven areas in the Upland (Areas 6, 7, 12, 13, 16, 17, and 19; see attached C/RAWP Figure 4.3-2) still being discussed with the Tribes.

3.1 Current Approach: Remedy Construction

The Upland portion of the Topock site is a uniquely challenging area to conduct construction-related activities given the environmental site conditions (e.g., topography); the limited acceptable access routes (jointly used with other utilities); the number of sensitive biological, cultural, and archaeological resources located in this area; as well as Tribes' preference for no additional disturbance outside of the present-day existing roadway (see Attachment G to Appendix I of the September 2014 90% BOD). These factors constrain the total area available for construction-related activities.

Therefore, in the C/RAWP, PG&E has proposed an approach to construction that allows for the safe and efficient installation of all remedial facilities, as well as the subsequent decommissioning of IM-3, while

protecting the surrounding sensitive resources, minimizing the overall construction footprint and use of undisturbed areas to the extent practicable, and minimizing the overall environmental impacts associated with the work activities. Central to this approach is locating support areas for staging of construction-related equipment and materials in close proximity to where the actual construction activities will occur. Further details on this approach are provided below.

Installation of Pipelines A and H in the Upland will require over 20,000 feet of piping and over 14,000 feet of electrical conduit, in addition to pipeline trench backfill materials, concrete trench boxes, and environmental/storm water protection materials, and related required construction materials. Due to the lack of overall work area in the Upland area (e.g., Pipeline A installation work located in the narrow access road), construction work in the Upland area will be very space-constrained. In order to minimize impacts, primary work zones will be restricted to a minimized area around the specific construction activity taking place at any one time. There will not be space available within primary work zones to stage equipment or materials, including those materials that will very quickly be consumed during construction (e.g., pipeline).

For example, the designed width of Pipeline A (approximately 8'-8" wide) will itself use much of the width of the access road and shoulder. Construction equipment will be operating adjacent to the trench edge, and at both ends of the trench within the primary work zone. Given the space constraints of the road, using additional area around the immediate trenching zone to temporarily store materials would obstruct the active construction equipment and associated traffic to and from the active primary work zone, and would obstruct any traffic attempting to bypass the work zone. This requires the extension of the primary work zone to key areas adjacent to the road. Establishing the primary work zone in this way will allow for effective transfer of equipment and materials and will minimize the dust and noise generated from frequent transfer trips by shortening the travel distance. Nearby supporting staging areas are necessary to maintain an adequate short-term supply of construction materials to be able to maintain an effective and safe (to workers and monitors/site visitors) operation at primary work zones.

Further, the construction of remedial facilities within the road, including the Bat Cave Wash crossing and wells MW-BB, MW-CC, and IRL-3, will already significantly impact the road, requiring intermittent traffic shutdowns. Use of the nearby **Areas 6 and 7** for staging will allow the project to minimize service interruptions to the access road.

In addition, most of **Area 6** will be used as primary work zones during the construction of wells IRL-1, MW-P, and MW-AA and the associated vaults, piping, and instrumentation (see Exhibit 1). During this period of well construction, **Area 7** will be used as a key support zone. As described in Section 3.2 of the C/RAWP, a significant amount of equipment and materials is needed to perform this work (e.g., drill rig, service vehicles, support equipment, bins/tanks, and crew facilities). Because of their central locations in the Upland, **Areas 6 and 7** are also proposed for the location of temporary facilities for the duration of construction of remedy infrastructure in the Upland area. These temporary facilities would include, but not be limited to, a trailer to serve as a central communication and coordination area for the crews working in the Upland in emergency situations, restroom facilities, safety and security lighting, a central equipment storage area, and a central parking area. The presence of these temporary facilities will also provide a safer working environment, as health and safety and first aid materials, as well as reliable means of communication (e.g., land line telephone, internet), would be available at these locations. After remedy construction is complete, **Area 6** will continue to be used for monitoring and O&M of installed remediation and monitoring wells and associated vaults/piping/conduits. **Area 7** will continue to be used for monitoring and O&M of the existing well cluster MW-41.

Similar to Area 6, most of **Area 12** will be used as the primary work zone and staging area for laydown of construction equipment, materials, supplies, and tools, as well temporary placement of displaced soils during the construction of remediation well FW-1 and associated vaults/piping/conduits. Note that ongoing O&M activities at the IM-3 injection well field will continue to occur during construction of FW-1, and close coordination with IM-3 operation staff will ensure that these concurrent activities will proceed in harmony.

After remedy construction is complete, **Area 12** will continue to be used for monitoring and O&M of the IM-3 injection wells until they are decommissioned as part of the decommissioning and removal of IM-3, as well as for O&M of the new well FW-1 and associated vaults/piping/conduits and of the existing monitoring wells located in this area.

Area 13 will be used as a staging area for laydown of construction equipment, materials, supplies, and tools, as well temporary placement of displaced soils during remedy construction. It will also serve as a critical vehicle turnaround area to allow for efficient construction and eliminate the need for construction vehicles and heavy equipment to travel a big loop along the unpaved road west of IM-3, along Park Moabi Road, and then again along National Trails Highway. After remedy construction is complete, **Area 13** will continue to be used for monitoring and O&M of the existing CW-01 well cluster.

Finally, as noted in footnote 3 of C/RAWP Figure 4.3-2, **Areas 16, 17, and 19** are not proposed to be used for staging during remedy construction. They will be needed as primary work zones during construction of Pipeline A for the same reasons as stated above. **Area 19** will also be used as a primary work zone for construction of monitoring well MW-N. After remedy construction is complete, these areas will continue to be used to support the O&M of the remedy infrastructure, including wells, along this narrow corridor. **Areas 17 and 19** will continue with their current use as a turn around and/or parking areas for vehicle traffic along the access road.

