Pacific Gas and Electric Company®

Yvonne J. Meeks
Manager

Environmental Remediation

Mailing Address
4325 South Higuera Street
San Luis Obispo, CA 93401

Location
6588 Ontario Road
San Luis Obispo, CA 93405

805.234.2257
Fax: 805.773.8281
E-Mail: yjm1@pge.com

April 28, 2014

Ms. Kimber Liebhauser
U.S. Department of the Interior
Bureau of Land Management
2610 Sweetwater Avenue
Lake Havasu City, Arizona 86406

Subject: Submittal of the *Final Programmatic Biological Assessment (PBA) for the Final Groundwater Remedy at the Topock Compressor Station*

Dear Ms. Liebhauser,

Pacific Gas and Electric (PG&E) is submitting the Final Programmatic Biological Assessment (PBA) for the Final Groundwater Remedy at the Topock Compressor Station. The Final Groundwater Remedy PBA is intended to support informal consultations for actions to be conducted by PG&E as part of the Comprehensive Environmental Response, Cleanup and Liability Act (CERCLA) remedial actions associated with the Topock Compressor Station, including activities located on BLM and U.S. Fish and Wildlife Service administered lands, including the Havasu National Wildlife Refuge.

The PBA activities are related to the construction and operation of the remedy facilities, as well as the eventual decommissioning, removal, and restoration of project-affected areas. Operations and maintenance of the final remedy facilities are expected to occur over a 30- to 50-year operating span. The loss of habitat to listed species is minimal with 3.5 acres to current floodplain, 8.8 acres to historical floodplain, and 3.6 acres to upland habitat.

The PBA covers the following species: southwestern willow flycatcher (*Empidonax traillii extimus*), western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), Yuma clapper rail (*Rallus longirostris yumanensis*), Agassiz's desert tortoise (*Gopherus agassizii*), and Morafkai's desert tortoise (*Gopherus morafkai*). Fish species included in the PBA are the razorback sucker (*Xyrauchen texanus*) and bonytail chub (*Gila elegans*), together with their critical habitat in the Colorado River. A determination of "not likely to adversely affect" has been concluded for all the above-listed species and their critical habitats, with the sole exception noted below. Because critical habitat has not yet been designated for western yellow-billed cuckoo, an evaluation of the constituent elements that would be part of any future critical habitat were considered in the PBA and considered discountable.

PG&E is requesting that BLM submit the attached PBA to the U.S. Fish and Wildlife Service for concurrence to listed species under Section 7 of the Endangered Species Act. We understand that in the case of a formal consultation with project adverse effects on species, that a 135-day review period is customary. It is hoped that, under the current circumstances where adverse species effects are not anticipated, that this consultation period may be somewhat shortened. We understand that BLM will also initiate a government-to-government consultation with the Tribes within this same timeframe. PG&E offers their technical support to BLM during that consultation.

Please feel free to contact Virginia Strohl (PG&E Senior Terrestrial Biologist) at 559-263-7417 or v1s4@pge.com if you have any questions or concerns.

Sincerely,

Yvonne Meeks
Topock Project Manager

Enclosure: *Final Programmatic Biological Assessment (PBA) for the Final Groundwater Remedy at the Topock Compressor Station*

cc: Leslie Fitzgerald
Carrie Marr
Pamela Innis

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.

