Topock Project Executive Abstract

Document Title:

Final RCRA Facility Investigation/Remedial Investigation (RFI/RI), PG&E Topock Compressor Station, Needles, California Volume 2 Addendum Report

Submitting Agency/Authored by: DTSC, DOI

Final Document? ☒ Yes ☐ No

Date of Document: June 29, 2009

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

PG&E

Priority Status: ☐ **HIGH** ☒ **MED** ☐ **LOW**

Is this time critical? ☐ Yes ☒ No

Type of Document:

☐ Draft ☒ Report ☐ Letter ☐ Memo

☐ Other / Explain:

Action Required:

☒ Information Only ☐ Review & Comment

Return to: ______________________

By Date:______________________

☐ Other / Explain:

What does this information pertain to?

☐ Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA)/Preliminary Assessment (PA)

☒ RCRA Facility Investigation (RFI)/Remedial Investigation (RI) (including Risk Assessment)

☐ Corrective Measures Study (CMS)/Feasibility Study (FS)

☐ Corrective Measures Implementation (CMI)/Remedial Action

☐ California Environmental Quality Act (CEQA)/Environmental Impact Report (EIR)

☐ Interim Measures

☐ Other / Explain:

Is this a Regulatory Requirement?

☒ Yes

☐ No

If no, why is the document needed?

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

Completion of the RFI/RI is required for the next phase of the cleanup process, which is the Corrective Measure Study/ Feasibility Study (CMS/FS).

Other Justification/s:

☐ Permit ☐ Other / Explain:

Brief Summary of attached document:

In February 2009, Volume 2 of the RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report was submitted to satisfy the characterization requirements of RCRA and CERCLA for past releases to groundwater from historical Topock Compressor Station operations. The approved Volume 2 addressed the former percolation bed in Bat Cave Wash (Solid Waste Management Unit (SWMU) 1 / Area Of Concern (AOC) 1) and the inactive injection well PGE-8 (SWMU 2). Additional data have been collected since the data cutoff for Volume 2. This RFI/RI Volume 2 Addendum Report presents the additional data and assesses the effects, if any, on the conclusions and recommendations of the Volume 2. This Addendum serves to supplement, rather than duplicate or supersede the Volume 2 Report.

Key conclusions from this Addendum are:

- Additional historical photographs and records obtained from BOR and Caltrans files more fully document the dredging history and the morphology of the Colorado River in the study area, but do not modify the site features and river morphology information presented in the RFI/RI Volume 2 Report.
- The additional drilling data and results obtained from the Arizona groundwater investigation confirm the site conceptual model for hydrogeologic conditions presented in the RFI/RI Volume 2 Report. Hydraulic data collected following installation of monitoring wells on the Arizona side of the Colorado River indicate the IM No. 3 extraction influence extends into Arizona. The Cr(VI) and Cr(T) results from five rounds of groundwater sampling (April-September 2008) in Arizona wells MW-54, MW-55, and MW-56 were less than naturally occurring background concentrations in all eight monitoring locations, and less than laboratory reporting limits in the wells screened beneath the river channel.
- Additional analytical results for trace metals collected in selected wells over three sampling periods between December

2007 and May 2008 indicated that the overall observed distributions and ranges of metal concentrations are consistent with those observed in the RFI/RI Volume 2 Report.

- DTSC has directed PG&E to carry nitrate forward as a COPC on the basis of its interpretation of nitrate concentration distribution and potential sources from the facility presented in this Addendum.

Other than nitrate recommendations, the recommendations in the RFI/RI Volume 2 Report with respect to a CMS/FS for SWMU 1/AOC 1 are unchanged with the addition of the data and information presented in this Addendum. Additionally, the information confirms that, of the media assessed for the RFI/RI Volume 2, only groundwater appears to be affected by SWMU 1/AOC 1 activities at the Topock Compressor Station.

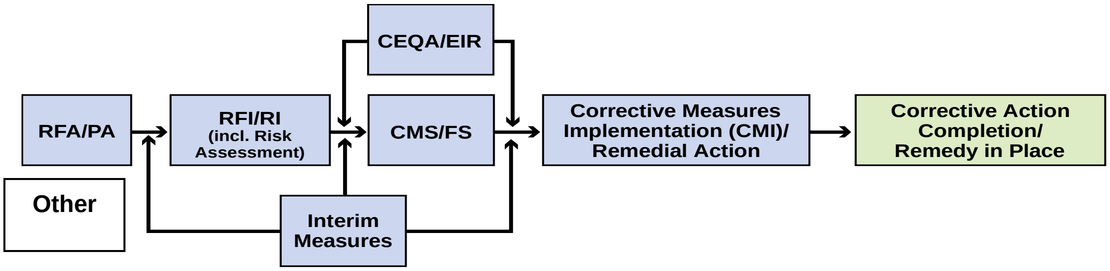
Written by: PG&E

Recommendations:
None.

How is this information related to the Final Remedy or Regulatory Requirements:
Along with the groundwater risk assessment and the RFI/RI Volume 2 Report, this RFI/RI Volume 2 Addendum Report provides required information for the evaluation of remedial alternatives for groundwater cleanup via the groundwater CMS/FS.

Other requirements of this information?
The data in this report are used as input for the groundwater risk assessment and the CMS/FS.

Related Reports and Documents:
Click any boxes in the Regulatory Road Map (below) to be linked to the Documents Library on the DTSC Topock Web Site (www.dtsc-topock.com). **The link to the Documents Library is currently UNDER CONSTRUCTION.**



Legend
RFA/PA – RCRA Facility Assessment/Preliminary Assessment
RFI/RI – RCRA Facility Investigation/CERCLA Remedial Investigation (including Risk Assessment)
CMS/FS – RCRA Corrective Measure Study/CERCLA Feasibility Study
CEQA/EIR – California Environmental Quality Act/Environmental Impact Report

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June 29, 2009

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Subject: Final RCRA Facility Investigation/Remedial Investigation Report, Volume 2 Addendum—Hydrogeologic Characterization and Results of Groundwater and Surface Water Investigation, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California (EPA ID NO. CAT080011729)

Dear Mr. Yue and Ms. Innis:

This letter transmits the Final RCRA Facility Investigation/ Remedial Investigation Report, Volume 2 Addendum—Hydrogeologic Characterization and Results of Groundwater and Surface Water Investigation, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California.

The June 8, 2009 redline version of the Addendum was approved by DOI on June 18, 2009 and DTSC on June 23, 2009, with the direction that all revisions be incorporated. No additional changes have been made to the report.

Please contact me at (805) 234-2257 if you have any questions regarding the attached report or any other aspect of the RFI/RI activities.

Sincerely,

Yvonne Meeks

Yvonne Meeks
Topock Remediation Project Manager

Cc: Christopher Guerre, DTSC
Rick Newill, DOI

Enclosures

Final Report

RCRA Facility Investigation/ Remedial Investigation Report
PG&E Topock Compressor Station
Needles, California

Volume 2 Addendum

Hydrogeologic Characterization and Results of Groundwater and Surface Water Investigation

Prepared for

Pacific Gas and Electric Company

June 29, 2009

Prepared by

CH2MHILL

155 Grand Avenue, Suite 1000
Oakland, California 94612

Certification

RCRA Facility Investigation/Remedial Investigation Report

PG&E Topock Compressor Station
Needles, California

Volume 2 Addendum

The information and results presented in this report are based on the review and compilation of available data obtained from numerous sources, including studies performed by others and data from independent laboratories. To the best of our knowledge, CH2M HILL has collected and incorporated the relevant data from these previous studies and reports into this document. This document and any interpretations, conclusions, and recommendations contained within are based upon those data.

This report was prepared by CH2M HILL under the supervision of the professionals whose seals and signatures appear hereon, in accordance with currently accepted professional practices; no warranty, expressed or implied, is made.

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Acronyms and Abbreviations

µm	micrometer
AOC	Area of Concern
ARAR	applicable or relevant and appropriate requirement
BOR	United States Bureau of Reclamation
BNSF	Burlington Northern and Santa Fe
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
Caltrans	California Department of Transportation
cfs	cubic feet per second
CMS/FS	corrective measures study/feasibility study
COPC	constituent of potential concern
Cr(T)	total chromium
Cr(VI)	hexavalent chromium
DOI	United States Department of the Interior
DTSC	California Department of Toxic Substances Control
FOIA	Freedom of Information Act
GMP	Groundwater Monitoring Program
HNWR	Havasu National Wildlife Refuge
IM	Interim Measures
IM-3	Interim Measure Number 3
mV	millivolt
PG&E	Pacific Gas and Electric Company
PMP	Performance Monitoring Program
RCRA	Resource Conservation and Recovery Act
RFI/RI	Resource Conservation and Recovery Act facility investigation/remedial investigation
SWMU	Solid Waste Management Unit
USGS	United States Geological Survey

UTL	upper tolerance limit

Executive Summary

ES.1 Purpose and Objectives of RFI/RI Volume 2 Addendum

In July 2008, the Pacific Gas and Electric Company (PG&E) completed the Final Resource Conservation and Recovery Act (RCRA) Facility Investigation/Remedial Investigation (RFI/RI) Volume 2 Report, which contains the hydrogeologic characterization and results of groundwater, surface water, pore water, and river sediment investigations to evaluate and characterize the historic discharge of wastewater from the PG&E Topock Compressor Station to Bat Cave Wash and injection well PGE-8. The RFI/RI Volume 2 Report contains data and characterization information collected through multiple investigation phases between the start of the RFI/RI sampling activities in July 1997 through October 2007. The RFI/RI Volume 2 Report was prepared to meet the requirements of both the RCRA corrective action process and the Comprehensive Environmental Response, Compensation, and Liability Act and provides recommendations for the disposition of the solid waste management units (SWMU) and areas of concern (AOC) within the site investigation, remediation, and closure process.

This document is an addendum to the RFI/RI Volume 2 Report and contains additional data and information collected by PG&E between October 2007 and September 2008. These data sets were collected at the direction of the Department of Toxic Substances Control (DTSC) or the Department of the Interior (DOI). These data sets were not available at the time of the RFI/RI Volume 2 Report preparation. The purpose of this Addendum is to supplement and not duplicate or supersede the RFI/RI Volume 2 Report, and to report the supplemental information and assess the influence, if any, on the conclusions and recommendations of the RFI/RI Volume 2 Report.

ES.2 Additional Characterization

ES.2.1 Colorado River Site Features

Historical photographs and records for the Topock site were obtained from the United States Bureau of Reclamation (BOR) files and other sources and reviewed. These photographs and records more fully document the dredging history and the morphology of the Colorado River in the study area. The documents obtained included historical reports, photographs, drawings, river gauging data, and other operation records from BOR's Boulder City Area office files for the time period from 1944 through 1968. Historical information on the Burlington Northern Santa Fe (BNSF) railroad and the original Red Rock railroad bridge at the Topock river crossing were reviewed to provide additional background information on Colorado River channel features at the bridge crossings. The purpose of this records search was to obtain additional detail on the dredging and bank stabilization operations along the Colorado River channel and shoreline that could have bearing on the surface water and sediment characterization in the RFI/RI. The search was conducted at the direction of DTSC in response to stakeholder comments on the 2005 Draft

RFI/RI Report and the results were not available at the time of the RFI/RI Volume 2 Report preparation.

The updated information and chronology of dredging locations, bank stabilization, and other man-made effects on river morphology are consistent with the historical review and information presented in the RFI/RI Report Volumes 1 and 2. No revisions or changes to the conceptual site model regarding site features and river morphology are needed based on this additional information.

ES.2.2 Additional Hydrogeologic Investigations

Additional hydrogeologic investigations conducted between October 2007 and September 2008 consisted of the drilling and installation of groundwater monitoring wells near the shore of the Colorado River in Arizona in March and April 2008, and collection of hydraulic data from the wells installed in Arizona. The purpose of the additional investigations were to further characterize the hydrogeologic conditions near the Arizona shore of the Colorado River, as well as beneath the river channel downstream of the chromium plume observed in the California floodplain and to assess the extent of hydraulic influence of Interim Measures (IM) No. 3 pumping on Arizona wells. The results were consistent with previous findings as described below.

Monitoring well clusters installed on the Arizona side of the Colorado River in March and April 2008 provided additional data on bedrock surface elevation and stratigraphy, groundwater gradients, and groundwater quality. Wells drilled as clusters at MW-54 (3 wells), MW-55 (2 wells), and MW-56 (slant boring with 3 wells) provided additional hydrogeologic characterization data, and data from geophysical logs at MW-54 and MW-55 were combined with drilling logs to estimate hydrostratigraphic thicknesses and contacts. Bedrock elevation was verified at each cluster, and the bedrock elevation map updated to reflect these measurements. The overall depth and configuration of the Miocene bedrock surface is similar to the interpretation developed prior to the Arizona groundwater investigation. In addition, the bedrock elevation map was updated at DTSC's request to incorporate data on bedrock elevation developed during the East Ravine investigation as of May 2009. The complete findings of the East Ravine investigation will be provided in future reports.

Groundwater elevation data were collected between May and July 2008 from the five wells in well clusters MW-54 and MW-55 via dedicated pressure transducers. Combined with water-level data from the California side, these measurements were used to construct a groundwater gradient map of the deep aquifer zone. Available data indicate that groundwater on the Arizona side is flowing towards the river, in agreement with the site conceptual model and numerical groundwater model. Data further suggest that the groundwater in the deep zone is captured by IM- 3 extraction wells PE-1 and TW-3D, also in agreement with numerical model predictions.

Hydraulic data collected during a temporary shut down of the IM-3 extraction wells in May 2008 were used to examine the influence of IM-3 pumping on Arizona wells and to provide data for model recalibration. Response in wells of the MW-54 cluster was detected but the magnitude of the response was only slightly greater than the "noise" in the water level signal. This was due to the influence of river and barometric fluctuations on water levels in the wells. These fluctuations were minimized by a deconvolution process but cannot be eliminated entirely. Although a response in these distant wells was noted, the response could not be quantified as it was within the remnant fluctuations not removed by deconvolution. The MW-54 cluster was again monitored during a similar temporary shutdown in September 2008, when the river levels were more stable and the smaller fluctuations were more readily removed by deconvolution. Responses of 0.06 to 0.08 feet were estimated for the three wells in this cluster during the September shutdown. The magnitude of response in these wells is consistent with the projections of the groundwater model and supports the hydraulic influence of IM-3 pumping extending into Arizona. The extent of hydraulic influence should not be confused with the extent of the capture zone associated with the IM-3 pumping, although the groundwater model projects that in the deeper portions of the aquifer, the capture zone of the IM-3 pumping extends to the radius of MW-54 .

ES.2.3 Additional Groundwater Characterization

Additional groundwater characterization conducted between October 2007 and September 2008 consisted of groundwater sampling and analysis of eight new monitoring wells installed in Arizona and sampling and metals analyses of selected RFI/RI wells. The purpose of the additional groundwater sampling was to define the eastern limit of the groundwater chromium plume associated with the Topock Compressor Station and further characterize the occurrence and distribution of trace metals in site groundwater. The results were consistent with previous groundwater quality characterization as described below.

In March and April 2008, the Arizona groundwater investigation further characterized the hydrogeologic conditions and groundwater quality near the Arizona shore of the Colorado River, as well as beneath the river channel downstream of the chromium plume observed in the California floodplain. The hexavalent chromium [Cr(VI)] and total chromium [Cr(T)] results from five rounds of groundwater sampling (April-September 2008) in wells MW-54, MW-55, and MW-56 were less than naturally occurring background concentrations in all eight monitoring locations, and less than laboratory reporting limits in the wells screened beneath the river channel. These findings provide field-measured confirmation concerning previous estimates about the eastern extent of Cr(VI) and Cr(T) in the Alluvial Aquifer. General chemistry parameters indicate a sodium-chloride chemistry and increasing concentrations of total dissolved solids (TDS) with depth, similar to the conditions on the California side. Chemically reducing conditions were found at all depth intervals of the wells.

Concentrations of Cr(VI) and Cr(T) in site monitoring wells between October 2007 and September 2008 were similar to ranges reported in the RFI/RI Volume 2 Report. Observed concentrations fluctuations did not change the overall plume shape or the site conceptual model of chromium distribution and fate.

At DTSC's direction, Title 22 metals analyses data were collected in selected wells over three sampling periods between December 2007 and May 2008. Of the trace metals analyzed, only arsenic, molybdenum, selenium, and vanadium have been detected in over 10% of samples and have concentrations exceeding background upper tolerance limit (UTL) concentrations in over 5% of samples. Although modest concentration increases and decreases were noted in a few wells for these trace metals, the observed distributions of concentrations are generally consistent with those observed in the RFI/RI Volume 2 Report and support the conclusions made in the report.

ES.3 Conclusions

Additional historical photographs and records obtained from BOR and BNSF files more fully document the dredging history and the channel morphology of the Colorado River in the study area but do not modify the site features and river morphology information presented in the RFI/RI Volume 2 Report.

The additional drilling data and results obtained from the Arizona groundwater investigation confirm the site conceptual model for hydrogeologic conditions presented in the RFI/RI Volume 2 Report. The depth to bedrock was confirmed at all three Arizona drilling locations, which provides additional geologic control for mapping the Miocene bedrock surface and defines the base of the Alluvial Aquifer. Hydraulic data collected following installation of monitoring wells on the Arizona side of the Colorado River indicate the IM- 3 extraction influence extends into Arizona. It is noted that the observed hydraulic influence does not necessarily imply hydraulic capture.

The results of five rounds of groundwater sampling at the well locations installed during the Arizona groundwater investigation have shown Cr(VI) and Cr(T) are not present in groundwater samples above background concentrations in all eight monitoring locations. These findings provide field-measured confirmation concerning previous estimates about the eastern extent of Cr(VI) and Cr(T) in the Alluvial Aquifer. The Arizona groundwater investigation has further documented the nature and extent of natural reducing conditions in the saturated fluvial and alluvial sediments that underlie the Arizona shore of the Colorado River in the investigation area.

Analytical results for Title 22 trace metals collected in selected wells over three sampling periods between December 2007 and May 2008 indicated that the overall observed distributions and ranges of concentrations are consistent with those observed in the RFI/RI Volume 2 Report.

DTSC has directed PG&E to carry nitrate forward as a COPC on the basis of its interpretation of nitrate concentration distribution and potential sources from the facility presented in this Addendum. Other than nitrate, the additional data and information collected between October 2007 and September 2008 and presented in this Addendum do not further modify the conclusions and recommendations of the RFI/RI Volume 2 Report. Further characterization and installation of additional monitoring wells in the East Ravine area and within the compressor station will be reported in future reports. Remediation of any groundwater contamination associated with sources other than SWMU 1/AOC 1 and SWMU 2 will be addressed in accordance with the RCRA and CERCLA processes.

1.0 Purpose and Objectives of RFI/RI Volume 2 Addendum

In February 2009, the Pacific Gas and Electric Company (PG&E) completed the *Revised Final RCRA Facility Investigation and Remedial Investigation Report, Volume 2, Hydrogeological Characterization and Results of Groundwater and Surface Water Investigation* (CH2M HILL, 2009a). The RCRA Facility Investigation/Remedial Investigation (RFI/RI) Volume 2 Report contains the hydrogeologic characterization and results of groundwater, surface water, pore water, and river sediment investigations to evaluate and characterize the historic discharge of wastewater from the PG&E Topock Compressor Station to Bat Cave Wash (SWMU 1/ AOC 1) and injection well PGE-8 (SWMU 2). The RFI/RI Volume 2 Report was prepared to meet the requirements of both the Resource Conservation and Recovery Act (RCRA) Corrective Action process, and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The report also provides recommendations for the disposition of SWMU 1/AOC 1 and SWMU 2 within the site investigation, remediation, and closure process.

The RFI/RI Volume 2 Report (CH2M HILL, 2009a) contains:

- Site location, description, and history of investigative and remedial activities at the Topock Compressor Station.
- Description and historic operations of the SWMUs and AOCs addressed in RFI/RI Volume 2.
- Physical characteristics and hydrogeologic setting of the site, including surface features, meteorology, geology, hydrogeology, surface water hydrology, and hydrologic budget.
- Previous studies and investigations.
- Hydrogeologic conditions and conceptual site model.
- Groundwater, surface water, pore water, and river sediment characterization.

The data and characterization information contained in the RFI/RI Volume 2 Report were collected through multiple investigation phases between the start of the RFI/RI sampling activities in July 1997 through October 2007. Information in the RFI/RI Volume 2 Report is not repeated in this Addendum, and the reader is referred to the RFI/RI Volume 2 Report for the information identified above.

This document is an addendum to the RFI/RI Volume 2 Report and contains select data and information collected between October 2007 and September 2008. The purpose of this document is to supplement and not duplicate or supersede the RFI/RI Volume 2 Report, and to report the supplemental information and assess the influence, if any, on the conclusions and recommendations of the RFI/RI Volume 2 Report. The information contained in this Addendum includes:

1. Additional information on Colorado River dredging history obtained in June 2008 from the United States Bureau of Reclamation (BOR) via a Freedom of Information Act (FOIA) request and additional information from the Burlington Northern Santa Fe (BNSF) Railway and other sources regarding the existing and former railroad bridges at the Topock site.
2. Additional hydrogeologic investigation information obtained from installation of groundwater monitoring wells near the shore of the Colorado River in Arizona in March and April 2008 (CH2M HILL, 2008a), as well as hydraulic data collected across the site between May and July 2008, following installation of the groundwater monitoring wells in Arizona.
3. Additional laboratory analytical data from initial sampling of Arizona wells between April 2008 and September 2008 and additional Title 22 metals analyses of select groundwater monitoring wells during quarterly monitoring in December 2007, March 2008, and May 2008 (CH2M HILL, 2008b-d).

Groundwater and surface water continues to be routinely monitored at the Topock site. Additional monitoring data collected at the site after October 2007 but not specifically discussed in this addendum have been reported separately in groundwater monitoring program reports, Interim Measure (IM) performance monitoring program reports, IM compliance monitoring reports, and *in-situ* pilot study monitoring reports related to individual monitoring programs.

2.0 Additional Site Characterization Information

This section presents and evaluates the additional RFI/RI datasets collected in response to stakeholder comments or at the direction of the California Department of Toxic Substances Control (DTSC) or the United States Department of the Interior (DOI). These data were not available at the time of the RFI/RI Volume 2 Report preparation.

2.1 Additional Information on Colorado River Site Features

The site setting and physical features of the Colorado River are discussed in Section 3.5.1 of the RFI/RI Volume 2 Report (CH2M HILL, 2009a). The discussion in the RFI/RI Volume 2 Report considered historical conditions and man-made effects on river morphology, including a review of dredging and historical aerial photos that had been presented in the *Revised Final RCRA Facility Investigation and Remedial Investigation Report, Volume 1 - Site Background and History* (CH2M HILL, 2007). In June 2008, additional information was obtained from the BOR files on dredging of the Colorado River and historical channel improvements that occurred in the vicinity of the study area. The historical records were obtained through a FOIA request. Additional historical information on the railroad bridges at the Topock river crossing is also summarized below.

2.1.1 Historical Records on Colorado River Dredging and Channel Modifications

The documents obtained included historical reports, photographs (aerial and land-based), drawings, river gauging data, and other operation records from BOR’s Boulder City area office files for the time period from 1944 through 1968. The purpose of this records search was to obtain additional detail on the dredging and bank stabilization operations along the Colorado River channel and shoreline that could have bearing on the surface water and sediment characterization in the RFI/RI. The search was conducted in response to DTSC direction on stakeholder comments on the 2005 Draft RFI/RI Report (CH2M HILL, 2005). The major dredging activities and channel improvements are summarized below by time period. Selected photographic records and drawings relevant to this document review are included in Appendix A1.

2.1.1.1 1944 through 1948

The BOR records from 1944 through 1948 document the emergency relief measures that were undertaken in the Needles area to address the aggradation of the Colorado River channel and groundwater level rise due to the closing of Parker Dam and subsequent filling of Lake Havasu. An existing levee near Needles, California was raised and extended. These modifications were considered temporary protection for Needles until Colorado River dredging and channelization could begin. The levee in the Needles area was also rip-rapped in 1948 as a further measure of protection.

2.1.1.2 1949 through 1953

On January 31, 1949, the BOR initiated dredging of the Colorado River channel from Needles to Topock, Arizona using "The Colorado" dredge. The primary channelization excavation work was completed by April 1951, and maintenance dredging continued through January 1953. During this period, 15,546,000 cubic yards of dredging material were removed from the Needles to Topock channel, according to the BOR Region 3 Reports on River Control Work and Investigations. The total dredging volume was based on the monthly operations records in the BOR reports. The dredge material was used to construct the bank line and levees on this section of the river, and additional material was placed at two sites immediately downstream of Topock (designated Spoil Sites 1 and 2). Refer to Appendix A1 for selected historical photographs of Colorado River channel and dredge placement in the Topock site area.

2.1.1.3 1953 through 1961

Once channelization of the Needles to Topock river section was complete, BOR dredging operations commenced in 1953 directly upstream of Needles (Big Bend to Needles section). The purpose of the upstream dredging was to protect the channelization downstream by preventing sediments in the Big Bend to Needles section from moving downstream. This excavation was completed in July 1960. Maintenance dredging of the river channel in the Topock area continued in 1961.

2.1.1.4 1965 through 1968

The BOR records indicate that major dredging was performed in 1965 to produce the side channel and slough at San Bernardino County's Park Moabi, as shown in Figure 2-1. Appendix A1 contains historical aerial photographs and drawings for the locations of the Park Moabi slough dredge cut and dredge spoil areas. The historical photographs indicate that much of the present shoreline, bank stabilization, and sand dune area features in the Park Moabi area were completed during this period.

In 1965, BOR initiated development of an active water management system for the Topock Marsh for the Havasu National Wildlife Refuge (HNWR). By 1966, a dike and inlet channel were constructed to divert Colorado River flow into Topock Marsh. A small inlet canal and control structure was constructed by dewatering the area and excavating materials from the current inlet. Jetties were constructed upstream of the inlet to form a narrower channel, and to cause the water to scour the sand bar at the entrance to the inlet. Levee systems were also constructed along the Colorado River shoreline during this time period. Appendix A1 contains selected historical aerial and land-based photographs of Topock Marsh development during this period.

In summary, the historical BOR photographs and operations records provide a more complete chronology of the dredging and channel improvements that were completed in the Park Moabi-Topock site area. The overall dredging and channelization work resulted in lower water surface elevations of the Colorado River near Needles, as well as reduction of sediment flows to Lake Havasu downstream of the Topock area. Channel capacity in this section of the river now averages approximately 15,000 cubic feet per second (cfs), with a levee system designed for up to 50,000 cfs.

2.1.2 Historical Information for Railroad Bridge Crossings at Topock

Additional site features information for the railroad bridge crossings of the Colorado River at Topock were reviewed as part of this Addendum. The information included historical construction drawings and records for the BNSF Railway Bridge (formerly Atchison, Topeka, and Santa Fe Railway) and the original Red Rock Cantilever Bridge (Figure 2-1). The original Red Rock Bridge (former Atlantic & Pacific Railroad) was constructed in 1890 and served as the railroad crossing until 1945, when the current BNSF Bridge was completed and put into service. With completion of the new railroad bridge, the Red Rock Bridge was used as the U.S. Route 66 highway crossing up until 1966 when the current I-40 bridge was completed. The historical records were obtained from the following sources: BNSF Railway (BNSF, 2008), an unpublished thesis (Robey, 1947), and a historical report (Rowe, 1891).

Appendix A2 includes copies of selected historical construction plans, as-built drawings, and elevation cross-sections (profiles) of the current BNSF Bridge and the former Red Rock Bridge. The bridge cross-sections present historical river levels, elevation profiles of the Colorado River channel, and depict the geologic formations that underlie the river channel at the bridge locations. Also shown on the historical drawings are bridge dimensions and plans and specifications for the bridge piers. The channel profiles and geologic data documented in the bridge drawings provide additional information on channel morphology, site hydrogeology, and the surface water characterization of the Colorado River.

2.2 Additional Hydrogeologic Investigation

The RFI/RI Volume 2 Report (CH2M HILL, 2009a) evaluated the hydrogeologic and groundwater characterization data collected during site investigations and monitoring between July 1997 and October 2007 and used these data to present a site conceptual model for groundwater flow and chromium plume migration in groundwater (see Section 6.6 of the RFI/RI Volume 2 Report). Additional hydrogeologic investigation information obtained from the installation of groundwater monitoring wells near the shore of the Colorado River in Arizona in March and April 2008, as well as hydraulic data collected across the site between May and July 2008, are presented in this section to supplement the site conceptual model and to complete the groundwater characterization of the eastern extent of the groundwater plume.

2.2.1 Arizona Groundwater Investigation

A primary objective of the Arizona groundwater investigation was to further characterize the hydrogeologic conditions near the Arizona shore of the Colorado River, as well as beneath the river channel downstream of the chromium plume observed in the California floodplain. The investigation was conducted between March and April 2008 and included the drilling, installation, testing, and sampling of groundwater monitoring wells at three sites on the Arizona shore.

Figure 2-1 shows the locations of the three well sites (MW-54, MW-55, and MW-56) installed for the Arizona groundwater investigation. Table 2-1 summarizes the drilling and well construction information for five monitoring wells and one angled/slant multilevel monitoring well (containing three separate sampling screens) installed at these three locations. The investigation activities and results of the Arizona groundwater investigation are described in the *Installation Report for Wells on the Arizona Shore of the Colorado River at Topock, Arizona* (CH2M HILL, 2008a). Key data and findings from the investigation are summarized below.

Two hydrogeologic cross-sections—H-H′, shown in Figure 2-2, and I-I′, shown in Figure 2-3—have been prepared to illustrate the drilling results and hydrogeologic data from the Arizona groundwater investigation. The cross-section locations are shown in Figure 2-1. The cross-sections present the interpreted hydrostratigraphy, the screened intervals of the wells, and the bedrock elevation data from Arizona drilling sites (MW-54 and MW-56) and several drilling sites on the California side of the river. Drilling data from within the channel (geotechnical CB-series borings drilled in 1962 by Caltrans) are also included on cross-section I-I′. Refer to Section 3.4.1 in the RFI/RI Report Volume 2 for the definitions and descriptions of the hydrostratigraphic units presented on cross-sections H-H′ and I-I′. Appendix B1 presents location, well construction, and survey details for the site wells.

Continuous core was collected from ground surface to several feet into consolidated Miocene Conglomerate at the three Arizona drilling sites. During drilling of the deep borings at MW-54, MW-55, and MW-56, depth-specific water quality samples and field measurements were collected for assessing groundwater conditions and selecting the well screen intervals. Appendix B2 contains the boring logs and results of the depth-discrete groundwater sampling for the Arizona wells. Following well installation, cased well geophysical logs (natural gamma ray and induction) were collected in MW-54-195 and MW-55-120, which are the deepest wells installed at these drilling locations, to further assess the hydrogeologic characteristics of the hydrostratigraphic units in the investigation area. The geophysical logs for these drilling locations are included in Appendix C1.

The depth to bedrock was confirmed at all three Arizona drilling locations and provides additional geologic control for mapping the Miocene bedrock surface. As described in the RFI/RI Volume 2 Report, the Miocene bedrock surface defines the base of unconsolidated alluvial and fluvial deposits that comprise the Alluvial Aquifer. The interpreted bedrock surface elevation map issued in the RFI/RI Volume 2 Report has been updated to reflect the drilling data from the Arizona groundwater investigation.

Figure 2-4 presents the updated structure elevation contour map of the Miocene bedrock surface at the Topock site and posts the elevations of bedrock that were encountered in the Arizona drilling. The bedrock structure contours shown underlying the Colorado River are inferred based on a reconnaissance seismic reflection survey conducted by the United States Geological Survey (USGS) in September 2004 (USGS, 2005). Minor modifications were made based on unpublished seismic survey data conducted by the USGS in June 2007 (USGS, 2008), which is included in Appendix C2.

Figure 2-4 incorporates data on bedrock elevation developed during the East Ravine investigation as of May 2009. The complete findings of the East Ravine investigation will be provided in future reports.

Overall, the interpreted bedrock structure depicted in the updated map (Figure 2-4) is similar to the structure map presented in the RFI/RI Volume 2 Report. The principal changes are:

- The Miocene Conglomerate bedrock on the Arizona shore was found at shallower depths than predicted prior to drilling, ranging from approximately 30 feet shallower at slant boring MW-56 to 125 feet shallower at MW-54.
- In an area near the East Ravine, the depth to bedrock is deeper than initially mapped and the bedrock surface forms a shallow 'embayment' adjacent to the bedrock outcrops. As a consequence, a comparatively thin interval of the Alluvial Aquifer (approximately 10 to 30 feet thickness) overlies the bedrock surface in the area immediately northeast of the compressor station (Figure 2-4).

The bedrock surface map updated to include the results of the Arizona drilling investigation has been incorporated in the site hydrogeologic conceptual model and groundwater numerical model, which are discussed in more detail in the RFI/RI Volume 2 Report.

2.2.2 Hydraulic Gradient, California Floodplain and Arizona Wells

Hydraulic data from wells in the MW-54 and MW-55 clusters have been combined with data from California-side floodplain wells to extend the groundwater gradient map into Arizona. Figures 2-5a, b, and c contain average groundwater elevations for wells in the shallow, mid-depth, and deep zones of the Alluvial Aquifer, respectively, for the period May through July 2008. As discussed in the IM performance monitoring reports (CH2M HILL, 2008e), the three depth zones in the Alluvial Aquifer are primarily defined based on screen interval elevation. Contouring water levels from wells all screened within a similar depth zone minimizes the influence of vertical gradients on these horizontal gradient maps.

Wells in the MW-54 cluster all fall into the deep elevation zone, as does well MW-55-120. As a result, only the deep zone contains enough data from Arizona wells to enable contouring of groundwater elevations. Deep zone water levels shown in Figure 2-5c indicate that potentiometric levels in monitoring wells in Arizona are higher than those in wells across the river on the California floodplain. This means that the direction of groundwater flow on the Arizona side of the river across from the Topock site is toward the west. This is consistent with the site conceptual model and with the current numerical groundwater flow model.

Although there are not sufficient data points to allow contouring of groundwater elevations in the middle zone on the Arizona side, the average elevation at well MW-55-45 is higher than the average river elevation in the California floodplain, indicating that groundwater is flowing toward the river in this area of the middle zone. The site groundwater model predicts flow toward the river in all zones on the Arizona side.

2.2.3 Hydraulic Response Testing

The IM-3 extraction and injection system was systematically shut down during May 29-30, 2008 and again during September 15-17, 2008 and the resulting water level responses were observed in monitoring wells across the site. The observed water level responses provide data that could be used for recalibrating the numerical groundwater model, if this action is deemed necessary in the future.

During May, the IM-3 pumping and injection wells were shut down one at a time to observe influence of each well individually. Well PE-1 was shut down at 6:58 a.m. on May 29, and TW-3D was turned off later that day at 2:59 p.m. That evening, at 9:59 p.m., the injection well IW-3 was shut down. All wells remained off overnight. TW-3D was turned back on at 7:10 a.m. on May 30. Well IW-3 was returned to service at 1:28 p.m. on May 30 and, finally, well PE-1 was turned on at 9:16 p.m. that night. A total of 104 wells were outfitted with pressure transducers that recorded water level responses during the shutdown. Of these, 49 wells were selected for analysis. Transducers were also installed at two river stations to provide detailed data on river levels during this test.

During September, both pumping wells were shut down simultaneously at 8:12 am on September 15 and restarted simultaneously at 9:09 am on September 17. The primary purpose of the September test was to see if a measurable response could be observed in the MW-54 wells. Therefore, water level monitoring was only conducted in seven wells.

A data deconvolution program, developed by the USGS (Halford, 2006), was used to mathematically remove the hydraulic influence of Colorado River level fluctuations, along with barometric pressure variation and earth tides, during the test period. The program uses signal processing techniques to determine the influence of river level and barometric pressure changes on water levels at each well during the time prior to and after the hydraulic test. The river and barometric influence is then subtracted out of the data collected during the test period so that only the response to the IM-3 shutdown is evident in the data from each well. For the May test, the deconvolution program allowed quantification of water level response in the range of 0.07 to 0.2 foot, depending on the location of the well. The river levels were more stable in September and therefore the noise in the test was less, allowing quantification of water level responses in the range of 0.03 to 0.1 foot. A time series plot of each well's response to the shutdown during the May test is provided in Appendix D1. The plots for the seven wells monitored in September are provided in Appendix D2.

The maximum response of each well to either the May or September shutdowns is presented in Figure 2-6. In May, the responses of two of the MW-54 cluster wells in Arizona were identified but were less than the remnant noise from the river fluctuations and could therefore not be accurately quantified. A significant dip in each of the deconvoluted drawdown curves for wells MW-54-140 and MW-54-195 may be observed in Appendix D1, and the timing and magnitude of these dips is consistent with the model projections. However, the unexpected rise in the river level just prior to the shutdown caused more noise than usual in the data, and caused the lack of a clear starting point from which to measure the water level response associated with the IM-3 shutdown for these wells. The MW-54 cluster was again monitored during the September 2008 shutdown, when the river fluctuations were more consistent, producing less noise in the deconvolution data. Plots of the September test data from the MW-54 cluster are provided in Appendix D2. Responses were evident in all three MW-54 wells. The reported maximum drawup responses on Figure 2-6 are estimates, because the small values are still within the noise range. Unlike the May shutdown data, however, the starting points for each well are clearly defined, so there is much more confidence in assigning a value to the responses. Four other wells were monitored and deconvoluted during the September shutdown (MW-34-100, MW-49-135, MW-55-045, and MW-55-120), and the plots for these wells are also provided in Appendix D2. These extra four wells were monitored for quality control purposes, and the observed drawups were comparable to those observed in May. The September shutdown was not exactly the same as the May shutdown, in that both extraction wells were shut down simultaneously and the river, barometric pressure, and earth tides were in a different position, so precise comparison was not carried out. Overall, the data indicate that the resolvable shutdown influence of IM-3 pumping extends to a radius of at least 1,000 feet from the TW-3D pumping well.

It should be noted that if a well is influenced by an aquifer test such as this, it does not necessarily indicate that the well is within the capture zone of the extraction well network. Distant wells may show a slight response to shutdown, but groundwater flow may only be deflected by pumping, as opposed to being directed to an extraction well. The response of the well is useful in estimating aquifer parameters between the extraction wells and the observation well. The extent of the capture zone in the deepest portions of the aquifer has been estimated using the groundwater flow model to extend to MW-54.

2.3 Additional Groundwater Analyses

The RFI/RI Volume 2 Report reported and evaluated groundwater characterization data collected at the site between July 1997 and October 2007 to identify and characterize the nature, degree, and extent of site constituents of potential concern (COPCs) in groundwater (see Section 6.0, CH2M HILL, 2009a). This section of the Addendum discusses the following two additional groundwater quality datasets collected between October 2007 and September 2008:

- The initial groundwater quality characterization and five rounds of chromium sampling data between April 2008 and September 2008 from the eight new monitoring wells installed for the Arizona groundwater investigation (CH2M HILL, 2008a).
- Additional Title 22 metals analyses of select groundwater monitoring wells in the RFI/RI study area during quarterly monitoring in December 2007, March 2008, and May 2008 (CH2M HILL 2008b-d).

The additional groundwater analytical data from these two datasets is presented in Appendix E.

2.3.1 Results of Samples from Monitoring Wells in Arizona

The results of the depth-discrete (during drilling) groundwater sampling and the initial groundwater sampling from the completed wells at locations MW-54, MW-55, and MW-56 are discussed in the Arizona well installation report (CH2M HILL, 2008a). The depth-discrete groundwater sampling and field water quality results collected during drilling are included with the boring logs in Appendix B2.

Table 2-2 presents the laboratory analytical results for hexavalent chromium [Cr(VI)], total chromium [Cr(T)], and field water quality measurements for the eight monitoring wells installed for the Arizona groundwater investigation. In the five groundwater monitoring rounds completed between April and September 2008, Cr(VI) and Cr(T) were not detected above the analytical reporting limits, with the exception of low level Cr(VI) and Cr(T) detections (0.614 µg/L and 1.17 µg/L) in groundwater sample from MW-55-120. These detections were well below the calculated background upper tolerance limits (UTLs) for Cr(VI) (31.8 µg/L) and Cr(T) (34.1 µg/L) as described in the RFI/RI Volume 2 Report (CH2M HILL, 2009a). The geologic log for the MW-55 cluster indicates alluvial material throughout the entire depth of the boring. Naturally-occurring Cr(VI) would be expected in alluvial wells in this area, provided that redox conditions are sufficiently oxidizing. The stable isotope signature for MW-55-120 was $\delta^{18}O$ = -11.3, $\delta^{2}H$ = -81.0, very similar to a nearby Arizona alluvial well, EPNG-2 ($\delta^{18}O$ = -11.5, $\delta^{2}H$ = -79.4 in the most recent sample from May 2007), indicating that the groundwater properties at this location are consistent with other alluvial wells in the area.

Field measurements of oxygen reduction potential (ORP) in Arizona wells during the five groundwater sample collection events were all negative, ranging from -81.8 millivolts (mV) to -228 mV, indicating reducing conditions. Field measurements of specific conductance ranged from 1,540 to 28,000 microSiemens per centimeter. Generally, specific conductance increased with depth, and the highest concentrations measured during field sampling were in MW-56D, as shown in Table 2-2.

In addition to Cr(VI) and Cr(T), the groundwater samples collected during the initial April 2008 sampling event were analyzed for a more comprehensive list of general chemistry analytes including cations and anions, TDS, and stable isotopes for initial water quality characterization. Table 2-3 presents the results for the general chemistry water quality analyses. Concentrations of TDS consistently increase with depth at each location, as was observed in the depth-specific samples during drilling. The cation and anion data indicate that the dissolved solids are predominantly sodium and chloride, with lesser sulfate concentrations. The general chemistry of the fluvial and alluvial wells in Arizona is similar to that observed in the California floodplain wells, which is described in Section 5.3.1 of the RFI/RI Volume 2 Report (CH2M HILL, 2009a).

Sampling results from a comprehensive site wide groundwater monitoring program (GMP) monitoring event conducted in October 2007 were used to show the distribution of chromium in groundwater at the site in the RFI/RI Volume 2 Report (CH2M HILL 2009a). With the installation of the new Arizona monitoring wells (Figure 2-1), additional sampling locations are now available to better delineate the eastern and southeastern extent of the chromium groundwater plume in the Alluvial Aquifer. Table 2-4 presents a listing of the groundwater Cr(VI) and Cr(T) results for the groundwater sampling events conducted from October 2007 through September 2008 that were used for this 2008 update to the RFI/RI groundwater characterization.