Summary

The proposed use of the Upland areas, which are in close proximity to the remedial infrastructure in the Upland, is required for efficient, successful and safe implementation of construction activities as they will result in the following benefits:

- Providing the minimum number of practical locations to temporarily stage the required quantity of equipment and materials necessary to safely construct Pipelines A and H, the Upland monitoring and remediation wells, Bat Cave Wash crossing, and supporting infrastructure.
- Increasing worker safety (e.g., reduces onsite construction traffic, vehicle congestion at primary work zones, and the overall mileage required to complete the work).
- Increasing public safety and reducing nuisance to the public by decreasing the density of construction vehicle traffic on public roads (e.g., between Moabi Regional Park and the staging areas in the Upland), and reducing both the trip frequency and trip duration for construction vehicles (typically have relatively poor visibility) traveling between primary work zones and distant staging areas.
- Reducing environmental impacts associated with execution of the work, including dust, noise, and GHG emissions.
- Reducing the total construction schedule by allowing for the most efficient construction approach.

In general, increasing the distance between an active primary work zone and its supporting staging area has several adverse impacts. Travel time increases significantly due to the greater distance between these locations, especially given the generally slow rate of travel of construction vehicles. To adequately supply a primary work zone from distant staging areas also requires use of either more frequent or larger, higher-capacity support vehicles to deliver required construction materials. Primary work zones then become more congested due to either the larger quantity of smaller vehicles or having larger vehicles unloading their materials at the already tightly-constrained primary work zones. The support vehicles will thus be more likely to become backed up at the primary work zone, impacting traffic at and near the work area and potentially traffic on nearby public roads (such as National Trails Highway). Congestion in primary work zones will also result in increased safety hazards associated with construction vehicles, which typically have relatively poor visibility, in close proximity to equipment and construction personnel. Increased traffic will increase dust, noise, and GHG emissions.

3.2 Current Approach: Decommissioning and Removal of IM-3

The IM-3 Decommissioning Work Plan (Appendix F of the C/RAWP) proposes the use of **Areas 6 and 7** as staging areas during the decommissioning and removal of IM-3 (see attached Figure 3-1 from the IM-3 Decommissioning Work Plan).

The proposed use of the centrally-located (relative to the primary work zone) staging **Areas 6 and 7** allows for the most efficient decommissioning and removal of the IM-3 system (specifically the IM-3 treatment plant); it minimizes the total vehicle and heavy equipment mileage required to complete the work (increasing worker and public safety), reduces the total GHG emissions, minimizes the total footprint of the project, and minimizes the dust and noise associated with execution of the work. Decommissioning of the treatment plant will require adequate space for demolition equipment around the perimeter of the plant to safely allow for removal of structures, thus requiring staging areas for the stockpiling of material, service vehicles, support equipment, bins/tanks, and crew facilities. PG&E shares the Tribes' and Agencies' goal of removing IM-3 at the earliest practical date, consistent with the requirements of the Settlement Agreement (DTSC 2012); using the nearby proposed staging areas best allows the project to meet this shared goal.

3.3 Evaluation of Alternative Approaches to Staging Areas

PG&E has conducted an evaluation of alternatives to the current approach and the associated impacts of those alternatives. The impacts evaluated include safety, environmental (e.g., traffic, GHG emissions, noise, dust, water for dust control), and construction schedule duration. Each alternative assumes that the Upland Areas 6, 7, 12, and 13 are not available for staging, and therefore incorporates the use of other staging areas to use instead. Tables 1 and 2 compare the current work approach to the alternative approaches identified below for remedy construction and IM-3 decommissioning and removal, respectively.

3.3.1 Evaluation of Alternative Approaches: Remedy Construction

The evaluation identified four alternative options for remedy construction staging areas, as described below and summarized in Table 1.

Option 1 – Use of Staging Areas At/Near the MW-20 Bench

Option 1 uses the staging areas located at or near the MW-20 Bench (14 and 18 in Figure 4.3-2) in lieu of staging Areas 6, 7, 12, and 13. These areas were not originally intended for such use when working in the Upland because they are planned for the competing, simultaneous use to support construction of the National Trails Highway In-situ Reactive Zone (NTH IRZ) and the remedial facilities on the MW-20 Bench, given their proximity to these areas. The NTH IRZ itself requires over 47,000 feet of piping and over 28,000 feet of electrical conduit, in addition to trench backfill materials, concrete trenches and utility vaults, mechanical and process equipment, electrical hardware, and environmental/storm water protection materials. Since these areas are already limited in size for their intended use, they are not large enough to simultaneously support additional work in the Upland. In addition, as access to staging areas 14 and 18 is directly from the National Trails Highway, any increase in traffic density in and out of these areas also directly increases traffic density and potential nuisance and traffic hazards to the public traveling on National Trails Highway. Key considerations associated with this approach include:

- Worker Safety – This approach will lead to over-crowding in staging areas 14 and 18, which are critical to support the construction of the wells and pipelines associated with the NTH IRZ and the remedial facilities on the MW-20 Bench. For example, staging area 18 will be used as a central staging area for the management of water generated during well construction and testing, which will require the majority of available square footage. In addition, the frequency of trips by construction vehicles and heavy equipment, travel duration, and the size of support vehicles will increase (MW-20 Bench is approximately 0.5 mile from staging areas 6 and 7), increasing the likelihood for vehicle-related accidents to occur.

- Public Safety and Nuisance – This approach increases the risk to public safety, and increases nuisance to the public by increasing the density of construction vehicle traffic on public roads, increasing both the trip frequency and trip duration for construction vehicles traveling between primary work zones and staging areas 14/18, and increasing congestion on National Trails Highway, as larger construction vehicles are required to slowly enter and exit staging areas 14 and 18 at a greater frequency and for a greater duration over the remedy construction project.
- Environmental Impacts – The total GHG emissions associated with the project will increase due to the additional vehicle and heavy equipment traffic. The increased traffic along the unpaved IM-3 access road and National Trails Highway will increase the potential for dust generation, require the usage of more water/vehicle trips to suppress the dust, and generate more noise.
- Construction Schedule Duration – As mentioned above, this approach will lead to over-crowding within the utilized staging areas and limit the number of parallel construction activities that can safely be conducted. This will result in an extended and less efficient construction schedule, ultimately delaying the project goal of completing the groundwater remedy construction project and the decommissioning and removal of IM-3 at the earliest practical date.