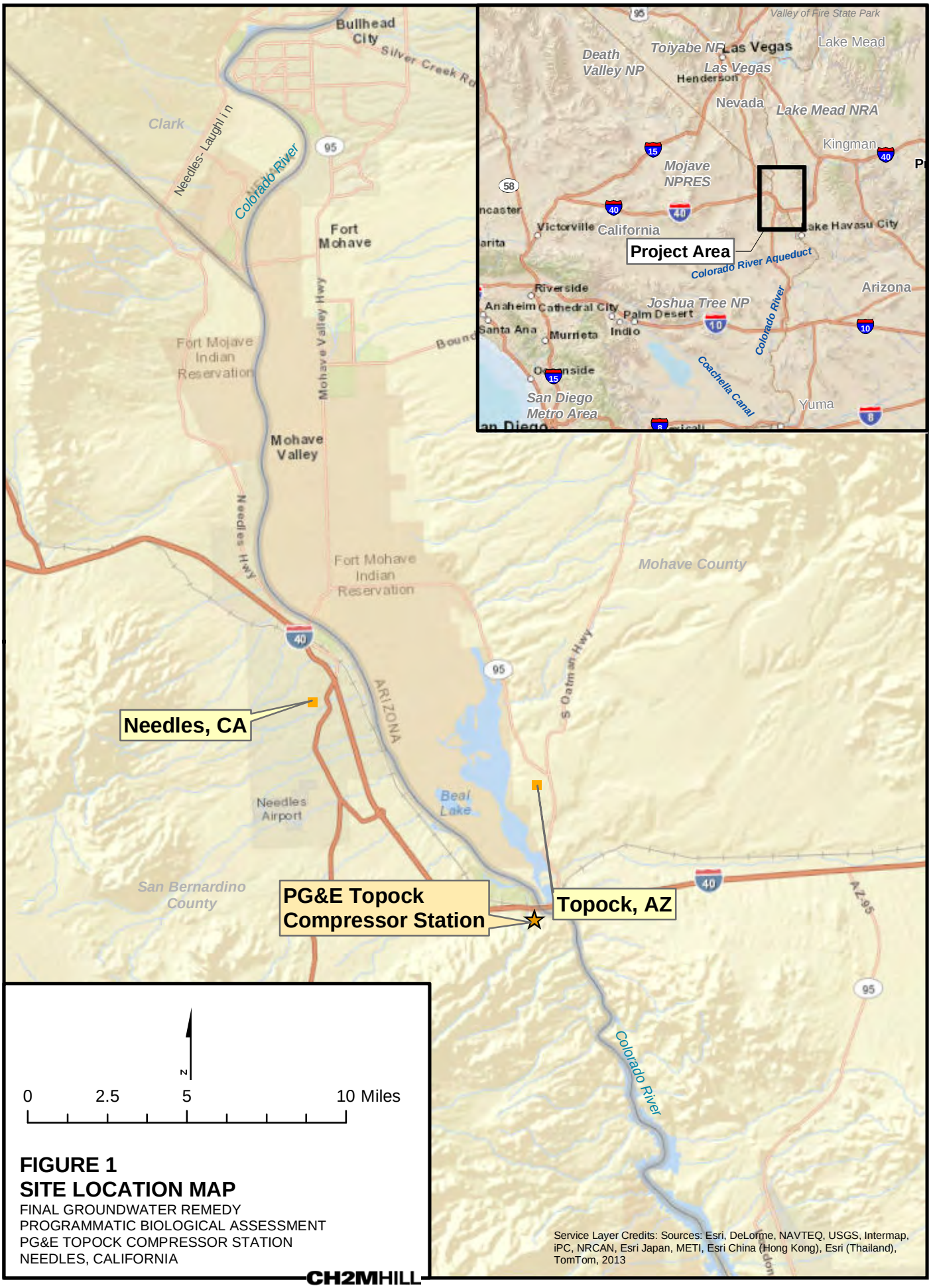

FIGURE 1
SITE LOCATION MAP
FINAL GROUNDWATER REMEDY
PROGRAMMATIC BIOLOGICAL ASSESSMENT
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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