The sampling results and the distribution of chromium in groundwater for the May 2008 sampling round are shown on Figures 2-7a, 2-7b, and 2-7c. The May 2008 groundwater quarterly monitoring event was selected for the figures to show a current distribution of chromium data that incorporates the eight new monitoring locations in Arizona (June 3-4, 2008 sampling results). Because only a subset of the RFI/RI wells were sampled in May 2008, there are fewer Cr(VI) results shown on these figures than on the figures in the RFI/RI Report Volume 2. The sampling results maps also show the approximate outline of the area of Cr(VI) concentrations at or greater than 32 micrograms per liter (µg/L) in each of the three Alluvial Aquifer monitoring zones. The 32 µg/L limit line shown on the figures is used for delineating the groundwater chromium plume and reflects the calculated Cr(VI) site background UTL of 31.8 µg/L, as described in the RFI/RI Volume 2 Report (CH2M HILL, 2009a). The positions of the Cr(VI) 32 µg/L contours on the May 2008 sampling results maps are based on the maximum concentrations measured within each monitoring interval during the more comprehensive sitewide October 2007 annual sampling event. Table 2-4 contains the chromium groundwater results for the RFI/RI wells sampled in the October 2007 monitoring event.

Figures 2-7a and b present May 2008 Cr(VI) results for shallow and middle zone wells of the Alluvial Aquifer, including Arizona locations MW-56S and MW-55-45. Although a limited number of shallow and middle zone wells were sampled in the May 2008 quarterly event, the results and plume limit lines shown in Figure 2-7a and Figure 2-7b are similar and consistent with 2007-2008 monitoring data for the site.

Figure 2-7c presents May 2008 Cr(VI) results for deep zone wells of the Alluvial Aquifer, including Arizona locations MW-54-85, MW-54-140, MW-54-195, MW-55-120, MW-56M, and MW-56D. The position of the 32 µg/L Cr(VI) limit line shown in the deep wells result map (Figure 2-7c) is based on results from six wells on the California floodplain and the results from three depth intervals at Arizona wells MW-54, MW-55, and slant well MW-56. The May-June 2008 chromium sampling data delineate the eastern extent of Cr(VI) in the deep zone of the Alluvial Aquifer.

Four wells in the RFI/RI network (MW-23, MW-24BR, MW-48, and PGE-7BR) are completed in the bedrock units. Figure 2-1 shows the locations of the bedrock monitoring wells. Table 2-4 presents the Cr(VI) sampling results for the bedrock monitoring wells sampled during between October 2007 and September 2008. In May 2008 sampling, Cr(VI) was detected at 23.2 µg/L in well MW-23, which is comparable to recent concentrations reported from this well (CH2M HILL, 2008b, d). Cr(VI) was not detected in groundwater samples from the three other bedrock wells (MW-24BR, MW-48, and PGE-7BR), similar to past results from these wells.

2.3.2 Additional Title 22 Metals Analyses

Additional Title 22 metals analyses were conducted during quarterly monitoring in December 2007, March 2008 and May 2008 (Table 2-5). DTSC directed that Title 22 metals data be collected quarterly from selected wells in the monitoring network for a period of at least 1 year (DTSC, 2007). This report includes the first three quarters of Title 22 metals data that was sampled after the RFI/RI Volume 2 Report cutoff date for data inclusion. The additional Title 22 metals data have also been reported in quarterly GMP reports (CH2M HILL 2008b-d). The analytical results are also included in Appendix E.

The analytical results and distribution of the metals analyzed are discussed below.

2.3.2.1 Hexavalent and Total Chromium

Table 2-4 presents a summary of the Cr(VI) and Cr(T) data evaluated in this Addendum, which includes samples from the May 2008 quarterly GMP event and the Arizona well sampling events from April to September 2008. Cr(T) results from Title 22 metals analyses collected during the December 2007, March 2008, and May 2008 sampling events are included. For comparison purposes, Table 2-4 also presents the October 2007 RFI/RI Volume 2 Report results for Cr(VI) and Cr(T).

Table 2-6 provides an update of Table 6-6 from the RFI/RI Volume 2 Report to include additional Addendum data collected after October 2007. This statistical summary lists the primary sampling statistics of the Cr(VI) and Cr(T) data sets and includes comparison with the calculated site background UTL and chemical-specific applicable or relevant and appropriate requirements (ARARs) from the RFI/RI Volume 2 Report (CH2M HILL, 2009a). In the table, results with concentrations less than analytical reporting limits were assigned half the reporting limit concentration in computing average concentrations for each well. Many wells had no detections of Cr(VI) or Cr(T) above analytical reporting limits in any of their samples yet, in some cases, half of the reporting limit was above the background UTL and sometimes also the ARAR. This is more frequently true of older samples and more saline samples in which the laboratory reporting limits were elevated. Higher salinity is often associated with matrix interferences in the analytical process which prevents the accurate measurement of small Cr(VI) concentrations. The reporting limit is therefore higher for these samples. The samples are not considered inaccurate or unacceptable by the QA/QC standards of the RFI/RI, they only have elevated reporting limits due to natural conditions and/or laboratory limitations. As a result, the number of wells with averages exceeding UTL and ARAR values is skewed upward. The impact of elevated reporting limits on exposure point concentrations will be taken into account during the Groundwater Risk Assessment.

2.3.2.2 Copper, Nickel, Zinc, and Lead

Table 2-5 provides analytical results for copper, lead, nickel, and zinc in samples collected between December 2007 and May 2008. As noted in the table, several of the wells sampled during this period had not previously been analyzed for these metals, whereas the other wells had previous sampling history reported in the RFI/RI Volume 2.

Table 2-6 summarizes the analytical results for copper, lead, nickel, and zinc collected between July 1997 and September 2008. This statistical summary lists the primary statistical parameters of the data sets for these metals and includes comparison with the calculated site background UTL and chemical-specific ARARs. As discussed in Section 2.3.2.1 for chromium, many samples reported as less than analytical reporting limits but with high reporting limits caused the number of UTL or ARAR exceedances to be skewed upward. The implications of high reporting limits on estimating risk will be examined in the Risk Assessment. The characterization results and distribution of each of the metals is discussed below.

The detection frequencies in Table 2-6 for copper, nickel, and lead are below 50%, which is consistent with the findings of the RFI/RI Volume 2 Report. In the case of chromium, the geochemical redox environment has a large influence on whether this metal will be detected, as discussed in Section 6.5 of the RFI/RI Volume 2 Report. Solubilities of copper, lead, nickel and zinc are not affected by the range of redox conditions encountered at the site, and observed concentrations of these metals in groundwater do not show a correlation to changes in redox.

Sampling results for these constituents from most wells consist of alternating detections and non-detections, which is an indication that results may not represent purely dissolved concentrations. It is common that suspended microparticles in groundwater, called colloids, pass through the 0.45 micrometer (µm) filters during sampling. Colloids range in size between 0.001 and 1 µm (McCarthy and Zachara, 1989), so the filters would only catch a portion of the colloid size range. Trace metals that are either a component of or adsorbed to the colloids are then counted as part of the total "dissolved" metal analysis (Puls and Barcelona, 1996). Samples with highly variable concentrations and/or high percentages of non-detects are suggestive of colloidal presence in samples since the amount and composition of colloids varies with each sample collected. Many of the Topock site data for trace metals follow this pattern. On the other hand, sampling results from wells that show repeatable or consistent concentrations over time suggest truly dissolved metal presence, as will be noted in the discussions below.

It is important to note that the source of metals as colloids in groundwater is generally the matrix material of the aquifer (i.e. the alluvial material). No anthropogenic source or discharge is needed to create the apparently elevated concentrations associated with colloidal detections. The quantity and origin of colloids in any given sample or area of an aquifer is not well understood (Seaman et al., 2007), and while some may be naturally mobile in the aquifer, others may be only mobilized by monitoring well sampling (Puls and Barcelona, 1996). Colloids can move more freely in coarse sand and gravel and can be effectively filtered from groundwater passing through fine grained aquifer material. The degree of filtration, and therefore the mobility of colloids in general, depends on the size of the colloid relative to the pore size in the aquifer. Because colloid concentrations are by nature variable, metals associated with colloids will consequently vary in concentration. Anomalously high concentrations of some trace metals in isolated samples from the Background Study were suspected to be due to colloids, and based on this, DTSC directed that some of those samples be removed from the study (CH2M HILL 2008f). A similar approach was taken in the RFI/RI, as discussed below.

Updated concentration maps for the four metals are provided on Figures 2-8 through 2-11. The pattern of concentrations of all four metals does not match that of the chromium plume, nor do they suggest other sources that would form a plume pattern. The distribution of these metals is discontinuous in space, suggesting a combination of natural variation and of sampling artifacts from colloid influences, as discussed above. Discussion of each individual metal is provided below.

Copper. Data presented in this Addendum confirms the conclusions of the RFI/RI Volume 2 Report, that is that copper is not a COPC in groundwater related to SWMU 1/AOC 1. Copper concentrations in the samples collected after October 2007 were all below reporting limits with the exception of one sample from MW-22. The five wells that had not been previously sampled for copper were below reporting limits in all three sampling rounds (Table 2-5). The frequency of sample results with concentrations that exceed the UTL remains below 10% with the additional data (8.5% of results collected in or before October 2007, and 8.3% of results including the data collected after October 2007) (Table 2-6). The frequency of samples that exceed the chemical-specific ARARs value for copper remains at 0%. As discussed above, the intermittent exceedances of the UTL for copper are attributed to colloids in the samples since samples with detected concentrations are frequently followed by those without detections, and no well shows repeated concentrations consistently above reporting limit. The pattern of copper concentrations shown on Figure 2-8 does not suggest a plume pattern.

Lead. Data presented in this Addendum confirms the conclusions of the RFI/RI Volume 2 Report, that is that lead is not a COPC in groundwater related to SWMU 1/AOC 1. Results for lead collected after October 2007 showed that four out of the 41 samples collected had detectable concentrations (Table 2-5). The four lead detections between October 2007 and September 2008 occurred as isolated detections in wells in which all other samples were less than analytical reporting limits (Table 2-5). Of the six wells not previously sampled for lead, MW-43-25 and MW-51 had one detection each, with the other two samples from each well below reporting limit. The remainder of newly sampled wells were non-detect for lead in all samples. The frequency of lead results with concentrations that exceed the UTL is unchanged with the additional data (9.1% before and after October 2007), and the frequency of results that exceed the chemical-specific ARARs decreased from 1.9% of results collected on or before October 2007 to 1.7% of results including the data collected after October 2007 (Table 2-6). The pattern of lead concentrations shown on Figure 2-9 does not suggest a plume pattern.

Nickel. Data presented in this Addendum confirms the conclusions of the RFI/RI Volume 2 Report, that is that nickel is not a COPC in groundwater related to SWMU 1/AOC 1. There were no detections of nickel above laboratory reporting limits in samples collected between October 2007 and September 2008 (Table 2-5). The overall frequency of nickel results at the site exceeding the UTL and chemical-specific ARARs decreased with the additional data collected after October 2007 (Table 2-6). The pattern of nickel concentrations shown on Figure 2-10 does not suggest a plume pattern.

Zinc. Data presented in this Addendum confirms the conclusions of the RFI/RI Volume 2 Report, that is that zinc is not a COPC in groundwater related to SWMU 1/AOC 1. Concentrations of zinc in well TW-1 were between 84.8 and 110 µg/L between October 2007 and September 2008 compared to the single sample concentration of 38.6 µg/L prior to October 2007 (Table 2-5). Zinc data from all other wells collected between October 2007 and September 2008 were found at concentrations consistent with data collected prior to October 2007. Of the five wells not previously sampled for zinc, three wells each had one of three samples above the reporting limit (all well below the background UTL of 77.7 µg/L for zinc), and the remaining two wells were each non-detect in all three samples. The frequency of zinc results with concentrations that exceed the UTL decreased from 20.4% of results for data collected before October 2007, to 19.8% of results including the data collected after October 2007 (Table 2-6). The percentage of results that exceed the ARAR of 5,000 µg/L remains at 0%. The pattern of zinc concentrations shown on Figure 2-11 does not suggest a plume pattern.

2.3.2.3 Other Trace Metals

Table 2-7 summarizes the sampling results for the following trace metals that were reviewed for the RFI/RI: aluminum, antimony, arsenic, barium, beryllium, cadmium, cobalt, mercury, molybdenum, selenium, silver, thallium, and vanadium. As with Table 2-6, Table 2-7 reflects both the data collected between July 1997 and October 2007 as presented in the RFI/RI Volume 2, as well as the data collected between October 2007 and September 2008 that are presented in this Addendum. The statistical summary in Table 2-7 lists the primary sampling parameters of the data sets, detection frequency, and includes comparison with the calculated site background UTL and chemical-specific ARARs. As discussed in Section 2.3.2.1, samples reported as less than analytical reporting limits but with high reporting limits caused the number of UTL or ARAR exceedances to be skewed upward for many metals. The implications of high reporting limits on estimating risk will be examined in the Risk Assessment. The characterization results for the trace metals are discussed below. Analytical results are also presented in Appendix E.

Of the metals listed in Table 2-7, only arsenic, barium, molybdenum, selenium, and vanadium have been detected in over 10% of samples. Given the variable pattern of occurrence it is likely that the remaining metals have only shown concentrations above reporting limits due to occasional colloid breakthrough and not from consistent dissolved concentrations in the aquifer. Further discussion will therefore be limited to those metals showing greater than 10% frequency of detection.

When the five metals are compared to background values (Table 2-7), arsenic, molybdenum, selenium, and vanadium exceed the site UTL in >5% of the data set, but barium does not. These observations are consistent with the findings of the RFI/RI Volume 2 Report. Based on the detection frequency and UTL exceedance findings and following a similar approach as previously presented in the RFI/RI Volume 2 Report, metals distribution analysis was conducted for these four metals. Updated distribution maps for arsenic, molybdenum, selenium, and vanadium are provided on Figures 2-12 through 2-15.

Arsenic. In the data collected since October 2007, arsenic samples that were above the UTL value were the three samples from MW-12 (all within the range of previous data) and one sample from well MW-43-25 at a concentration (24.4 µg/L) essentially equal to the UTL (24.3 µg/L) (Table 2-5). In the nine wells not previously sampled for arsenic, three were consistently below reporting limits. One well (MW-44-115) showed one non-detect and two samples slightly above reporting limits, and arsenic was consistently detected in well MW-43-25 at concentrations between 18.9 and 24.4 µg/L. Well MW-43-25 is screened in shallow fluvial material in a relatively reducing environment dominated by floodplain vegetation. This is a similar environment to Background Study well BOR-2, located several miles north of the site on the Arizona side of the river. Well BOR-2 had an arsenic concentration range of 14.8 to 19.1 µg/L, similar to that of MW-43-25. Arsenic levels measured in MW-24A are believed to be associated with groundwater effects from the In-Situ Pilot Study (ARCADIS, 2008). Groundwater recirculation and injection of carbon substrate in the Upland *in situ* Pilot Study area began on March 5, 2008, and all elevated arsenic samples from MW-24A were collected after that date. Arsenic concentration were believed to be elevated due to dissolution of naturally occurring arsenic from the aquifer matrix under the reducing conditions created within the *in-situ* treatment zone (ARCADIS, 2009).

The conclusions regarding arsenic distribution in groundwater made in the RFI/RI Volume 2 Report are confirmed by the additional data collected between October 2007 and September 2008. The source of arsenic in the vicinity of MW-12 is unknown, but may be associated with herbicides commonly used during the time when that area was adjacent to railroad and highway right-of-way, or with refractory materials/debris that have been observed in the fill used to create the former railroad grade. Note that wells near these transportation corridors in Arizona (e.g., Sanders well) also show elevated levels of arsenic. Whatever the actual source of arsenic in the vicinity of MW-12, it does not appear to be associated with a source in Bat Cave Wash. Outside of this area, the concentration distribution of arsenic shown on Figure 2-12 is inconsistent, and not suggestive of a plume distribution associated with the Bat Cave Wash discharge with the possible exception of arsenic at well MW-10 (as postulated by DTSC). Arsenic is therefore not recommended for consideration as a COPC in groundwater related to SWMU 1/AOC 1.

Molybdenum. Of the eight wells that had been previously sampled for molybdenum, results between October 2007 to September 2008 were variable, but generally consistent with previous data (Table 2-5). Samples collected at wells MW-10 and MW-22 were within the range of previous results. In well MW-21, the three additional samples ranged from 38.2 to 52 µg/L, above the maximum level of 26 µg/L previously observed for this well. In nearby well MW-12, the three additional samples ranged from 19.0 to 19.6 µg/L, below the average concentration of 49.8 µg/L previously observed for this well. Two of three samples from well TW-1 were slightly above the previous single sample of 13.8 µg/L, with the maximum at 22.0 µg/L. Wells MW-23, MW-24A and MW-26 each had one sample (out of three) with molybdenum concentrations above the previous range for these wells.

Of the six wells not previously sampled for molybdenum, results are similar to other wells in the same areas and depth zones. Starting in the shallow zone, wells MW-32-35 and MW-43-25 showed molybdenum between 10 and 20 µg/L, consistently below the UTL of 36.3 µg/L, and similar to other shallow wells near the river. The deep wells MW-44-115, MW-50-200 and MW-51 each had molybdenum concentrations above UTL in two to three of the samples, consistent with several other deep zone wells both inside and outside of the chromium plume, as discussed in the RFI/RI Volume 2 Report. The bedrock well MW-48 had concentrations consistently below the UTL and within the range of concentrations observed in other bedrock wells.

There is no established ARAR for molybdenum. The elevated average molybdenum concentrations at the site are found at shallow well MW-10, near the site of the historical Cr(VI) discharge, and at deep wells in the MW-38 cluster (Bat Cave Wash) and MW-44 and MW-46 clusters (floodplain), as shown on Figure 2-13.

While the elevated molybdenum distribution within the plume area is inconsistent, with very low levels in wells down the wash from SWMU 1, there are enough plume wells with elevated molybdenum to suggest that the potential for facility contribution to groundwater cannot be ruled out at this time.

As discussed in the RFI/RI Volume 2 Report, several incidental spills have occurred at the facility, resulting in wastewater being temporarily released in Bat Cave Wash. The molybdenum concentration in the only available wastewater sample was 6,700 µg/L (Table 3-14 in CH2M HILL, 2007). Unlike arsenic, molybdenum is mobile under the aerobic geochemical conditions in the unsaturated zone, and would be expected to move with the water with relatively minimal attenuation. Although molybdenum concentrations in numerous non-plume wells also exceed the UTL (Figure 2-13), it cannot be eliminated as a COPC in groundwater associated with SWMU 1/AOC 1. The data collected for the Addendum Report therefore support the conclusions of the RFI/RI Volume 2 Report.

Selenium. Concentrations of selenium remained consistent with previous ranges. Well TW-1 remained the only site well with concentrations significantly above the UTL of 10.3 µg/L and ARAR of 50 µg/L, although none of the post-October 2007 samples from this well exceeded the well's previous maximum concentration of 155 µg/L (Table 2-5). Evaluation of the TW-1 chromium and selenium data contained within Table 2-5 indicates that the fluctuations in chromium concentrations tracked with changing selenium concentrations. One sample from well MW-24A exceeded the ARAR of 50 µg/L (50.7 µg/L on March 12, 2008), while the other two samples from this well were near or below the reporting limit of 5 µg/L. It is suspected that either colloidal material or a temporary change in groundwater flow was responsible for the elevated concentration in the March 2008 sample from MW-24A. The only previous selenium analysis for well MW-24A was for an unfiltered sample collected in July 2007 as baseline data for the Upland *in situ* Pilot Study. The reported unfiltered concentration was 3.36 µg/L. Although well MW-24A is located in the Upland In Situ Pilot Study area, the reducing conditions introduced by testing would be expected to further limit selenium mobility rather than enhance mobility (Frankenberger and Benson, 1994). Groundwater recirculation and injection of carbon substrate in the Upland *in situ* Pilot Study area began on March 5, 2008.

Among the nine wells besides MW-24A not previously sampled for selenium, MW-26 and MW-51 had selenium concentrations above the UTL in all three of their samples (Table 2-5), although none of the samples exceeded the selenium ARAR. Note that these wells are shallow and deep wells from the same cluster location (Figure 2-14). No UTL exceedances were observed in the other seven newly sampled wells.

The wells with elevated selenium within the chromium plume (TW-1, MW-24A/B, MW-26/51, and MW-20-130) correlate with some of the higher chromium concentrations on the site in the shallow, middle, and deep zones. All of these wells have chromium concentrations greater than 1,000 ug/L (see Figure 2-7a, b, and c), and are therefore considered central plume wells.

As stated in the RFI/RI Volume 2 Report, PG&E interprets the pattern of average selenium concentrations as influenced by colloidal material and not suggesting a clear source. DTSC interprets additional selenium results in the Addendum data set to possibly form a pattern that suggests a plume (see Figure 2-14). DTSC postulates that the updated average values further support their conclusion that selenium is a COPC related to SWMU 1/AOC 1 activities, and has directed PG&E to designate selenium as such. The additional Title 22 metals data that have been collected and reported in the Addendum and the conclusion to consider selenium as a COPC related to SWMU 1/AOC 1 activities and carry it forward through the RCRA/CERCLA process has not changed.

Vanadium. Concentrations of vanadium that exceed the background UTL of 59.9 µg/L are limited to one or two isolated samples from wells spread across the site. As shown on Figure 2-15, not one well average exceeds the UTL. Among the six wells not previously sampled for vanadium, four were non-detect in all three sampling rounds (Table 2-5). The other two wells, the deep well MW-44-115 and the bedrock well MW-48, showed vanadium concentrations between non-detect and 17.3 µg/L.

Similar to other trace metals, the distribution of vanadium does not suggest a source associated with the Bat Cave Wash discharges. There was no documented use of vanadium at the facility, and no monitoring well has produced samples consistently above UTL. Based on these observations, vanadium is not recommended to be a COPC in groundwater related to SWMU 1/AOC 1.

Manganese, Beryllium, and Antimony. These metals were discussed in RFI/RI Volume 2, where it was concluded that none of their distributions suggested a plume associated with SWMU 1 /AOC 1 or SWMU 2. Additional data were collected for these metals during the Addendum period, and are summarized below. The Addendum data support the conclusions of the RFI/RI Volume 2 Report.

In the Addendum data set, manganese was only analyzed in samples from the Arizona well clusters MW-54, MW-55 and MW-56. All samples were below the background UTL of 1,320 µg/L with the exception of the sample from MW-54-140, which had a concentration of 1,410 µg/L. This well is screened in fluvial material and has shown reducing conditions since installation. These findings are consistent with those of the RFI/RI Volume 2 report, which noted that naturally occurring manganese concentrations above UTL were nearly exclusively found in floodplain wells under reducing conditions.

Beryllium was only detected in one sample out of 41 in the Addendum data set. The one detection was 1.1 µg/L, just slightly above the reporting limit of 1 µg/L, in a sample from well MW-43-25. The other two samples from this well analyzed for beryllium were below reporting limit. The data are consistent with those reported in the RFI/RI Volume 2 report, and therefore the conclusions remain unchanged.

Antimony was not detected in any of the 41 samples in the addendum data set. The conclusions of the RFI/RI Volume 2 Report regarding antimony are supported by these data.

2.3.3 Other Inorganic Constituents

2.3.3.1 Nitrate

Citing the fact that there are nitrate concentrations that exceed ARARs within the plume area, DTSC has requested a concentration distribution map be added for nitrate in the same format as for the other COPCs. It is included in this report as Figure 2-16. Nitrate concentrations were discussed in Section 5.3.1.6 of the RFI/RI Volume 2 Report, but a map was not included in the report. The only nitrate data collected between November 2007 and July 2008 were for the Arizona well clusters MW-54, MW-55, and MW-56.

As shown on Figure 2-16, most average concentrations of nitrate are below the background UTL of 5.03 mg/L (expressed as nitrogen). This is especially true in the shallow and middle-depth floodplain area, where predominantly reducing conditions favor the reduction of nitrate to either nitrogen gas or ammonia. Concentrations elevated above the UTL and in some cases above the ARAR of 10 mg/L are found in the alluvial zone of the aquifer along the mountain front recharge areas (i.e. southern Bat Cave Wash and the New Evaporation Ponds). As discussed in the RFI/RI Volume 2 Report, there are several potential sources of nitrate, including concentration by lightning in rainfall, disruption of desert pavement, blasting materials from nearby quarries and roadway construction, animal grazing, and evaporative concentration in industrial wastewater (CH2M HILL, 2009a). Mountain front recharge areas receive the most concentrated precipitation recharge from local thunderstorm events, and both the New Evaporation Ponds wells (MW-1 through MW-8) and upper Bat Cave Wash area wells (MW-9 through MW-11, MW-24 cluster, MW-38S, and upland *in situ* pilot study wells) represent nearly all of the elevated nitrate concentrations found at the site. In the case of the New Evaporation Ponds, elevated nitrate cannot be attributed to leakage of concentrated brine, because the shallow groundwater TDS is relatively low here (300 to 980 mg/L).

DTSC concludes that nitrate is a COPC related to SWMU 1/ AOC 1 activities, and has directed PG&E to designate nitrate as such. Although multiple potential sources exist for elevated nitrate in groundwater, it cannot be eliminated as a COPC.

TABLE 2-1

Summary of Drilling and Well Installation, Arizona Groundwater Investigation
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

Well ID	Monitoring Zone [1]	Well Type	Date Installed	Ground Surface Elevation (feet msl)	Screen Interval (MLABS sampler) (feet bgs)	Well Construction [2]	Borehole Depth (feet bgs)	Borehole Depth (feet drilled along slant)
MW-54-085	DA - fluvial	Vertical nested well pair	3/28/2008	466.39	77-87	2" Sch 40 PVC	147	---
MW-54-140	DA - fluvial	Vertical nested well pair	3/28/2008	466.39	128-138	2" Sch 40 PVC	147	---
MW-54-195	DA - alluvial	Vertical well	3/20/2008	466.28	185-195	2" Sch 80 PVC	237	---
MW-55-045	MA - alluvial	Vertical nested well pair	4/1/2008	463.57	37-47	2" Sch 40 PVC	137	---
MW-55-120	DA - alluvial	Vertical nested well pair	4/1/2008	463.57	108-118	2" Sch 80 PVC	137	---
MW-56S	SA - fluvial	Slant multilevel well [3]	4/20/2008	459.93	33.5-35.5	MLABS samplers with 10' filter-pack intervals	111.5	223
MW-56M	DA - fluvial	Slant multilevel well [3]	4/20/2008	459.93	73.5-75.5	MLABS samplers with 10' filter-pack intervals	111.5	223
MW-56D	DA - fluvial	Slant multilevel well [3]	4/20/2008	459.93	103.5-105.5	MLABS samplers with 10' filter-pack intervals	111.5	223

NOTES:

[1] Monitoring zones:
SA: Shallow zone of the Alluvial Aquifer completed in alluvial fan deposits (alluvial) or Colorado River deposits (fluvial)
MA: Mid-depth zone of the Alluvial Aquifer completed in alluvial fan deposits (alluvial) or Colorado River deposits (fluvial)
DA: Deep zone of the Alluvial Aquifer completed in alluvial fan deposits (alluvial) or Colorado River deposits (fluvial)

[2] Vertical wells constructed of poly vinyl chloride (PVC) casing and well screen.
MLABS = Multilevel Angled Borehole System (patented by BESST, Inc.)

[3] Slant boring for MW-56 multilevel well drilled 30 degrees from horizontal at azimuth bearing 270 degrees.

(---)	not applicable
feet bgs	feet below ground surface (datum is ground surface at top of borehole)
msl	mean sea level

See Appendix B for well survey data, drilling and continous core logs prepared for deep borings MW-54, MW-55 and MW-56.

TABLE 2-2

Chromium and Groundwater Quality Parameter Results for Arizona Monitoring Wells, April through September 2008

RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)

PG&E Topock Compressor Station, Needles, California

		Lab Data		**Field Data**						
Location	**Sampling Date**	**Chromium (total) (µg/L)**	**Hexavalent Chromium (µg/L)**	**Specific Conductance (µS/cm)**	**Temperature (°C)**	**pH (pH units)**	**ORP (mV)**	**Dissolved Oxygen (mg/L)**	**Salinity (%)**	**Turbidity (NTU)**
MW-54-085	15-Apr-08	ND (1.0)	ND (0.2)	10,100	25.9	7.67	-202	0.20	0.565	16.0
MW-54-085	03-Jun-08	ND (1.0)	ND (0.2)	11,500	25.8	7.45	-139	0.26	0.741	4.00
MW-54-085	09-Jul-08	ND (1.0)	ND (0.2)	10,900	25.9	7.39	-178	0.17	0.705	1.00
MW-54-085	19-Aug-08	ND (1.0)	ND (0.2)	11,400	26.5	7.35	-159	0.16	0.735	4.00
MW-54-085	04-Sep-08	ND (1.0)	ND (0.2)	10,900	26.1	7.25	-151	0.20	0.616	1.00
MW-54-140	14-Apr-08	ND (1.0)	ND (0.2)	12,400	25.0	7.66	-162	0.16	0.71	5.00
MW-54-140	03-Jun-08	ND (1.0)	ND (0.2)	13,900	24.9	7.70	-139	0.20	0.898	1.70
MW-54-140	09-Jul-08	ND (1.0)	ND (1.0)	13,300	25.1	7.72	-164	0.20	0.859	3.00
MW-54-140	19-Aug-08	ND (1.0)	ND (1.0)	13,800	26.6	7.73	-126	0.13	0.892	4.00
MW-54-140	04-Sep-08	ND (1.0)	ND (1.0)	13,400	25.4	7.76	-154	0.20	0.773	1.00
MW-54-195	14-Apr-08	ND (1.0)	ND (1.0)	21,800	25.1	8.18	-202	0.15	1.31	4.00
MW-54-195	03-Jun-08	ND (1.0)	ND (1.0)	21,500	24.9	8.22	-199	0.13	1.39	8.84
MW-54-195	09-Jul-08	ND (1.0)	ND (1.0)	20,300	25.1	8.09	-210	0.11	1.31	4.00
MW-54-195	19-Aug-08	ND (1.0)	ND (1.0)	20,800	26.2	7.94	-172	0.19	1.35	22.0
MW-54-195	04-Sep-08	ND (1.0)	ND (1.0)	19,500	25.4	7.45	-184	0.33	1.19	3.00
MW-55-045	15-Apr-08	ND (1.0)	ND (0.2)	1,580	22.9	8.08	-222	0.13	0.079	26.0
MW-55-045	03-Jun-08	ND (1.0)	ND (0.2)	1,700	27.6	7.66	-176	0.09	0.11	3.00
MW-55-045	08-Jul-08	ND (1.0)	ND (1.0)	1,580	27.9	7.77	-179	0.11	0.102	7.00
MW-55-045	18-Aug-08	ND (1.0)	ND (0.2)	1,630	27.9	7.54	-187	0.15	0.106	26.0
MW-55-045	03-Sep-08	ND (1.0)	ND (0.2)	1,540	28.2	7.40	-167	0.19	0.077	21.0
MW-55-120	15-Apr-08	ND (1.0)	ND (0.2)	8,940	28.6	8.10	-206	0.17	0.497	7.00
MW-55-120	03-Jun-08	ND (1.0)	ND (0.2)	9,810	28.5	7.91	-170	0.23	0.634	4.68
MW-55-120	08-Jul-08	ND (1.0)	ND (0.2)	8,990	28.7	7.90	-169	0.09	0.581	2.00
MW-55-120	18-Aug-08	ND (1.0)	ND (0.2)	2,430	28.0	7.86	-249	0.20	0.157	25.0
MW-55-120	03-Sep-08 *	ND (1.0)	0.60 J	*	*	*	*	*	*	*
MW-55-120	03-Sep-08	1.17	0.614	8,500	28.7	7.61	-81.8	0.18	0.50	21.0
MW-56S	29-Apr-08	ND (1.0)	ND (0.2)	6,760	22.3	7.39	-214	0.00	0.37	0.60
MW-56S	04-Jun-08	ND (1.0)	ND (0.2)	7,220	22.1	7.95	-173	0.23	0.467	1.30
MW-56S	09-Jul-08	ND (1.0)	ND (0.2)	7,110	22.3	7.29	-118	0.33	0.46	2.00
MW-56S	18-Aug-08	ND (1.0)	ND (0.2)	7,230	23.2	7.36	-139	0.25	0.467	21.0
MW-56S	03-Sep-08	ND (1.0)	ND (0.2)	6,880	22.4	6.78	-127	2.69	0.378	24.0

TABLE 2-2

Chromium and Groundwater Quality Parameter Results for Arizona Monitoring Wells, April through September 2008
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

		Lab Data		**Field Data**						
Location	**Sampling Date**	**Chromium (total) (µg/L)**	**Hexavalent Chromium (µg/L)**	**Specific Conductance (µS/cm)**	**Temperature (°C)**	**pH (pH units)**	**ORP (mV)**	**Dissolved Oxygen (mg/L)**	**Salinity (%)**	**Turbidity (NTU)**
MW-56M	29-Apr-08	ND (1.0)	ND (0.2)	18,700	23.0	7.38	-228	0.30	1.15	0.70
MW-56M	04-Jun-08	ND (1.0)	ND (0.2)	18,900	22.3	7.56	-210	0.02	1.22	4.10
MW-56M	09-Jul-08	ND (1.0)	ND (1.0)	20,500	24.0	7.53	-173	0.27	1.33	2.00
MW-56M	18-Aug-08	ND (1.0)	ND (1.0)	15,100	25.3	7.38	-133	7.01	0.975	34.0
MW-56M	03-Sep-08	ND (1.0)	ND (1.0)	14,800	26.1	7.58	-157	7.44	0.857	25.0
MW-56D	29-Apr-08	ND (5.0)	ND (1.0)	24,500	23.3	8.00	-181	3.50	1.50	0.70
MW-56D	04-Jun-08	ND (1.0)	ND (1.0)	21,900	22.7	7.91	-146	6.52	1.41	1.22
MW-56D	09-Jul-08	ND (1.0)	ND (5.0)	21,500	24.2	7.92	-142	3.30	1.39	1.00
MW-56D	18-Aug-08	ND (1.0)	ND (1.0)	22,600	29.9	7.75	-154	6.68	1.46	22.0
MW-56D	03-Sep-08	ND (1.0)	ND (1.0)	28,000	25.9	7.45	-138	7.00	1.74	17.0

NOTES:

µg/L	dissolved metals concentrations in micrograms per liter
µS/cm	microSiemens per centimeter
°C	degree centigrade
ORP	oxidation reduction potential, results rounded off to whole point
mV	millivolts
mg/L	milligrams per liter
%	percentage
NTU	Nephelometric Turbidity Unit
ND	not detected at listed reporting limit

* Split samples analyzed at Truesdail Laboratory for confirmation purposes. No additional field parameters are associated with this sample.

TABLE 2-3

General Chemistry Groundwater Results for Arizona Monitoring Wells
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

		Dissolved Metals																	
Loc ID	**Sample Date**	**Sodium (mg/L)**	**Potassium (mg/L)**	**Calcium (mg/L)**	**Magnesium (mg/L)**	**Manganese (mg/L)**	**Iron (mg/L)**	**Alkalinity, as carbonate (mg/L)**	**Alkalinity, bicarbonate as CaCo3 (mg/L)**	**Alkalinity, total as CaCO3 (mg/L)**	**Chloride (mg/L)**	**Sulfate (mg/L)**	**Nitrate as nitrogen (mg/L)**	**Total Dissolved Solids (mg/L)**	**Total Organic Carbon (mg/L)**	**Ammonia as nitrogen (mg/L)**	**Total Kjeldahl Nitrogen (mg/L)**	**Deuterium (0/00)**	**Oxygen 18 (0/00)**
MW-54-085	15-Apr-08	1790	17.8	225	91.6	0.771	0.892	ND (5.0)	145	145	3140	351	ND (0.5)	5680 J	1.33	ND (0.5)	ND (0.5)	-82.8	-11.5
MW-54-140	14-Apr-08	2550	19.3	135	14.8	1.41	ND (0.5)	ND (5.0)	110	110	3920	498	ND (0.5)	6900	3.26	ND (0.5)	ND (0.5)	-85.3	-12
MW-54-195	14-Apr-08	5020	39.2	131	5.90	0.837	ND (0.5)	ND (5.0)	55.0	55.0	7150	1100	ND (0.5)	13000	5.01	ND (0.5)	ND (0.5)	-86.1	-12.4
MW-55-045	15-Apr-08	267	8.63	32.7	9.48	0.547	ND (0.5)	ND (5.0)	195	195	315	74.9	ND (0.5)	865 J	2.77	ND (0.5)	ND (0.5)	-80.1	-11.4
MW-55-120	15-Apr-08	1780	27.6	136	8.21	0.935	ND (0.5)	ND (5.0)	70.0	70.0	2750	290	ND (0.5)	4870 J	4.09	ND (0.5)	ND (0.5)	-81	-11.3
MW-56S	29-Apr-08	1240	13.6	88.9	34.5	0.787	2.59	ND (5.0)	520	520	1550	396	ND (0.5)	3770	6.97	ND (0.5)	ND (0.5)	-77.2	-10
MW-56M	29-Apr-08	2530	19.0	285	73.6	0.754	3.98	ND (5.0)	423	423	3690	931	ND (0.5)	8140	6.15	ND (0.5)	0.574	-84.3	-10.9
MW-56D	29-Apr-08	4360	35.5	343	65.5	ND (2.5)	ND (2.5)	ND (5.0)	105	105	6640	946	ND (0.5)	12400	4.79	ND (0.5)	ND (0.5)	-85.3	-11.2

NOTES:

ND	not detected at listed reporting limit
mg/L	milligrams per liter
0/00	differences from global standard in parts per thousand
J	concentration or RL (reporting limit) estimated by laboratory or data validation

TABLE 2-4

Groundwater Analytical Results for Chromium, October 2007 through September 2008
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

Well ID	Monitoring Zone[1]	Sample Date	Hexavalent Chromium (µg/L)	Total Chromium (µg/L)
Groundwater Monitoring Wells				
MW-9	SA	10/04/2007	304	304
MW-10	SA	10/02/2007	1,010	1,050
MW-12	SA	10/04/2007	2,970	2,800
		05/05/2008	2,580	2,800
MW-13	SA	10/02/2007	21.8	23.6
MW-14	SA	10/02/2007	27.2	31.2
MW-15	SA	10/02/2007	12.2	12.5
MW-16	SA	10/02/2007	8.80	9.70
MW-17	SA	10/03/2007	6.50	7.30
MW-18	SA	10/02/2007	27.9	27.5
MW-19	SA	10/05/2007	1,390	1,510
MW-20-70	SA	10/11/2007	2,400	2,140
MW-20-100	MA	10/10/2007	9,000	10,700
MW-20-130	DA	10/05/2007	12,200	13,000
MW-21	SA	10/04/2007	ND (5.0)	ND (1.0)
		05/06/2008	ND (1.0)	3.01
MW-22	SA	10/10/2007	ND (1.0)	ND (1.0)
MW-23	BR-Tmc	10/04/2007	19.2	22.2
		05/06/2008	23.2	23.0
MW-24BR	BR-pTbr	10/04/2007	ND (1.0)	ND (1.0)
		05/08/2008	ND (1.0)	2.40
MW-25	SA	10/02/2007	933	884
MW-26	SA	10/02/2007	3,510	3,740
MW-27-20	SA	10/02/2007	ND (0.2)	2.20
MW-27-60	MA	10/02/2007	ND (0.2)	ND (1.0)
MW-27-85	DA	10/02/2007	ND (1.0)	ND (1.0)
		05/06/2008	ND (1.0)	ND (1.0)
MW-28-25	SA	10/04/2007	ND (1.0)	ND (1.0)
MW-28-90	DA	10/04/2007	ND (1.0)	ND (1.0)
		05/07/2008	ND (0.2)	ND (1.0)
MW-29	SA	10/04/2007	ND (1.0)	ND (1.0)
MW-30-30	SA	10/08/2007	ND (1.0)	ND (1.0)
MW-31-60	SA	10/04/2007	726 J	669
MW-33-40	SA	10/05/2007	ND (0.2)	1.10
		05/05/2008	ND (0.2)	ND (1.0)
MW-33-90	MA	10/05/2007	18.2	19.4
		05/05/2008	21.1	20.2
MW-33-150	DA	10/09/2007	9.40	8.30
		05/06/2008	8.83	9.21
MW-33-210	DA	10/05/2007	11.9	11.5
		05/05/2008	10.6	9.93
MW-34-55	MA	10/03/2007	ND (0.2)	ND (1.0)
MW-34-80	DA	10/03/2007	ND (0.2)	ND (1.0)
		05/06/2008	ND (0.2)	ND (1.0)
MW-34-100	DA	10/03/2007	521	609 J
		05/06/2008	238	228

TABLE 2-4
Groundwater Analytical Results for Chromium, October 2007 through September 2008
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

Well ID	Monitoring Zone[1]	Sample Date	Hexavalent Chromium (µg/L)	Total Chromium (µg/L)
Groundwater Monitoring Wells				
MW-36-20	SA	10/03/2007	ND (1.0)	ND (1.0)
MW-36-40	SA	10/03/2007	ND (1.0)	ND (1.0)
MW-36-50	MA	10/10/2007	ND (0.2)	2.00
MW-36-70	MA	10/09/2007	ND (0.2)	ND (1.0)
MW-36-90	DA	10/09/2007	3.20	2.90
MW-36-100	DA	10/10/2007	228	196
MW-37S	MA	10/04/2007	7.70	7.50
MW-37D	DA	10/04/2007	834	794
MW-39-40	SA	10/08/2007	ND (1.0)	ND (1.0)
MW-39-50	MA	10/08/2007	ND (0.2)	ND (1.0)
MW-39-60	MA	10/08/2007	ND (0.2)	ND (1.0)
MW-39-70	MA	10/08/2007	5.50	6.20
MW-39-80	DA	10/08/2007	58.6	48.3
MW-39-100	DA	10/10/2007	1,660	1,840
MW-40S	SA	10/04/2007	5.70	7.40
MW-40D	DA	10/04/2007	112	104
MW-41S	SA	10/03/2007	19.6	18.2
MW-41M	DA	10/03/2007	10.5	8.80
MW-41D	DA	10/03/2007	ND (1.0)	1.30
MW-42-30	SA	10/04/2007	ND (1.0)	ND (1.0)
MW-42-55	MA	10/04/2007	ND (1.0)	ND (1.0)
		05/06/2008	ND (1.0)	ND (1.0)
MW-42-65	MA	10/03/2007	ND (1.0)	ND (1.0)
		05/06/2008	ND (1.0)	ND (1.0)
MW-43-25	SA	10/02/2007	ND (1.0)	ND (1.0)
MW-43-75	DA	10/02/2007	ND (1.0)	ND (1.0)
MW-43-90	DA	10/02/2007	ND (1.0)	ND (1.0)
MW-44-70	MA	10/04/2007	ND (0.2)	ND (1.0)
		05/07/2008	ND (0.2)	ND (1.0)
MW-44-115	DA	10/04/2007	783	866
		05/08/2008	620	590
MW-44-125	DA	10/04/2007	314	347
		05/08/2008	253	342
MW-46-175	DA	10/05/2007	100	86.7
		05/07/2008	77.9	74.7
MW-46-205	DA	10/05/2007	3.70	4.60
		05/07/2008	4.52	4.25
MW-47-55	SA	10/04/2007	61.9	59.2
		05/07/2008	34.8	32.7
MW-47-115	DA	10/04/2007	11.6	12.2
		05/07/2008	18.2	18.3
MW-48	BR-Tmc	10/04/2007	ND (1.0)	ND (1.0)
		05/07/2008	ND (1.0)	1.40
MW-49-135	DA	10/10/2007	ND (1.0)	2.80
MW-49-275	DA	10/09/2007	ND (1.0)	ND (1.0)