Option 2 – Use of Staging Areas at Moabi Regional Park

Option 2 uses one or more of the areas located at Moabi Regional Park (staging areas 3, 4, and 5 in Figure 4.3-2). These areas could be used in lieu of staging areas 6, 7, 12, and 13, but were not originally intended for temporary facilities or as a support zone for construction in the Upland because they were not adjacent or central to the primary work zone in the Upland. Area 3 is already designated to serve as the Construction Headquarters (CHQ) and main temporary equipment and material laydown area. This area is meant to serve as the initial delivery or "check-in" area for materials or equipment, after which these materials are transferred to localized staging areas. This area was sized assuming that adequate staging areas are available near primary work zones. Using this area as a direct support zone for work in the Upland area will both impact work in the Upland area and reduce the ability of the CHQ to serve its intended role.

As described in the previous alternative approach option, vehicles and heavy equipment would have to travel along the National Trails Highway and the IM-3 access road to access the Upland multiple times each day to support construction activities. Support trips would be more frequent, resulting in increased total travel time and traffic density for construction vehicles and increasing both traffic safety risk and potential public nuisance. Congestion in the primary work zones in the Uplands would increase risk to worker safety, decrease the practicality of the construction effort, and increase the overall construction schedule. All of these staging areas (3, 4, and 5) are also located on an existing dirt road, which would also require additional dust control. The GHG emissions would be greater than if areas 6, 7, and 13 were used because of the approximate 3-mile round-trip distance between the Upland and these staging areas, and the associated increase in trips by construction vehicles.

Option 3 – Use of Staging Areas Near I-40/Park Moabi Road Exit

Option 3 is to use the fenced staging area owned by Caltrans (staging area 10 in Figure 4.3-2) located south of the I-40/Park Moabi Road exit and the area north of the I-40/Park Moabi Road exit (staging area 9 in Figure 4.3-2). The Caltrans staging area has never been used by PG&E or PG&E's contractors. Caltrans has used this staging area for work on I-40, and the availability of this area is subject to negotiations with Caltrans. This area was not originally intended for temporary facilities or as a support zone for construction in the Upland because it is not adjacent or central to the primary work zones in the Upland. Staging area 9 has been used for temporary equipment staging and as a parking area by various entities.

Vehicles and heavy equipment would have to travel along Park Moabi Road and National Trails Highway to access the Upland multiple times each day to support construction activities, resulting in increased total travel time and traffic density and leading to increased traffic safety risk and public nuisance. Using these areas may also increase traffic congestion at nearby I-40 on-ramps. Since the staging areas (9 and 10) are

located on a paved road, additional dust control would not be required. However, the GHG emissions would be greater than if staging areas 6, 7, 12, and 13 were used because of the approximately 2.4-mile round trip distance between the Upland and these staging areas and the increase in trips by construction vehicles.

Again, as mentioned previously, to adequately supply a primary work zone from distant staging areas also requires use of either more frequent or larger, higher-capacity support vehicles to deliver required construction materials. Primary work zones then become more congested due to either the larger quantity of smaller vehicles or having larger vehicles unloading their materials at the already tightly-constrained primary work zones. The support vehicles will thus be more likely to become backed up at the primary work zone, impacting traffic at and near the work area and potentially traffic on nearby public roads (such as National Trails Highway). Congestion in the primary work zones in the Upland would increase risk to worker safety, decrease the practicality of the construction effort, and increase the overall construction schedule.

Option 4 – Use of TCS evaporation ponds and Staging Areas In/Around TCS

Option 4 is to use a combination of the TCS evaporation ponds (staging area 11 in Figure 4.3-2) and the staging areas in/around TCS (staging areas 20 through 25 in Figure 4.3-2). A portion of the area west of the ponds will be used as a primary work zone and staging area for construction of remedy facilities at the ponds. The entire area around the ponds would not be available because PG&E would still require access to the ponds for use and maintenance. Similarly to Options 2 and 3, this area was not originally intended for temporary facilities or as a support zone for construction in the Upland because it is not adjacent or central to the primary work zone.

Vehicles and heavy equipment would have to travel from these staging areas along National Trails Highway, TCS entrance road, ponds access road, and IM-3 access road to access the primary work zones in the Upland multiple times each day to support construction activities, resulting in increased total travel time and traffic density and leading to increased traffic safety risk and public nuisance. Approximately ½ mile of the access road to the ponds is unpaved, so dust control mitigation measures would need to be employed. The frequency of maintenance of this road would also increase. GHG emissions would be greater than if Areas 6, 7, and 13 were used because of the approximate 3-mile round-trip distance between the primary work zone and these staging areas, the increase in trips, and the additional work required for dust control and road maintenance.

Again, as with the other options discussed above, adequately supplying a primary work zone from distant staging areas requires use of either more frequent or larger, higher-capacity support vehicles to deliver required construction materials. Primary work zones then become more congested due to either the larger quantity of smaller vehicles or having larger vehicles unloading their materials at the already tightly-constrained primary work zones. The support vehicles will thus be more likely to become backed up at the primary work zone, impacting traffic at and near the work area and potentially traffic on nearby public roads (such as National Trails Highway). Congestion in the primary work zones in the Upland would increase risk to worker safety, decrease the practicality of the construction effort, and increase the overall construction schedule.