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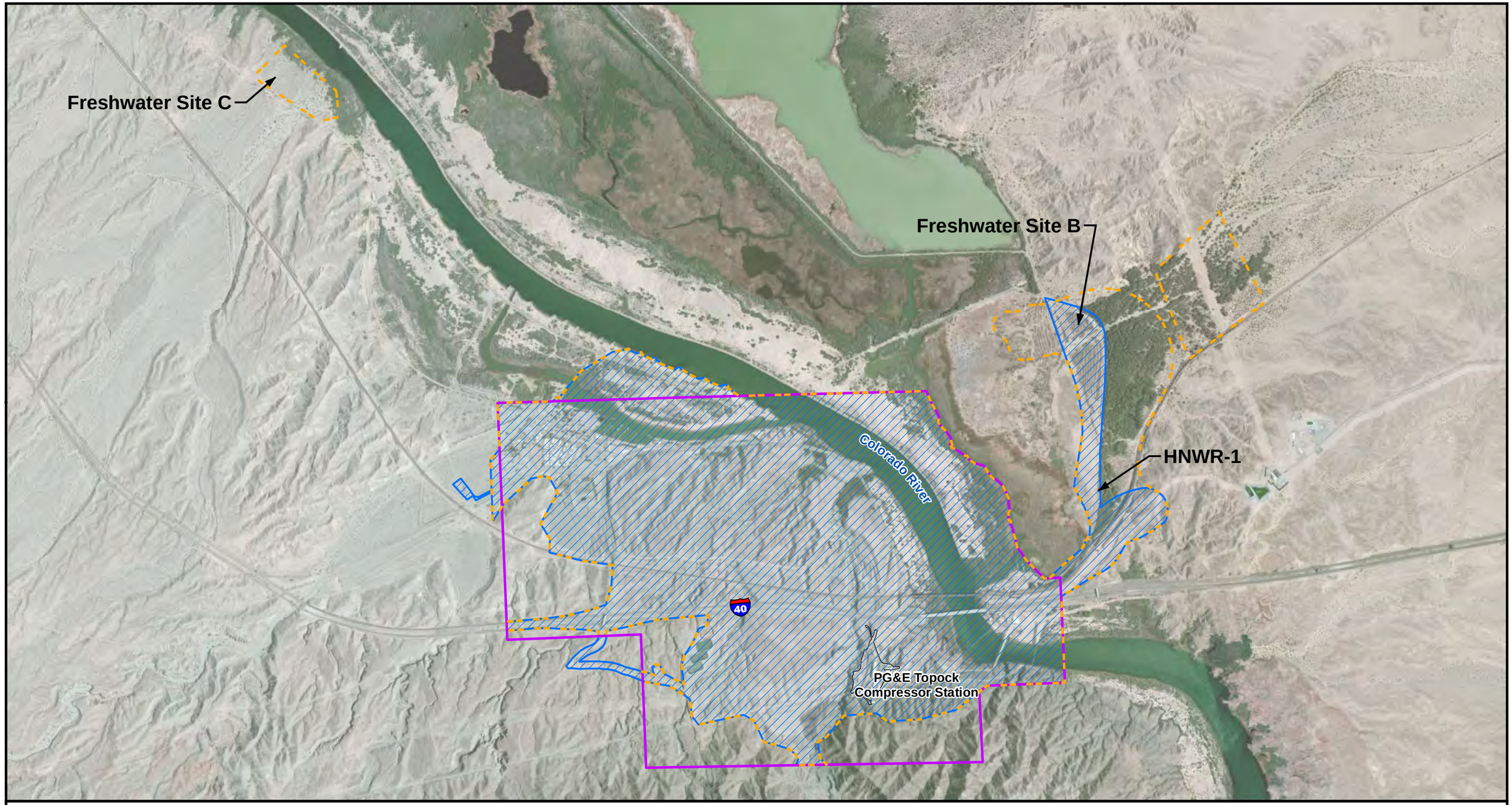

LEGEND

- 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

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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.