Well ID	Monitoring Zone[1]	Sample Date	Hexavalent Chromium (µg/L)	Total Chromium (µg/L)
Groundwater Monitoring Wells				
MW-49-365	DA	10/09/2007	ND (2.0)	ND (1.0)
MW-50-095	MA	10/04/2007	217	216
		05/07/2008	164	192
MW-50-200	DA	10/04/2007	9,430	9,780
		05/08/2008	10,500	11,000
MW-51	MA	10/05/2007	4,500	4,340
MW-52S	MA	10/11/2007	ND (1.0)	ND (1.0)
		05/07/2008	ND (1.0)	ND (1.0)
MW-52M	DA	10/11/2007	ND (1.0)	ND (1.0)
		05/07/2008	ND (1.0)	ND (1.0)
MW-52D	DA	10/11/2007	ND (1.0)	ND (1.0)
		05/07/2008	ND (1.0)	ND (1.0)
MW-53M	DA	10/11/2007	ND (1.0)	ND (1.0)
		05/07/2008	ND (1.0)	ND (1.0)
MW-53D	DA	10/11/2007	ND (2.0)	2.30 J
		05/07/2008	ND (1.0)	ND (1.0)
MW-54-85	DA	04/15/2008	ND (0.2)	ND (1.0)
		06/03/2008	ND (0.2)	ND (1.0)
		07/09/2008	ND (0.2)	ND (1.0)
		08/19/2008	ND (0.2)	ND (1.0)
		09/04/2008	ND (0.2)	ND (1.0)
MW-54-140	DA	04/14/2008	ND (0.2)	ND (1.0)
		06/03/2008	ND (0.2)	ND (1.0)
		07/09/2008	ND (1.0)	ND (1.0)
		08/19/2008	ND (1.0)	ND (1.0)
		09/04/2008	ND (1.0)	ND (1.0)
MW-54-195	DA	04/14/2008	ND (1.0)	ND (1.0)
		06/03/2008	ND (1.0)	ND (1.0)
		07/09/2008	ND (1.0)	ND (1.0)
		08/19/2008	ND (1.0)	ND (1.0)
		09/04/2008	ND (1.0)	ND (1.0)
MW-55-45	MA	04/15/2008	ND (0.2)	ND (1.0)
		06/03/2008	ND (0.2)	ND (1.0)
		07/08/2008	ND (1.0)	ND (1.0)
		08/18/2008	ND (0.2)	ND (1.0)
		09/03/2008	ND (0.2)	ND (1.0)
MW-55-120	DA	04/15/2008	ND (0.2)	ND (1.0)
		06/03/2008	ND (0.2)	ND (1.0)
		07/08/2008	ND (0.2)	ND (1.0)
		08/18/2008	ND (0.2)	ND (1.0)
		09/03/2008	0.614	1.17
MW-56S	SA	04/29/2008	ND (0.2)	ND (1.0)
		06/04/2008	ND (0.2)	ND (1.0)
		07/09/2008	ND (0.2)	ND (1.0)
		08/18/2008	ND (0.2)	ND (1.0)
		09/03/2008	ND (0.2)	ND (1.0)
MW-56M	DA	04/29/2008	ND (0.2)	ND (1.0)

TABLE 2-4

Groundwater Analytical Results for Chromium, October 2007 through September 2008
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

Well ID	Monitoring Zone[1]	Sample Date	Hexavalent Chromium (µg/L)	Total Chromium (µg/L)
Groundwater Monitoring Wells				
MW-56M	DA	06/04/2008	ND (0.2)	ND (1.0)
		07/09/2008	ND (1.0)	ND (1.0)
		08/18/2008	ND (1.0)	ND (1.0)
		09/03/2008	ND (1.0)	ND (1.0)
MW-56D	DA	04/29/2008	ND (1.0)	ND (5.0)
		06/04/2008	ND (1.0)	ND (1.0)
		07/09/2008	ND (5.0)	ND (1.0)
		08/18/2008	ND (1.0)	ND (1.0)
		09/03/2008	ND (1.0)	ND (1.0)
CW-1M	MA	10/17/2007	3.90 J	4.81
CW-1D	DA	10/17/2007	ND (0.2)	1.05
CW-2M	MA	10/18/2007	14.5	15.1
CW-2D	DA	10/18/2007	ND (1.0)	1.55
CW-3M	MA	10/18/2007	11.8	11.9
CW-3D	DA	10/18/2007	2.50	2.63
CW-4M	MA	10/18/2007	21.0	21.7
CW-4D	DA	10/18/2007	3.40	3.73
OW-1S	SA	10/16/2007	21.6	19.7
OW-1M	MA	10/16/2007	1.10	ND (1.0)
OW-1D	DA	10/16/2007	1.00	1.15
OW-2S	SA	10/17/2007	34.1	33.6
OW-2M	MA	10/16/2007	1.20	1.11
OW-2D	DA	10/17/2007	ND (0.2)	ND (1.0)
OW-3S	SA	10/03/2007	22.3	21.8
OW-3M	MA	10/03/2007	16.5 J	18.5
OW-3D	DA	10/03/2007	3.90	4.20
OW-5S	SA	10/17/2007	26.3	25.6
OW-5M	DA	10/17/2007	ND (1.0)	ND (1.0)
OW-5D	DA	10/17/2007	ND (0.2)	1.38
PGE-7BR	BR-pTbr	12/19/2007	ND (1.0)	ND (1.0)
		05/08/2008	ND (1.0)	ND (1.0)
Extraction, Test & Injection Wells				
PE-1	DA	10/03/2007	52.6	45.4
TW-1	SA-MA-DA	10/11/2007	4,610	4,220
TW-2S	SA-MA	10/04/2007	1,250	1,220
TW-2D	DA	10/04/2007	210	228
TW-3D	DA	10/03/2007	2,000	1,860
TW-4	DA	10/03/2007	33.6	32.7
		05/08/2008	22.6	23.2
TW-5	DA	10/04/2007	6.60	7.50
Water Supply Wells				
Park Moabi-3	MA	10/04/2007	ND (1.0)	ND (1.0) *
Park Moabi-4	MA	10/04/2007	21.4	23.5 *

TABLE 2-4

Groundwater Analytical Results for Chromium, October 2007 through September 2008
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

Notes:

Results shown are maximum concentrations in primary and duplicate samples for listed sampling events used for 2008 updated groundwater chromium characterization.

Groundwater samples collected using conventional casing volume purge method.

Samples which were analyzed for dissolved chromium (total) were field-filtered, except where noted.

[1] Monitoring Zone:
SA - Shallow zone of the Alluvial Aquifer
MA - Mid-depth zone of the Alluvial Aquifer
DA - Deep zone of the Alluvial Aquifer
BR-Tmc - Bedrock well, completed in Miocene Conglomerate
BR-pTbr - Bedrock well, completed in pre-Tertiary crystalline bedrock

ND	not detected at listed reporting limit
J	concentration or reporting limit estimated by laboratory or data validation
µg/L	micrograms per liter
*	total metal concentrations from samples that were not filtered

TABLE 2-5
Title 22 Metals Results, December 2007 through May 2008
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

	Chemical-Specific ARARs:	6	10	1,000	4	5	NE	50	1,000	15	2	NE	100	50	100	2	NE	5,000
	Background UTL:	1.22	24.3	195	0.663	---[a]	0.843	34.1	10.5	1.91	---[a]	36.3	10.6	10.3	2.13	0.908	59.9	77.7
Well ID	**Sample Date**	**Antimony**	**Arsenic**	**Barium**	**Beryllium**	**Cadmium**	**Cobalt**	**Chromium**	**Copper**	**Lead**	**Mercury**	**Molybdenum**	**Nickel**	**Selenium**	**Silver**	**Thallium**	**Vanadium**	**Zinc**
MW-10	03/11/2008	ND (3.0)	ND (5.0)	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	**473**	ND (10)	ND (2.0)	ND (0.2)	68.3	ND (20)	5.17	ND (5.0)	ND (1.0)	29.8	ND (20)
MW-12	12/13/2007	ND (3.0)	**75.4**	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	**2,930**	ND (10)	ND (2.0)	ND (0.2)	19.3	ND (20)	8.00	ND (5.0)	ND (1.0)	34.1	ND (20)
	03/10/2008	ND (3.0)	**66.1**	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	**2,860**	ND (10)	ND (2.0)	ND (0.2)	19.6	ND (20)	6.59	ND (5.0)	ND (1.0)	26.3	22.1
	05/05/2008	ND (3.0)	**62.0**	ND (500)	ND (1.0)	ND (2.0)	ND (5.0)	**2,800**	ND (10)	ND (5.0)	ND (0.2)	19.0	ND (20)	6.02	ND (5.0)	ND (10)	17.0	34.4
MW-21	12/11/2007	ND (3.0)	ND (5.0)	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	ND (1.0)	ND (10)	ND (2.0)	ND (0.2)	38.2	ND (20)	16.2	ND (5.0)	ND (1.0)	ND (5.0)	ND (20)
	03/11/2008	ND (3.0)	ND (5.0)	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	1.80	ND (10)	ND (2.0)	ND (0.2)	39.6	ND (20)	38.0	ND (5.0)	ND (1.0)	ND (5.0)	ND (20)
	05/06/2008	ND (5.0)	ND (5.4)	ND (500)	ND (1.0)	ND (2.0)	ND (5.0)	3.01	ND (10)	ND (5.0)	ND (0.2)	52.0	ND (20)	12.0	ND (5.0)	ND (1.0)	6.20	ND (20)
MW-22	12/17/2007	ND (3.0) ^	**11.7** ^	ND (300)	ND (1.0) ^	ND (2.0) ^	5.00 ^	1.50	ND (10)	ND (2.0)	ND (0.2) ^	31.6	ND (20)	ND (5.0) ^	ND (5.0) ^	ND (1.0) ^	ND (5.0)	ND (20)
	03/11/2008	ND (3.0)	5.51	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	ND (1.0)	22.6	ND (2.0)	ND (0.2)	36.4	ND (20)	ND (5.0)	ND (5.0)	ND (1.0)	ND (5.0)	ND (20)
	07/29/2008	ND (3.0)	**13.8**	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	ND (1.0)	ND (10)	ND (2.0)	0.40 J	48.2	ND (20)	ND (5.0)	ND (5.0)	ND (1.0)	ND (5.0)	ND (20)
MW-23	12/11/2007	ND (3.0) ^	ND (5.0) ^	ND (300)	ND (1.0) ^	ND (2.0) ^	ND (5.0) ^	40.1	ND (10)	ND (2.0)	ND (0.2) ^	ND (5.0)	ND (20)	6.10 ^	ND (5.0) ^	ND (1.0) ^	ND (5.0)	ND (20)
	03/10/2008	ND (3.0)	ND (5.0)	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	24.3	ND (10)	ND (2.0)	ND (0.2)	6.01	ND (20)	5.44	ND (5.0)	ND (1.0)	ND (5.0)	ND (20)
	03/11/2008	ND (3.0)	ND (5.0)	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	39.6	ND (10)	4.26	ND (0.2)	ND (5.0)	ND (20)	6.14	ND (5.0)	ND (1.0)	ND (5.0)	ND (20)
	05/06/2008	ND (5.0)	ND (5.0)	ND (500)	ND (1.0)	ND (2.0)	ND (5.0)	22.0	ND (10)	ND (5.0)	ND (0.2)	15.0	ND (20)	10.9	ND (5.0)	ND (2.0)	ND (5.0)	21.0
FD	05/06/2008	ND (5.0)	ND (5.0)	ND (500)	ND (1.0)	ND (2.0)	ND (5.0)	23.0	ND (10)	ND (5.0)	ND (0.2)	14.0	ND (20)	7.68	ND (5.0)	ND (1.0)	ND (5.0)	23.0
MW-24A	12/12/2007	ND (3.0) ^	ND (5.0)	ND (300)	ND (1.0) ^	ND (2.0) ^	ND (5.0) ^	**3,300**	ND (10)	ND (2.0)	ND (0.2) ^	39.7	ND (20)	ND (5.0) ^	ND (5.0) ^	ND (1.0) ^	27.3	ND (20)
	03/12/2008	ND (3.0)	**10.8**	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	**2,000**	ND (10)	ND (2.0)	ND (0.2)	29.6	ND (20)	**50.7**	ND (5.0)	ND (1.0)	7.18	ND (20)
	05/08/2008	ND (5.0)	**33.6**	944	ND (1.0)	ND (2.0)	ND (5.0)	10.0	ND (10)	ND (5.0)	ND (0.2)	11.0	ND (20)	5.29	ND (5.0)	ND (1.0)	ND (5.0)	ND (20)
MW-26	12/11/2007	ND (3.0) ^	ND (5.0) ^	ND (300)	ND (1.0) ^	ND (2.0) ^	ND (5.0) ^	**2,980**	ND (10)	ND (2.0)	ND (0.2)	34.0	ND (20)	14.4 ^	ND (5.0) ^	ND (1.0) ^	5.90	ND (20)
	03/12/2008	ND (3.0)	ND (5.0)	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	**2,560**	ND (10)	ND (2.0)	ND (0.2)	28.8	ND (20)	14.8	ND (5.0)	ND (1.0)	6.14	21.3
FD	03/12/2008	ND (3.0)	ND (5.0)	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	**2,640**	ND (10)	ND (2.0)	ND (0.2)	27.7	ND (20)	13.3	ND (5.0)	ND (1.0)	5.88	ND (20)
	05/05/2008	ND (3.0)	ND (5.0)	ND (500)	ND (1.0)	ND (2.0)	ND (5.0)	**2,600**	ND (10)	ND (5.0)	ND (0.2)	43.0	ND (20)	16.8	ND (5.0)	ND (1.0)	ND (5.0)	37.3
MW-32-35	12/10/2007	ND (3.0) ^	**19.3** ^	ND (300)	ND (1.0) ^	ND (2.0) ^	ND (5.0) ^	ND (2.0)	ND (10)	ND (2.0) ^	ND (0.2) ^	17.2 ^	ND (20)	ND (5.0) ^	ND (50) ^	ND (2.0) ^	ND (5.0) ^	ND (200)
	03/10/2008	ND (3.0)	**23.1**	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	ND (1.0)	ND (10)	ND (2.0)	ND (0.2)	13.8	ND (20)	ND (5.0)	ND (5.0)	ND (1.0)	ND (5.0)	ND (20)
	05/06/2008	ND (5.0)	ND (32)	ND (500)	ND (1.0)	ND (2.0)	ND (5.0)	1.90	ND (10)	ND (5.0)	ND (0.2)	19.0	ND (20)	7.10	ND (5.0)	ND (2.0)	ND (5.0)	ND (20)
MW-43-25	12/10/2007	ND (3.0) ^	**23.0** ^	ND (300)	ND (1.0) ^	ND (2.0) ^	ND (5.0) ^	ND (1.0)	ND (10) ^	ND (1.0) ^	ND (0.2) ^	10.8 ^	ND (20) ^	ND (5.0) ^	ND (5.0) ^	ND (1.0) ^	ND (5.0) ^	ND (20) ^
	03/10/2008	ND (3.0)	**18.9**	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	ND (1.0)	ND (10)	ND (2.0)	ND (0.2)	10.5	ND (20)	ND (5.0)	ND (5.0)	ND (1.0)	ND (5.0)	ND (20)
	05/07/2008	ND (5.0)	**24.4**	ND (500)	1.10	ND (2.0)	ND (5.0)	4.60	ND (10)	5.90	ND (0.2)	15.0	ND (20)	ND (5.0)	ND (5.0)	ND (1.0)	ND (5.0)	ND (20)
MW-44-115	12/11/2007	ND (3.0) ^	5.40 ^	ND (300) ^	ND (1.0) ^	ND (2.0) ^	ND (5.0) ^	**766**	ND (10) ^	ND (2.0) ^	ND (0.2) ^	72.9 ^	ND (20) ^	ND (5.0) ^	ND (5.0) ^	ND (1.0) ^	7.10 ^	ND (20) ^
	03/11/2008	ND (3.0)	ND (5.0)	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	**596**	ND (10)	ND (2.0)	ND (0.2)	85.6	ND (20)	ND (5.0)	ND (5.0)	ND (1.0)	6.54	ND (20)
	05/08/2008	ND (5.0)	6.93	ND (500)	ND (1.0)	ND (2.0)	ND (5.0)	**590**	ND (10)	ND (5.0)	ND (0.2)	83.0	ND (20)	ND (5.0)	ND (5.0)	ND (2.0)	6.50	38.3
MW-48	12/14/2007	ND (3.0) ^	ND (5.0) ^	ND (300) ^	ND (1.0) ^	ND (2.0) ^	ND (5.0) ^	1.10	ND (10) ^	ND (2.0) ^	ND (0.2) ^	13.6 ^	ND (20) ^	ND (5.0) ^	ND (5.0) ^	ND (1.0) ^	17.3 ^	ND (20) ^
	03/11/2008	ND (3.0)	ND (5.0)	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	2.93	ND (10)	ND (2.0)	ND (0.2)	14.3	ND (20)	ND (5.0)	ND (5.0)	ND (1.0)	7.52	ND (20)
	05/07/2008	ND (5.0)	ND (5.0)	ND (500)	ND (1.0)	ND (2.0)	ND (5.0)	1.40	ND (10)	ND (5.0)	ND (0.2)	19.0	ND (20)	5.24	ND (5.0)	ND (2.0)	ND (5.0)	ND (20)
MW-50-200	12/11/2007	ND (3.0) ^	ND (5.0) ^	ND (300) ^	ND (1.0) ^	ND (2.0) ^	ND (5.0) ^	**9,340**	ND (10) ^	ND (2.0) ^	ND (0.2) ^	44.3 ^	ND (20) ^	ND (5.0) ^	ND (5.0) ^	ND (1.0) ^	ND (5.0) ^	ND (20) ^
	03/12/2008	ND (3.0)	ND (5.0)	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	**11,800**	ND (10)	ND (2.0)	ND (0.2)	40.4	ND (20)	6.21	ND (5.0)	ND (1.0)	ND (5.0)	ND (20)
	05/08/2008	ND (3.0)	ND (5.0)	ND (500)	ND (1.0)	ND (2.0)	ND (5.0)	**11,000**	ND (10)	ND (5.0)	ND (0.2)	54.0	ND (20)	10.2	ND (5.0)	ND (2.0)	ND (5.0)	31.7
MW-51	12/11/2007	ND (3.0) ^	ND (5.0) ^	ND (300) ^	ND (1.0) ^	ND (2.0) ^	ND (5.0) ^	**4,460**	ND (10) ^	ND (2.0) ^	ND (0.2) ^	37.6 ^	ND (20) ^	18.2 ^	ND (5.0) ^	ND (1.0) ^	ND (5.0) ^	ND (20) ^
	03/11/2008	ND (3.0)	ND (5.0)	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	**4,590**	ND (10)	ND (2.0)	ND (0.2)	33.6	ND (20)	11.5	ND (5.0)	ND (1.0)	ND (5.0)	ND (20)
	05/08/2008	ND (3.0)	ND (5.0)	ND (500)	ND (1.0)	ND (2.0)	ND (5.0)	**4,600**	ND (10)	5.80	ND (0.2)	40.0	ND (20)	16.4	ND (5.0)	ND (2.0)	ND (5.0)	34.4
TW-1	12/12/2007	ND (3.0)	ND (5.0)	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	**4,090**	ND (10)	ND (2.0)	ND (0.2)	16.1	ND (20)	**129**	ND (5.0)	ND (1.0)	7.90	84.8
	03/11/2008	ND (3.0)	ND (5.0)	ND (300)	ND (1.0)	ND (2.0)	ND (5.0)	**2,450**	ND (10)	ND (2.0)	ND (0.2)	13.4	ND (20)	**55.3**	12.2	ND (1.0)	7.35	88.1
	05/08/2008	ND (3.0)	ND (5.0)	ND (500)	ND (1.0)	ND (2.0)	ND (5.0)	**3,900**	ND (10)	5.10	ND (0.2)	22.0	ND (20)	**87.8**	ND (5.0)	ND (2.0)	ND (5.0)	110

Notes:

ND	not detected at listed reporting limit
FD	field duplicate sample
NE	not established
ARARs	applicable or relevant and appropriate requirements
UTL	Background upper tolerance limit

Title 22 metals are the metals listed in California Code of Regulations, Title 22, Section 66261.24(a)(2)(A).

All results are dissolved metals concentrations in micrograms per liter from field-filtered samples.

Metals analyzed by Methods SW6020A and SW7470A.

The chemical-specific ARARs and background UTLs are described in the Revised Final RFI/RI Volume 2 Report (CH2M Hill, 2009)

Analytes detected above ARARs are in bold.

Monitoring well MW-22 was sampled in July rather than May 2008.

During the March 10, 2008 purge of monitoring well MW-23, the well did not purge dry as it typically does. An additional sample was collected on March 11 after the well recharged as normal.

[^] Samples not analyzed for this metal prior to December 2007.

[a] The background values for cadmium and mercury are detection limits of 1.0 and 0.2 mg/L, respectively

TABLE 2-6

Summary of Cr(T), Cr(VI), Cu, Pb, Ni, and Zn Groundwater Results, July 1997 through September 2008

RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

	Results Summary for RFI/RI Wells[1]						Background Comparison[2]				Chemical-Specific ARAR[3]			
Parameter	Number of Wells Sampled	Number of Primary Samples	Number of Detects	Detection Frequency %	Average Concentration (µg/L)	Maximum Concentration (µg/L)	UTL Value (µg/L)	Number of Wells with Average Exceeding UTL[5]	Number of Wells with Max Exceeding UTL	Frequency of UTL Exceedances	ARAR Value (µg/L)	Number of Wells with Average Exceeding ARAR[5]	Number of Wells with Max Exceeding ARAR	Frequency of ARAR Exceedances
[4] Chromium, Hexavalent	175	2,994	1,764	58.9	905	15,700	31.8	63	73	1,148 / 2,994 (38.3%)	---	---	---	--- ---
[4] Chromium (total)	174	3,052	2,004	65.7	911	16,400	34.1	66	79	1,155 / 3,052 (37.8%)	50	62	73	1,098 / 3,052 (36.0%)
Copper	94	1,174	422	35.9	10.4	306	10.5	24	47	97 / 1,174 (8.3%)	1,000	0	0	0 / 1,174 (0.0%)
Nickel	94	1,174	542	46.2	11.4	500	10.6	24	40	128 / 1,174 (10.9%)	100	0	9	10 / 1,174 (0.9%)
Lead	91	529	69	13.0	2.30	76	1.91	25	38	48 / 529 (9.1%)	15	3	8	9 / 529 (1.7%)
Zinc	94	1,174	837	71.3	66.0	1,870	77.7	20	49	233 / 1,174 (19.8%)	5,000	0	0	0 / 1,174 (0.0%)

Notes:

[1] See Table 4-4 of Volume 2 (CH2M HILL, 2008) for listing of wells in monitoring network.
- Wells Sampled is the number of wells sampled for each parameter.
- Number of Samples is the total number of primary samples analyzed for each parameter.
- Detection Frequency is the number of times each parameter was detected over the total number of samples analyzed.
- Average concentration is the average of all results using one-half the reporting limit for non detects. Rejected data is not included.
- For duplicate results, the highest concentration between the two results is included. If one result was found above the analytical reporting limit while the other was not, the detected concentration was used, regardless of the analytical reporting limit for the other result. If both results were found to be non-detect, the minimum reporting limit was used.

[2] Site background concentration is the 95% upper tolerance limit (UTL) of the elevated percentile from the Steps 3 and 4 Groundwater Background Study Report (CH2M HILL, 2008), see Table 6-3. Number of Exceedances is the number of times each parameter was detected above the background concentration.

[3] Chemical-specific applicable or relevant and appropriate requirements (ARARs) listed are the most stringent drinking water standard from regulatory standards, see Table 6-2 of Volume 2 (CH2M HILL, 2008).

[4] Only the hexavalent chromium and total chromium results included in the Addendum dataset (July 1997 – September 2008) were used in the calculations. This includes results from the Arizona wells and the Title 22 metals data, but not other data collected during the same time period that are not discussed in the Addendum, such the Compliance Monitoring Program data.

[5] In several cases, the laboratory reporting limit was over two times the UTL and/or ARAR. Assigning half the reporting limit for these samples during calculation of averages will result in a UTL/ARAR exceedence being counted toward the average. As a result, many wells were found to have averages exceeding UTL/ARAR mainly due to this assignment.

µg/L	dissolved metals concentrations in micrograms per liter
---	not assigned or not applicable

TABLE 2-7

Summary of Other Trace Metals Groundwater Results, July 1997 through September 2008
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

	Results Summary for RFI/RI Wells [1]						Background Comparison [2]				Chemical-Specific ARAR [3]			
Parameter	**Number of Wells Sampled**	**Number of Samples**	**Number of Detects**	**Detection Frequency %**	**Average Concentration (µg/L)**	**Maximum Concentration (µg/L)**	**UTL Value (µg/L)**	**Number of Wells With Average Exceeding UTL [4]**	**Number of Wells with Max Exceeding UTL**	**Frequency of UTL Exceedances**	**ARAR Value (µg/L)**	**Number of Wells with Average Exceeding ARAR [4]**	**Number of Wells with Max Exceeding ARAR**	**Frequency of ARAR Exceedances**
Aluminum	72	339	27	8.0	38.9	749	55.8	12	20	25 / 339 (7.4%)	200	0	2	2 / 339 (0.6%)
Antimony	76	428	9	2.1	2.51	155	1.22	48	8	9 / 428 (2.1%)	6	4	7	8 / 428 (1.9%)
Arsenic	118	505	232	45.9	7.84	157	24.3	3	6	31 / 505 (6.1%)	10	15	19	56 / 505 (11.1%)
Barium	115	619	419	67.7	122	5,300	195	18	10	13 / 619 (2.1%)	1,000	1	3	3 / 619 (0.5%)
Beryllium	76	418	20	4.8	0.91	8.80	0.663	37	14	20 / 418 (4.8%)	4	1	1	1 / 418 (0.2%)
Cadmium	76	418	1	0.2	0.941	10.5	---	---	---	--- ---	5	1	1	1 / 418 (0.2%)
Cobalt	76	418	16	3.8	1.46	10.0	0.843	49	10	16 / 418 (3.8%)	---	---	---	--- ---
Mercury	76	424	1	0.2	0.107	0.40	---	---	---	--- ---	2	0	0	0 / 424 (0.0%)
Molybdenum	91	618	581	94.0	27.9	301	36.3	25	39	154 / 618 (24.9%)	---	---	---	--- ---
Selenium	84	441	205	46.5	5.62	155	10.3	10	19	49 / 441 (11.1%)	50	1	2	5 / 441 (1.1%)
Silver	76	418	10	2.4	2.15	87.3	2.13	19	7	8 / 418 (1.9%)	100	0	0	0 / 418 (0.0%)
Thallium	76	418	3	0.7	2.15	1.20	0.908	36	3	3 / 418 (0.7%)	2	36	0	0 / 418 (0.0%)
Vanadium	91	516	417	80.8	19.0	326	59.9	0	28	35 / 516 (6.8%)	---	---	---	--- ---

Notes:

[1] See Table 4-4 of Volume 2 (CH2M HILL, 2008) for listing of wells in monitoring network.
- Wells Sampled is the number of wells sampled for each parameter.
- Number of Samples is the total number of primary samples analyzed for each parameter.
- Detection Frequency is the number of times each parameter was detected over the total number of samples analyzed.
- Average concentration is the average of all results using one-half the reporting limit for non detects. Rejected data is not included.
- For duplicate results, the highest concentration between the two results is included. If one result was found above the analytical reporting limit while the other was not, the detected concentration was used, regardless of the analytical reporting limit for the other result. If both results were found to be non-detect, the minimum reporting limit was used.

[2] Site background concentration is the 95% upper tolerance limit (UTL) of the elevated percentile from the Steps 3 and 4 Groundwater Background Study Report (CH2M HILL, 2008), see Table 6-3. Number of Exceedances is the number of times each parameter was detected above the background concentration.

[3] Chemical-specific applicable or relevant and appropriate requirements (ARARs) listed are the most stringent drinking water standard from regulatory standards, see Table 6-2 of Volume 2 (CH2M HILL, 2008)

[4] In several cases, the laboratory reporting limit was over two times the UTL and/or ARAR. Assigning half the reporting limit for these samples during calculation of averages will result in a UTL/ARAR exceedence being counted toward the average. As a result, many wells were found to have averages exceeding UTL/ARAR mainly due to this assignment.

ND	not detected
µg/L	dissolved metals concentrations in micrograms per liter
---	not assigned or not applicable

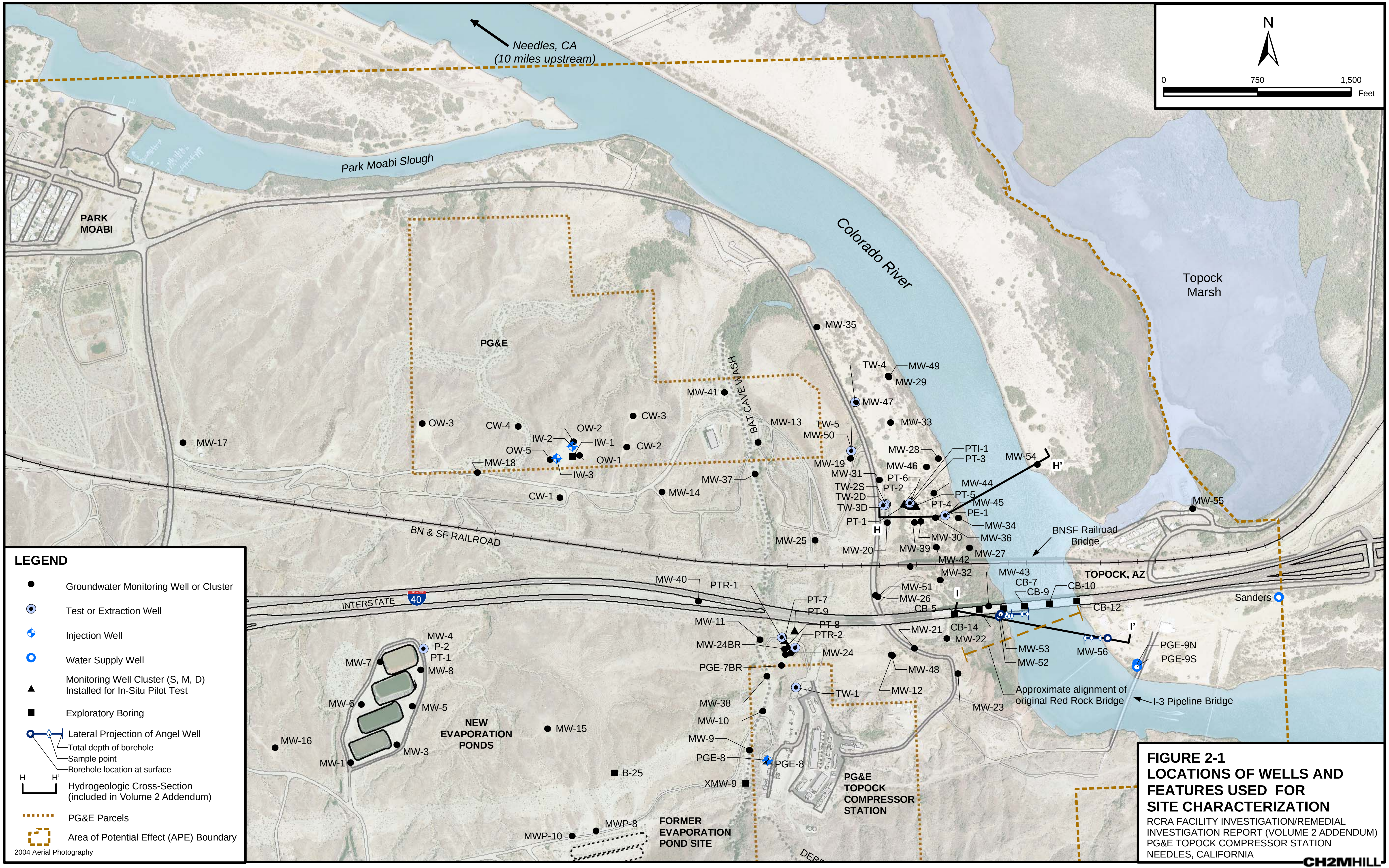

FIGURE 2-1
LOCATIONS OF WELLS AND FEATURES USED FOR SITE CHARACTERIZATION

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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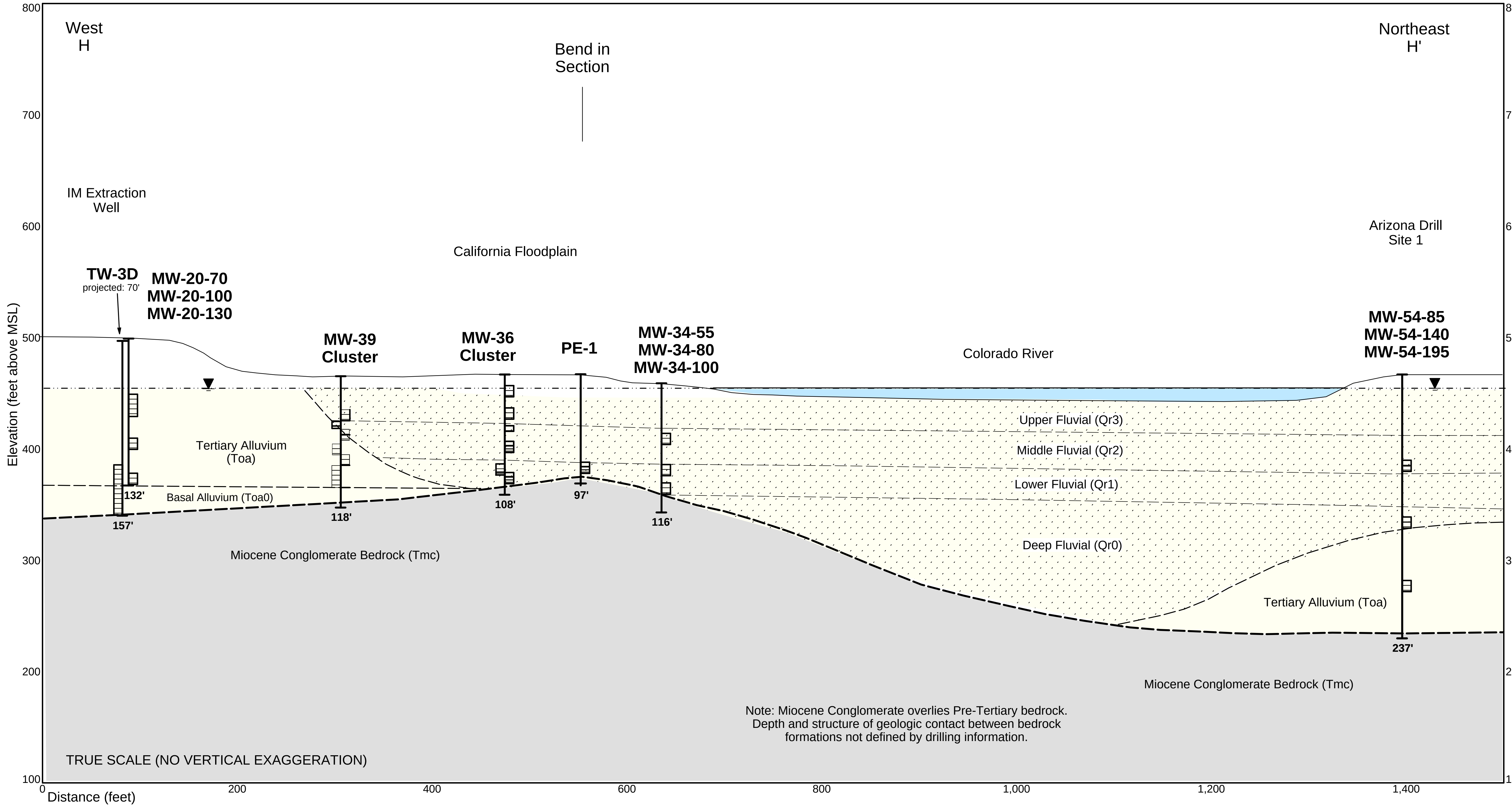

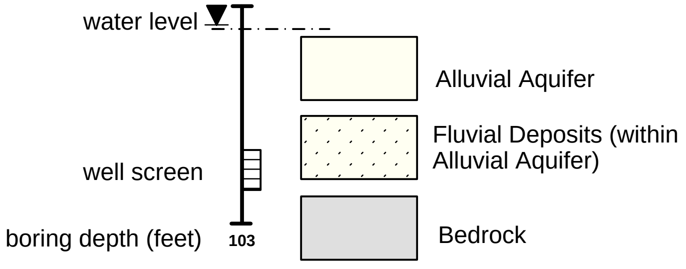

Notes:
Refer to Figure 2-1 for location of cross-section.
MSL = mean sea level

FIGURE 2-2
SITE HYDROGEOLOGIC SECTION H-H'
CALIFORNIA FLOODPLAIN TO ARIZONA
WELL CLUSTER MW-54

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
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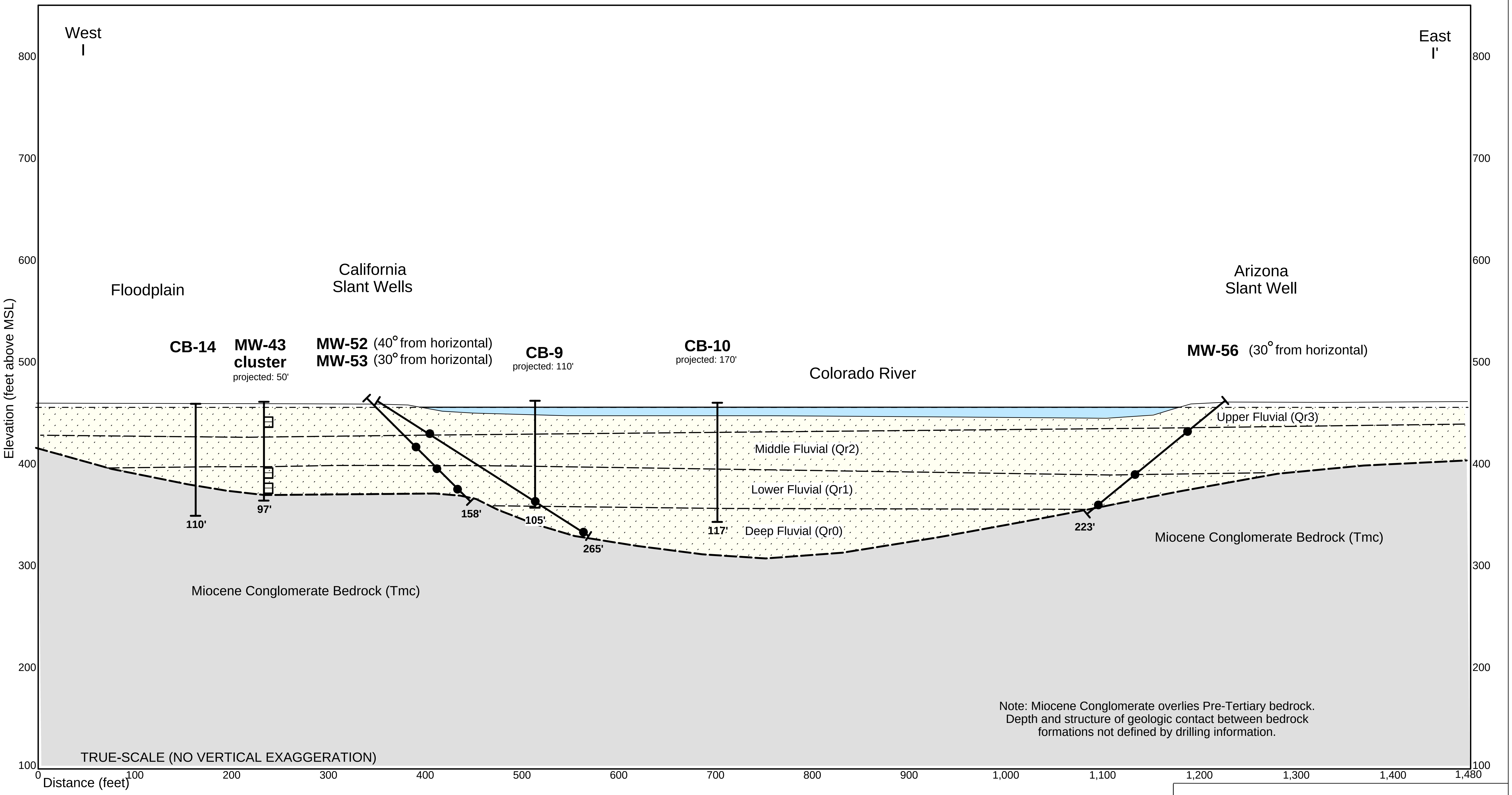

Notes:
Refer to Figure 2-1 for location of cross-section.
MSL = mean sea level

FIGURE 2-3
HYDROGEOLOGIC SECTION I-I'
CALIFORNIA AND ARIZONA SLANT
WELLS MW-52/53 AND MW-56

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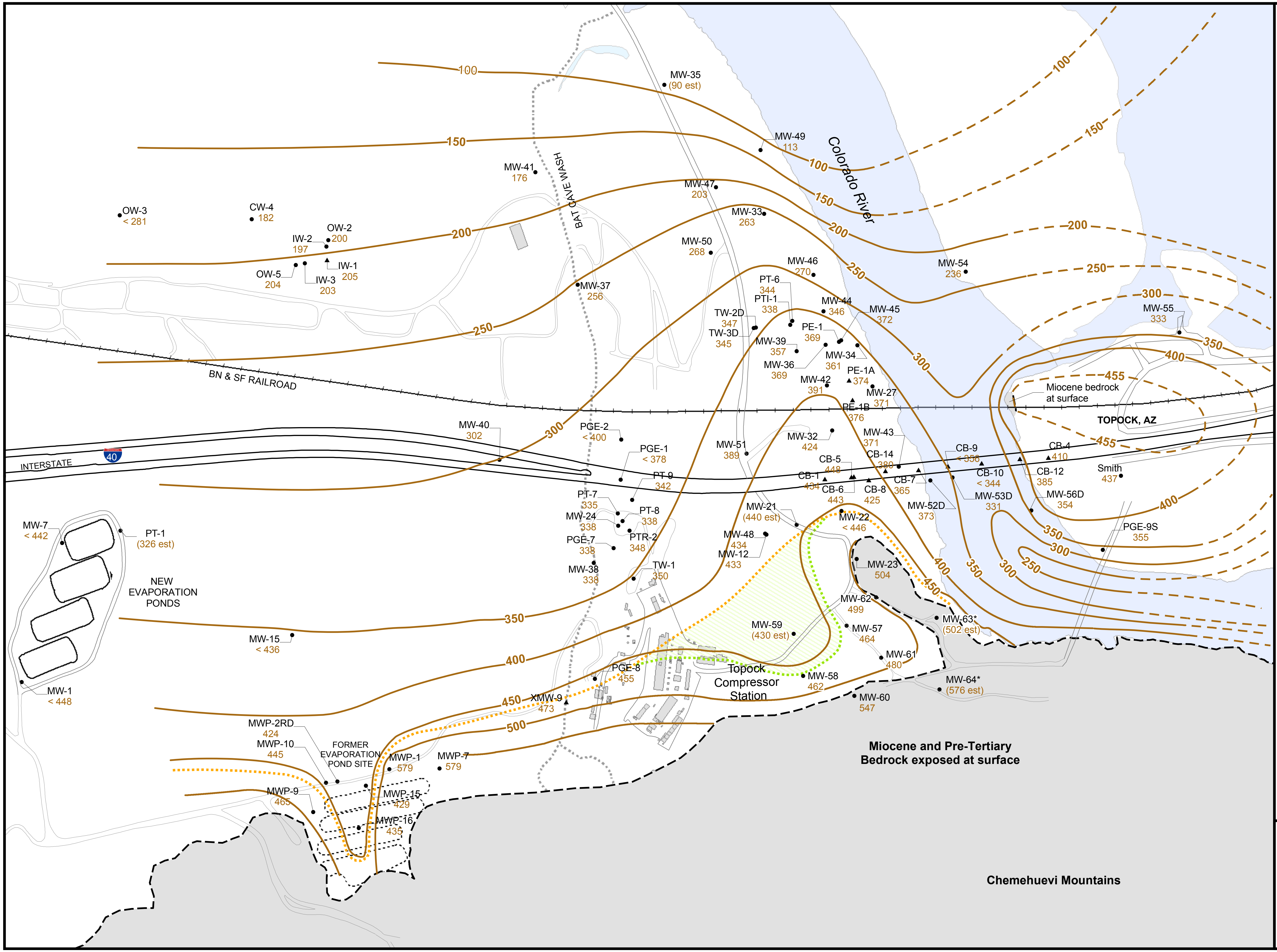

N

0 500 1,000 Feet

LEGEND

● MW-41 177	Elevation of Bedrock in feet above mean sea level (MSL)
(326 est)	Bedrock elevation estimated from cross-section
< 240	Bedrock elevation deeper than elevation of total depth of boring (data posted for selected locations)
350	Bedrock elevation contour (feet MSL) Contours are dashed where inferred from USGS seismic surveys and extended beyond drilling locations.
⋯	Approximate bedrock / Alluvial Aquifer contact at elevation 455 ft MSL before 2009 East Ravine drilling
⋯	Approximate bedrock / Alluvial Aquifer contact at elevation 455 ft MSL after May 2009 East Ravine drilling.