Staging areas in and around TCS were also not proposed originally for temporary facilities or as a support zone for construction in the Upland because they were intended primarily for use as support zones for construction of remedial facilities at the TW Bench, inside the TCS, and along the access road to TCS. In addition, staging area 25 will house a temporary construction water storage and distribution system so interference with TCS operations is minimized.

3.3.2 Evaluation of Alternative Approach: IM-3 Decommissioning and Removal

This evaluation assumes staging **Areas 6 and 7** are not available and other identified staging areas shown in Figure 4.3-2 will be used during decommissioning and removal of IM-3. This evaluation is very similar in terms of rationale to that for Options 1 through 4 in Section 3.2.1, so for brevity it is not repeated here. In brief, this alternative would have similar adverse effects on worker safety, public safety and nuisance,

environmental impacts, and construction schedule duration as described above for the groundwater remedy construction and operation.

In addition, utilizing distant staging areas to support IM-3 decommissioning could delay the start of the IM-3 decommissioning effort. For example, using the remedy CHQ laydown area to support IM-3 decommissioning will require that laydown area to be completely cleared and available after completion of groundwater remedy construction. The time required to demobilize the CHQ laydown area prior to supporting IM-3 decommissioning will delay the start of IM-3 decommissioning.

3.4 Conclusion

All of the alternative approaches evaluated to avoid the use of the proposed Upland areas would have adverse effects on worker safety, public safety and nuisance, environmental impacts, and construction schedule duration that in PG&E's view would outweigh the benefits of eliminating those areas. Location of support zones for staging of construction-related equipment in close proximity to the actual construction activities is critical to PG&E's proposed approach for construction at the Topock site, and specifically in the Upland. This will allow for the safe and effective installation of all remedial facilities, as well as the subsequent decommissioning of IM-3, while protecting the surrounding sensitive resources, minimizing the overall construction footprint and use of undisturbed areas to the extent practicable, and minimizing the overall environmental impacts associated with the work activities.

PG&E and its contractors will fully comply with the project mitigation measures to avoid and protect sensitive resources, including workers sensitivity training. PG&E will not tolerate disrespectful behavior in the field and will remove staff, workers, or contractors who do not comply with site protocols.

4.0 References

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Tables

TABLE 1
Summary of Evaluation Results of Impacts to Remedy Construction Based on Areas 6, 7, 12, and 13 Availability as Staging Areas

Approach/Option	Scenario Description[1]	Estimated Periods of Staging Area Use (durations do not account for work that might be conducted concurrently or demobilization)	Estimated Impact on Worker and Public Safety	Estimated Impact on the Environment	Factors that Impact Estimated Project Schedule
Current Work Plan Approach	Fully utilize areas 6, 7, 12, and 13 as support zones (staging areas). In addition, most of staging area 6 will be used as primary work zones during the construction of wells IRL-1, MW-P, and MW-AA. **Staging areas are close to primary work zones.**	For use during construction of remedy infrastructure in the Upland area only. Major elements include: • Upland Area Wells – 19 months • Pipeline A – 10 months	Preferred option for worker and public safety due to: • Staging areas are located close to the Upland primary work zones. • Provides needed space to support construction activities in the Upland. • Minimizes risk to public safety and nuisance by avoiding increased construction vehicle traffic and potential congestion on public roads (e.g., National Trails Highway). • Minimizes risk to worker safety by avoiding congestion in the primary work zones in the Upland due to the need for more vehicles or larger (and slower) vehicles to support the Upland from distant staging areas.	This scenario minimizes environmental impact due to: • Use of these previously-disturbed areas allows for the most efficient construction while minimizing the total construction footprint. • Minimizes total construction duration and associated environmental impacts (dust, noise, water). • Minimizes the total vehicle traffic/ mileage required to complete the work and the associated greenhouse gas emissions, as well as the increase in dust and noise associated with execution of the work.	This scenario minimizes the total project duration due to: • Maximizes opportunities for conducting multiple construction activities simultaneously given adequate staging area space. • Minimizes inefficiencies associated with increased time required to access staging areas.
Alternative Approach Option 1	Utilize areas 14 and 18 in the vicinity of the MW-20 Bench as support zones in lieu of Upland staging areas 6, 7, 12, and 13. **Round-trip distance between staging areas and primary work zones is approx. 1 mile.**	For use during construction of remedy infrastructure in the vicinity of the Flood Plain and in the Upland area. Major elements include: • NTH IRZ and Flood Plain Area Wells – 15 months • Pipeline C – 17 months • Pipeline G – 10 months • MW-20 Bench Structures – 21 months • Upland Area Wells – 19 months • Pipeline A – 10 months	Scenario will complicate worker safety due to: • Over-crowding in staging areas 14 and 18 during overlap of major construction elements. • Increased vehicle and heavy equipment traffic (both mileage and number of trips) on National Trails Highway and IM-3 access road. Therefore, increased potential for vehicle-related accidents. • Increases risk to public safety and nuisance to the public due to increasing the density of construction vehicle traffic on public roads - increasing both trip frequency and trip duration for construction vehicles traveling between primary work zones and staging areas 14/18, and congestion on National Trails Highway, as larger construction vehicles are required to slowly enter and exit staging areas 14 and 18 at a greater frequency and for a greater duration over the remedy construction project. • Increases risk to worker safety by increased congestion in the primary work zones in the Upland due to the need for more vehicles or larger (and slower) vehicles to support the Upland from distant staging areas.	Increases environmental impact due to: • Increased greenhouse gas (GHG) emissions due to increase vehicle and equipment traffic. • Increased dust generation (and associated water usage for dust control) due to increase traffic along unpaved access pathways. • Increased noise generation due to increased vehicle traffic, over a longer duration of construction.	Project schedule duration would likely increase due to: • The MW-20 bench was intended primarily for use as a staging area/ support zone for construction of the NTH IRZ and the remedial facilities on the MW-20 Bench. Since these areas are already limited in size for their intended use, this scenario will severely limit the opportunities to conduct multiple construction activities simultaneously, which would result in a longer construction schedule, ultimately delaying the project goal of completing the groundwater remedy construction project and the decommissioning and removal of IM-3 at the earliest practical date. • Inefficiencies associated with increased time required to access staging areas. • Decreased practicality of construction due to congestion in the primary work zones in the Upland.