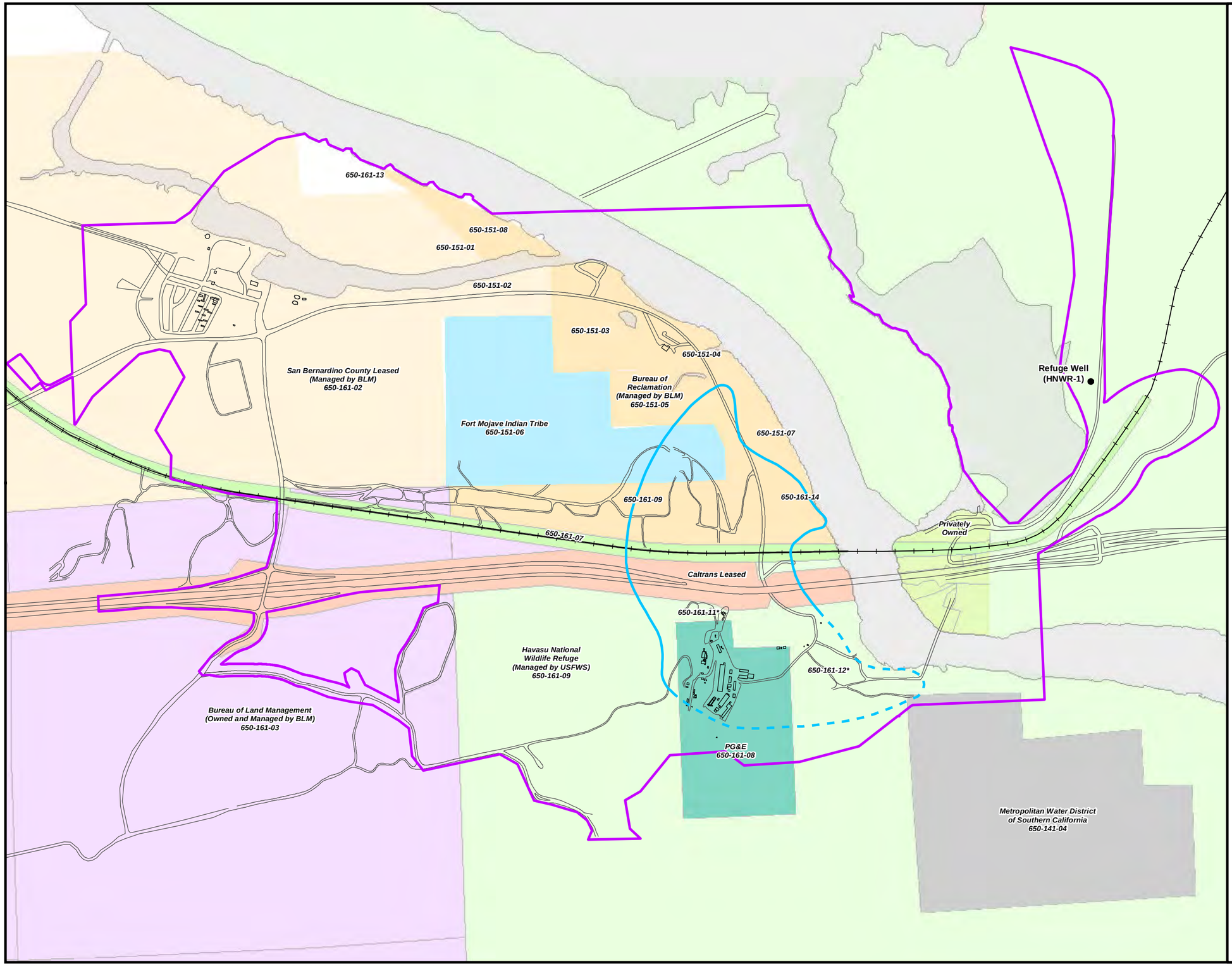
The TCS occupies approximately 65 acres of PG&E-owned land within the Action Area. PG&E also owned a 100-acre parcel located about 0.25 mile north of the compressor station that was purchased to facilitate interim remedial measures, but subsequently transferred the parcel to the Fort Mojave Indian Tribe 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.