Note:

1. The bedrock structure map has been updated with drilling data from the 2008 Arizona and 2009 East Ravine groundwater investigations. Contouring reflects drilling results through May 2009.
2. East Ravine investigation locations MW-63* and MW-64* are approximate (to be surveyed).

FIGURE 2-4
ELEVATION CONTOUR MAP FOR TOP OF BEDROCK

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT
(VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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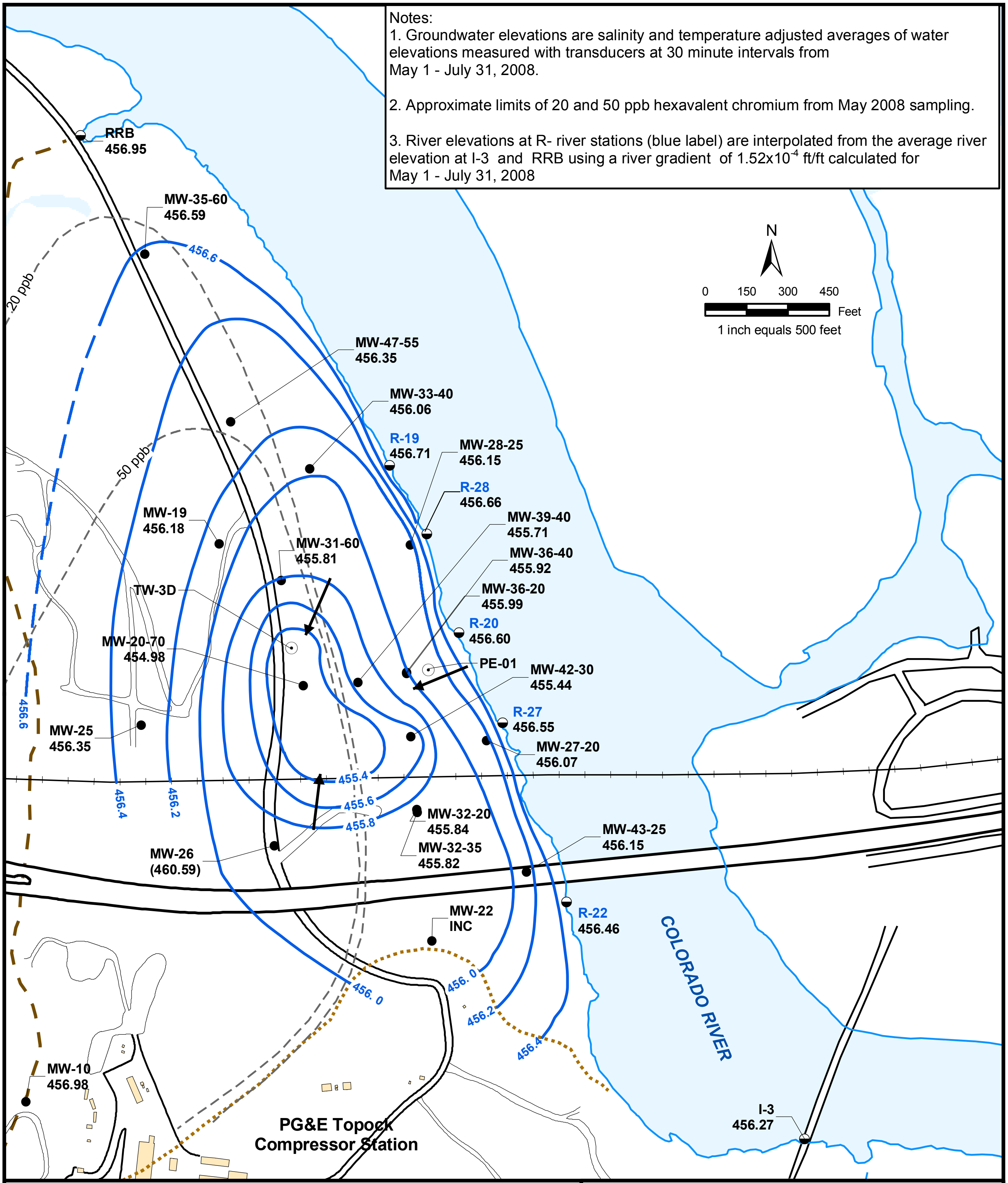

Notes:
1. Groundwater elevations are salinity and temperature adjusted averages of water elevations measured with transducers at 30 minute intervals from May 1 - July 31, 2008.

2. Approximate limits of 20 and 50 ppb hexavalent chromium from May 2008 sampling.

3. River elevations at R- river stations (blue label) are interpolated from the average river elevation at I-3 and RRB using a river gradient of 1.52×10^{-4} ft/ft calculated for May 1 - July 31, 2008

● **MW-29** 455.85 Average Groundwater Elevation at Monitoring Station (ft AMSL)

● **MW-29** (455.85) Average Groundwater Elevation at Monitoring Station (ft AMSL) Not Used for Contouring

◒ River Elevation (ft AMSL) Interpolated Average

→ Interpreted Groundwater Flow Direction

⋯ Approximate Bedrock Contact at 455 ft AMSL

● Monitoring Well

◒ River Station

⊙ Extraction Well

— Groundwater Elevation Contour 0.2 ft

– – Inferred Groundwater Elevation Contour 0.2 ft

INC Data incomplete or unavailable over reporting period

FIGURE 2-5a
AVERAGE GROUNDWATER ELEVATIONS SHALLOW WELLS AND RIVER ELEVATIONS, MAY THROUGH JULY 2008

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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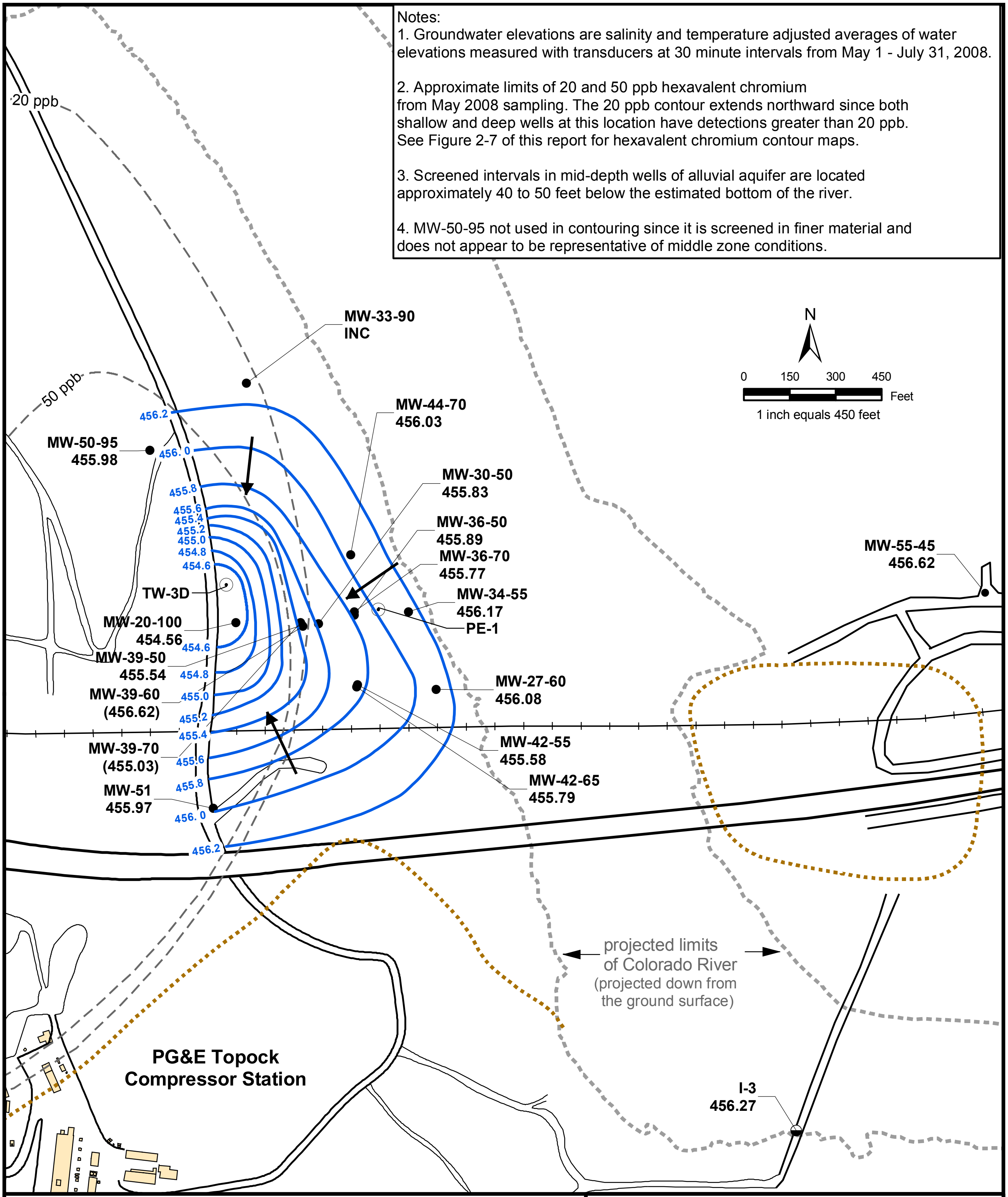
RFI_AVERAGE_GROUNDWATER_UA_0808.PDF PJOYCE1 9/3/2008 11:30:54

Notes:
1. Groundwater elevations are salinity and temperature adjusted averages of water elevations measured with transducers at 30 minute intervals from May 1 - July 31, 2008.

2. Approximate limits of 20 and 50 ppb hexavalent chromium from May 2008 sampling. The 20 ppb contour extends northward since both shallow and deep wells at this location have detections greater than 20 ppb. See Figure 2-7 of this report for hexavalent chromium contour maps.

3. Screened intervals in mid-depth wells of alluvial aquifer are located approximately 40 to 50 feet below the estimated bottom of the river.

4. MW-50-95 not used in contouring since it is screened in finer material and does not appear to be representative of middle zone conditions.



● **MW-29** **455.85**	Average Groundwater Elevation at Monitoring Station (ft AMSL)
● **MW-29** **(455.85)**	Average Groundwater Elevation at Monitoring Station (ft AMSL) Not Used for Contouring
······	Bedrock Contact at 425 ft AMSL
➞	Interpreted Groundwater Flow Direction
●	Monitoring Well
◒	River Station
⊙	Extraction Well
━	Groundwater Elevation Contour 0.2 ft
– –	Inferred Groundwater Elevation Contour 0.2 ft
INC	Data incomplete for reporting period

FIGURE 2-5b
AVERAGE GROUNDWATER ELEVATIONS MID-DEPTH WELLS MAY THROUGH JULY 2008

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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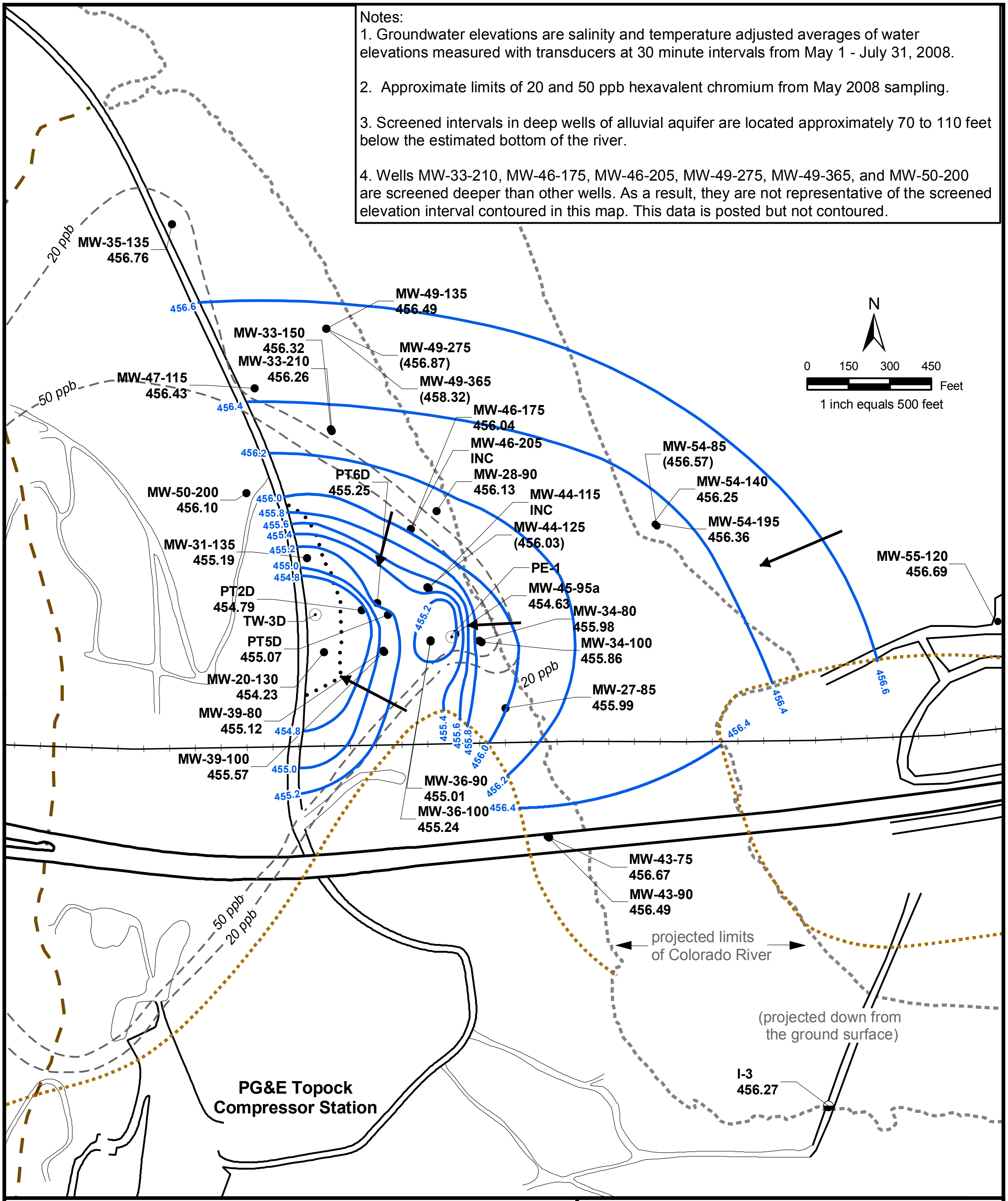

Notes:

1. Groundwater elevations are salinity and temperature adjusted averages of water elevations measured with transducers at 30 minute intervals from May 1 - July 31, 2008.

2. Approximate limits of 20 and 50 ppb hexavalent chromium from May 2008 sampling.

3. Screened intervals in deep wells of alluvial aquifer are located approximately 70 to 110 feet below the estimated bottom of the river.

4. Wells MW-33-210, MW-46-175, MW-46-205, MW-49-275, MW-49-365, and MW-50-200 are screened deeper than other wells. As a result, they are not representative of the screened elevation interval contoured in this map. This data is posted but not contoured.

MW-29 ● **455.85**	Average Groundwater Elevation at Monitoring Station (ft AMSL)
MW-29 ● **(455.85)**	Average Groundwater Elevation at Monitoring Station (ft AMSL) Not Used for Contouring
➞	Interpreted Groundwater Flow Direction
┈	Approximate Bedrock Contact at 395 ft AMSL
●	Monitoring Well
◒	River Station
⊙	Extraction Well
━	Groundwater Elevation Contour 0.2 ft
╌	Inferred Groundwater Elevation Contour 0.2 ft
INC	Data incomplete for reporting period

FIGURE 2-5c
AVERAGE GROUNDWATER ELEVATIONS DEEP WELLS MAY THROUGH JULY 2008

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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RFI_AVERAGE_GROUNDWATER_LA_0808.PDF PJOYCE1 9/3/2008 11:33:31

Note:
May aquifer responses were estimated at approximately 7:00am on May 30, 2008, prior to the re-start of extraction well TW-03D. September aquifer responses were estimated at approximately 7:00am on September 17, 2008, prior to the re-start of the extraction wells.

FIGURE 2-6
MAY AND SEPTEMBER 2008 AQUIFER TEST RESPONSES IN OBSERVATION WELLS

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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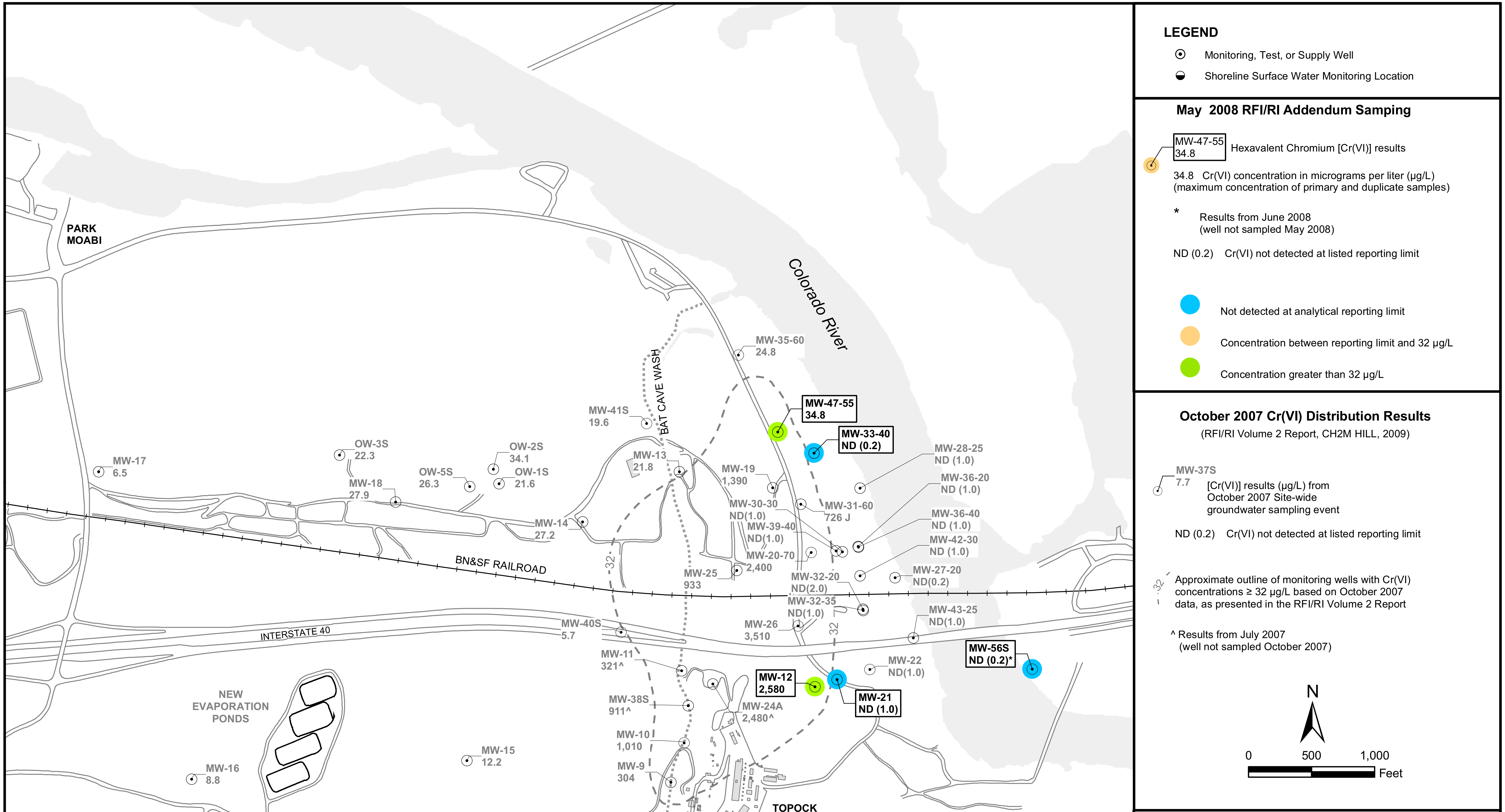

FIGURE 2-7a
GROUNDWATER CR(VI) RESULTS
SHALLOW WELLS OF ALLUVIAL AQUIFER
MAY 2008

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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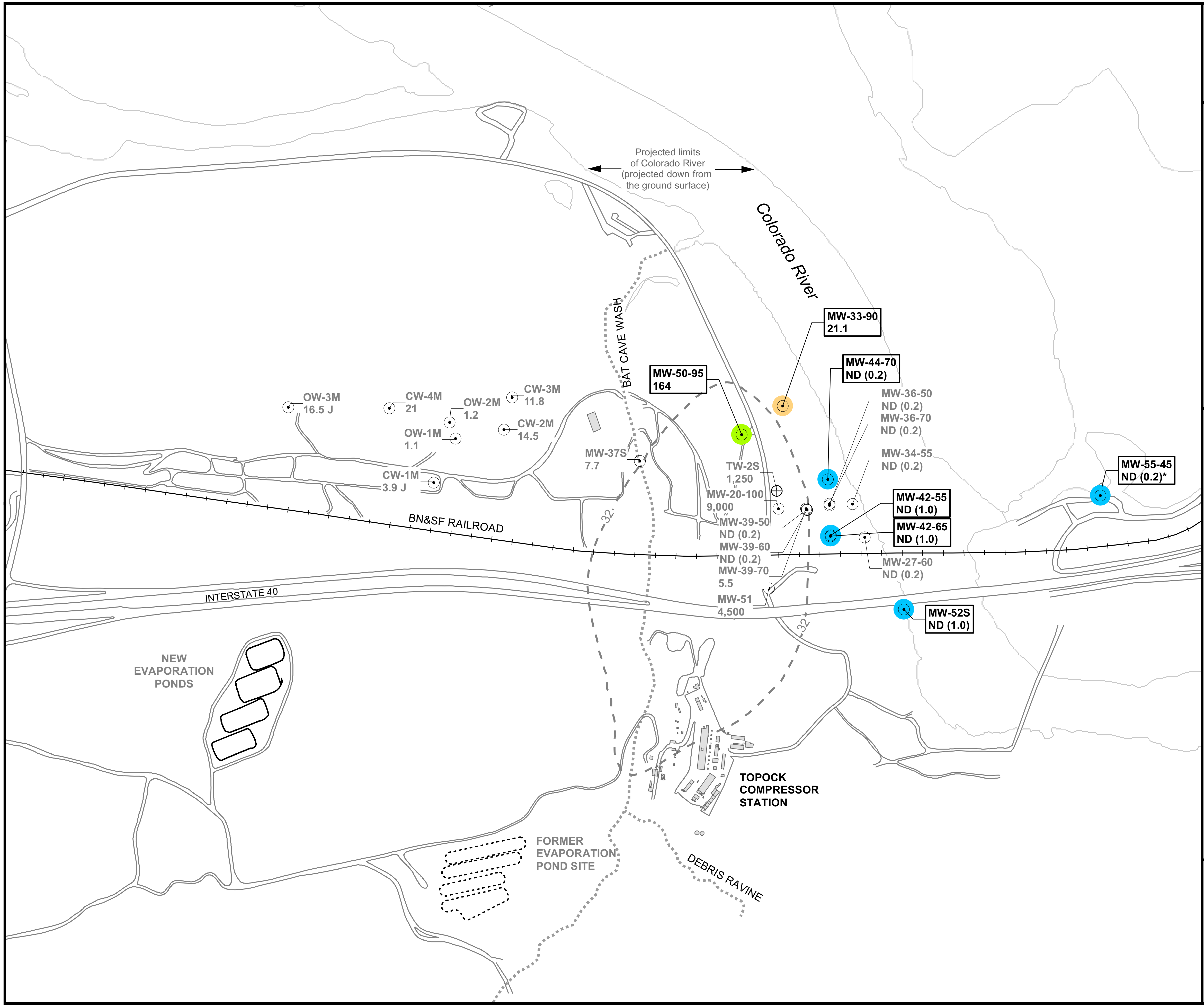


LEGEND

⊙ Monitoring, Test, or Supply Well

⊕ Extraction Well

May 2008 RFI/RI Addendum Samping

MW-33-90
21.1 Hexavalent Chromium [Cr(VI)] results

21.1 Cr(VI) concentration in micrograms per liter (µg/L)
(maximum concentration of primary and duplicate samples)

* Results from June 2008
(well not sampled May 2008)

ND (0.2) Cr(VI) not detected at listed reporting limit

● Not detected at analytical reporting limit

● Concentration between reporting limit and 32 µg/L

● Concentration greater than 32 µg/L

October 2007 Cr(VI) Distribution Results

(RFI/RI Volume 2 Report, CH2M HILL, 2009)

MW-37S
7.7 [Cr(VI)] results (µg/L) from
October 2007 Site-wide
groundwater sampling event

ND (0.2) Cr(VI) not detected at listed reporting limit

32 Approximate outline of monitoring wells with Cr(VI)
concentrations ≥ 32 µg/L based on October 2007
data, as presented in RFI/RI Volume 2 Report

^ Results from July 2007
(well not sampled October 2007)

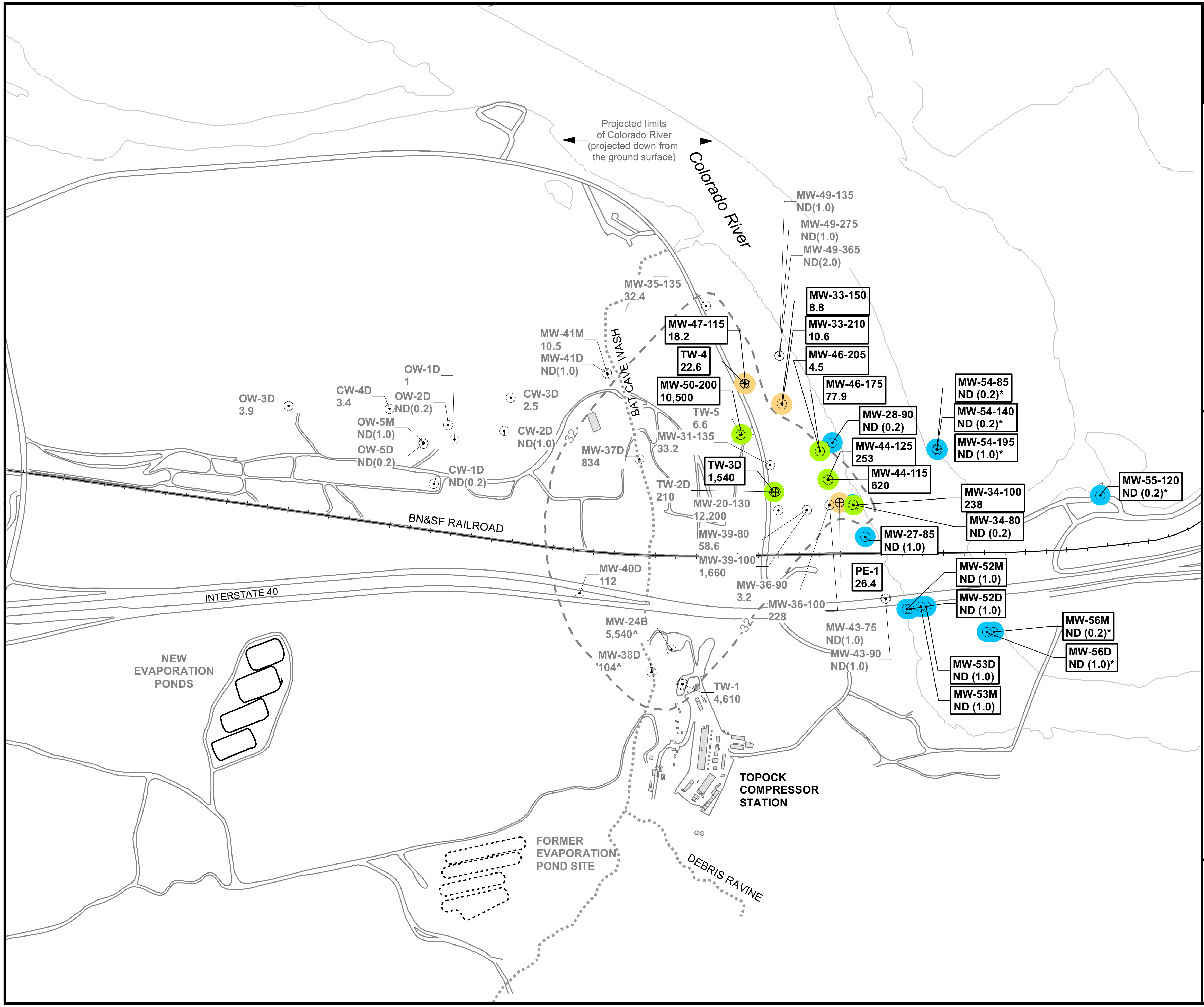
N

0 500 1,000
Feet

FIGURE 2-7b
GROUNDWATER Cr(VI) RESULTS MID-DEPTH WELLS OF ALLUVIAL AQUIFER MAY 2008

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



LEGEND

⦿ Monitoring, Test or Supply Well

⊕ Extraction Well

May 2008 RFI/RI Addendum Samping

MW-33-90 21.1 Hexavalent Chromium [Cr(VI)] results

21.1 Cr(VI) concentration in micrograms per liter (µg/L) (maximum concentration of primary and duplicate samples)

* Results from June 2008 (well not sampled May 2008)

ND (0.2) Cr(VI) not detected at listed reporting limit

● Not detected at analytical reporting limit

● Concentration between reporting limit and 32 µg/L

● Concentration greater than 32 µg/L

October 2007 Cr(VI) Distribution Results

(RFI/RI Volume 2 Report, CH2M HILL, 2009)

MW-37S 7.7 [Cr(VI)] results (µg/L) from October 2007 Site-wide groundwater sampling event

ND (0.2) Cr(VI) not detected at listed reporting limit

^ Result from July 2007 (well not sampled October 2007)

32 Approximate outline of monitoring wells with Cr(VI) concentrations ≥ 32 µg/L based on October 2007 data, as presented in the RFI/RI Volume 2 Report

In the floodplain area, the 32 µg/L outline for Cr(VI) in Deep zone (80-90 feet below Colorado River) is estimated based on available groundwater sampling, hydrogeologic and geochemical data. There are no data confirming the existence of Cr(VI) under the Colorado River.

N

0 500 1,000 Feet

FIGURE 2-7c
GROUNDWATER CR(VI) RESULTS DEEP WELLS OF ALLUVIAL AQUIFER MAY 2008

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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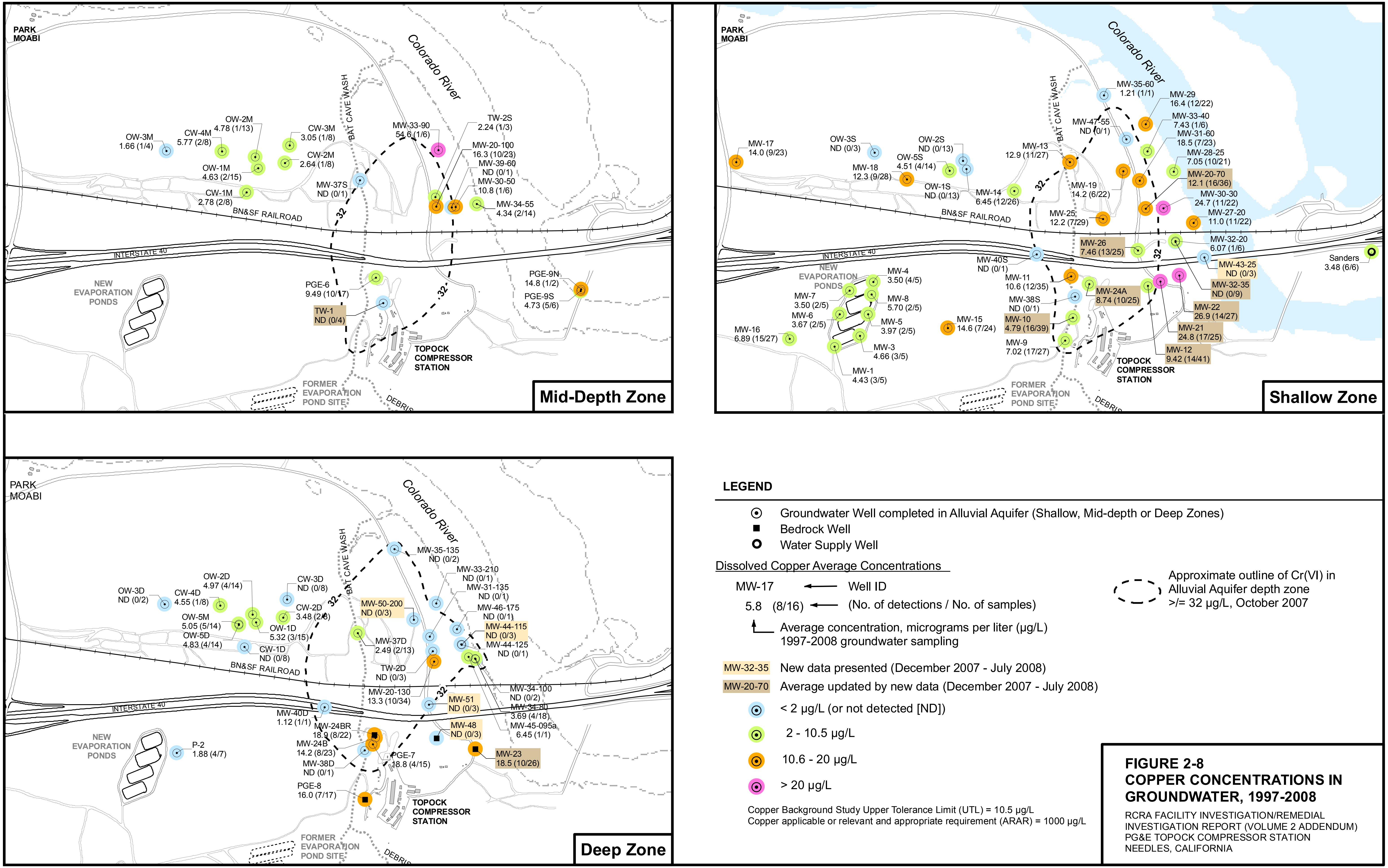

LEGEND

⊙ Groundwater Well completed in Alluvial Aquifer (Shallow, Mid-depth or Deep Zones)
■ Bedrock Well
○ Water Supply Well

Dissolved Copper Average Concentrations

MW-17 ⟵ Well ID
5.8 (8/16) ⟵ (No. of detections / No. of samples)
↑ Average concentration, micrograms per liter (µg/L) 1997-2008 groundwater sampling

MW-32-35 New data presented (December 2007 - July 2008)
MW-20-70 Average updated by new data (December 2007 - July 2008)

⊙ < 2 µg/L (or not detected [ND])
⊙ 2 - 10.5 µg/L
⊙ 10.6 - 20 µg/L
⊙ > 20 µg/L

Approximate outline of Cr(VI) in Alluvial Aquifer depth zone >/= 32 µg/L, October 2007

Copper Background Study Upper Tolerance Limit (UTL) = 10.5 µg/L
Copper applicable or relevant and appropriate requirement (ARAR) = 1000 µg/L

FIGURE 2-8
COPPER CONCENTRATIONS IN GROUNDWATER, 1997-2008

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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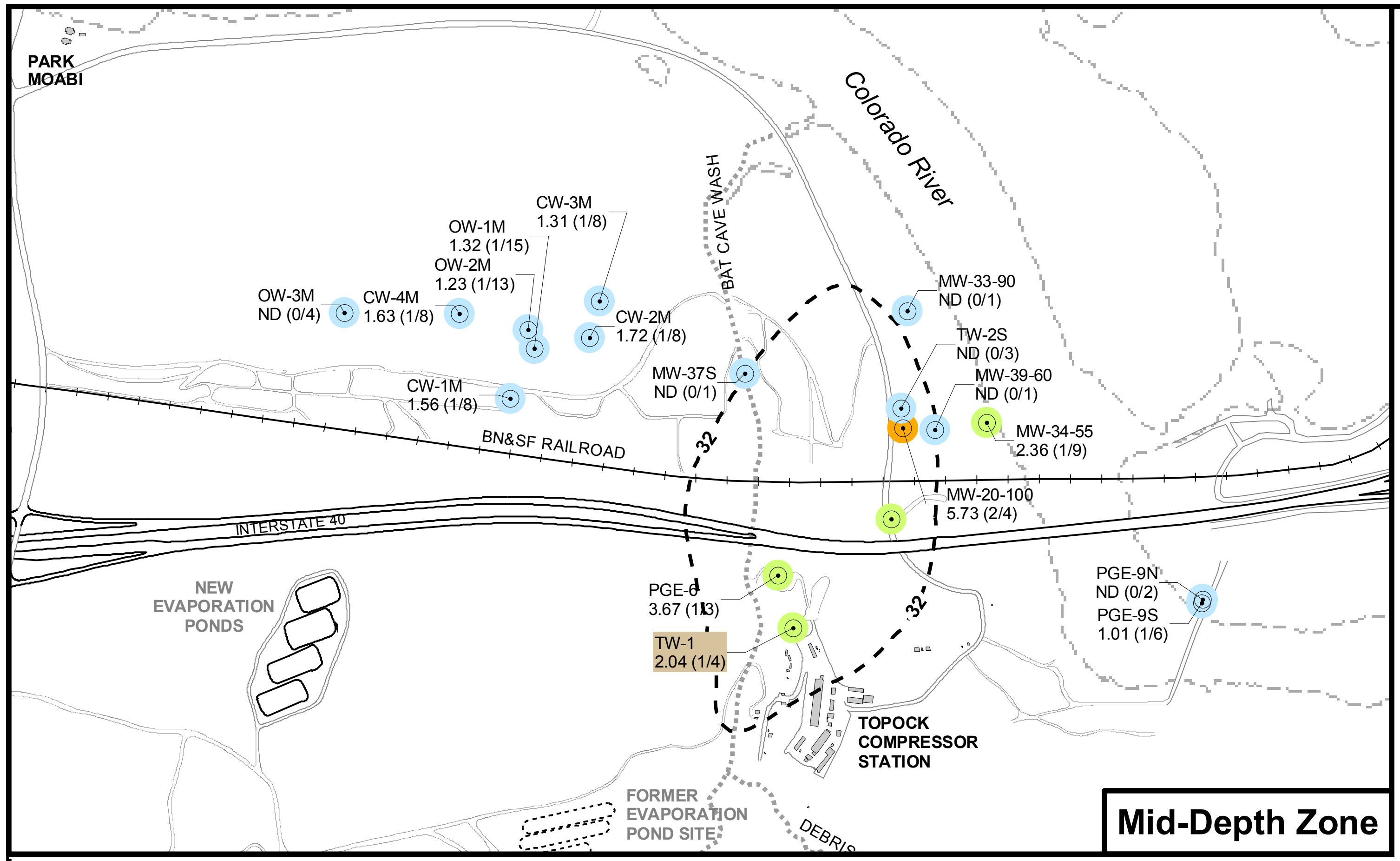