TABLE 1
Summary of Evaluation Results of Impacts to Remedy Construction Based on Areas 6, 7, 12, and 13 Availability as Staging Areas

Approach/Option	Scenario Description[1]	Estimated Periods of Staging Area Use (durations do not account for work that might be conducted concurrently or demobilization)	Estimated Impact on Worker and Public Safety	Estimated Impact on the Environment	Factors that Impact Estimated Project Schedule
Alternative Approach Option 2	Utilize staging areas 3, 4, and 5 in the vicinity of Moabi Regional Park in lieu of Upland staging areas 6, 7, 12, and 13. **Round-trip distance between staging areas and primary work zones is approx. 3 miles.**	These areas will be used during the construction of all remedy infrastructure.	Scenario will complicate worker safety due to: • Over-crowding in staging areas 3, 4, and 5 during overlap of major construction elements. • Increased vehicle and heavy equipment traffic (both mileage and number of trips) on National Trails Highway and IM-3 access road. Therefore, increased potential for vehicle-related accidents. • Increases risk to public safety and nuisance to the public due to increasing the density of construction vehicle traffic on public roads - increasing both trip frequency and trip duration for construction vehicles traveling between primary work zones and Moabi Regional Park, and congestion on National Trails Highway. • Increases risk to worker safety by increased congestion in the primary work zones in the Upland due to the need for more vehicles or larger (and slower) vehicles to support the Upland from distant staging areas.	Increases environmental impact due to: • Increased GHG emissions due to increase vehicle and equipment traffic. • Increased dust generation (and associated water usage for dust control) (particularly in the vicinity of Moabi Regional Park) due to increased traffic along unpaved access pathways, over a longer duration of construction. • Increased noise generation (particularly in the vicinity of Moabi Regional Park) due to increased vehicle traffic, over a longer duration of construction.	Project schedule duration would likely increase due to: • Staging areas 3, 4, and 5 were intended to support all construction activities. Since these areas are already limited in size for their intended use, this scenario will severely limit the opportunities to conduct multiple construction activities simultaneously, which would result in a longer construction schedule. • Specifically, Area 3 is already designated to serve as the Construction Headquarters and main temporary equipment and material laydown area. This area is meant to serve as the initial delivery or "check-in" area for materials or equipment, after which these materials are transferred to localized staging areas. This area was sized assuming that adequate staging areas are available near primary work zones. Using this area as a direct support zone for work in the Upland area will both impact work in the Upland area and reduce the ability of the CHQ to serve its intended role. • Inefficiencies associated with increased time required to access staging areas. • Decreased practicality of construction due to congestion in the primary work zones in the Upland.
Alternative Approach Option 3	Utilize staging areas 9 and 10 in the vicinity of the Interstate 40 access ramps in lieu of Upland staging areas 6, 7, 12, and 13. **Round-trip distance between staging areas and primary work zones is approx. 2.4 miles.** Note: Availability of staging area 10 is subject to negotiations with Caltrans.	These areas will be used during the construction of all remedy infrastructure.	Scenario will complicate worker safety due to: • Over-crowding in staging areas 9 and 10 during overlap of major construction elements. • Increased vehicle and heavy equipment traffic (both mileage and number of trips) on National Trails Highway, Park Moabi road, and IM-3 access road. Therefore, increased potential for vehicle-related accidents. • Increases risk to public safety and nuisance to the public due to increasing the density of construction vehicle traffic on public roads - increasing both trip frequency and trip duration for construction vehicles traveling between primary work zones and distant staging areas. • Increases risk to worker safety by increase congestion in the primary work zones in the Upland due to the need for more vehicles or larger (and slower) vehicles to support the Upland from distant staging areas.	Increases environmental impact due to: • Increased GHG emissions due to increase vehicle and equipment traffic. • Increased dust generation (and associated water usage for dust control) due to increase traffic along unpaved access pathways (particularly in the Upland). • Increased noise generation due to increased vehicle traffic over a longer duration of construction.	Project schedule duration would likely increase due to: • Staging areas 9 and 10 were intended to support all construction activities. Since these areas are already limited in size for their intended use, this scenario will limit the opportunities to conduct multiple construction activities simultaneously, which would result in a longer construction schedule. • Inefficiencies associated with increased time required to access staging areas. • Decreased practicality of construction due to congestion in the primary work zones in the Upland.

TABLE 1
Summary of Evaluation Results of Impacts to Remedy Construction Based on Areas 6, 7, 12, and 13 Availability as Staging Areas