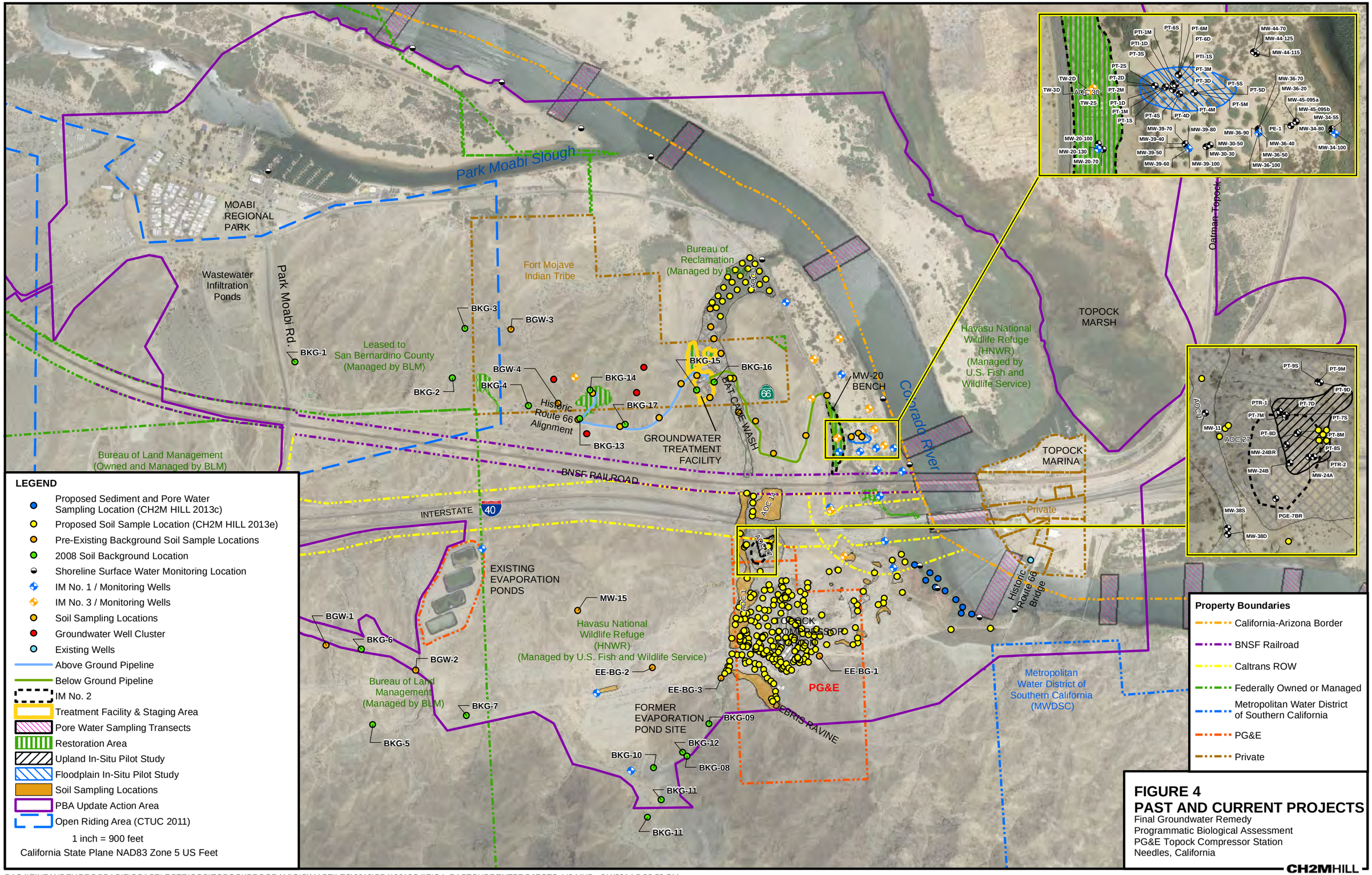
Past and present projects are depicted in Figure 4 and summarized in Table 1, and the existing network of monitoring wells that is part of the ongoing groundwater monitoring program and will be incorporated into the Final Groundwater Remedy is depicted in Figure 5. All of the past activities fall within 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