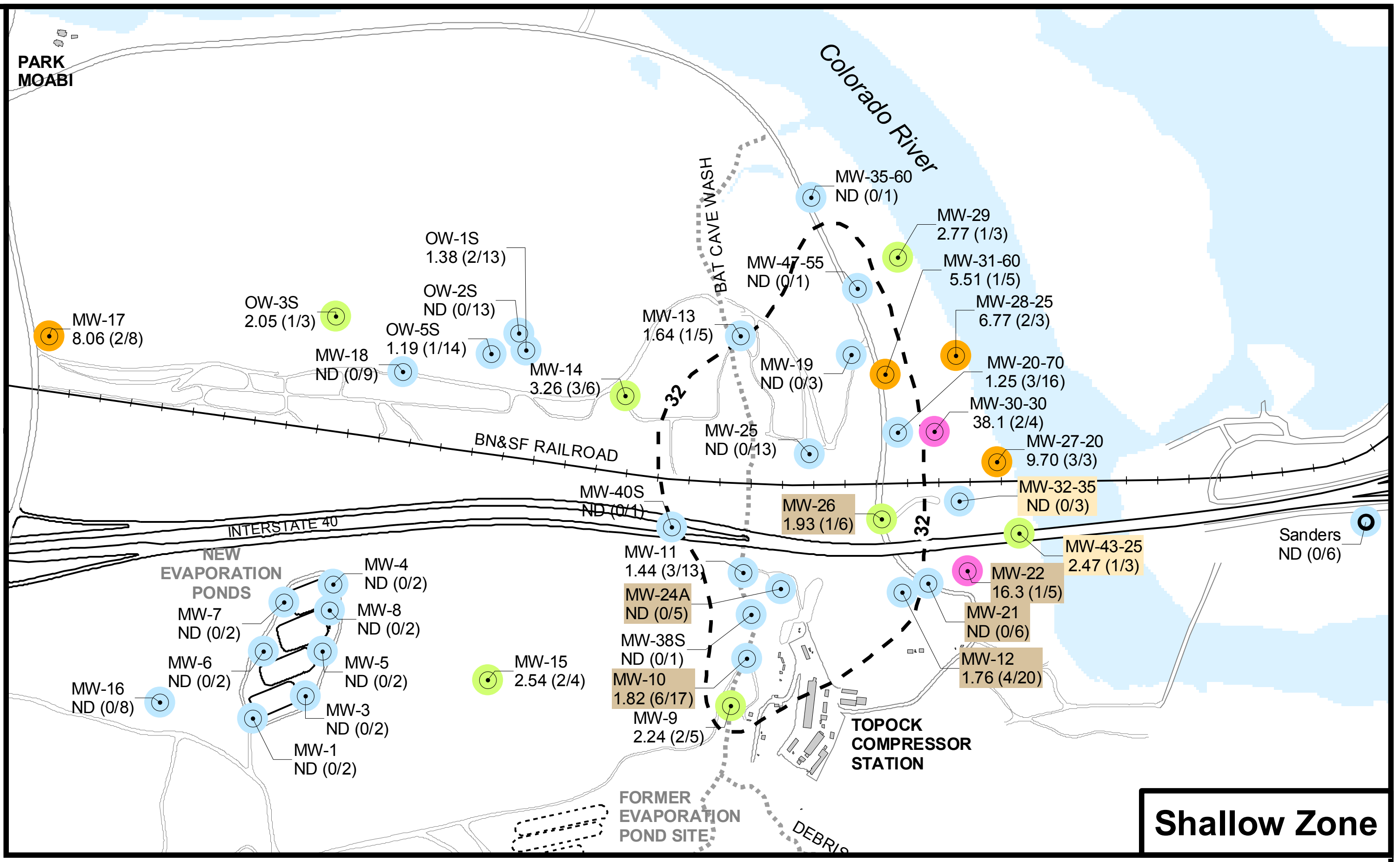

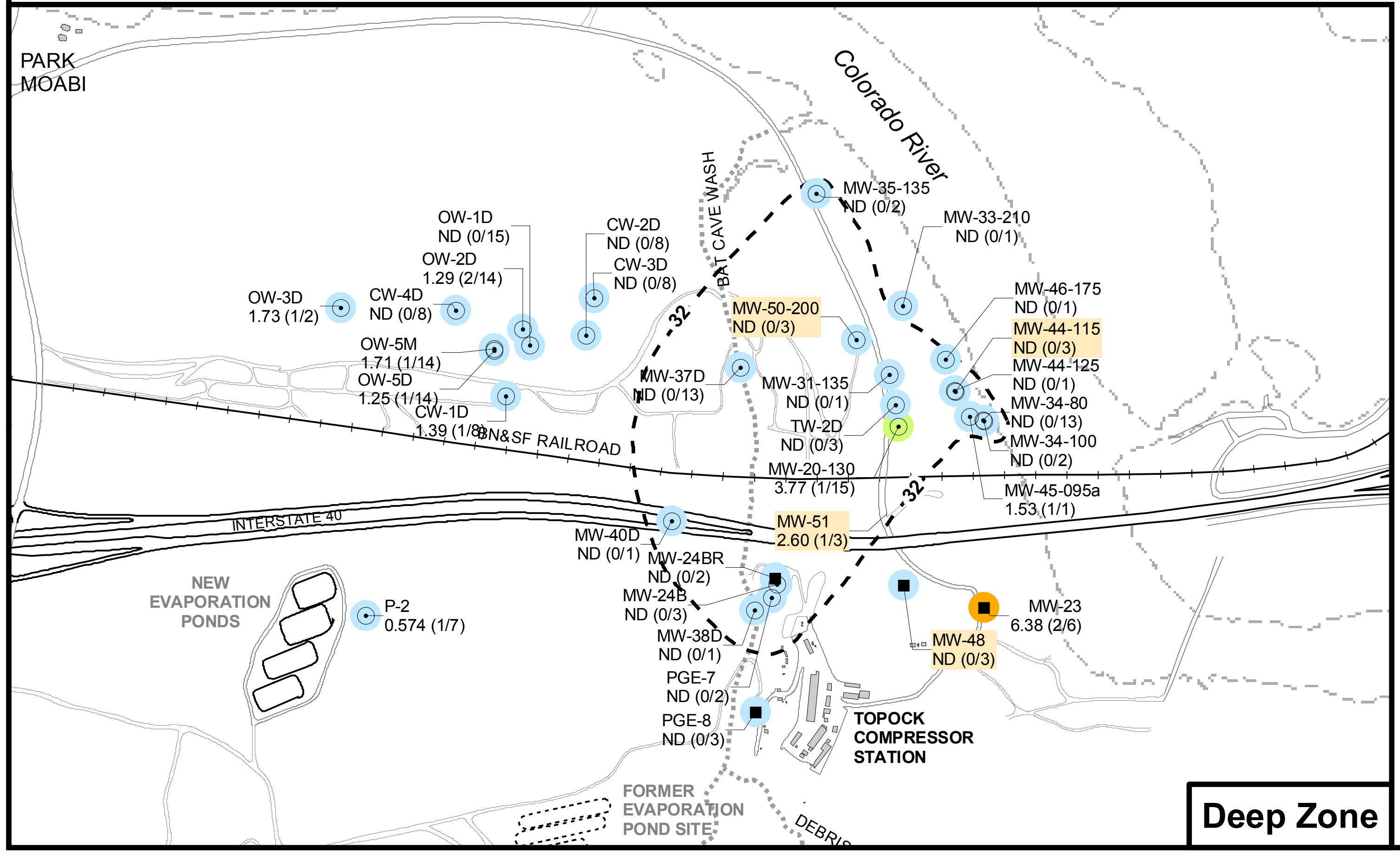

LEGEND

⊙ Groundwater Well completed in Alluvial Aquifer (Shallow, Mid-depth or Deep Zones)

■ Bedrock Well

○ Water Supply Well

Dissolved Lead Average Concentrations

MW-17 ← Well ID

5.8 (8/16) ← (No. of detections / No. of samples)

Average concentration, micrograms per liter (µg/L)
1997-2008 groundwater sampling

MW-32-35 New data presented (December 2007 - July 2008)

MW-20-70 Average updated by new data (December 2007 - July 2008)

⊙ < 1.9 µg/L (or not detected [ND])

⊙ 1.9 - 4 µg/L

⊙ 4.1 - 15 µg/L

⊙ > 15 µg/L

Approximate outline of Cr(VI) in
Alluvial Aquifer depth zone
>/= 32 µg/L, October 2007

Lead Background Study Upper Tolerance Limit (UTL) = 1.91 µg/L
Lead applicable or relevant and appropriate requirement (ARAR) = 15 µg/L

FIGURE 2-9
LEAD CONCENTRATIONS IN GROUNDWATER, 1997-2008

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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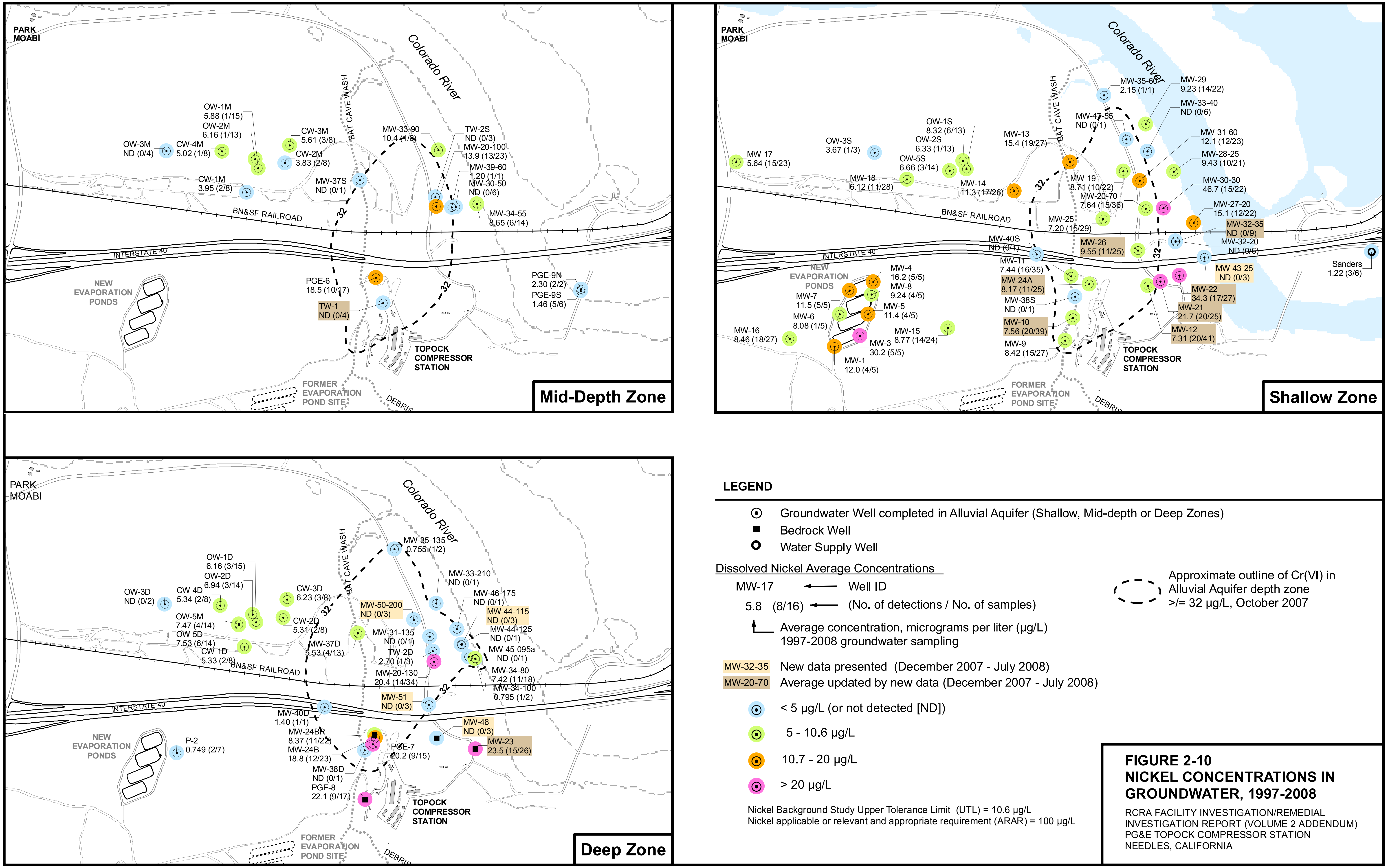

FIGURE 2-10
NICKEL CONCENTRATIONS IN GROUNDWATER, 1997-2008

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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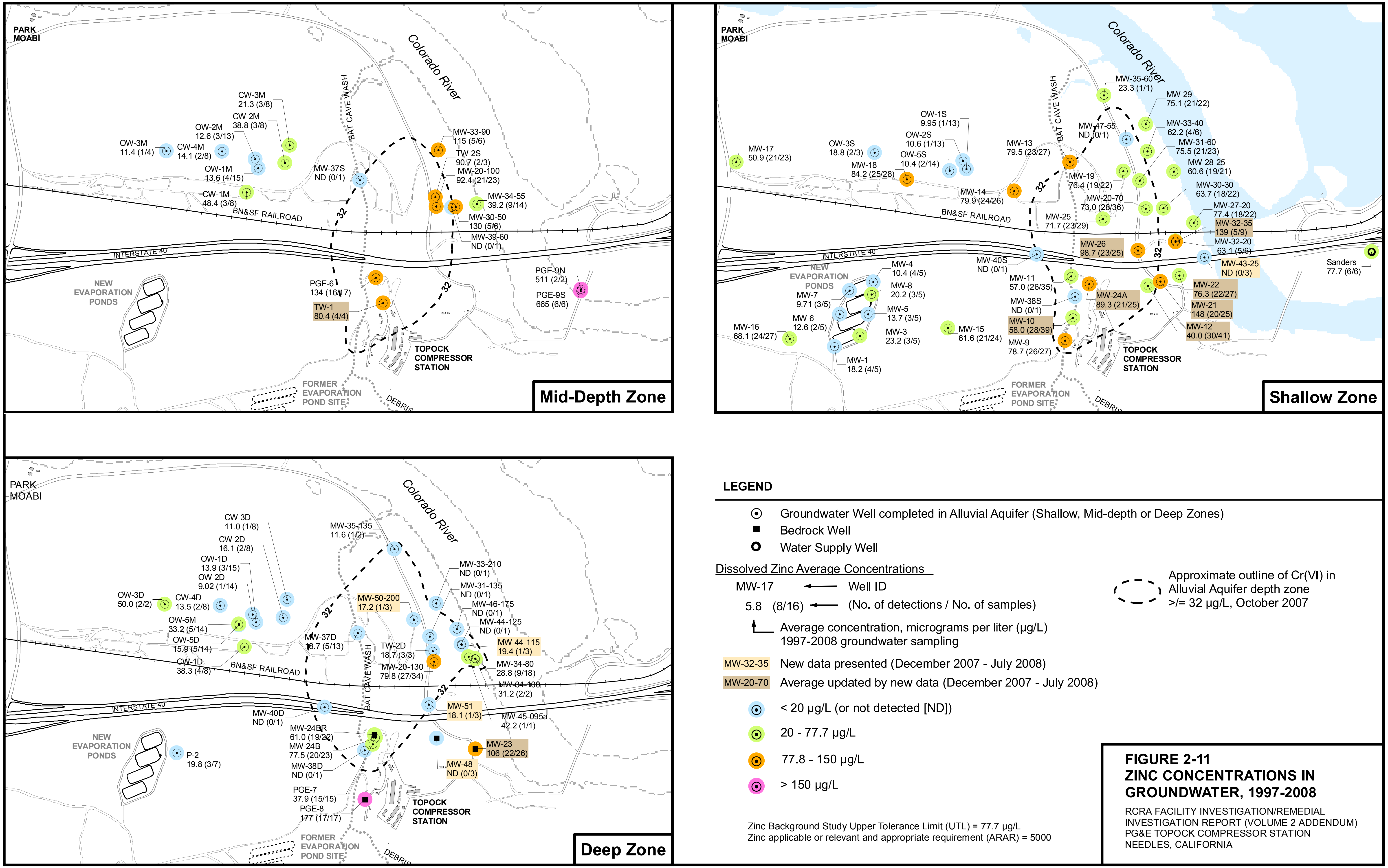

LEGEND

⊙ Groundwater Well completed in Alluvial Aquifer (Shallow, Mid-depth or Deep Zones)

■ Bedrock Well

○ Water Supply Well

Dissolved Zinc Average Concentrations

MW-17 ← Well ID

5.8 (8/16) ← (No. of detections / No. of samples)

Average concentration, micrograms per liter (µg/L) 1997-2008 groundwater sampling

MW-32-35 New data presented (December 2007 - July 2008)

MW-20-70 Average updated by new data (December 2007 - July 2008)

⊙ < 20 µg/L (or not detected [ND])

⊙ 20 - 77.7 µg/L

⊙ 77.8 - 150 µg/L

⊙ > 150 µg/L

Approximate outline of Cr(VI) in Alluvial Aquifer depth zone >/= 32 µg/L, October 2007

Zinc Background Study Upper Tolerance Limit (UTL) = 77.7 µg/L
Zinc applicable or relevant and appropriate requirement (ARAR) = 5000

FIGURE 2-11
ZINC CONCENTRATIONS IN GROUNDWATER, 1997-2008

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

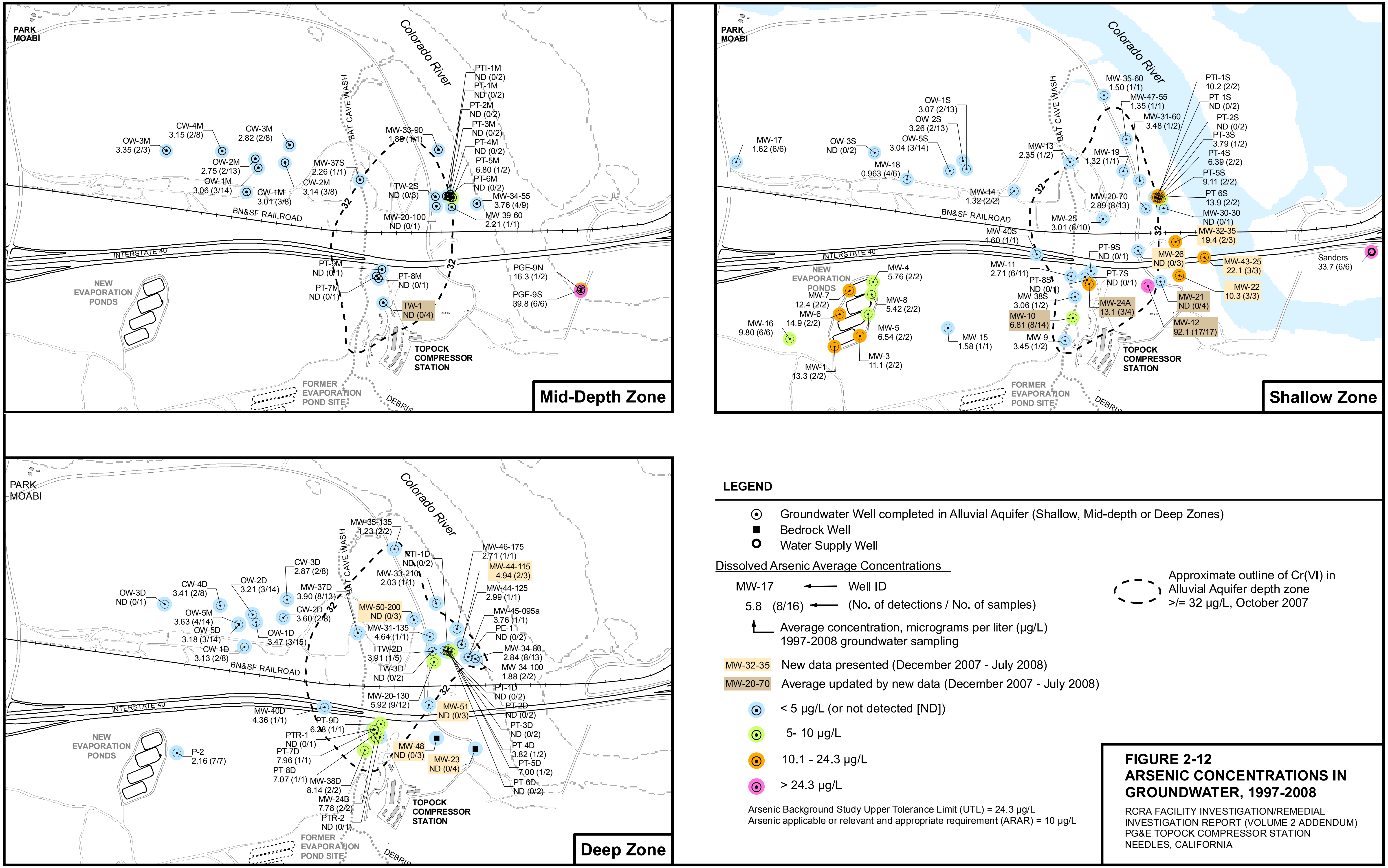

FIGURE 2-12
ARSENIC CONCENTRATIONS IN GROUNDWATER, 1997-2008

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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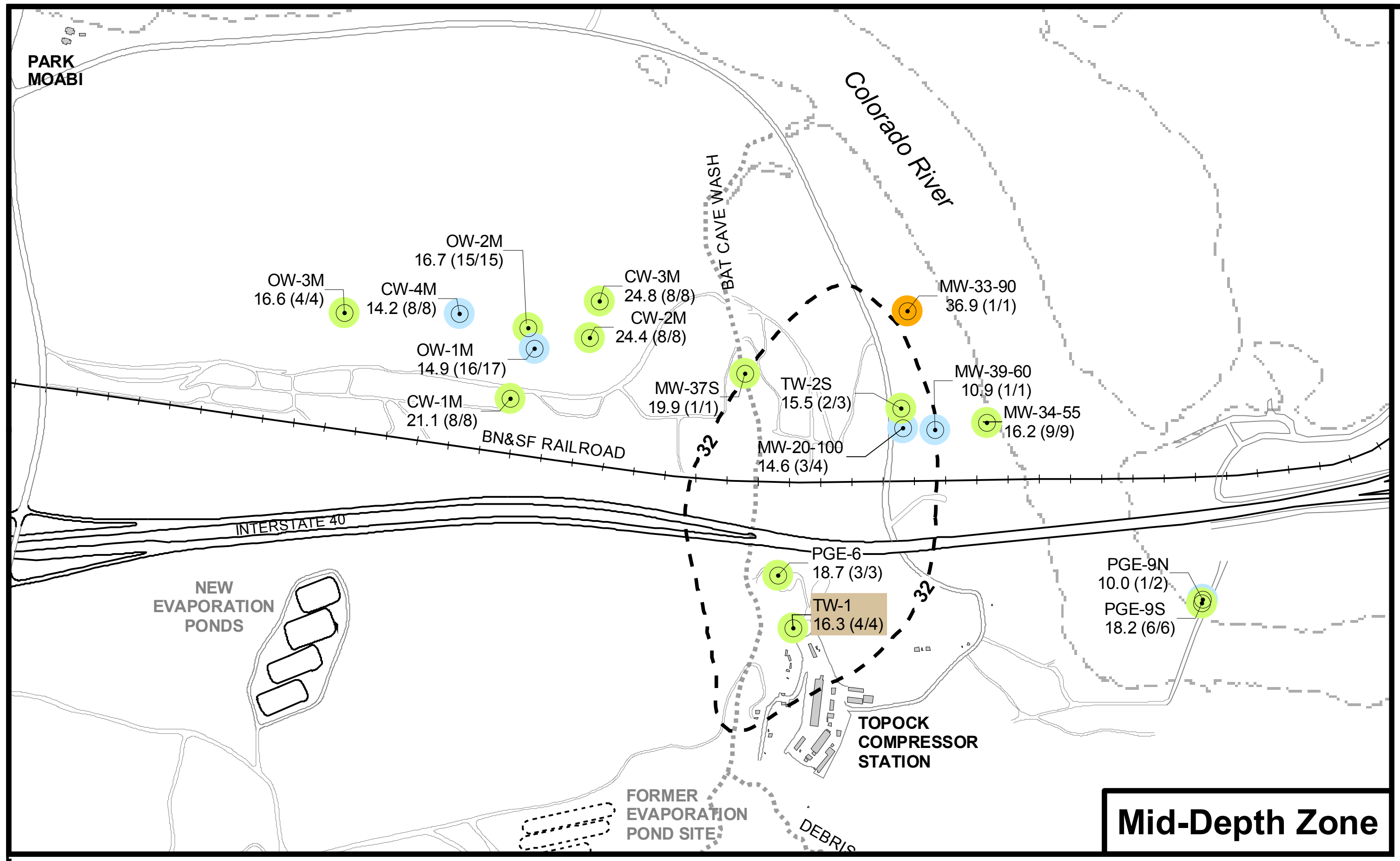

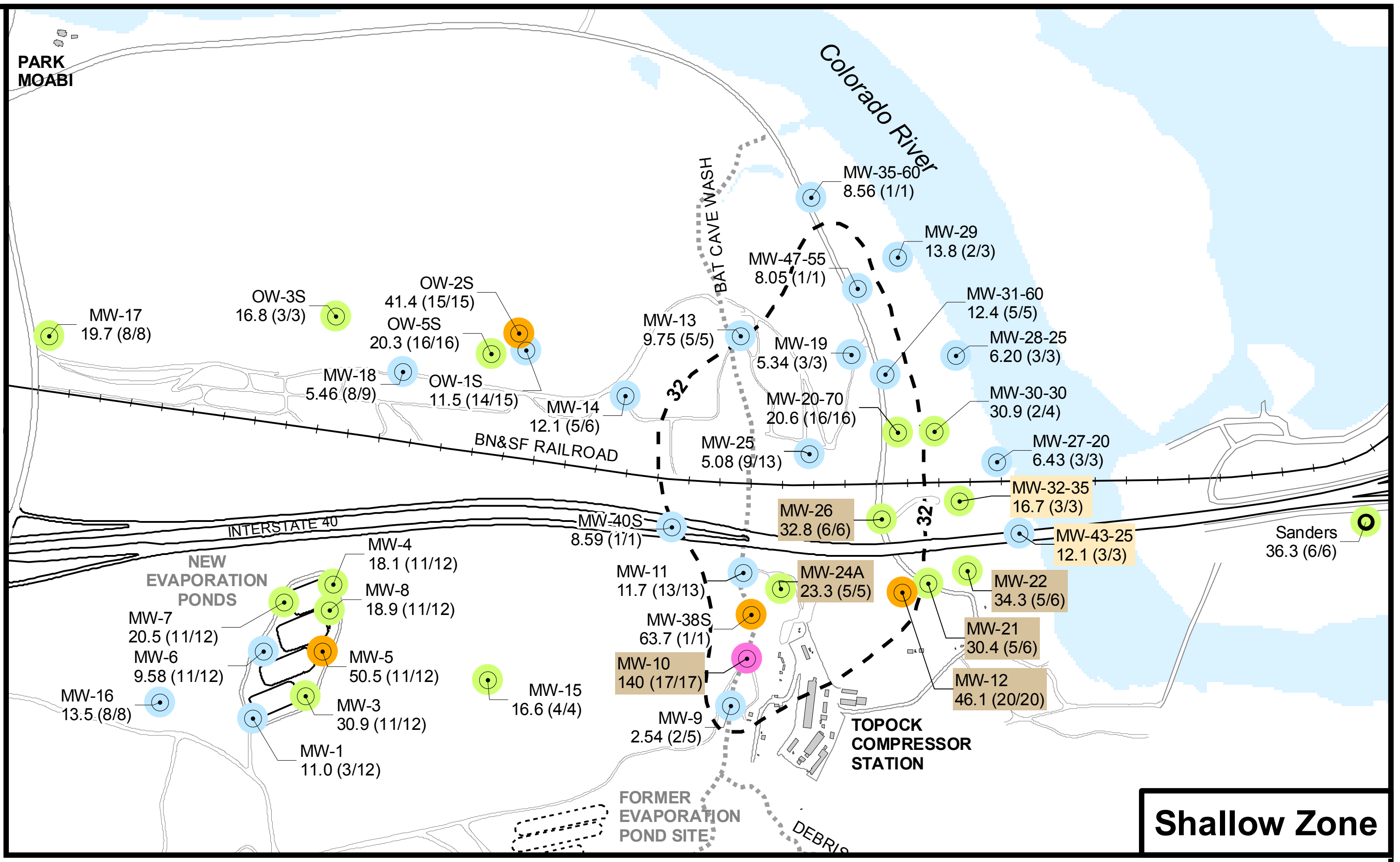

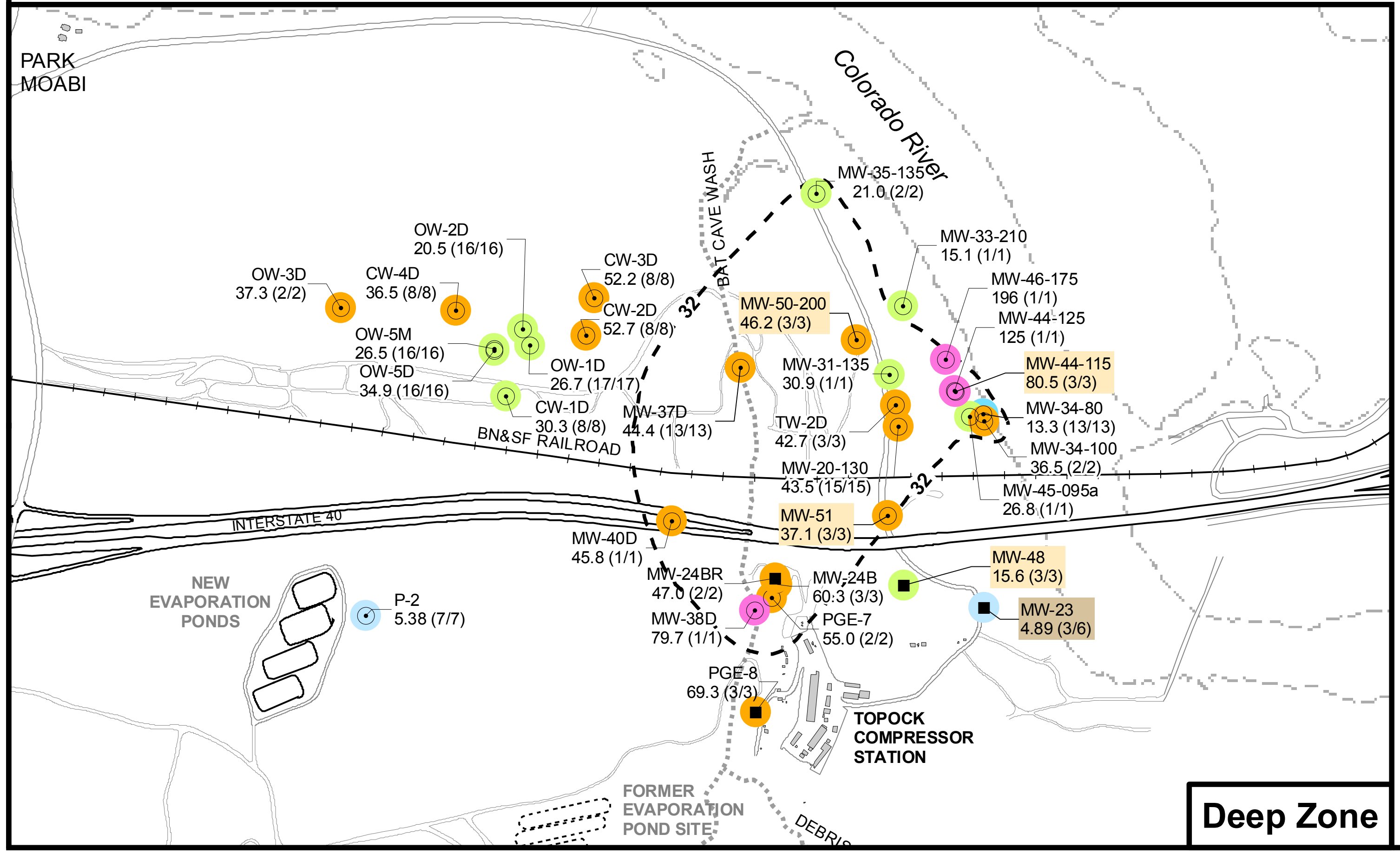

LEGEND

⊙ Groundwater Well completed in Alluvial Aquifer (Shallow, Mid-depth or Deep Zones)

■ Bedrock Well

○ Water Supply Well

Dissolved Molybdenum Average Concentrations

MW-17 ← Well ID

5.8 (8/16) ← (No. of detections / No. of samples)

Average concentration, micrograms per liter (µg/L)
1997-2008 groundwater sampling

◌ Approximate outline of Cr(VI) in Alluvial Aquifer depth zone >/= 32 µg/L, October 2007

MW-32-35 New data presented (December 2007 - July 2008)

MW-20-70 Average updated by new data (December 2007 - July 2008)

🔵 < 15 µg/L (or not detected [ND])

🟢 15 - 36.3 µg/L

🟠 36.4 - 70 µg/L

🟣 > 70 µg/L

Molybdenum Background Study Upper Tolerance Limit (UTL) = 36.3 µg/L

FIGURE 2-13
MOLYBDENUM CONCENTRATIONS IN GROUNDWATER, 1997-2008

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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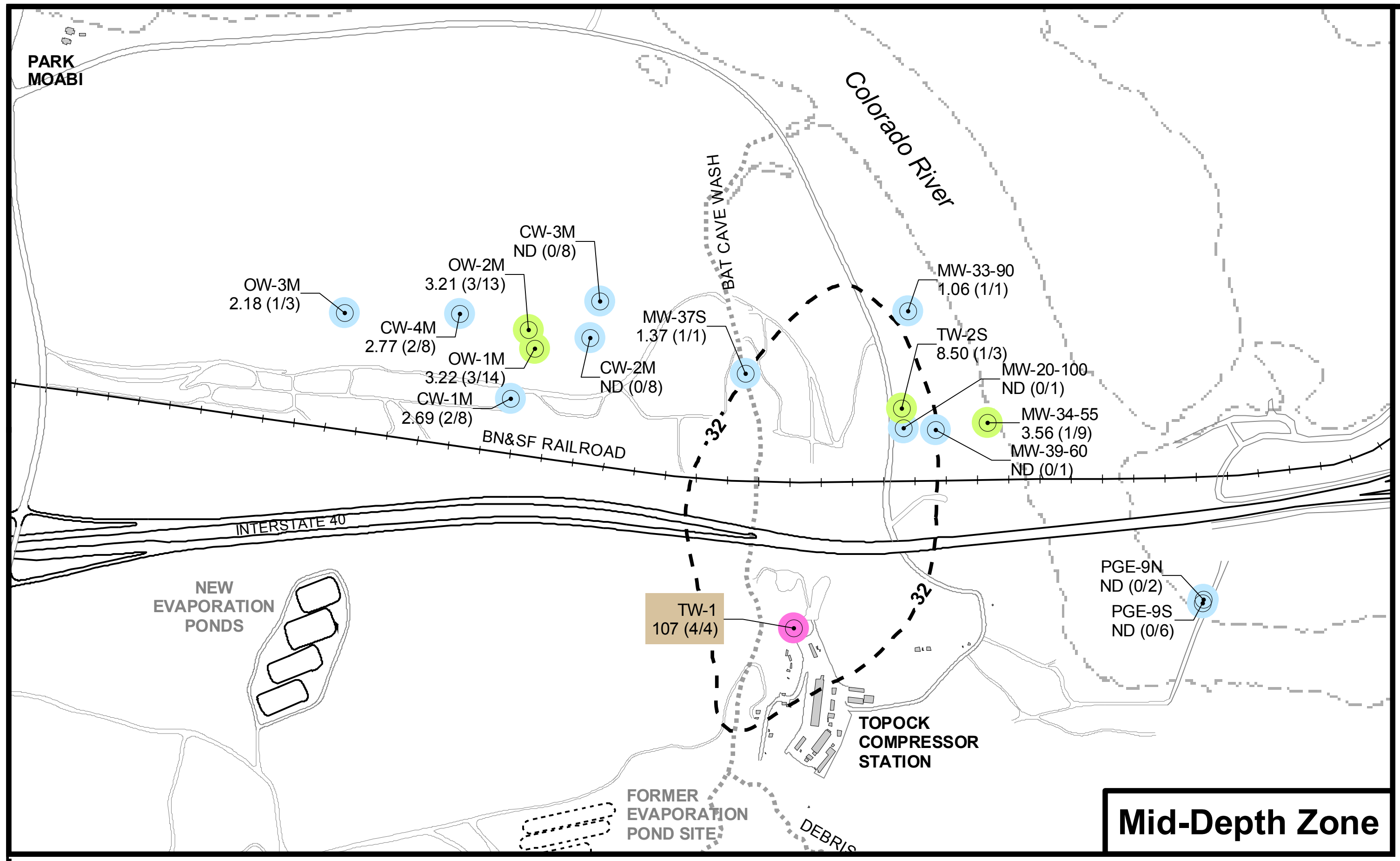

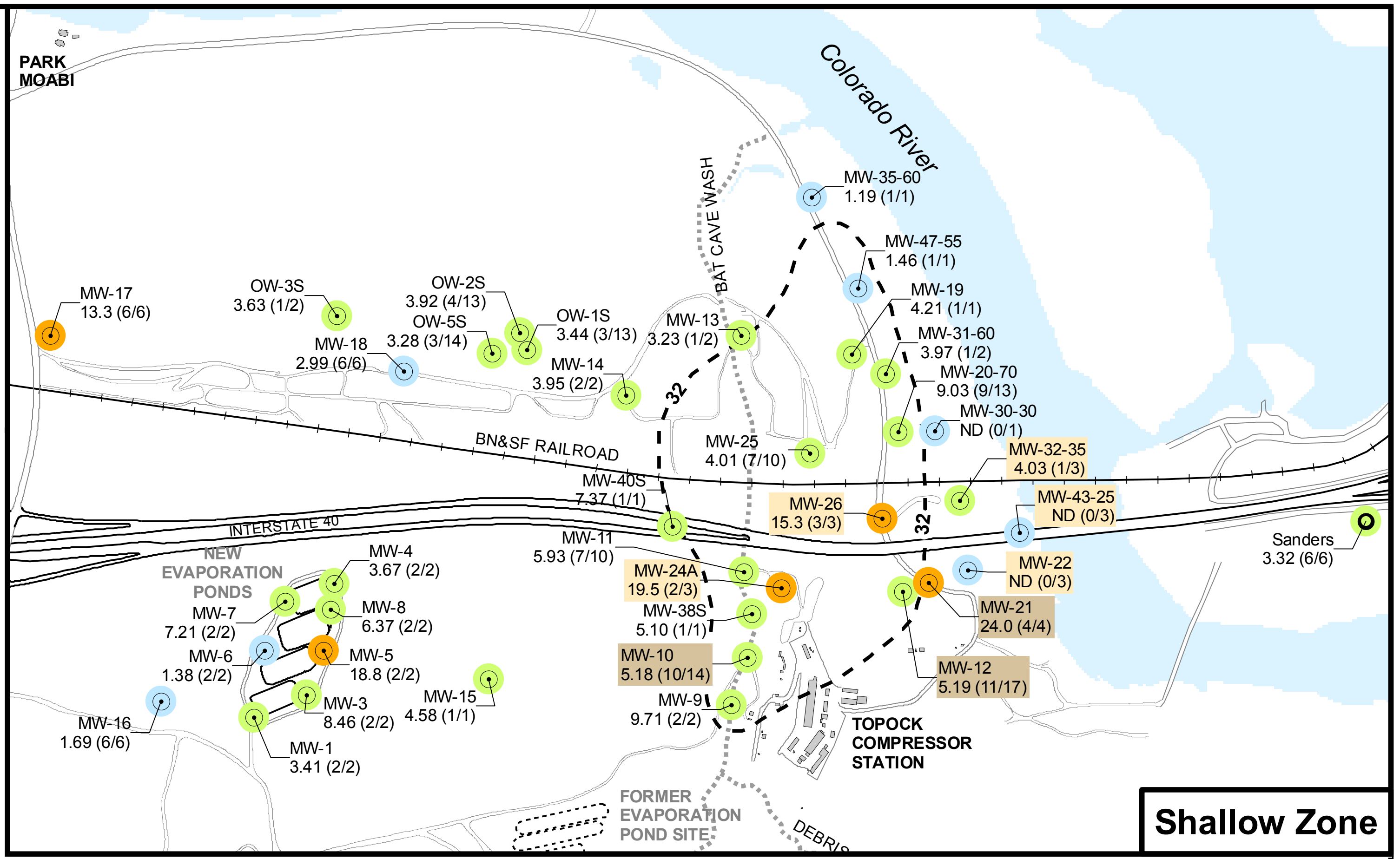

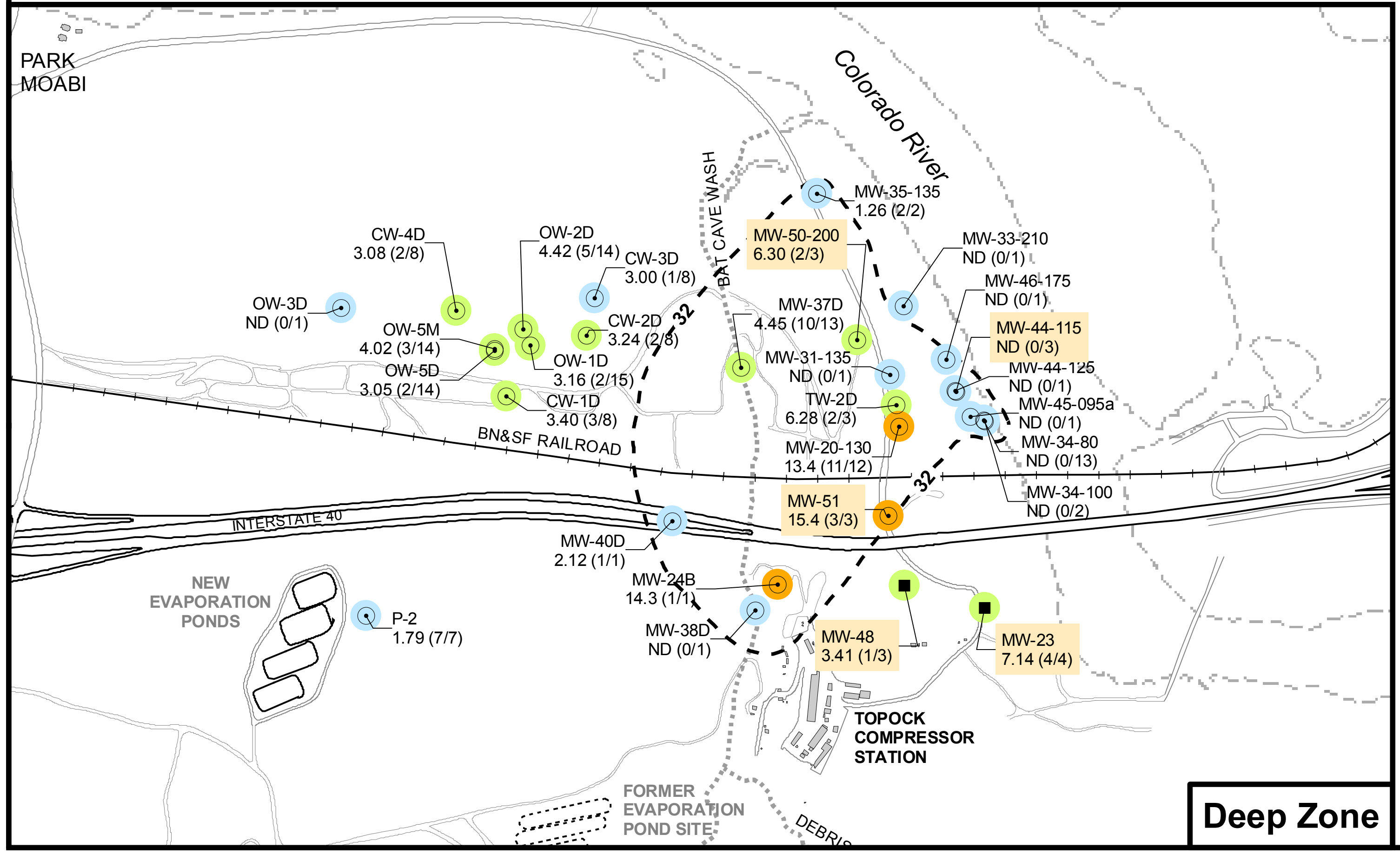

LEGEND

⊙ Groundwater Well completed in Alluvial Aquifer (Shallow, Mid-depth or Deep Zones)