Approach/Option	Scenario Description[1]	Estimated Periods of Staging Area Use (durations do not account for work that might be conducted concurrently or demobilization)	Estimated Impact on Worker and Public Safety	Estimated Impact on the Environment	Factors that Impact Estimated Project Schedule
Alternative Approach Option 4	Utilize staging areas 11 and 20 through 25 in the vicinity of the Topock Compressor Station (TCS) and associated evaporation ponds in lieu of Upland staging areas 6, 7, 12, and 13. **Round-trip distance between staging areas and primary work zones is approx. 3 miles.**	For use during construction of remedy infrastructure in the vicinity of the Flood Plain and in the Upland area. Major elements include: • TW Bench Wells – 3 months • Bat Cave Wash Area Wells – 7 months • TCS Area Wells – 2 months • East Ravine Area Wells – 7 months • A portion of Pipeline B – less than 9 months • Pipeline D – 3 months • Pipeline E – 4 months • Pipeline F – 10 months • Pipeline J – 3 months • Pipeline I – 11 months • Pipeline L – 5 months • Pipeline M – 8 months • Pipeline N – 2-3 months • TW Bench Structures –23 months • TCS Structures – 48 months	Scenario will complicate worker safety due to: • Increase activities in and around the operating TCS. • Over-crowding in Staging areas 11 and 20 through 25 during overlap of major construction elements. • Increased vehicle and heavy equipment traffic (both mileage and number of trips) on National Trails Highway, TCS entrance road, ponds access road, and IM-3 access road. Therefore, increased potential for vehicle-related accidents. • Increases risk to public safety and nuisance to the public due to increasing the density of construction vehicle traffic on public roads – increasing both trip frequency and trip duration for construction vehicles traveling between primary work zones and distant staging areas. • Increases risk to worker safety by increase congestion in the primary work zones in the Upland due to the need for more vehicles or larger (and slower) vehicles to support the Upland from distant staging areas.	Increases environmental impact due to: • Increased GHG emissions due to increase vehicle and equipment traffic. • Increased dust generation (and associated water usage for dust control) due to increase traffic along unpaved access pathways (particularly in the Upland). • Increased noise generation due to increased vehicle traffic over a longer duration of construction.	Project schedule duration would likely increase due to: • Staging areas in/around TCS were intended primarily for use as staging areas/support zones for construction of remedial facilities at the TW Bench, inside the TCS, and along the access road to TCS. Due to the limited space available for construction staging in/near the TCS this scenario will limit the opportunities to conduct multiple construction activities simultaneously, which would result in a longer construction schedule. • Inefficiencies associated with increased time required to access staging areas. • Decreased practicality of construction due to congestion in the primary work zones in the Upland.

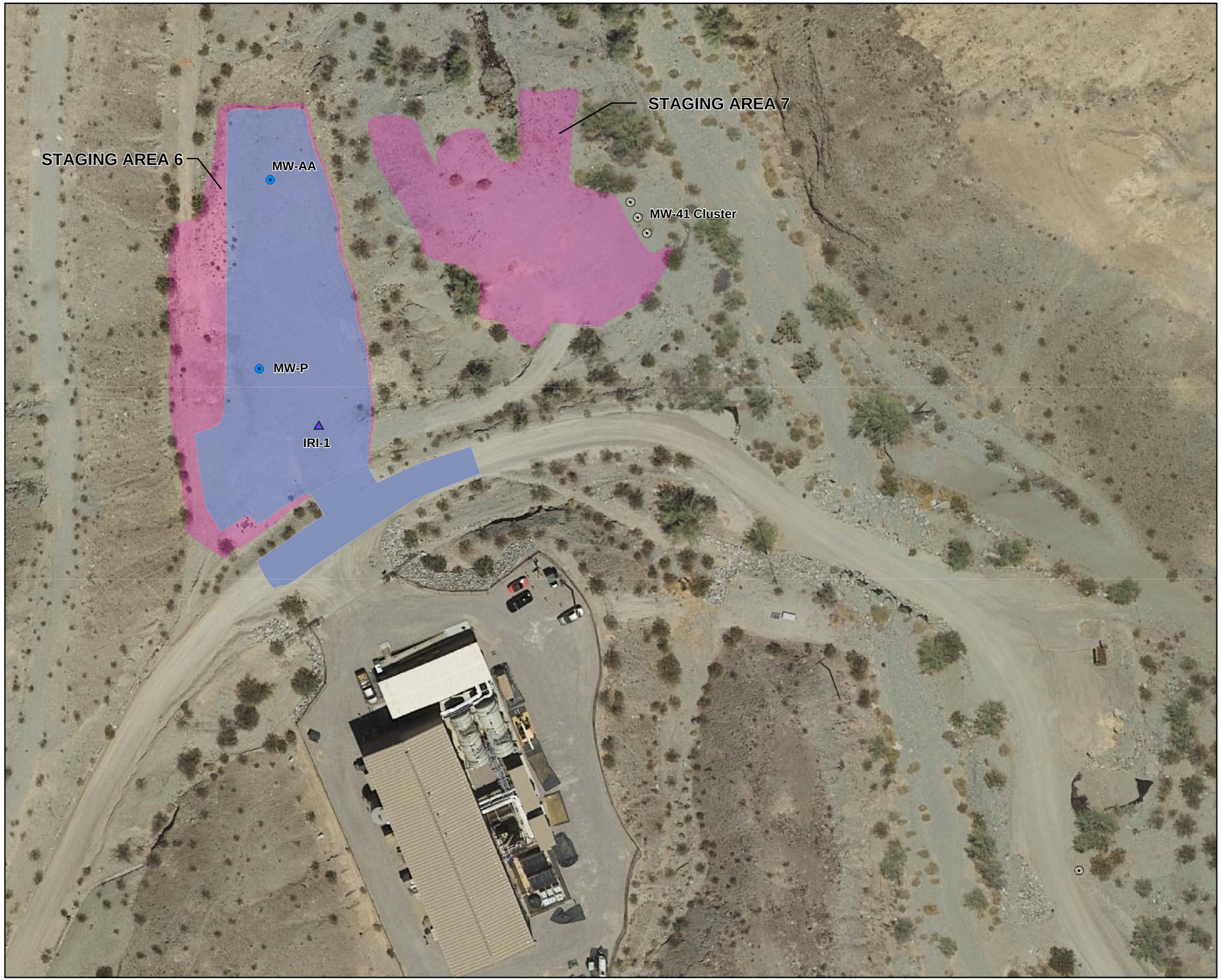
Note:
[1] See Section 1.0 for definitions of the terms primary work zone (construction area) and support zone (staging area).