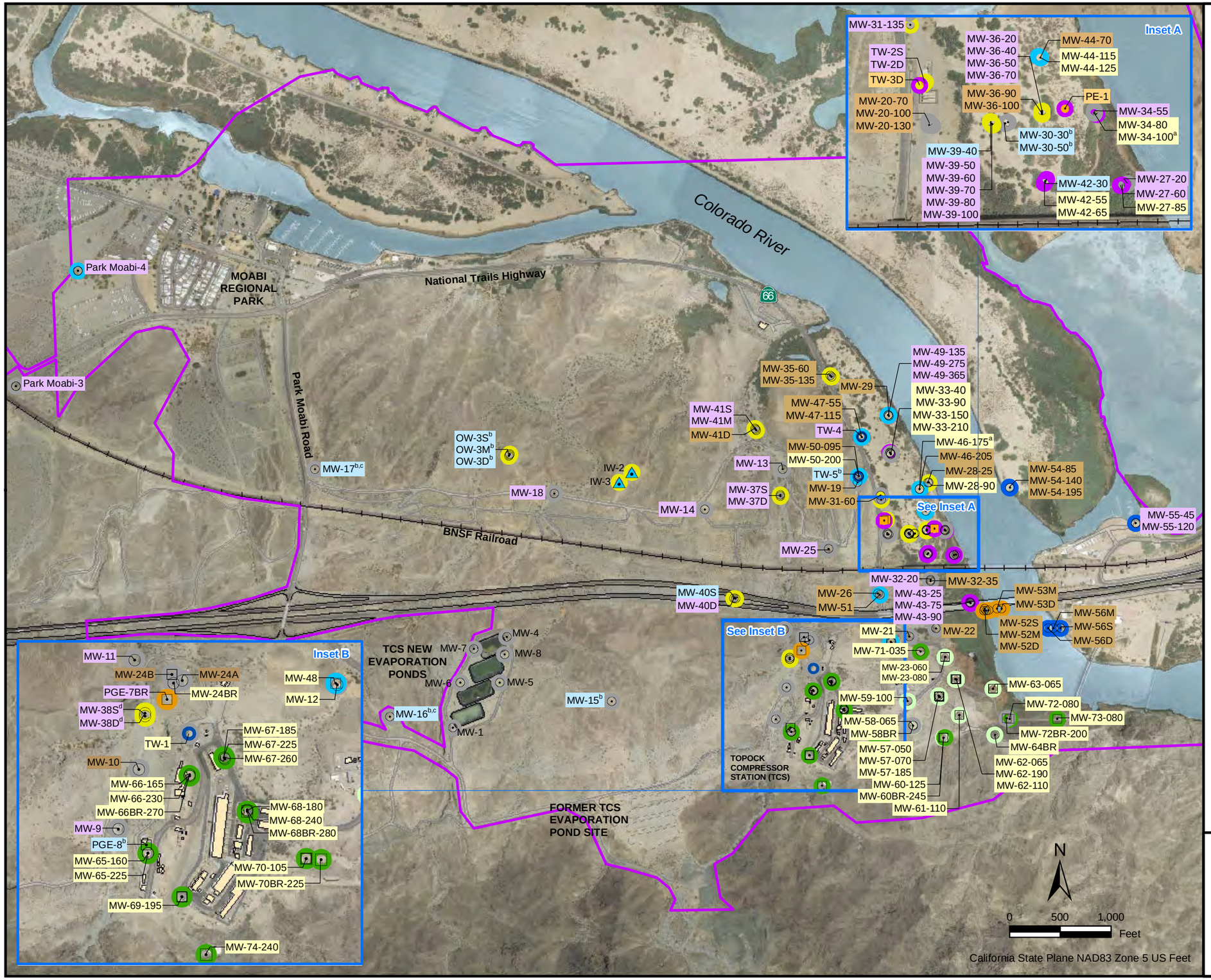
Property Boundaries

- 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