■ Bedrock Well

○ Water Supply Well

Dissolved Selenium Average Concentrations

MW-17 ← Well ID

5.8 (8/16) ← (No. of detections / No. of samples)

↑ Average concentration, micrograms per liter (µg/L) 1997-2008 groundwater sampling

MW-32-35 New data presented (December 2007 - July 2008)

MW-20-70 Average updated by new data (December 2007 - July 2008)

⊙ < 3 µg/L (or not detected [ND])

⊙ 3 - 10.3 µg/L

⊙ 10.4 - 30 µg/L

⊙ > 50 µg/L

Approximate outline of Cr(VI) in Alluvial Aquifer depth zone >/= 32 µg/L, October 2007

Selenium Background Study Upper Tolerance Limit (UTL) = 10.3 µg/L
Selenium applicable or relevant and appropriate requirement (ARAR) = 50 µg/L

FIGURE 2-14
SELENIUM CONCENTRATIONS IN GROUNDWATER, 1997-2008

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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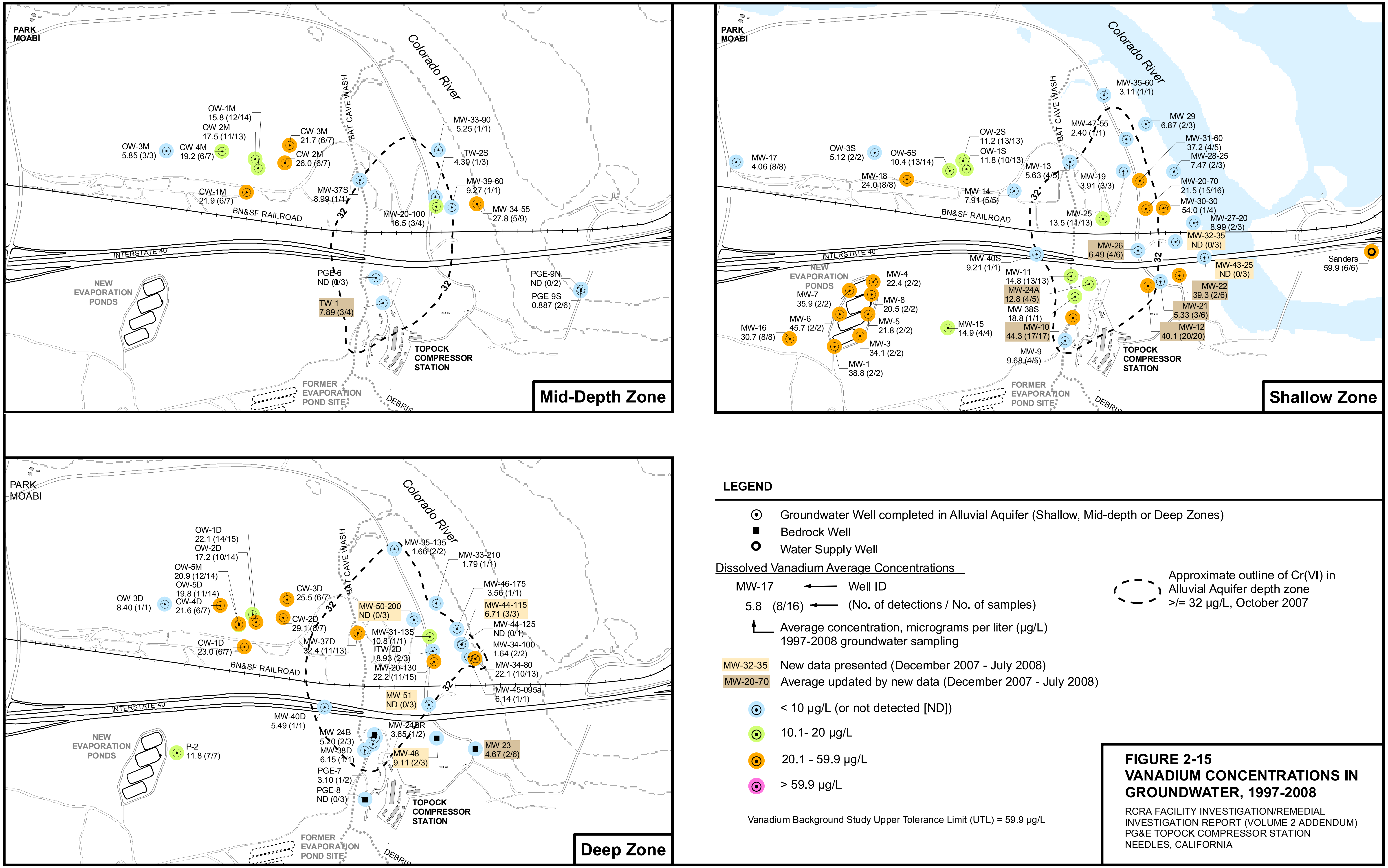

LEGEND

⊙ Groundwater Well completed in Alluvial Aquifer (Shallow, Mid-depth or Deep Zones)
■ Bedrock Well
○ Water Supply Well

Dissolved Vanadium Average Concentrations

MW-17 ⟵ Well ID
5.8 (8/16) ⟵ (No. of detections / No. of samples)
↑ Average concentration, micrograms per liter (µg/L) 1997-2008 groundwater sampling

MW-32-35 New data presented (December 2007 - July 2008)
MW-20-70 Average updated by new data (December 2007 - July 2008)

⊙ < 10 µg/L (or not detected [ND])
⊙ 10.1- 20 µg/L
⊙ 20.1 - 59.9 µg/L
⊙ > 59.9 µg/L

Vanadium Background Study Upper Tolerance Limit (UTL) = 59.9 µg/L

Approximate outline of Cr(VI) in Alluvial Aquifer depth zone >/= 32 µg/L, October 2007

FIGURE 2-15
VANADIUM CONCENTRATIONS IN GROUNDWATER, 1997-2008

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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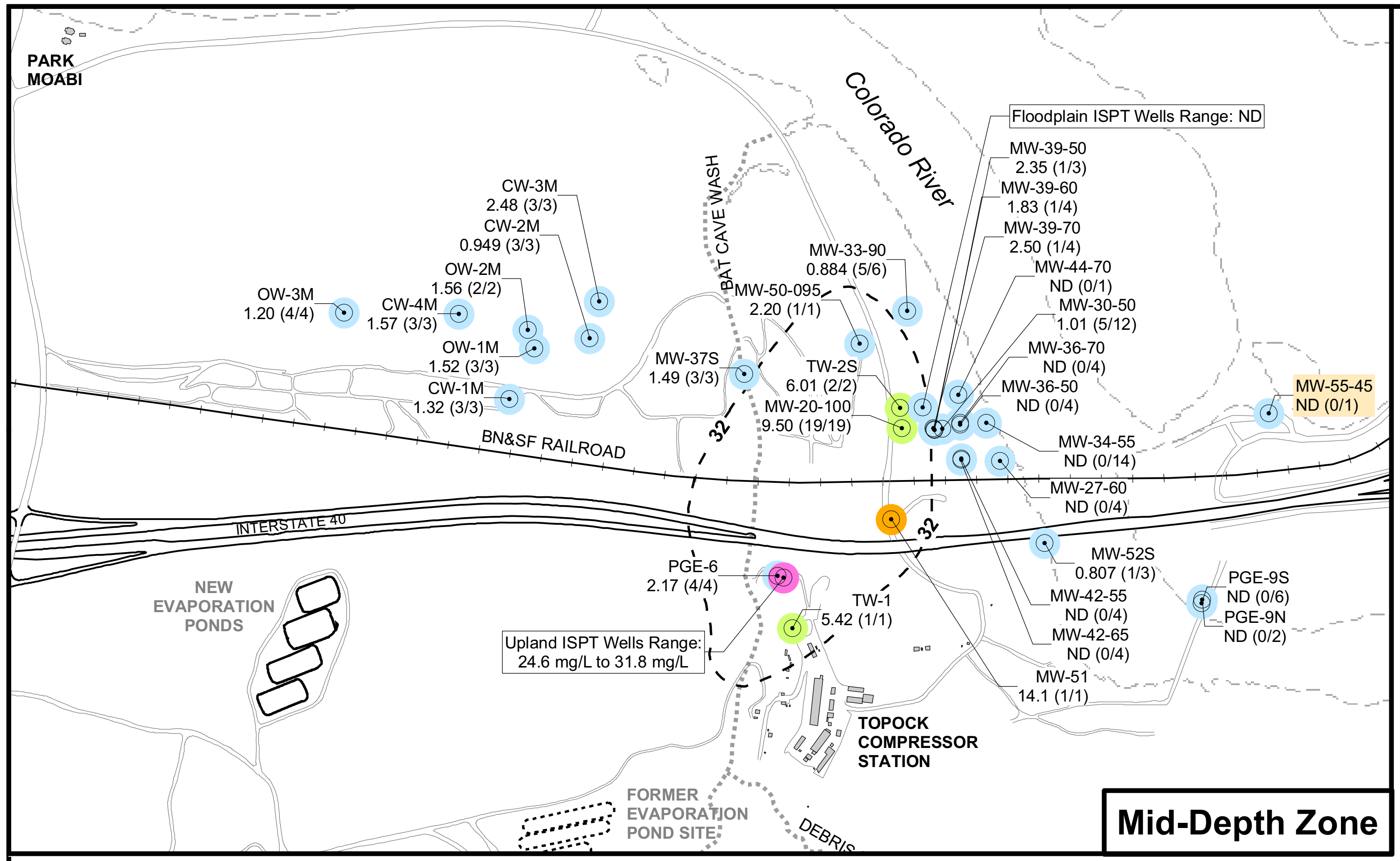
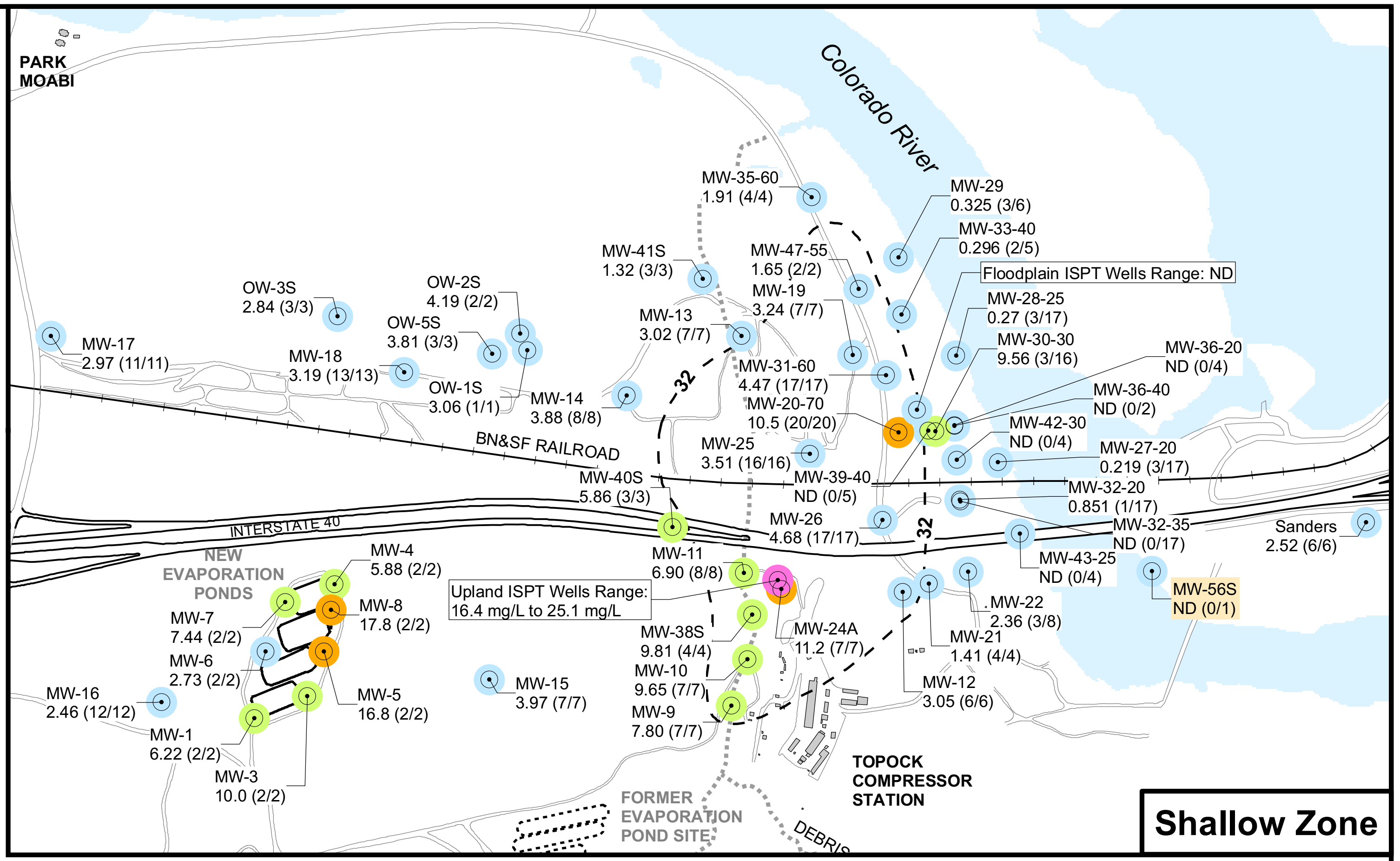
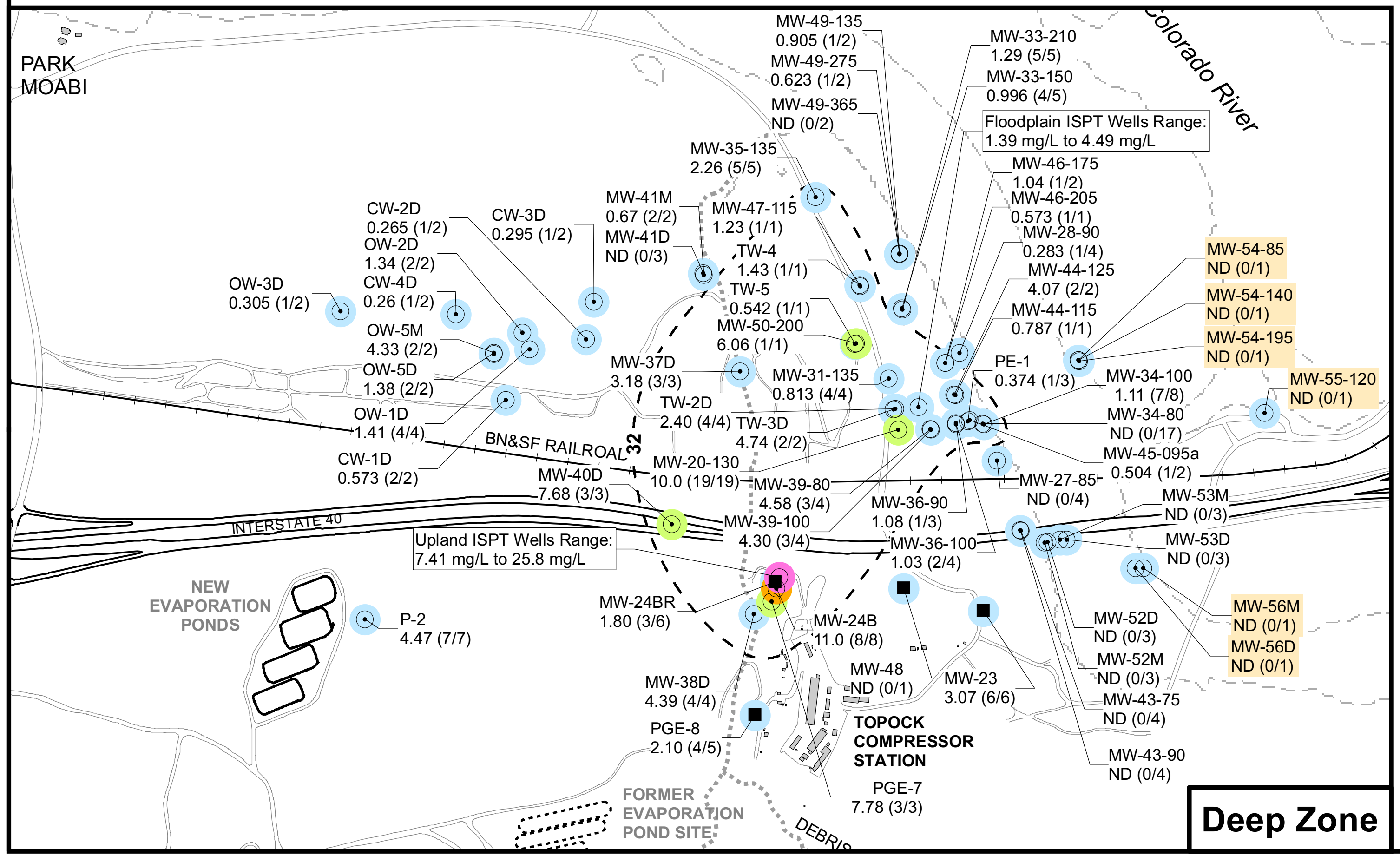


Mid-Depth Zone



Shallow Zone



Deep Zone

LEGEND

⊙ Groundwater Well completed in Alluvial Aquifer (Shallow, Mid-depth or Deep Zones)

■ Bedrock Well

Dissolved Nitrate Average Concentrations

MW-17 ⟵ Well ID

5.8 (8/16) ⟵ (No. of detections / No. of samples)

Average concentration, milligrams per liter (mg/L) 1997-2008 groundwater sampling

MW-55-120 New data presented (December 2007 - July 2008)

⊙ < 5.03 mg/L (or not detected [ND])

⊙ 5.03 - 10 mg/L

⊙ 10.1 - 19.9 mg/L

⊙ > 20 mg/L

Approximate outline of Cr(VI) in Alluvial Aquifer depth zone >/= 32 μg/L, October 2007

Nitrate Background Study Upper Tolerance Limit (UTL) = 5.03 mg/L
Nitrate applicable or relevant and appropriate requirement (ARAR) = 10 mg/L

Note:
All concentrations shown are for nitrate as nitrogen. Some historical data required conversion to these units for computation of averages.

FIGURE 2-16
NITRATE CONCENTRATIONS IN GROUNDWATER 1997 - 2008

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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3.0 Conclusions

This section summarizes the evaluation of the Addendum datasets in relation to the conceptual side model and groundwater characterization conclusions drawn in the RFI/RI Volume 2 Report.

3.1 Conceptual Site Model

The historical photographs and records obtained from BOR and other information sources more fully document the dredging history and the morphology of the Colorado River in the study area. The updated information and chronology of dredging locations, bank stabilization, and other man-made effects on river morphology are consistent with the historical review and information presented in the RFI/RI Report Volumes 1 and 2. No revisions or changes to the conceptual site model regarding site features and river morphology are needed based on this additional information.

The drilling data and results obtained from the Arizona groundwater investigation confirm the site conceptual model for hydrogeologic conditions presented in the RFI/RI Volume 2 Report. The depth to bedrock was confirmed at all three Arizona drilling locations, which provides additional geologic control for mapping the Miocene bedrock surface, and defines the base of the Alluvial Aquifer. The overall depth and configuration of the Miocene bedrock surface is somewhat shallower but still similar to the interpretation developed prior to the Arizona drilling investigation. The bedrock surface map updated to include the results of the Arizona investigation has been incorporated in the site hydrogeologic conceptual model and groundwater numerical model. In an area near the East Ravine, the depth to bedrock is deeper than initially mapped and the bedrock surface forms a shallow 'embayment' adjacent to the bedrock outcrops. The complete findings of the East Ravine investigation will be provided in future reports.

Hydraulic data collected during the May and September 2008 IM-3 system shutdown tests indicate the hydraulic influence from the IM-3 pumping extends into Arizona.) It should be noted that detected response in a monitoring well does not necessarily indicate that that well is within the capture zone of the pumping well. The existing model, calibrated in 2005, predicted drawup of between 0.05 and 0.06 feet in the MW-54 wells for the May 2008 shutdown test. The model was not used to simulate the results of the September test, but because the flow rates of the wells were the same and the duration of the shutdown was similar, it would be expected that the projected drawup in September would be very similar to May. Figures for well clusters MW-49 and MW-54 provided in Appendix D1 show the model projected water level responses along with the measured responses for the May 2008 shutdown test. The model projections are consistent with the observed responses at both sets of wells. This shows that the current calibration of the model is generally adequate to simulate the hydraulic effects of IM-3. Should recalibration of the groundwater flow model be necessary for remedy selection or design, monitoring well hydraulic data collected during the May and September IM-3 shutdowns will be used in the recalibration.

3.2 Groundwater Characterization

The Arizona groundwater investigation conducted in March to April 2008 served to further characterize the hydrogeologic conditions and groundwater quality near the Arizona shore of the Colorado River, as well as beneath the river channel downstream of the chromium plume observed in the California floodplain. This investigation included drilling, detailed characterization, well installation, and sampling at three investigation sites: MW-54, MW-55, and MW-56. The results of five rounds of groundwater sampling (April-September 2008) have shown that Cr(VI) and Cr(T) are not present in groundwater samples above background concentrations in all eight monitoring locations. These findings provide field-measured confirmation concerning previous estimates about the eastern extent of Cr(VI) and Cr(T) in the Alluvial Aquifer. The Arizona groundwater investigation has further documented the nature and extent of natural reducing conditions in the saturated fluvial and alluvial sediments that underlie the Arizona shore of the Colorado River in the investigation area. It is noted that the full extent and capacity of effective reducing material in the fluvial sediments in the floodplain areas on both sides of the river have not been fully characterized, and although the vast majority of the monitoring wells in the upper- and middle-depth fluvial sediments show reducing conditions, there have been two fluvial wells (MW-30-50 and MW-39-50) that encountered non-reducing material.

Analytical results for Title 22 trace metals were collected over three sampling periods between December 2007 and May 2008. Although modest concentration increases and decreases were noted in a few wells for a limited number of trace metals, the overall observed distributions and ranges of concentrations are consistent with those observed in the RFI/RI Volume 2 Report and support the conclusions made in the report.

3.3 Conclusions

Except for selenium, the additional data and information presented in this Addendum do not modify the conclusions of the RFI/RI Volume 2 Report. Additionally, the information confirms that, of the media assessed for the RFI/RI Volume 2 (i.e., groundwater, surface water, pore water, and river sediment), only groundwater appears to be affected by SWMU 1/AOC 1 activities at the Topock Compressor Station. Newly collected selenium data was interpreted by DTSC to further support its previous conclusion that selenium is a site COPC. Given the consistency of trace metal concentration distribution presented in this Addendum compared with the analogous information in the RFI/RI Volume 2 Report, the conclusion of the RFI/RI Volume 2 Report that Cr(VI), Cr(T), molybdenum, and selenium are the COPCs for groundwater related to SWMU 1/AOC 1 is unchanged. In addition, DTSC has directed PG&E to carry nitrate forward as a COPC on the basis of its interpretation of nitrate concentration distribution and potential sources from the facility presented in this Addendum. The additional wells installed on the Arizona side of the Colorado River and associated analytical data presented in this report provide field-measured confirmation concerning previous estimates about the eastern extent of Cr(VI) and Cr(T) in groundwater.

Other than nitrate recommendations, the recommendations in the RFI/RI Volume 2 Report with respect to a CMS/FS for SWMU 1/AOC 1 are unchanged with the addition of the data and information presented in this Addendum. Further characterization and installation of additional monitoring wells in the East Ravine area and within the compressor station will be reported in future reports. Remediation of any groundwater contamination associated with sources other than SWMU 1/AOC 1 and SWMU 2 will be addressed in accordance with the RCRA and CERCLA processes.

4.0 References

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Appendix A
Historical Photographs and Information on Dredging and Channel Improvements to the Colorado River Site Characterization

A1 Photographs and Maps from BOR Records, 1956 – 1969

P423-306-1299A. Jetties constructed on Arizona bank at 300´ and 500´ intervals from Sta. 38-00 to Sta. 67-00. Jan. 31, 1956. Photo by H.B. Burress.

Aerial view of the Colorado River.
P423-306-1334A – CRFW&LS – Sta. 60-100. August 1956.

APPENDIX A-1
PHOTOS OF THE COLORADO RIVER TAKEN DURING CHANNEL IMPROVEMENTS, 1956 – 1969

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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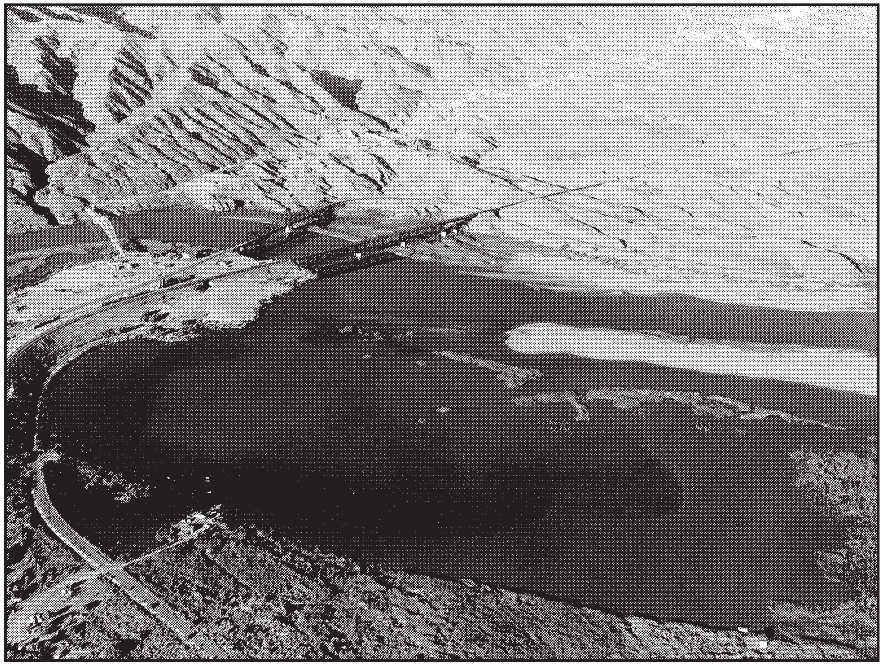

P423-306-371A-CRFW&LS – Topock Bridges. August 1956.

300-4385A. Colorado River Front Work & Levee System.
Photograph of highway bridge across Colorado River near Topock, California, 1962.
Bureau photo by R.C. Middleton.

APPENDIX A-2
PHOTOS OF THE COLORADO RIVER TAKEN DURING CHANNEL IMPROVEMENTS, 1956 – 1969

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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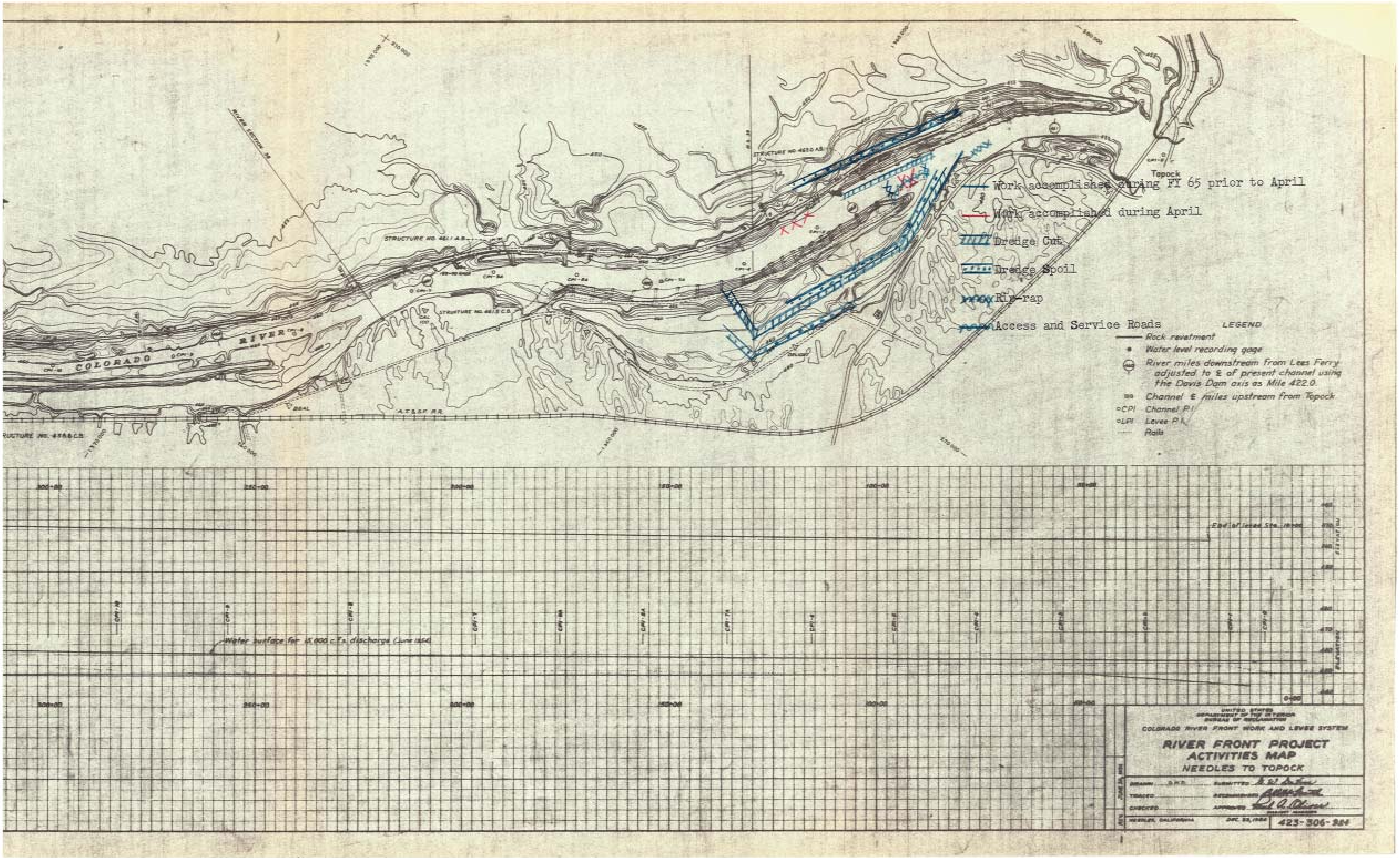

APPENDIX A-3
COLORADO RIVER FRONT ACTIVITIES MAP, APRIL 1965

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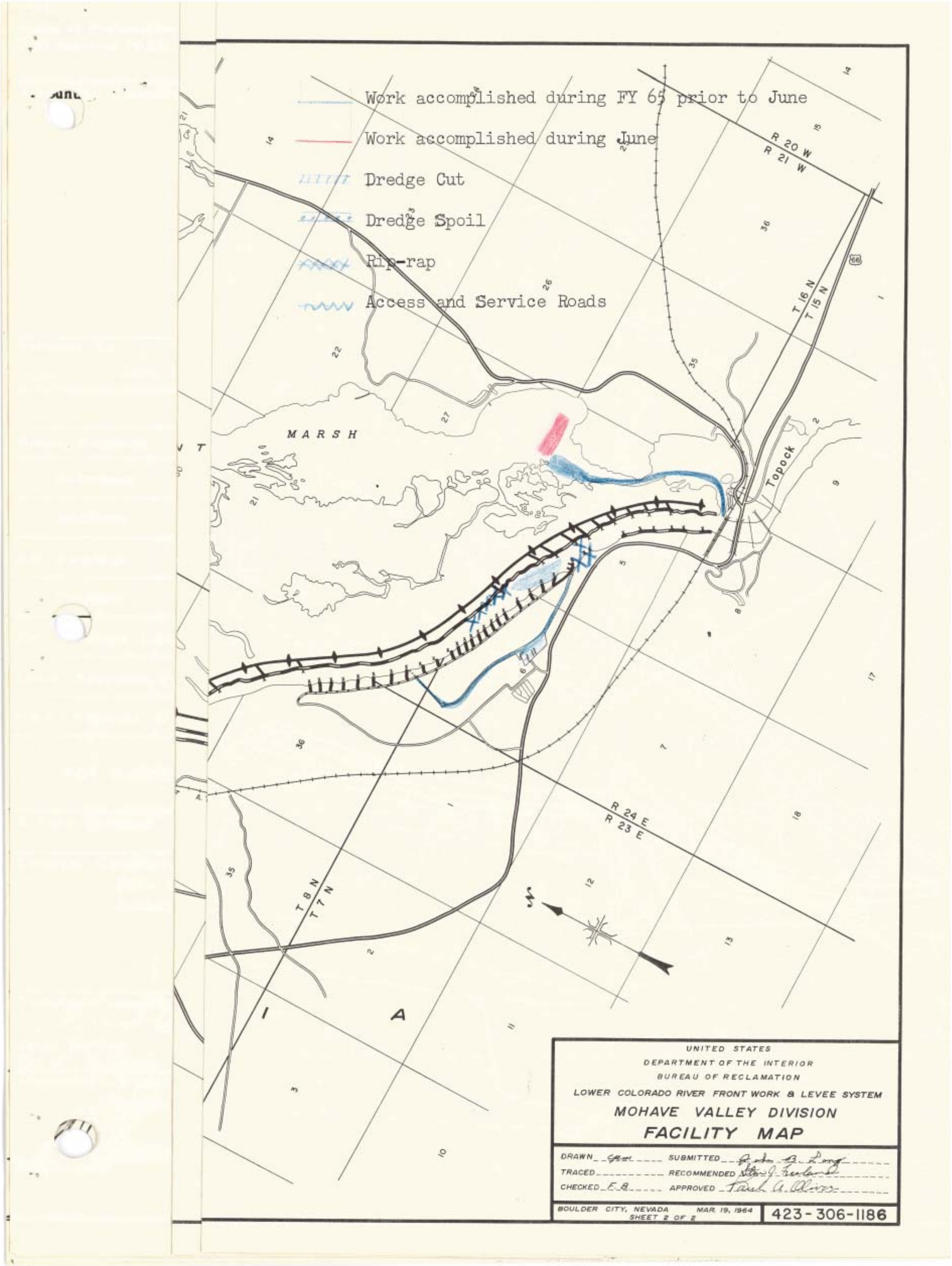
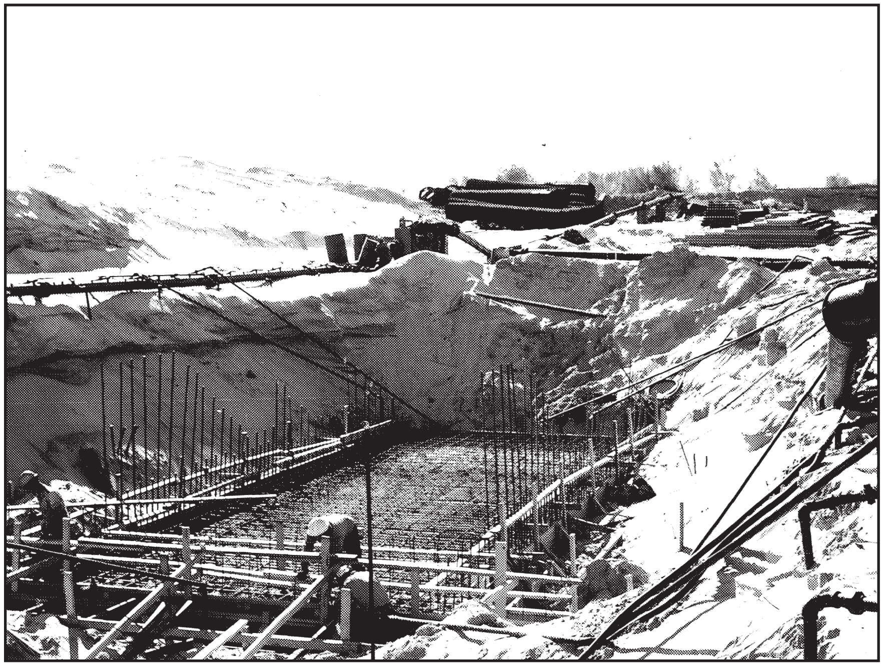


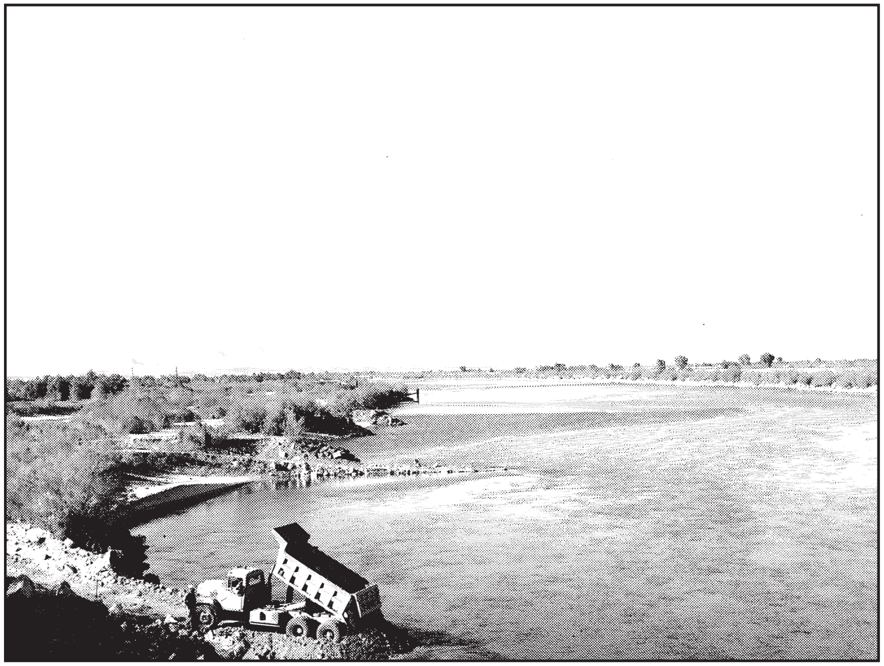
APPENDIX A-4
COLORADO RIVER FRONT ACTIVITIES MAP, JUNE 1965



P423-306-4347 NA. Colorado River Front Work and Levee System, Region 3. Topock Marsh Development. Specifications No. 300C-232. Contractor's forces placing reinforcing steel in floor of inlet structure. 11/29/65. Bureau of Reclamation photo by Fred Burley.