TABLE 2
Summary of Evaluation Results of Impacts to IM-3 Decommissioning and Removal Based on Areas 6 and 7 Availability as Staging Areas

Approach/Option[1]	Scenario Description[2]	Estimated Periods of Staging Area Use (durations do not account for work that might be conducted concurrently or demobilization)	Estimated Impact on Worker Safety	Estimated Impact on the Environmental	Factors that Impact Estimated Project Schedule
Current Work Plan Approach	Fully utilize areas 6 and 7 as staging areas. **Staging areas are in close proximity to the primary work zones.**	For use during decommissioning and removal of IM-3. Major elements include: • IM-3 Treatment Plant – 12 months • IM Facilities on MW-20 Bench and Extraction Wells – 12 months • Injection Well Field and Conveyance Piping/Conduits – 6 months • Punch List/Demobilization – 6 months	Preferred option for worker safety due to: • Staging areas are located close to the Upland primary work zones. • Provides adequate space to support decommissioning activities in the Upland.	This scenario minimizes environmental impact due to: • Use of these previously disturbed areas allows for the most efficient construction while minimizing the total construction footprint. • Minimizes total construction duration and associated environmental impacts. • Minimizes the total vehicle traffic/ mileage required to complete the work and the associated greenhouse gas emissions, as well as increases in dust generation (and associated water usage for dust control) and noise associated with execution of the work. An increase in water for dust control will be required.	This scenario minimizes the total project duration due to: • Maximizes opportunities for conducting multiple construction activities simultaneously given adequate staging area space. • Minimizes inefficiencies associated with increased time required to access staging areas.

Notes:
[1] The evaluation for the Alternative Approach for IM-3 decommissioning and removal (staging areas 6 and 7 unavailable, with other staging areas used instead) is very similar in terms of rationale to that for alternative remedy construction approach Options 1 through 4 summarized in Table 1, so for brevity it is not repeated here. In brief, this alternative would have similar adverse effects on worker safety, public safety and nuisance, environmental impacts, and construction schedule duration as described for Options 1 through 4 in Table 1.
[2] See Section 1.0 for definitions of the terms primary work zone (construction area) and support zone (staging area).

Exhibit and Figures



VICINITY MAP



LEGEND

Existing Wells:

- Monitoring Well

Planned Remedy Wells:

- Injection, Inner Recirculation Loop
- Monitoring Well
- Staging Areas 6 and 7
- Estimated Primary Work Zone for Construction of Wells Located in Staging Area 6

Note: Areas shown are for discussion only (December 2014).

N

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EXHIBIT 1
PLANNED USE OF STAGING AREAS 6 AND 7 DURING REMEDY CONSTRUCTION
IM3 RECOMMISSIONING, REMOVAL, AND RESTORATION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALFORNIA

CH2MHILL

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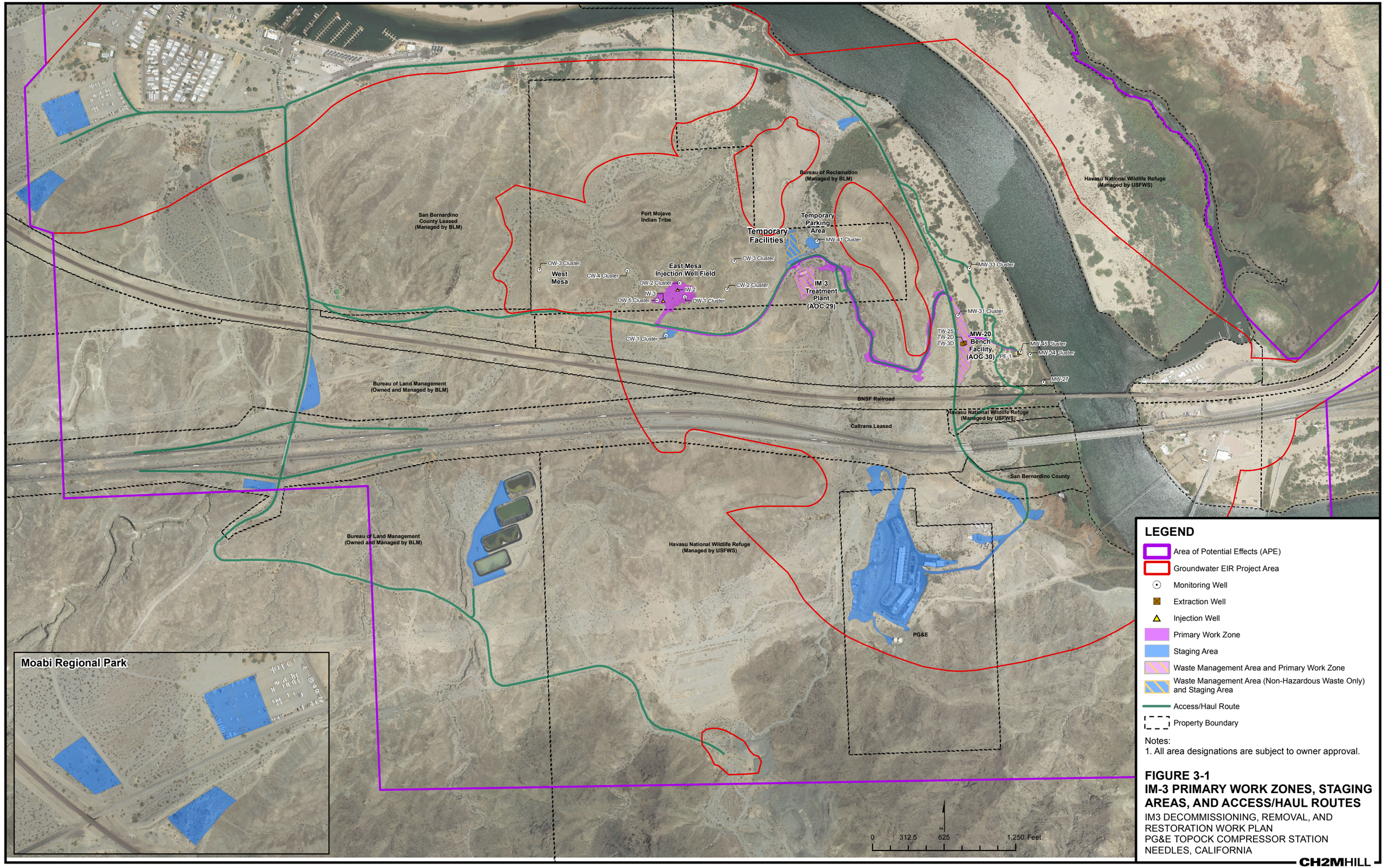
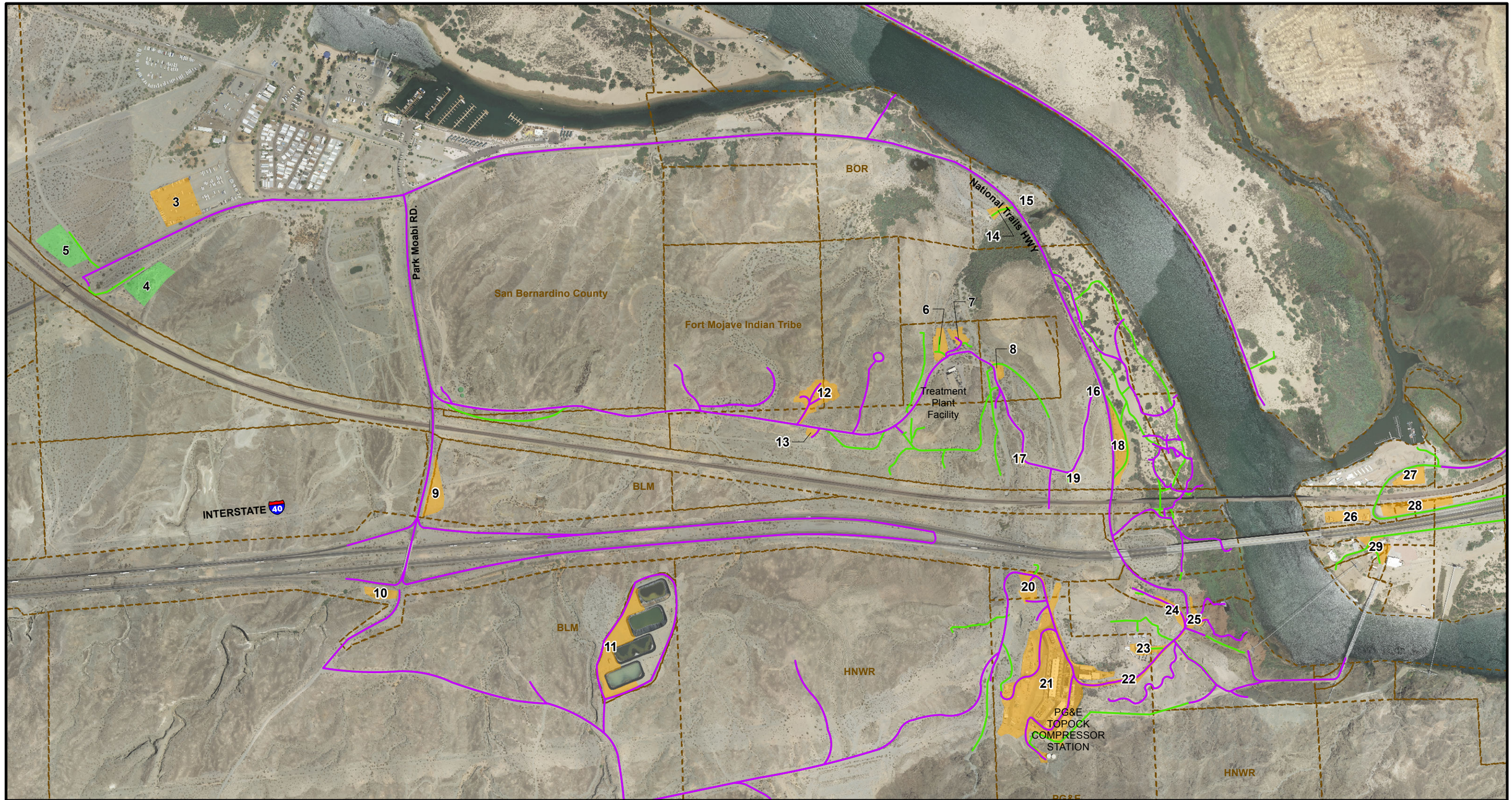


Notes:
1. All area designations are subject to owner approval.

FIGURE 3-1
IM-3 PRIMARY WORK ZONES, STAGING AREAS, AND ACCESS/HAUL ROUTES
IM3 DECOMMISSIONING, REMOVAL, AND RESTORATION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



LEGEND

- Existing Access Route
- New Remedy Access Route
- Potential Soil Processing and Storage Areas for Remediation Project
- Proposed Staging Areas for Remediation Project

Notes:

1. Area 3 (CHQ) will be used as the primary truck inspection area. Areas #9, #18, and #23 or other staging areas might also be used depending on the specific construction activity.
2. Decontamination pads will be located in Area #3 (Construction Headquarters), Area #21 (Topock Compressor Station), and Area #23 (Transwestern Bench).
3. Areas #15, 16, 17, and 19 will not be used as staging areas. Areas #16, 17, and 19 may be part of the primary work zones for remedy infrastructure along the access road.

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Feet

FIGURE 4.2-3
CONSTRUCTION SITE PLAN AND ACCESS ROUTES
GROUNDWATER REMEDY CONSTRUCTION/ REMEDIAL ACTION WORK PLAN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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