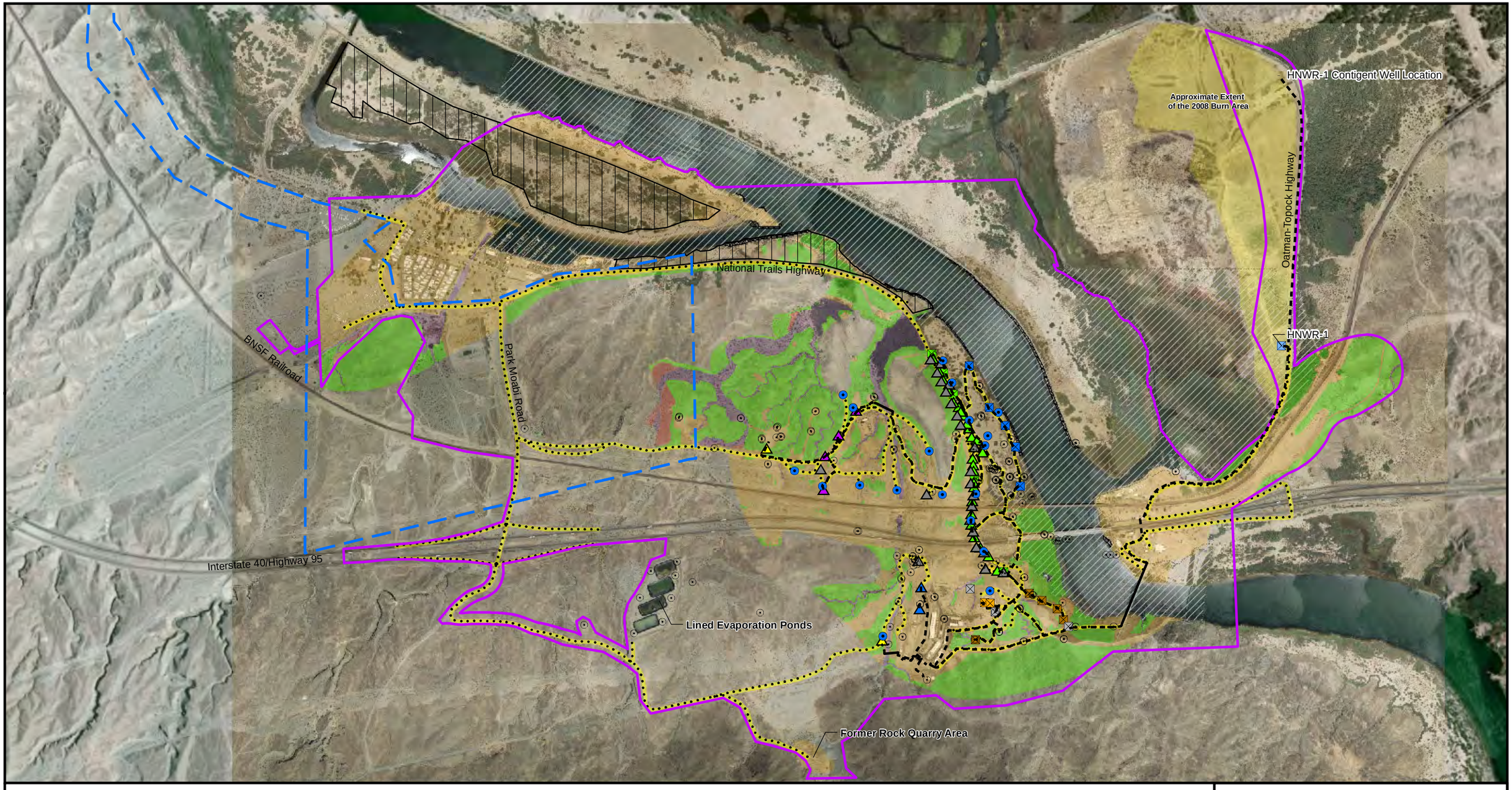
0 300 600 1,200 Feet

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.