APPENDIX A-5
PHOTOS OF THE COLORADO RIVER TAKEN DURING CHANNEL IMPROVEMENTS, 1956 – 1969

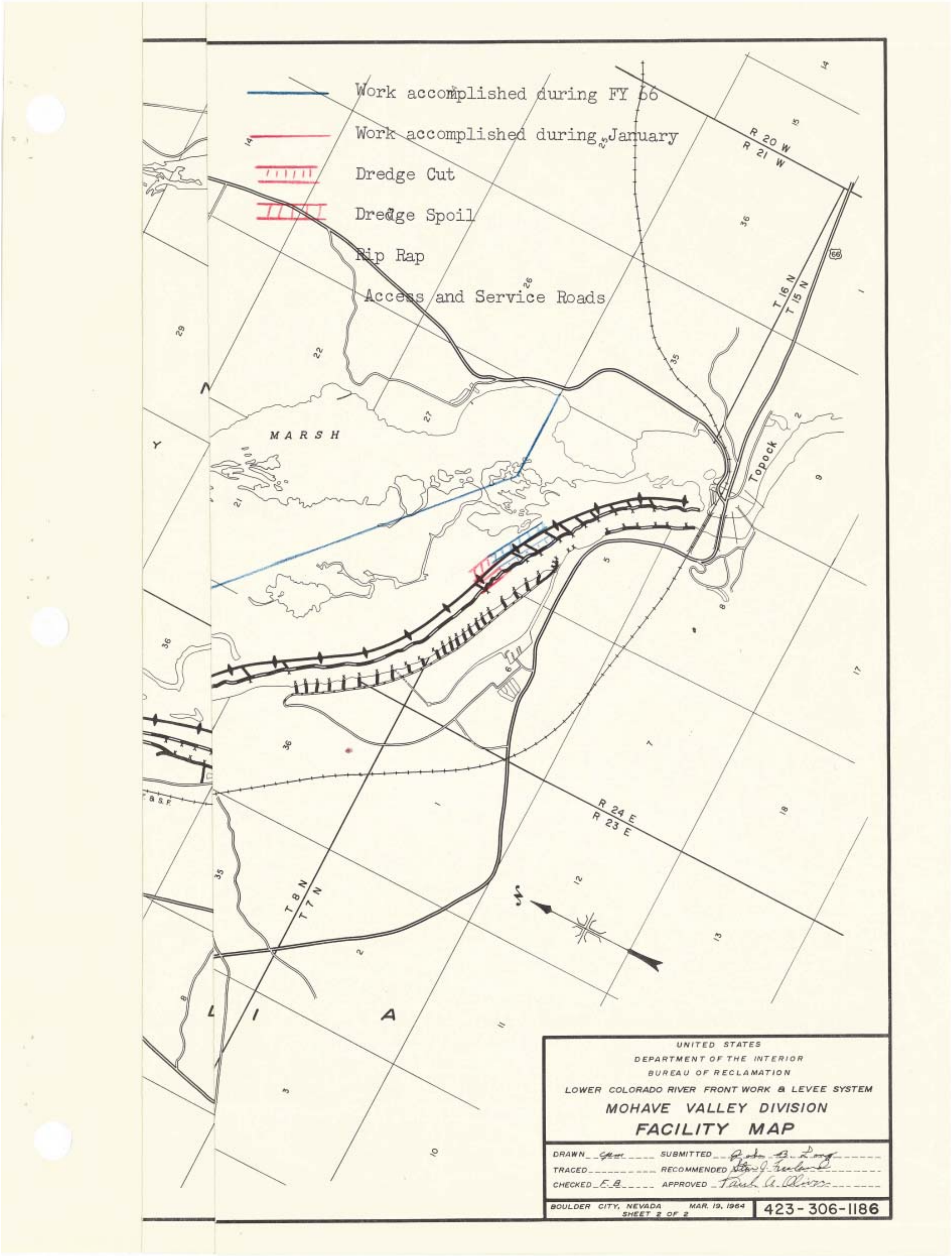
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



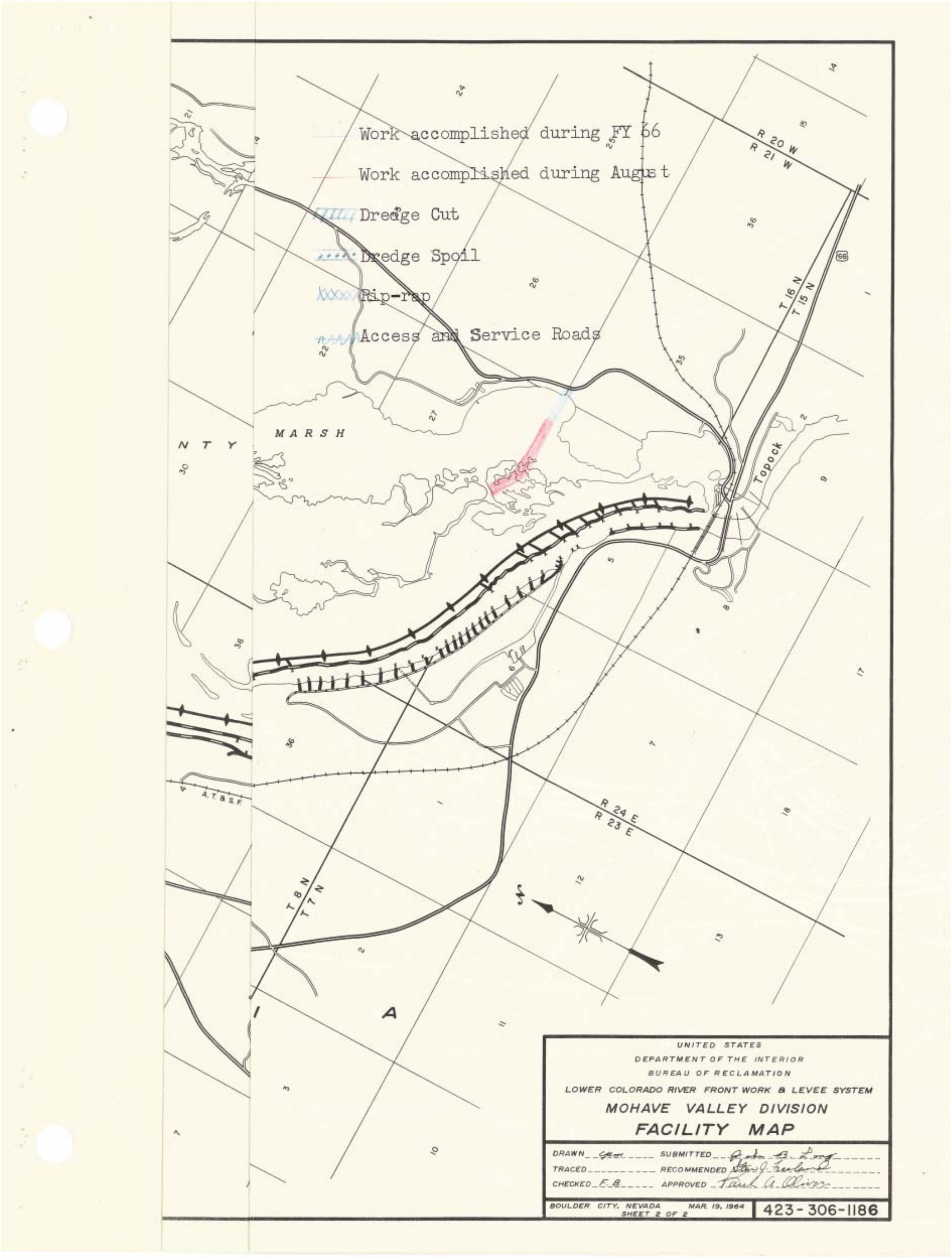
P423-306-4340 NA. Colorado River Front Work and Levee System, Region 3. Needles to Topock Division. Government forces constructing jetty to narrow the width of channel. The channel was narrowed to cause the water to scour sand bar at entrance to Topock Marsh inlet channel structure. Truck at Station 558, California bank. 12/1/65. Bureau of Reclamation photo by Fred Burley.

APPENDIX A-6
PHOTOS OF THE COLORADO RIVER TAKEN DURING CHANNEL IMPROVEMENTS, 1956 – 1969

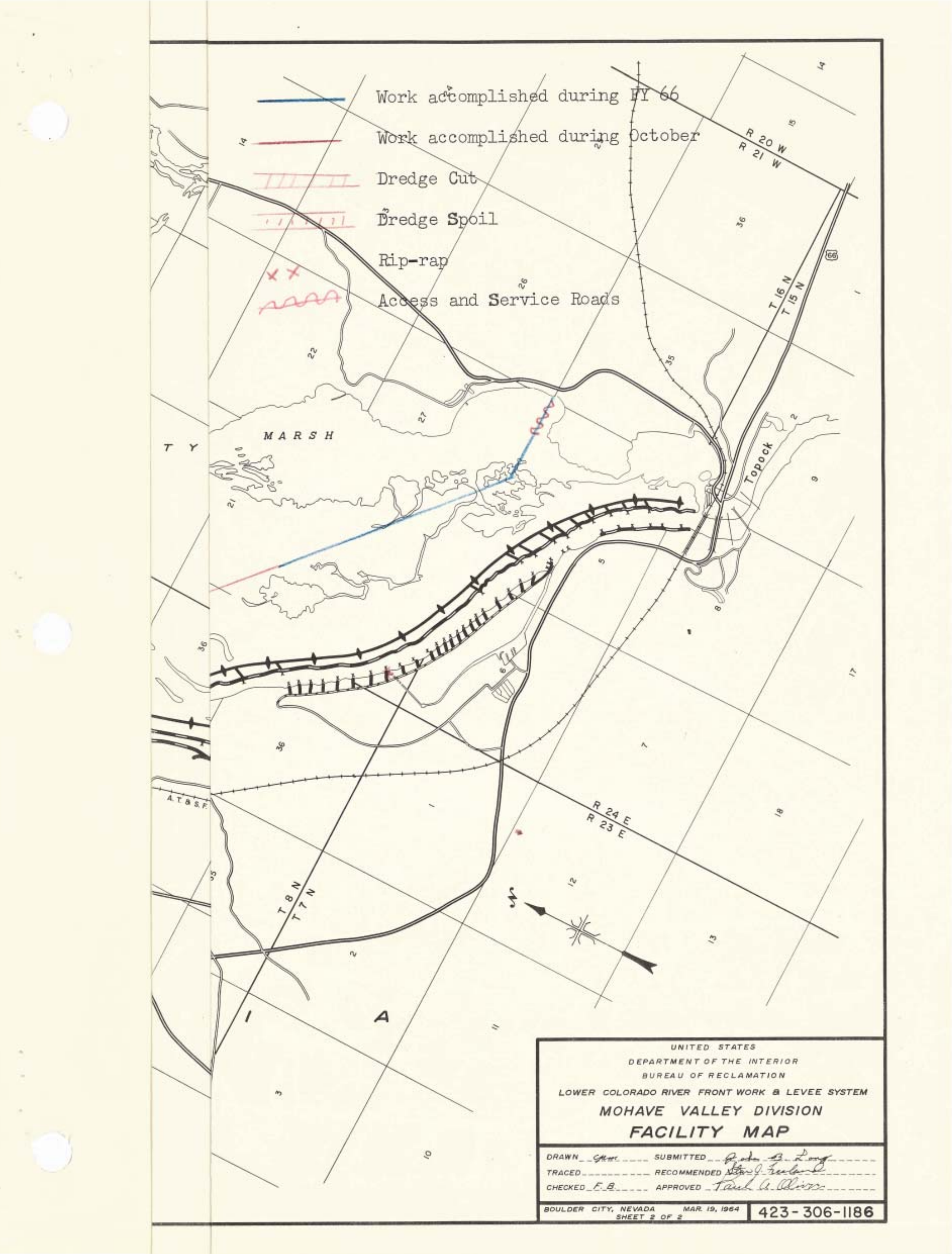
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



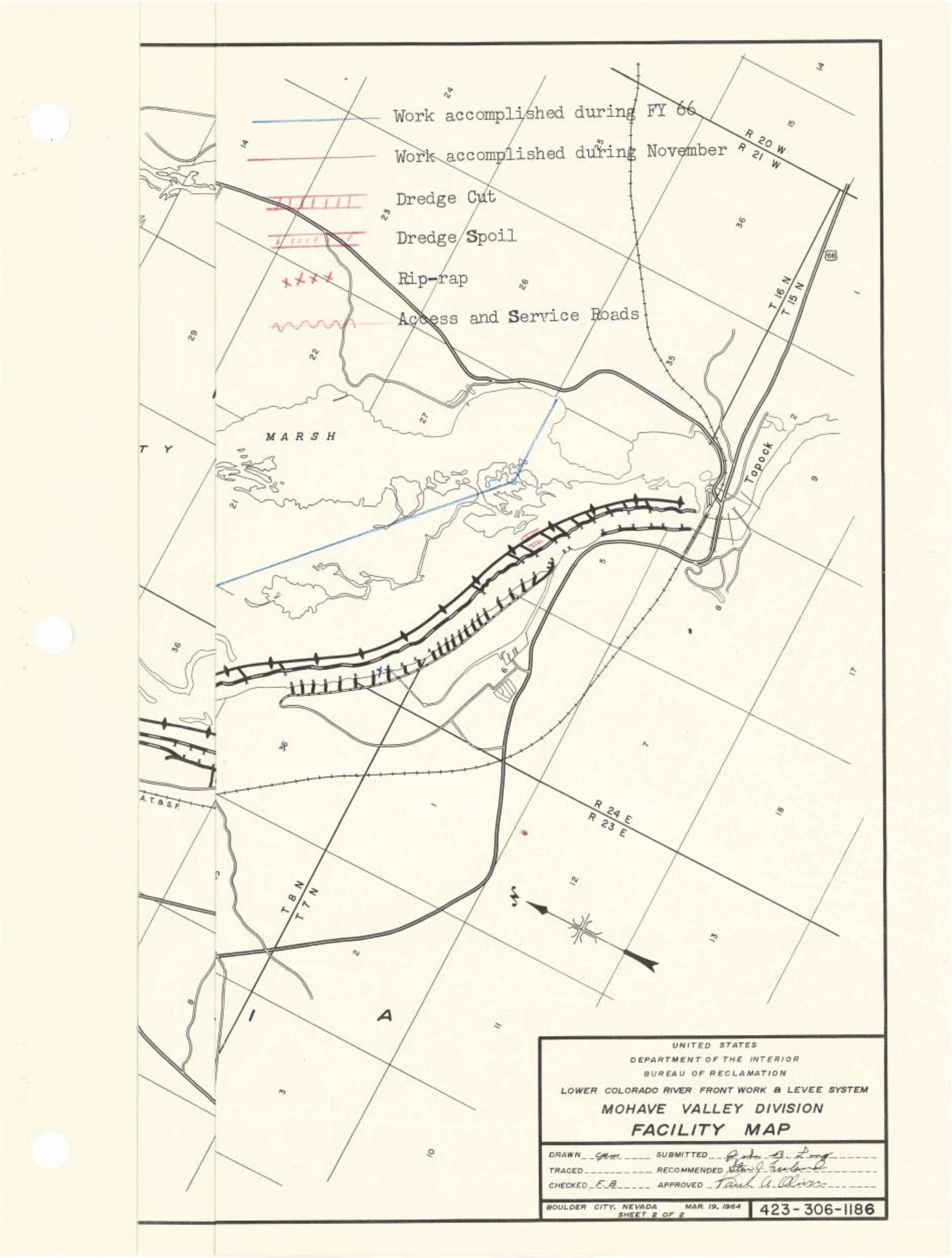
APPENDIX A-7
COLORADO RIVER FRONT ACTIVITIES MAP, JANUARY 1966



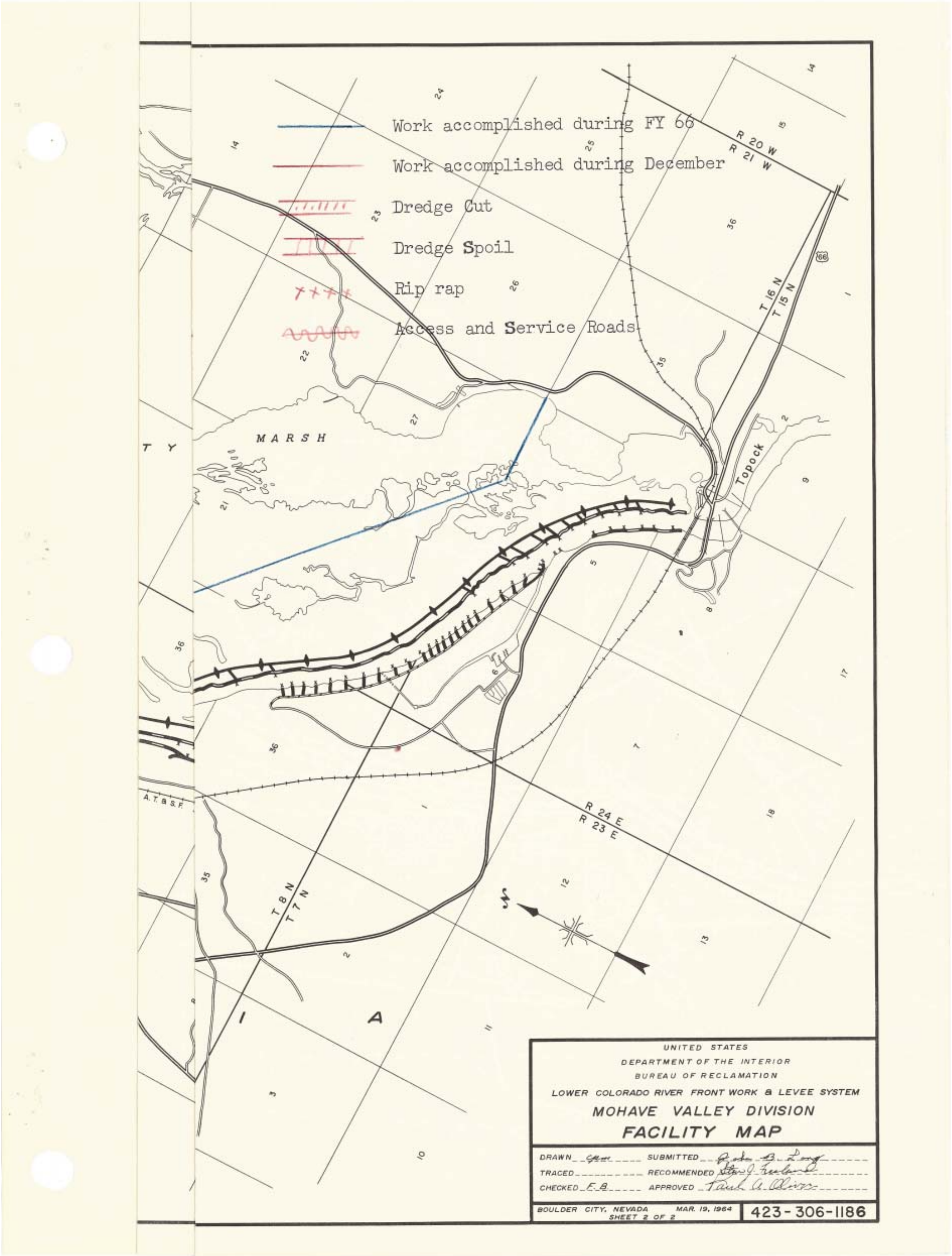
APPENDIX A-8
COLORADO RIVER FRONT ACTIVITIES MAP, AUGUST 1966



APPENDIX A-9
COLORADO RIVER FRONT ACTIVITIES MAP, OCTOBER 1966



APPENDIX A-10
COLORADO RIVER FRONT ACTIVITIES MAP, NOVEMBER 1966



APPENDIX A-11
COLORADO RIVER FRONT ACTIVITIES MAP, DECEMBER 1966

P423-300-7748 NA Topock Gorge Division – Colorado River Front Work & Levee System, Arizona-California. Looking upstream at Spoil Site No. 1 (south of U.S. 66). Spoil will be placed here to provide an access site for recreation and wildlife use. The Bureau of Reclamation will provide a parking lot, boat ramp, restroom facilities, and landscape the site for day-use. 2/29/68 Bureau of Reclamation photo by Al R. Jonez.

APPENDIX A-12
PHOTOS OF THE COLORADO RIVER TAKEN DURING CHANNEL IMPROVEMENTS, 1956 – 1969

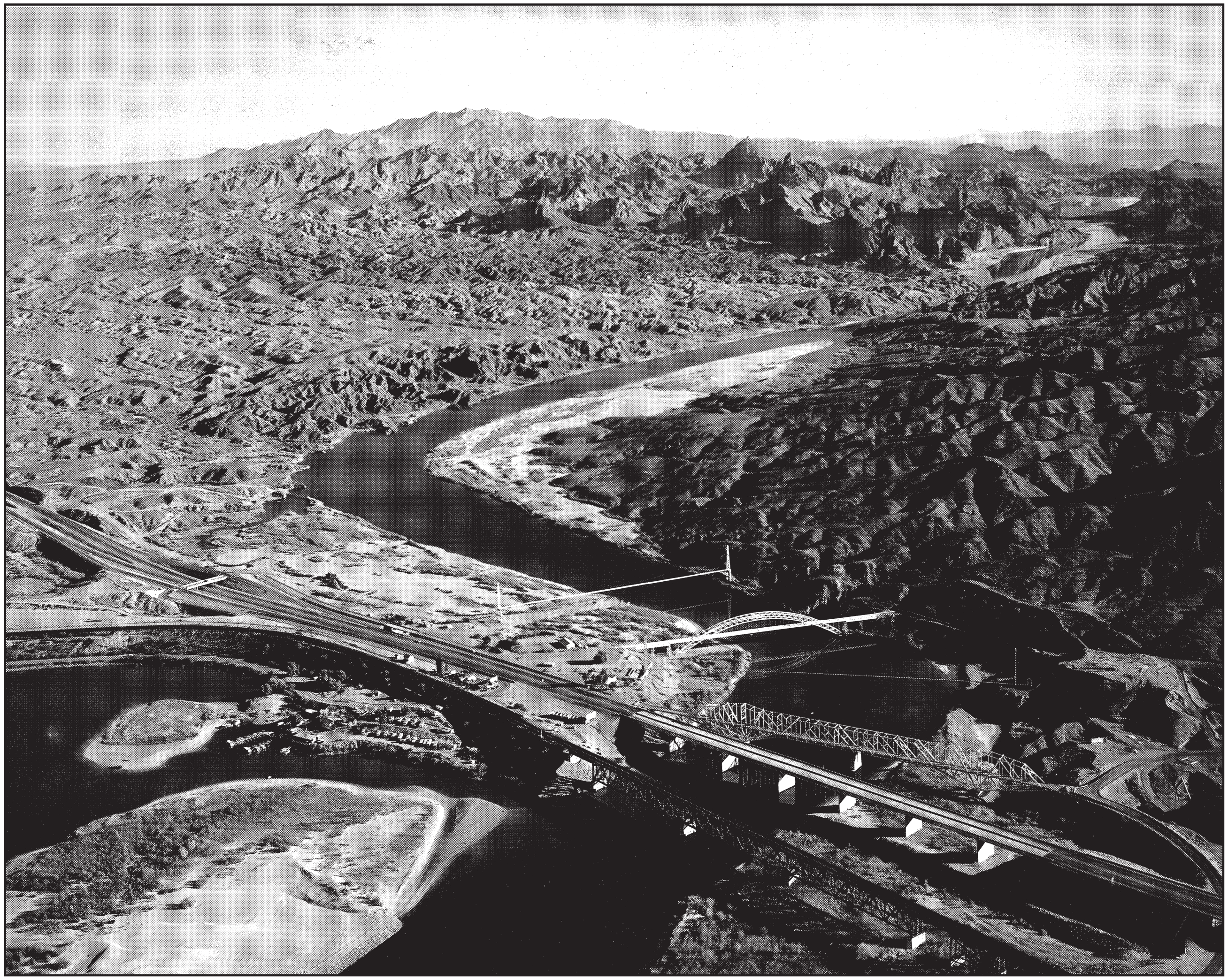
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

P423-300-7747 NA Topock Gorge Division – Colorado River Front Work & Levee System, Arizona-California. Looking north at the Topock Ridge which is the start of the Division. Spoil placed on Spoil Site No. 2 on the left, will be landscaped and planted for recreation day-use this spring. Topock Marsh can be seen in the distance (River Mile 465). 2/29/68 Bureau of Reclamation photo by Al R. Jonez.

APPENDIX A-13
PHOTOS OF THE COLORADO RIVER TAKEN DURING CHANNEL IMPROVEMENTS, 1956 – 1969

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



P423-300-8736 NA Mohave Valley Division – Colorado River Front Work & Levee System, Arizona-California. Looking downstream at the end of the Mohave Division and the starting point for the Topock Gorge Division. The bridge crossing the Colorado River at Topock, Arizona, is the dividing point. Golden Shores concession can be seen in the bay on the left before the bridge. Sediment removed from the first 1.7 mile section of the Topock Gorge Division can be seen on the two areas downstream from the bridge. River Mile 463.8 is at the bottom of the photograph. 1/6/69 Bureau of Reclamation photo by E. E. Hertzog.

APPENDIX A-14
PHOTOS OF THE COLORADO RIVER TAKEN DURING CHANNEL IMPROVEMENTS, 1956 – 1969

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

P423-300-8735 NA Mohave Valley Division – Colorado River Front Work & Levee System, Arizona-California. Looking upstream at the Park Moabi Marina complex operated by the County of San Bernardino. The Reclamation withdrawn lands are leased to the county for park and recreation purposes. River Mile 462.5 is at the bottom of the photograph. 1/6/69 Bureau of Reclamation photo by E. E. Hertzog.

APPENDIX A-15
PHOTOS OF THE COLORADO RIVER TAKEN DURING CHANNEL IMPROVEMENTS, 1956 – 1969

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

P423-300-8737 NA Topock Gorge Division – Colorado River Front Work & Levee System, Arizona-California. Looking upstream at the start of the Topock Gorge Division area. Portions of this section have been dredged prior to the time that Secretary of the Interior, Stewart Udall, suspended all work in the Topock Gorge Division pending a revaluation of the dredging program. River Mile 465 is at the bottom of the photograph. 1/6/69 Bureau of Reclamation photo by E. E. Hertzog.

APPENDIX A-16
PHOTOS OF THE COLORADO RIVER TAKEN DURING CHANNEL IMPROVEMENTS, 1956 – 1969

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

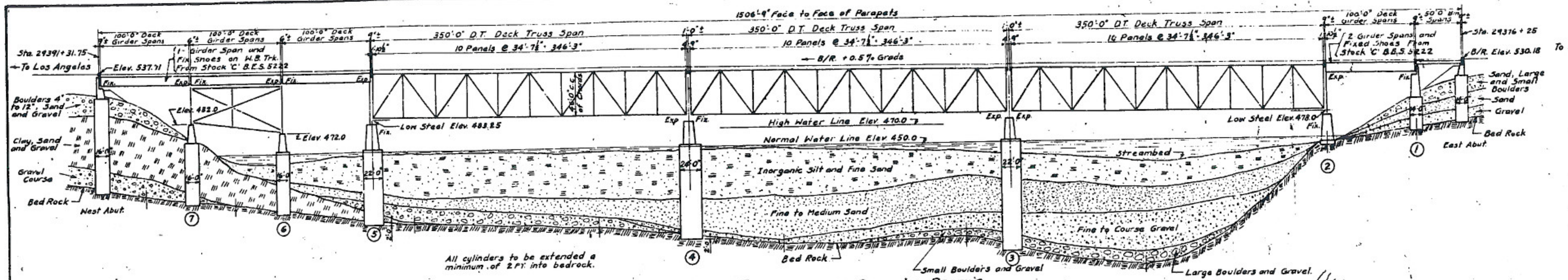
P423-300-8734 NA Mohave Valley Division – Colorado River Front Work & Levee System, Arizona-California. Looking upstream in the river section opposite the inlet to Park Moabi Marina. The lake on the right is called Lost Lake. The sandy areas are a by-product of several years settling basin dredging in this section. Part of the sediment moving downstream in the Mohave Division was removed at this location before it moved on into the Topock Gorge Division. River Mile 462 is at the bottom of the photograph. 1/6/69 Bureau of Reclamation photo by E. E. Hertzog.

APPENDIX A-17
PHOTOS OF THE COLORADO RIVER TAKEN DURING CHANNEL IMPROVEMENTS, 1956 – 1969

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

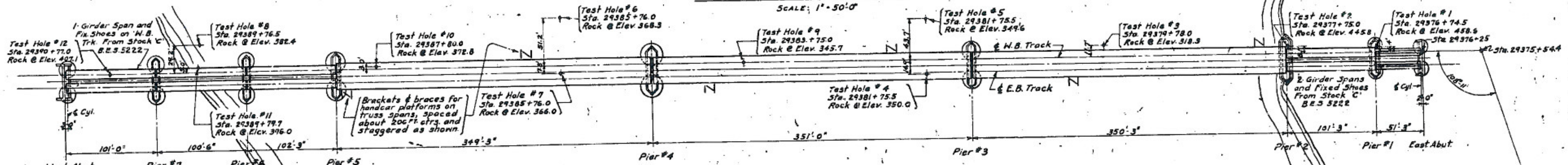
CH2MHILL

A2 Historical Information on Railroad Bridge Crossings at Topock



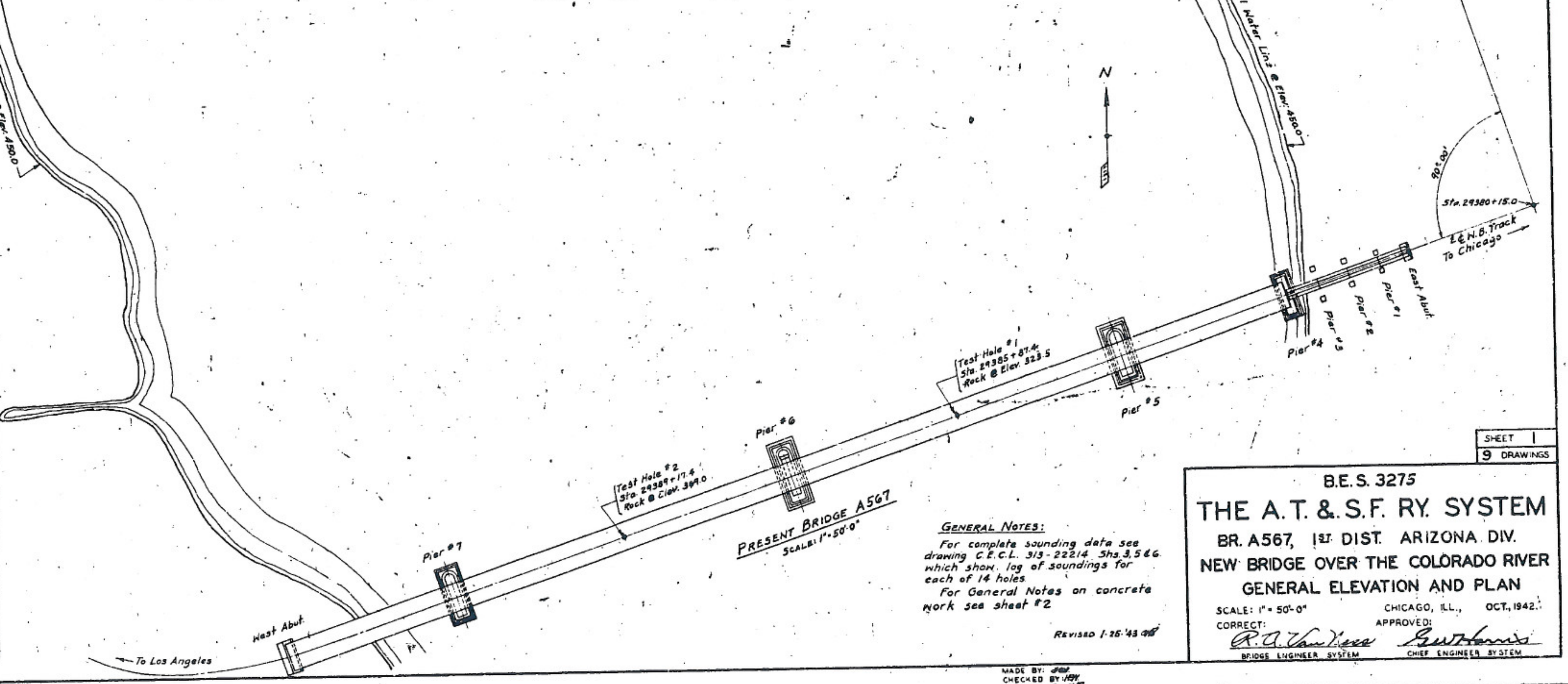
ELEVATION AND SOUNDING PROFILE

SCALE: 1" = 50'-0"



PLAN OF NEW BRIDGE AND TEST HOLE LOCATIONS

SCALE: 1" = 50'-0"



PRESENT BRIDGE A567

SCALE: 1" = 50'-0"

ESTIMATED QUANTITIES

	CONCRETE - CU. YDS.			REINFORCING STEEL TONS	EXCAVATION - CU. YDS.		
	FOUNDATION		NEATWORK		COMMON	LOOSE ROCK	SOLID ROCK
	2000#	3000#	3000#				
EAST ABUTMENT	230	390	90	7.0			
PIER #1	150	235	325	7.0			
PIER #2	155	—	590	0.2			
PIER #3	560	*2680	485	12.5			
PIER #4	550	*2780	550	18.0			
PIER #5	430	*1850	635	16.0			
PIER #6	285	*740	230	9.0			
PIER #7	285	655	230	9.0			
WEST ABUTMENT	430	1120	150	12.0			
TOTAL	3075	10450	3285	95.7			

* Includes concrete between cylinders as shown.

GENERAL NOTES:

For complete sounding data see drawing C.E.C.L. 313-22214 Shs. 3, 5 & 6 which show log of soundings for each of 14 holes.

For General Notes on concrete work see sheet #2

REVISED 1-26-'43

SHEET 1
9 DRAWINGS

B.E.S. 3275

THE A.T. & S.F. RY. SYSTEM

BR. A567, 1ST DIST. ARIZONA DIV.

NEW BRIDGE OVER THE COLORADO RIVER

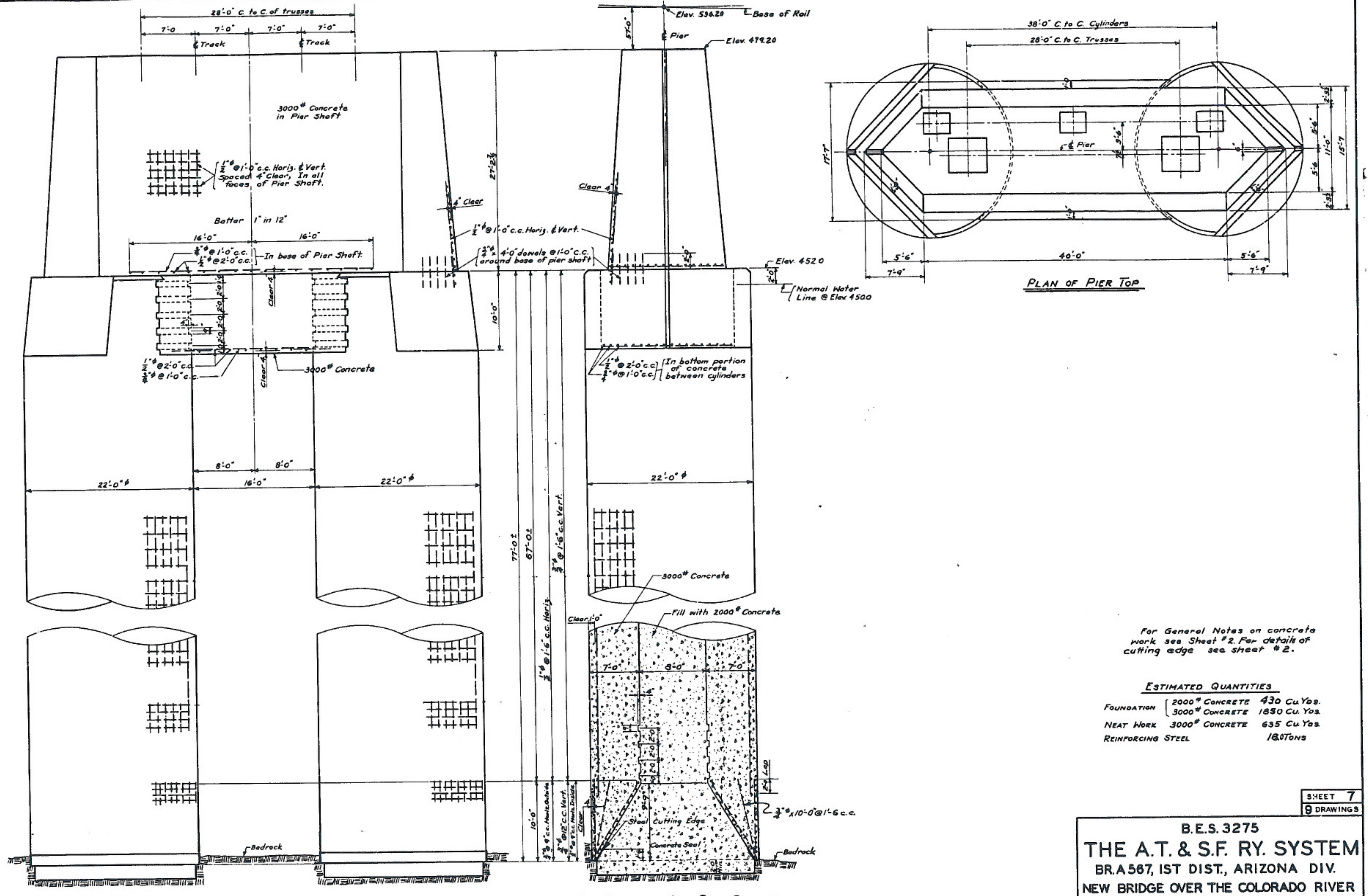
GENERAL ELEVATION AND PLAN

SCALE: 1" = 50'-0"   CHICAGO, ILL., OCT., 1942.

CORRECT: R. A. Van Ness
BRIDGE ENGINEER SYSTEM

APPROVED:
CHIEF ENGINEER SYSTEM

MADE BY:
CHECKED BY: HBW
EXAMINED BY:



ELEVATION

END ELEVATION AND PART SECTION

PLAN OF PIER TOP

For General Notes on concrete work see Sheet #2. For details of cutting edge see sheet #2.

ESTIMATED QUANTITIES

FOUNDATION	2000# CONCRETE	430 CU. YDS.
	3000# CONCRETE	1850 CU. YDS.
NEAT WORK	3000# CONCRETE	635 CU. YDS.
REINFORCING STEEL		18.0 TONS

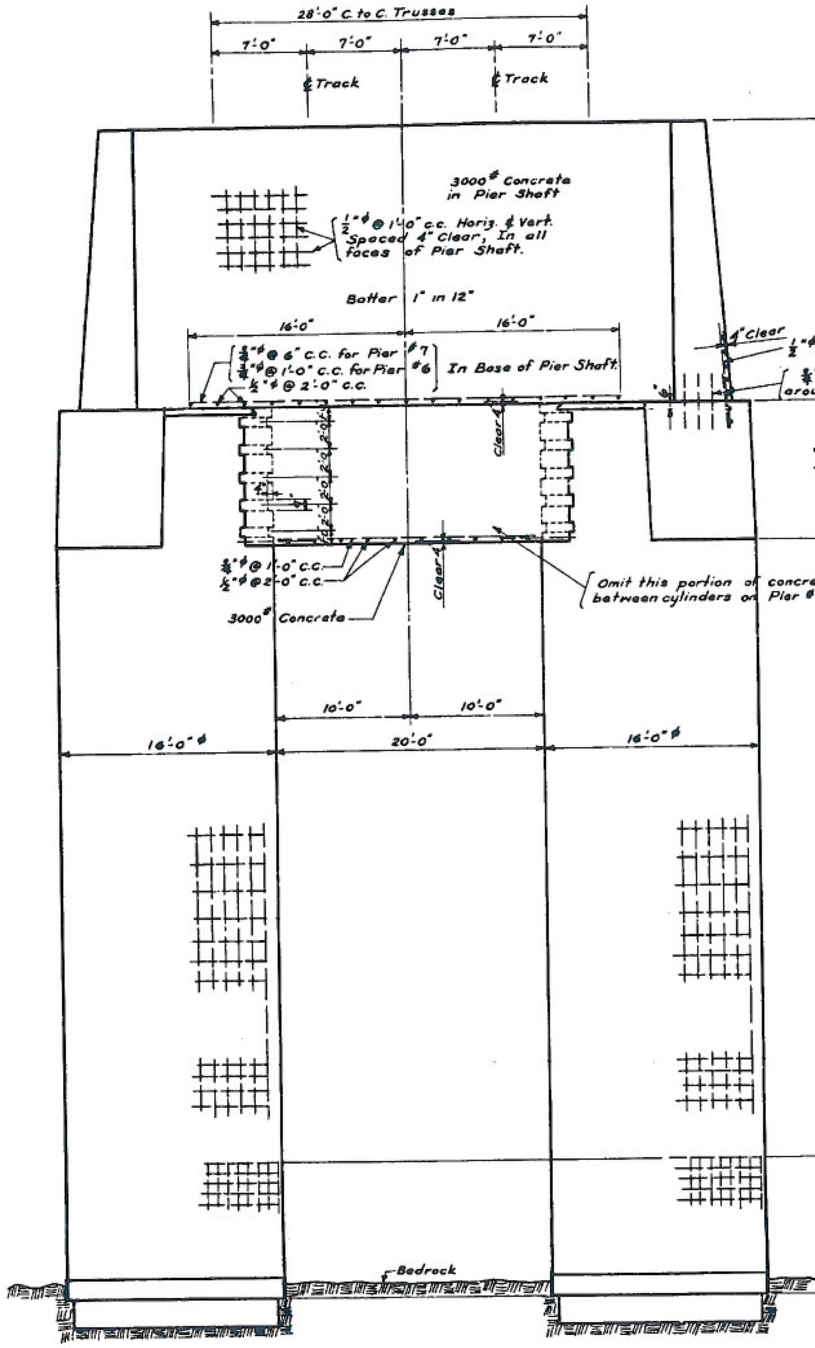
SHEET 7
9 DRAWINGS

B.E.S. 3275
THE A.T. & S.F. RY. SYSTEM
BR. A 567, 1ST DIST., ARIZONA DIV.
NEW BRIDGE OVER THE COLORADO RIVER
DESIGN OF PIER #5

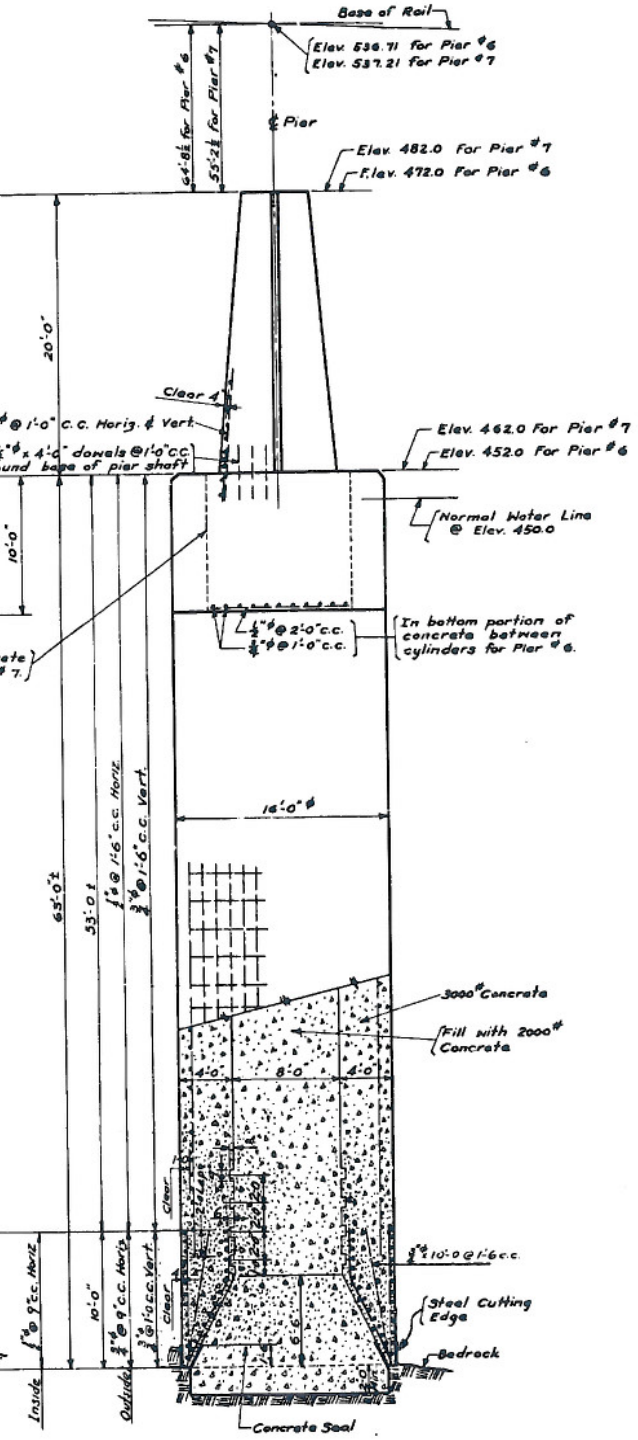
SCALE: 3/16"=1'-0"   CHICAGO, ILL.,   OCT., 1942
CORRECT: APPROVED:
R. A. Van Ness   G. W. Harris
BRIDGE ENGINEER SYSTEM   CHIEF ENGINEER SYSTEM

Rev. 10/30/42 C.H.S.