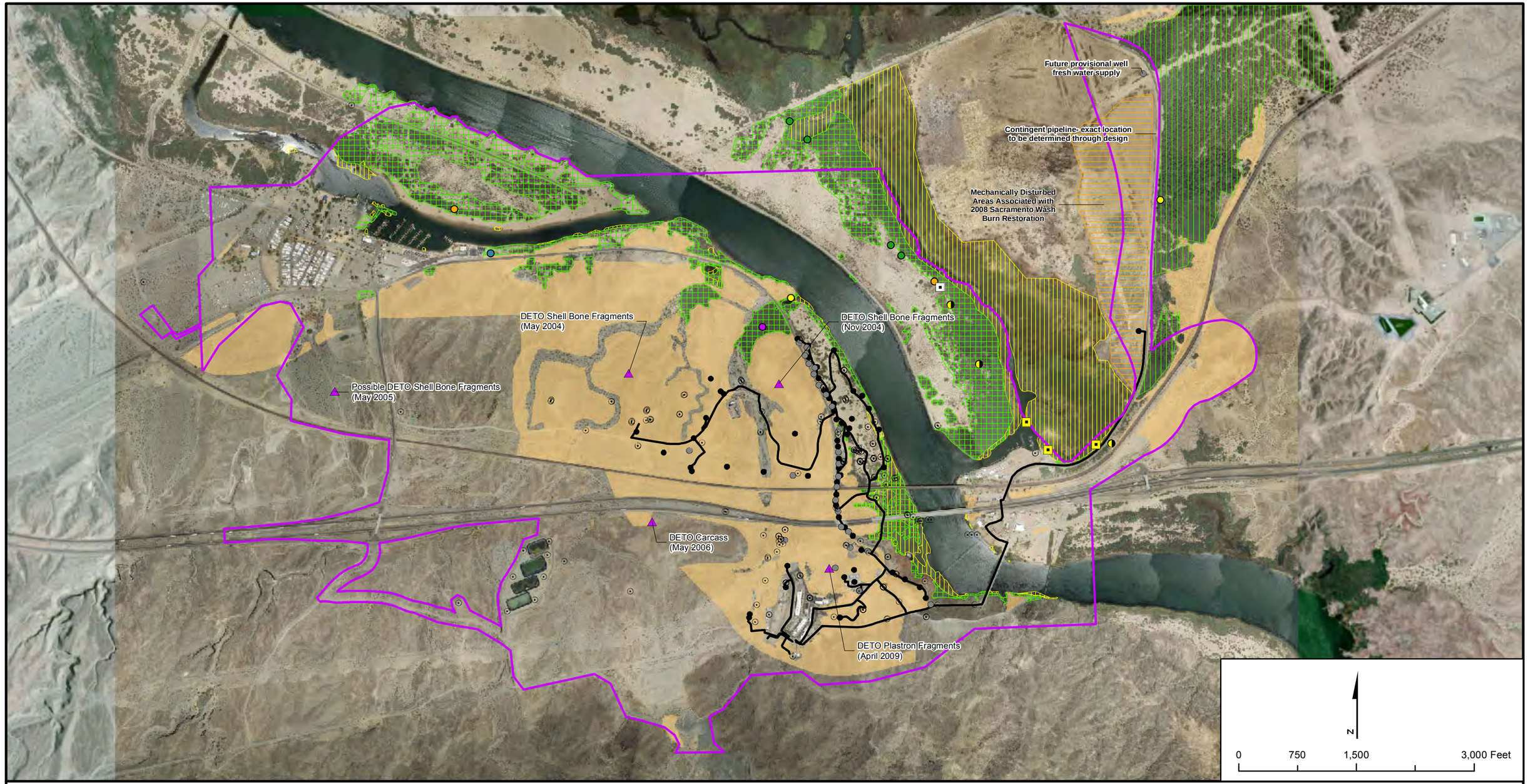
The Freshwater Implementation Plan activities are being completed under the 2012 Reinitiated PBA. The evaluations of HNWR-1 and the Site B well are expected to be completed prior to the March 15 date associated with southwestern willow flycatcher in-migration and nesting season in 2014, so that these 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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