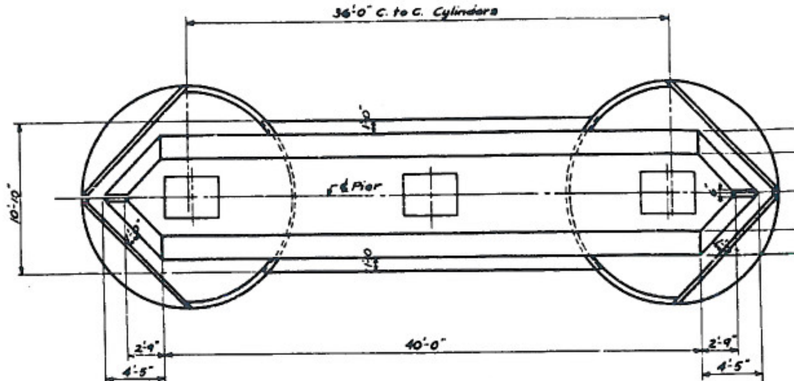
MADE BY: GRE
CHECKED BY VEW
EXAMINED BY CHB



ELEVATION



END ELEVATION AND PART SECTION



PLAN OF PIER TOP

For General Notes on concrete work see Sheet #2. For Details of Cutting Edge See Sheet #2.

ESTIMATED QUANTITIES

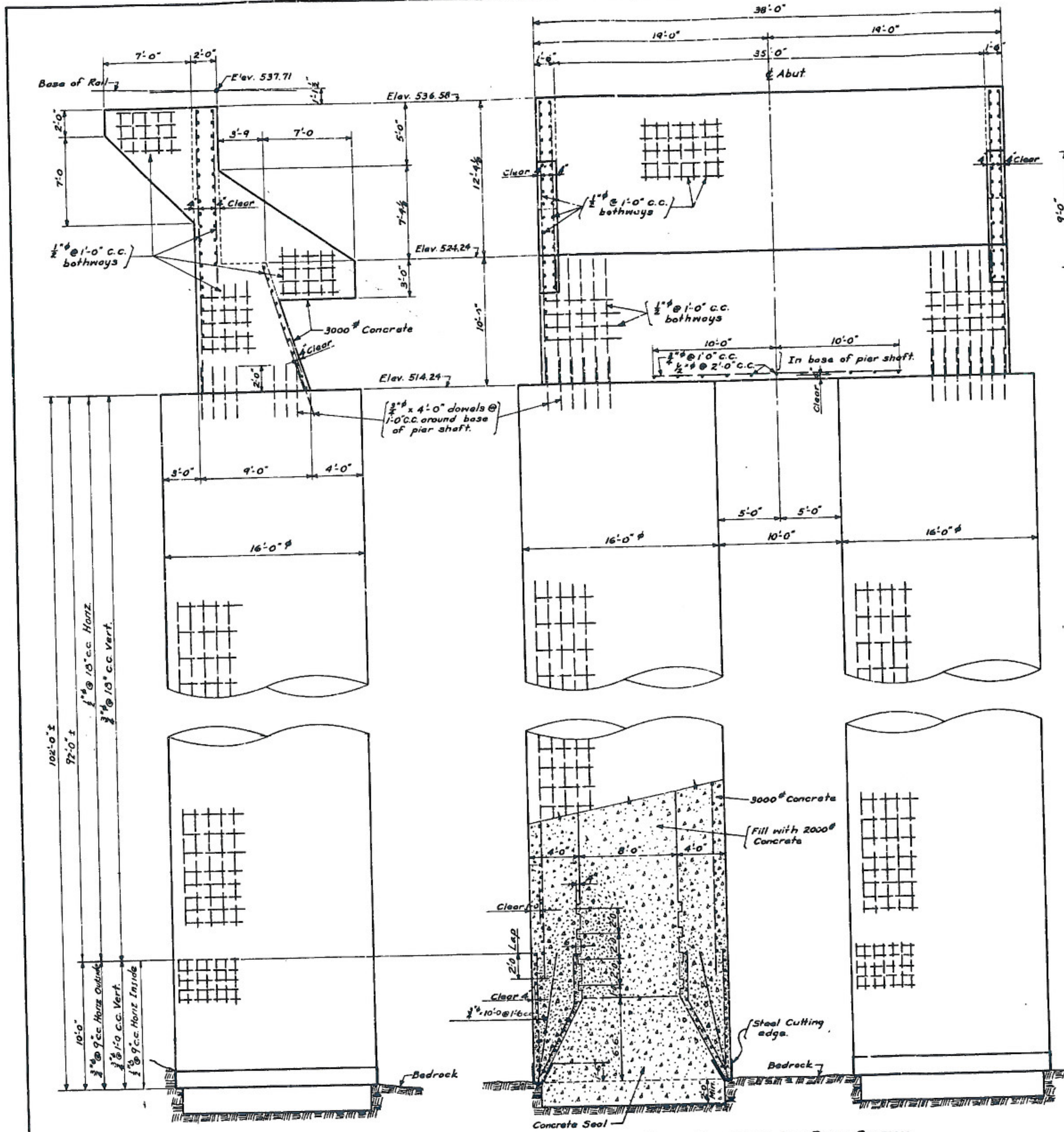
		PIER #6	PIER #7
FOUNDATION	2000# CONCRETE	285 CU. YDS.	285 CU. YDS.
	3000# CONCRETE	740 CU. YDS.	655 CU. YDS.
NEAT WORK	3000# CONCRETE	230 CU. YDS.	230 CU. YDS.
REINFORCING STEEL		9.0 TONS	9.0 TONS

SHEET 3
9 DRAWINGS

B.E.S. 3275
THE A.T. & S.F. RY. SYSTEM
BR. A567, 1ST DIST. ARIZONA DIV.
NEW BRIDGE OVER THE COLORADO RIVER
DESIGN OF PIER #6 AND #7
SCALE: 3/16" = 1'-0"
CHICAGO, ILL., OCT., 1942
CORRECT:
R. A. Van Ness
BRIDGE ENGINEER SYSTEM
APPROVED:
CHIEF ENGINEER SYSTEM

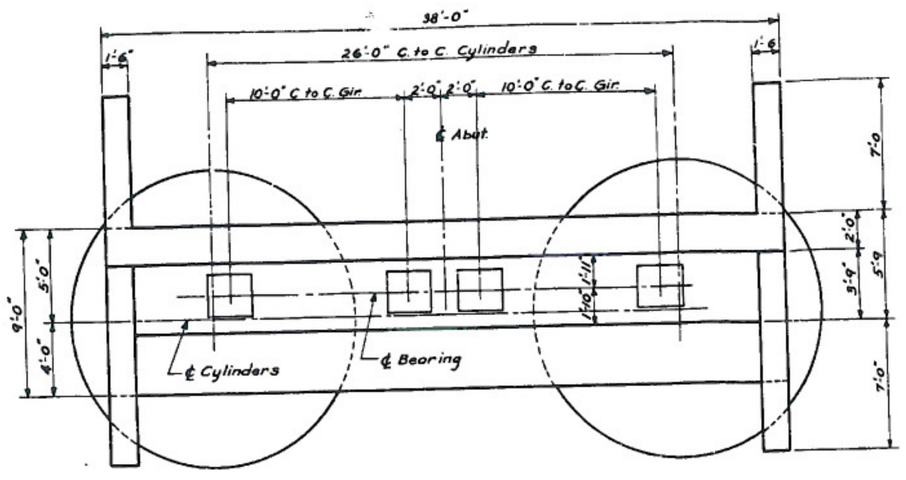
Rev. 10/30/42

MADE BY:
CHECKED BY:
EXAMINED BY:



END ELEVATION

FRONT ELEVATION AND PART SECTION



PLAN VIEW

For General Notes on concrete work see Sheet #2. For Details of Cutting Edge See Sheet #2.

ESTIMATED QUANTITIES

FOUNDATION	2000# CONCRETE	430 CU. YDS.
	3000# CONCRETE	1120 CU. YDS.
NEAT WORK	3000# CONCRETE	150 CU. YDS.
REINFORCING STEEL		12.0 TONS

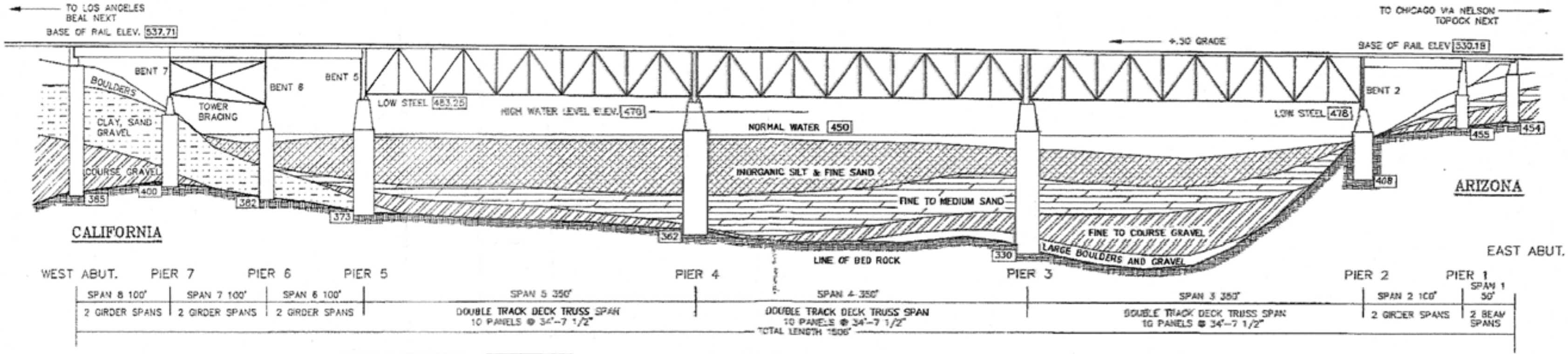
SHEET 9
9 DRAWINGS

B.E.S. 3275
THE A.T.&S.F. RY. SYSTEM
BR. A567, 1ST DIST., ARIZONA DIV.
NEW BRIDGE OVER THE COLORADO RIVER
DESIGN OF WEST ABUTMENT

SCALE: 1/4" = 1'-0"
CHICAGO, ILL., OCT., 1942
CORRECT:
R. A. Van Ness
BRIDGE ENGINEER SYSTEM
APPROVED:
CHIEF ENGINEER SYSTEM

Rev. 10/30/42 CHB

MADE BY:
CHECKED BY: NEW.
EXAMINED BY: CHB.



STEEL BRIDGE CONSTRUCTED 1945

FROM ROBEY 1946

1946 BRIDGE PIER CYLINDER DATA			
PIER	CYL. DIA	DEPTH	BOTTOM ELEV. OF CYL.
E ABUT	14	61	454
1	14	34	455
2	22	49	408
3	22	129	330
4	24	94	362
5	22	84	373
6	16	74	382
7	16	65	400
W ABUT	16	129	385

1946 BRIDGE WEIGHTS	
SPAN	WEIGHT TONS
SPAN 1	84
SPAN 2	164
BENT 2	32
SPAN 3	1844
SPAN 4	1838
SPAN 5	1834
BENT 5	33
SPAN 6	168
BENT 6	118
SPAN 7	174
BENT 7	32
SPAN 8	186
TOTAL	[illegible]

NOTE:
1. ALL CYLINDERS EXTEND A MINIMUM OF 2 FEET INTO BED ROCK.
2. 1945 BRIDGE DESIGNED TO CARRY COOPER'S E-72 LOADING

MC

LEGEND

0 50 100 150 200 250 300 350
SCALE IN FEET

362 ELEVATION ABOVE SEA LEVEL IN FEET
- - - - - - BOTTOM OF RIVER 1890
———— BOTTOM OF RIVER 1885

▦ BED ROCK (VOLCANIC)
▤ FINE TO MEDIUM SAND
▨ INORGANIC SILT & FINE SAND
▨ FINE TO COURSE GRAVEL

FIGURE 3
RIVER CROSS SECTION AT BNSF RAILROAD BRIDGE

SUMMARY OF COLORADO RIVER BRIDGE PIER CONSTRUCTION AND HYDROGEOLOGIC ASSESSMENT
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

AMERICAN SOCIETY OF CIVIL ENGINEERS.
INSTITUTED 1852.

TRANSACTIONS.

518.

(Vol. XXV.—December, 1891.)

RED ROCK CANTILEVER BRIDGE.

FOUNDATIONS.

By S. M. Rowe, M. Am. Soc. C. E.

WITH DISCUSSION.

As a formal report has already been made to the Atlantic and Pacific Railroad Company, through its General Manager, D. B. Robinson, the purpose of this paper will be to outline the history of the construction of the bridge; the causes that led to its construction, and to give all facts that may be of interest to the civil engineer and the scientist. The original line of the Atlantic and Pacific Railroad, when constructed in 1883, was laid in such a way as to skirt and traverse the valley of the Colorado River for a distance of nearly 8 miles, finally crossing that river about 2½ miles south of what is now Needles Station, on the California side. This point of crossing is 18 miles south of Fort Mohave, near which is fixed the southernmost point of the State of Nevada. Ten miles south of the original bridge, the river valley narrows into what is known as Mohave or Needles Cañon; so named from a small but rugged

PLATE CXI.
TRANS. AM. SOC. CIV. ENGINEERS.
VOL. XXV No. 516
RED ROCK CANTILEVER BRIDGE.

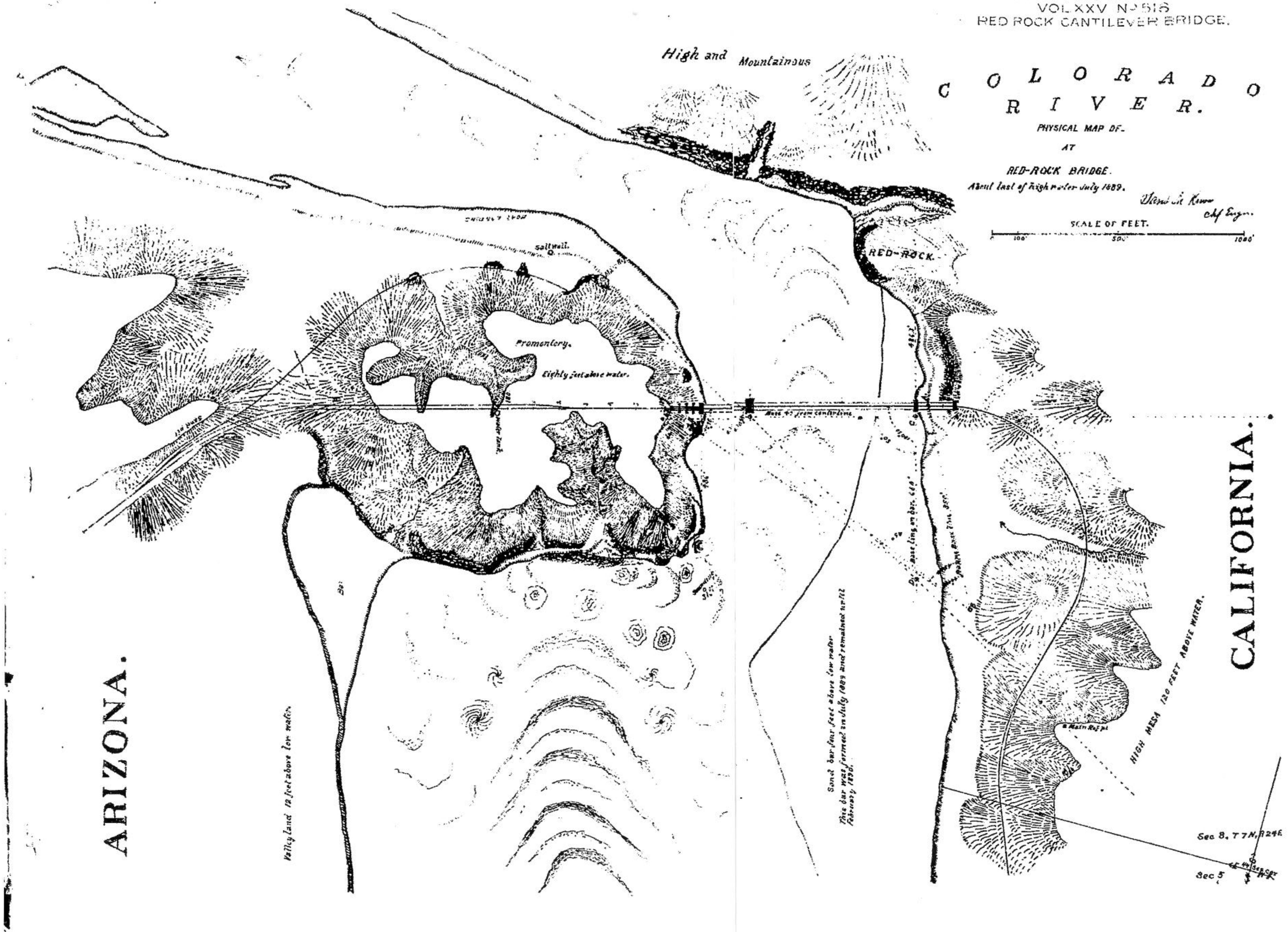
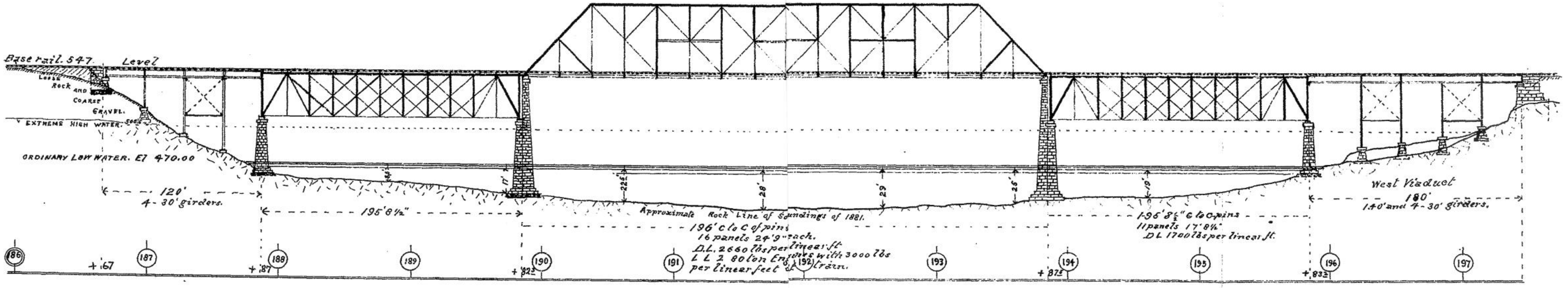


PLATE CXII.
TRANS AM SOC CIV ENGRS
VOL XXV N°515
RED ROCK CANTILEVER BRIDGE

KEYSTONE Br Co, Design, Modified.

RED ROCK CROSSING OF THE COLORADO RIVER.



Sept 5th 1888 Saml. M. Rowe C.E.

PLATE CXVI.
TRANS AM SOC. CIV ENG'RS
VOL. XXV. No 518
RED ROCK CANTILEVER BRIDGE.

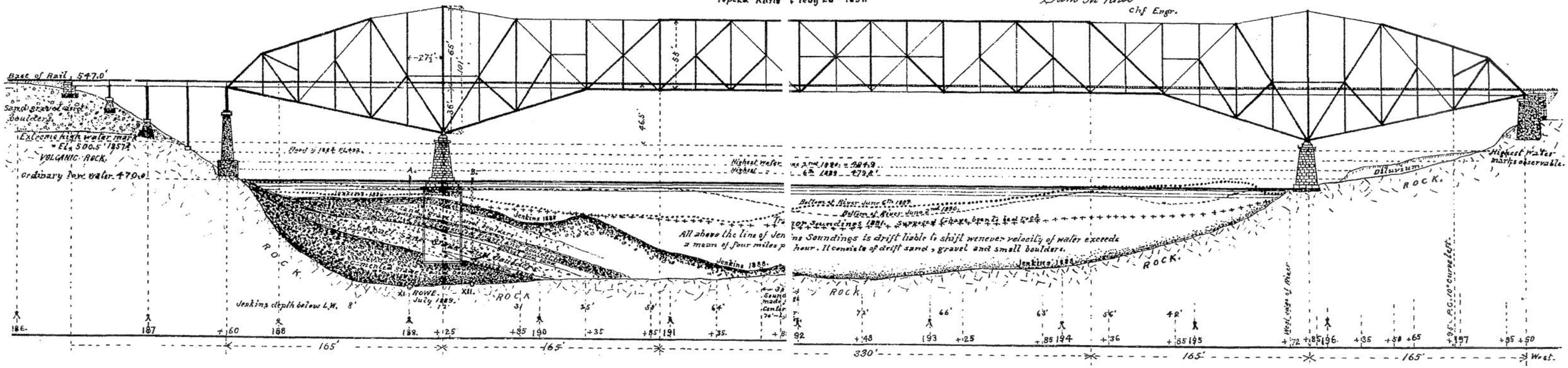
Atl;atic & Pacific Railroad.

RED-ROCK BRIDGE

(Cantilever.)

Topeka Kans, Feby 28th 1891.

Saml M Rowe
Chf Engr.



Appendix B
Drilling and Well Construction Information

B1 Summary Information for Drilling and Groundwater Wells in Study Area

TABLE B-1

Drilling and Well Construction Summary for RFI/RI Characterization
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

				Elevation [5]			Top of Screen [6]		Base of Screen [6]								
Location ID[1]	Investigation Program[2] & Well Type	Status[3]	Monitoring[4] Zone	Ground (ft MSL)	Measure Point (ft MSL)	Boring Total Depth (ft bgs)	Depth (ft bgs)	Elevation (ft MSL)	Depth (ft bgs)	Elevation (ft MSL)	Well Depth[7] (ft bgs)	Approx Depth[8] to Water (ft TOC)	Screen Length (ft)	Well Casing	Sump Length	Date Installed	Drilling Method
Groundwater Monitoring Wells																	
MW-1	New Ponds - Monitoring	Active	SA - alluvial	660.3	661.76	212	201	461	211	451	211	205	10	4" PVC	---	Aug-86	Air Percuss
MW-3	New Ponds - Monitoring	Active	SA - alluvial	649.1	650.51	207	193	458	203	448	204	195	10	4" PVC	---	Aug-86	Air Percuss
MW-4	New Ponds - Monitoring	Active	SA - alluvial	624.3	625.73	180	165	461	175	451	175	169	10	4" PVC	---	Aug-86	Air Percuss
MW-5	New Ponds - Monitoring	Active	SA - alluvial	634.8	635.69	188	176	460	185	451	185	179	9	4" PVC	---	Jun-89	Air Rotary
MW-6	New Ponds - Monitoring	Active	SA - alluvial	642.4	642.84	194	185	458	194	449	194	186	9	4" PVC	---	Jun-89	Air Rotary
MW-7	New Ponds - Monitoring	Active	SA - alluvial	630.2	631.91	188	173	459	183	449	183	176	10	4" PVC	---	Jun-89	Air Rotary
MW-8	New Ponds - Monitoring	Active	SA - alluvial	626.7	627.54	179	169	459	178	450	178	171	9	4" PVC	---	Jun-89	Air Rotary
MW-9	RFI - Monitoring	Active	SA - alluvial	534.1	536.56	89	77	460	87	450	87	80	10	4" PVC	---	Jul-97	Rotosonic
MW-10	RFI - Monitoring	Active	SA - alluvial	529.3	530.65	99	74	457	94	437	95	75	20	4" PVC	---	Jun-97	Rotosonic
MW-11	RFI - Monitoring	Active	SA - alluvial	520.8	522.61	87	63	460	83	440	84	4	20	4" PVC	---	Jun-97	Rotosonic
MW-12	RFI - Monitoring	Active	SA - alluvial	483.1	484.01	50	28	457	48	437	49	28	20	4" PVC	---	Jul-97	Rotosonic
MW-13	RFI - Monitoring	Active	SA - alluvial	486.8	488.64	50	29	460	49	440	50	33	20	4" PVC	---	Jul-97	Rotosonic
MW-14	RFI - Monitoring	Active	SA - alluvial	570.2	570.99	135	111	460	131	440	131	114	20	4" PVC	---	Jul-97	Rotosonic
MW-15	RFI - Monitoring	Active	SA - alluvial	639.7	641.52	204	181	461	201	441	202	185	20	4" PVC	---	Jul-97	Rotosonic
MW-16	RFI - Monitoring	Active	SA - alluvial	655.4	657.31	218	198	459	218	439	218	200	20	4" PVC	---	Apr-98	Air Rotary
MW-17	RFI - Monitoring	Active	SA - alluvial	587.9	589.96	151	130	460	150	440	150	132	20	4" PVC	---	May-98	Rotosonic
MW-18	RFI - Monitoring	Active	SA - alluvial	543.5	545.32	110	85	460	105	440	105	89	20	4" PVC	---	Apr-98	Air Rotary
MW-19	RFI - Monitoring	Active	SA - alluvial	499.3	499.92	66	46	454	66	434	66	50	20	4" PVC	---	Mar-98	Air Rotary
MW-20-70	RFI - Monitoring	Active	SA - alluvial	499.1	500.15	70	50	450	70	430	70	46	20	4" PVC	---	Mar-98	Air Rotary
MW-20-100	RFI - Monitoring	Active	MA - alluvial	499.0	500.58	100	90	411	100	401	100	47	10	4" PVC	---	Apr-99	Rotosonic
MW-20-130	RFI - Monitoring	Active	DA - alluvial	499.1	500.66	132	121	380	131	370	131	47	10	4" PVC	---	Apr-99	Rotosonic
MW-21	RFI - Monitoring	Active	SA - alluvial	506.1	505.55	62	39	467	59	447	59	32	20	4" PVC	---	May-98	Rotosonic
MW-22	RFI - Monitoring	Active	SA - fluvial	458.2	460.72	12	6	455	11	450	11	6	5	2" PVC	---	Apr-98	Hand Auger
MW-23	RFI - Monitoring	Active	BR-Tmc	504.6	507.33	80	60	447	80	427	80	52	20	4" PVC	---	Apr-98	Air Rotary
MW-24A	RFI - Monitoring	Active	SA - alluvial	564.9	567.16	125	104	463	124	443	125	111	20	4" PVC	---	May-98	Rotosonic
MW-24B	RFI - Monitoring	Active	DA - alluvial	562.8	564.76	218	193	372	213	352	213	110	20	4" PVC	---	May-98	Rotosonic
MW-24BR	RFI - Monitoring	Active	BR-pTbr	562.6	563.95	442	378	186	437	127	437	108	59	4" PVC	---	Apr-98	Air Rotary
MW-25	RFI - Monitoring	Active	SA - alluvial	541.0	542.90	107	85	458	105	438	105	87	20	4" PVC	---	Apr-99	Rotosonic
MW-26	RFI - Monitoring	Active	SA - alluvial	502.9	502.22	74	52	451	72	431	72	47	20	2" PVC	---	Apr-99	Rotosonic
MW-27-20	RFI - Monitoring	Active	SA - fluvial	458.8	460.56	17	7	454	17	444	17	5	10	2" PVC	---	Apr-99	Hollow Stem Auger
MW-27-60	IM - Monitoring	Active	MA - fluvial	458.4	461.38	60	47	414	57	404	58	9	10	2" PVC	---	Feb-05	Rotosonic
MW-27-85	IM - Monitoring	Active	DA - fluvial	458.4	460.99	107	78	383	88	373	98	6	10	2" PVC	10' sump	Feb-05	Rotosonic
MW-28-25	RFI - Monitoring	Active	SA - fluvial	464.9	466.77	23	13	454	23	444	23	12	10	2" PVC	---	Apr-99	Hollow Stem Auger
MW-28-90	IM - Monitoring	Active	DA - fluvial	464.9	467.53	148	70	398	90	378	95	13	20	2" PVC	5' sump	Apr-04	Rotosonic
MW-29	RFI - Monitoring	Active	SA - fluvial	483.0	485.21	40	30	456	40	446	40	30	10	2" PVC	---	Apr-99	Hollow Stem Auger
MW-30-30	RFI - Monitoring	Active	SA - fluvial	466.2	468.12	32	12	456	32	436	32	14	20	2" PVC	---	Apr-99	Hollow Stem Auger
MW-30-50	RFI - Monitoring	Active	MA - fluvial	466.4	468.81	63	40	429	50	419	50	14	10	4" PVC	---	Mar-03	Rotosonic
MW-31-60	RFI - Monitoring	Active	SA - alluvial	495.1	496.81	65	42	455	62	435	62	42	20	4" PVC	---	Apr-99	Rotosonic
MW-31-135	IM - Monitoring	Active	DA - alluvial	495.1	498.11	168	113	385	133	365	133	44	20	2" PVC	---	Mar-04	Rotosonic
MW-32-20	RFI - Monitoring	Active	SA - fluvial	459.1	461.51	20	10	452	20	442	20	6	10	2" PVC	---	Mar-03	Rotosonic
MW-32-35	RFI - Monitoring	Active	SA - fluvial	459.2	461.63	37	28	434	35	427	35	7	8	4" PVC	---	Mar-03	Rotosonic
MW-33-40	RFI - Monitoring	Active	SA - fluvial	485.0	487.38	40	29	458	39	448	39	32	10	4" PVC	---	Mar-03	Rotosonic
MW-33-90	RFI - Monitoring	Active	MA - alluvial	485.0	487.55	130	69	419	89	399	89	32	20	4" PVC	---	Mar-03	Rotosonic
MW-33-150	IM - Monitoring	Active	DA - alluvial	485.0	487.77	158	132	356	152	336	152	33	20	2" PVC	---	Feb-05	Rotosonic
MW-33-210	IM - Monitoring	Active	DA - alluvial	485.0	487.25	237	190	297	210	277	220	33	20	2" PVC	10' sump	Feb-05	Rotosonic
MW-34-55	RFI - Monitoring	Active	MA - fluvial	458.9	460.95	57	45	416	55	406	55	6	10	4" PVC	---	Jun-03	Rotosonic

TABLE B-1

Drilling and Well Construction Summary for RFI/RI Characterization
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

				Elevation[5]			Top of Screen[6]		Base of Screen[6]								
Location ID[1]	Investigation Program[2] & Well Type	Status[3]	Monitoring Zone[4]	Ground (ft MSL)	Measure Point (ft MSL)	Boring Total Depth (ft bgs)	Depth (ft bgs)	Elevation (ft MSL)	Depth (ft bgs)	Elevation (ft MSL)	Well Depth[7] (ft bgs)	Approx Depth[8] to Water (ft TOC)	Screen Length (ft)	Well Casing	Sump Length	Date Installed	Drilling Method
Groundwater Monitoring Wells																	
MW-34-80	RFI - Monitoring	Active	DA - fluvial	459.1	461.20	93	73	388	83	378	83	5	10	4" PVC	---	Jun-03	Rotosonic
MW-34-100	IM - Monitoring	Active	DA - fluvial	458.9	460.96	116	90	371	100	361	115	6	10	2" PVC	15' sump	Jan-05	Rotosonic
MW-35-60	IM - Monitoring	Active	SA - alluvial	481.1	484.33	61	41	443	61	423	61	29	20	2" PVC	---	Mar-04	Rotosonic
MW-35-135	IM - Monitoring	Active	DA - alluvial	481.2	484.24	168	116	368	136	348	156	29	20	2" PVC	20' sump	Mar-04	Rotosonic
MW-36-20	IM - Monitoring	Active	SA - fluvial	466.5	469.33	20	10	459	20	449	20	16	10	1" PVC	---	May-04	Rotosonic
MW-36-40	IM - Monitoring	Active	SA - fluvial	466.7	469.59	40	30	440	40	430	40	16	10	1" PVC	---	May-04	Rotosonic
MW-36-50	IM - Monitoring	Active	MA - fluvial	466.8	469.62	108	46	424	51	419	51	15	5	1" PVC	---	May-04	Rotosonic
MW-36-70	IM - Monitoring	Active	MA - fluvial	466.5	469.27	70	60	409	70	399	70	15	10	1" PVC	---	May-04	Rotosonic
MW-36-90	IM - Monitoring	Active	DA - fluvial	466.7	469.64	90	80	390	90	380	90	16	10	1" PVC	---	May-04	Rotosonic
MW-36-100	IM - Monitoring	Active	DA - fluvial	466.8	469.65	108	88	382	98	372	108	15	10	2" PVC	10' sump	May-04	Rotosonic
MW-37S	IM - Monitoring	Active	MA - alluvial	483.5	485.97	85	64	422	84	402	84	31	20	2" PVC	---	Apr-04	Rotosonic
MW-37D	IM - Monitoring	Active	DA - alluvial	483.7	486.19	228	180	306	200	286	225	31	20	2" PVC	25' sump	Apr-04	Rotosonic
MW-38S	IM - Monitoring	Active	SA - alluvial	522.8	525.51	130	75	451	95	431	95	70	20	2" PVC	---	Apr-04	Rotosonic
MW-38D	IM - Monitoring	Active	DA - alluvial	523.0	525.31	195	163	362	183	342	188	70	20	2" PVC	5' sump	Apr-04	Rotosonic
MW-39-40	IM - Monitoring	Active	SA - fluvial	465.2	468.02	70	30	438	40	428	42	14	10	1" PVC	2' sump	Apr-04	Rotosonic
MW-39-50	IM - Monitoring	Active	MA - fluvial	465.1	467.93	80	47	421	52	416	54	13	5	1" PVC	2' sump	Apr-04	Rotosonic
MW-39-60	IM - Monitoring	Active	MA - alluvial	465.3	468.00	118	49	419	59	409	64	13	10	1" PVC	5' sump	Apr-04	Rotosonic
MW-39-70	IM - Monitoring	Active	MA - alluvial	465.2	468.02	70	60	408	70	398	72	14	10	1" PVC	2' sump	Apr-04	Rotosonic
MW-39-80	IM - Monitoring	Active	DA - alluvial	465.1	467.92	80	70	398	80	388	80	14	10	1" PVC	---	Apr-04	Rotosonic
MW-39-100	IM - Monitoring	Active	DA - alluvial	465.3	468.12	118	80	388	100	368	115	14	20	2" PVC	15' sump	Apr-04	Rotosonic
MW-40S	IM - Monitoring	Active	SA - alluvial	566.3	566.04	135	115	451	135	431	135	110	20	2" PVC	---	May-04	Rotosonic
MW-40D	IM - Monitoring	Active	DA - alluvial	566.5	566.08	268	240	326	260	306	265	111	20	2" PVC	5' sump	May-04	Rotosonic
MW-41S	IM - Monitoring	Active	SA - alluvial	477.4	480.07	60	40	440	60	420	60	24	20	2" PVC	---	Nov-04	Rotosonic
MW-41M	IM - Monitoring	Active	DA - alluvial	477.1	479.83	190	170	310	190	290	190	24	20	2" PVC	---	Nov-04	Rotosonic
MW-41D	IM - Monitoring	Active	DA - alluvial	476.9	479.42	320	271	208	291	188	311	24	20	2" PVC	20' sump	Nov-04	Rotosonic
MW-42-30	IM - Monitoring	Active	SA - fluvial	461.4	463.74	30	10	454	30	434	30	12	20	2" PVC	---	Feb-05	Rotosonic
MW-42-55	IM - Monitoring	Active	MA - fluvial	461.2	463.85	53	43	421	53	411	53	9	10	2" PVC	---	Feb-05	Rotosonic
MW-42-65	IM - Monitoring	Active	MA - fluvial	461.0	463.37	81	56	407	66	397	81	9	10	2" PVC	15' sump	Feb-05	Rotosonic
MW-43-25	IM - Monitoring	Active	SA - fluvial	462.5	462.54	25	15	448	25	438	25	8	10	2" PVC	---	Feb-05	Rotosonic
MW-43-75	IM - Monitoring	Active	DA - fluvial	462.7	462.71	75	65	398	75	388	75	8	10	2" PVC	---	Feb-05	Rotosonic
MW-43-90	IM - Monitoring	Active	DA - fluvial	459.9	462.76	97	80	383	90	373	90	7	10	2" PVC	---	Feb-05	Rotosonic
MW-44-70	IM - Monitoring	Active	MA - fluvial	470.7	471.90	134	61	411	71	401	71	16	10	2" PVC	---	Mar-06	Rotosonic
MW-44-115	IM - Monitoring	Active	DA - alluvial	470.3	472.01	117	103	369	113	359	113	18	10	2" PVC	---	Mar-06	Rotosonic
MW-44-125	IM - Monitoring	Active	DA - alluvial	470.7	472.04	134	116	356	125	347	134	18	9	2" PVC	10' sump	Mar-06	Rotosonic
MW-45-095a	IM - Monitoring	Active	DA - fluvial	466.6	470.03	97	83	387	93	377	94	15	10	2" PVC	---	Feb-06	Rotosonic
MW-45-095b	IM - Monitoring	Active	DA - fluvial	466.6	469.51	97	83	387	93	377	94	18	10	1" PVC	---	Feb-06	Rotosonic
MW-46-175	IM - Monitoring	Active	DA - alluvial	480.8	482.16	217	165	317	175	307	217	27	10	2" PVC	---	Feb-06	Rotosonic
MW-46-205	IM - Monitoring	Active	DA - alluvial	480.8	482.23	217	197	286	207	276	217	28	10	2" PVC	---	Feb-06	Rotosonic
MW-47-55	IM - Monitoring	Active	SA - alluvial	482.6	484.04	117	45	439	55	429	100	28	10	2" PVC	---	Mar-06	Rotosonic
MW-47-115	IM - Monitoring	Active	DA - alluvial	482.6	484.17	117	105	379	115	369	117	29	10	2" PVC	---	Mar-06	Rotosonic
MW-48	IM - Monitoring	Active	BR-Tmc	484.4	486.22	155	124	362	134	352	138	32	10	2" PVC	---	May-06	Rotosonic
MW-49-135	IM - Monitoring	Active	DA - alluvial	482.6	484.02	135	125	359	135	349	135	28	10	1.5" PVC	---	Mar-06	Rotosonic
MW-49-275	IM - Monitoring	Active	DA - alluvial	482.6	483.95	275	255	229	275	209	275	30	20	2" PVC	---	Mar-06	Rotosonic
MW-49-365	IM - Monitoring	Active	DA - alluvial	482.6	484.01	384	345	139	365	119	370	31	20	2" PVC	---	Mar-06	Rotosonic
MW-50-095	IM - Monitoring	Active	MA - alluvial	495.0	496.49	249	85	411	95	401	---	41	10	2" PVC	---	Apr-06	Rotosonic
MW-50-200	IM - Monitoring	Active	DA - alluvial	495.0	496.35	248	190	306	200	296	---	42	10	2" PVC	---	Apr-06	Rotosonic

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RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

				Elevation [5]			Top of Screen [6]		Base of Screen [6]								
Location ID [1]	Investigation Program [2] & Well Type	Status [3]	Monitoring [4] Zone	Ground (ft MSL)	Measure Point (ft MSL)	Boring Total Depth (ft bgs)	Depth (ft bgs)	Elevation (ft MSL)	Depth (ft bgs)	Elevation (ft MSL)	Well Depth [7] (ft bgs)	Approx Depth [8] to Water (ft TOC)	Screen Length (ft)	Well Casing	Sump Length	Date Installed	Drilling Method
Groundwater Monitoring Wells																	
MW-51	IM - Monitoring	Active	MA - alluvial	502.0	501.56	114	97	405	112	390	---	47	15	4" PVC	---	Apr-06	Rotosonic
MW-52S	IM - Monitoring	Active	MA - fluvial	459.5	462.16	---	47	415	49	413	49	10	2	0.75" MLABS	---	Mar-07	Rotosonic
MW-52M	IM - Monitoring	Active	DA - fluvial	459.5	462.16	---	66	396	68	394	68	11	2	0.75" MLABS	---	Mar-07	Rotosonic
MW-52D	IM - Monitoring	Active	DA - fluvial	459.5	462.16	102	85	377	87	375	87	11	2	0.75" MLABS	---	Mar-07	Rotosonic
MW-53S	IM - Monitoring	Inactive	SA - fluvial	459.8	461.32	---	29	433	30	431	30	---	2	0.75" MLABS	---	Mar-07	Rotosonic
MW-53M	IM - Monitoring	Active	DA - fluvial	459.8	461.32	---	99	363	100	361	100	14	2	0.75" MLABS	---	Mar-07	Rotosonic
MW-53D	IM - Monitoring	Active	DA - fluvial	459.8	461.32	133	124	338	125	336	125	14	2	0.75" MLABS	---	Mar-07	Rotosonic
MW-54-85	RFI - Monitoring	Active	DA - fluvial	466.4	466.10	147	77	389	87	379	87	11	10	2" PVC	---	Mar-08	Rotosonic
MW-54-140	RFI - Monitoring	Active	DA - fluvial	466.4	465.98	147	128	338	138	328	138	10	10	2" PVC	---	Mar-08	Rotosonic
MW-54-195	RFI - Monitoring	Active	DA - alluvial	466.3	466.32	237	185	281	195	271	195	10	10	2" PVC	---	Mar-08	Rotosonic
MW-55-45	RFI - Monitoring	Active	MA - alluvial	463.6	463.41	---	37	426	47	416	47	7	10	2" PVC	---	Apr-08	Rotosonic
MW-55-120	RFI - Monitoring	Active	DA - alluvial	463.6	463.21	137	108	355	118	345	118	7	10	2" PVC	---	Apr-08	Rotosonic
MW-56S	RFI - Monitoring	Active	SA - fluvial	459.9	461.36	---	34	428	36	426	36	14	2	0.75" MLABS	---	Apr-08	Rotosonic
MW-56M	RFI - Monitoring	Active	DA - fluvial	459.9	461.36	---	74	388	76	386	76	15	2	0.75" MLABS	---	Apr-08	Rotosonic
MW-56D	RFI - Monitoring	Active	DA - fluvial	459.9	461.36	112	104	358	106	356	106	16	2	0.75" MLABS	---	Apr-08	Rotosonic
MWP-1	Old Ponds - Monitoring	decomm	SA - alluvial	675.0	---	127	75	---	115	---	125	---	40	3"	---	Jul-85	---
MWP-2	Old Ponds - Monitoring	decomm	SA - alluvial	674.7	---	---	200	---	260	---	270	---	60	3"	---	Jul-85	---
MWP-2RD	Old Ponds - Monitoring	decomm	BR-pTbr	674.0	---	279	265	---	275	---	275	---	10	5"	---	Jul-85	---
MWP-3	Old Ponds - Monitoring	decomm	SA - alluvial	660.7	---	222	108	---	208	---	218	---	100	3"	10' sump	Jul-85	---
MWP-7	Old Ponds - Monitoring	decomm	SA - alluvial	675.1	---	110	70	---	110	---	110	---	40	3"	---	Oct-85	---
MWP-8	Old Ponds - Monitoring	Standby	SA - alluvial	676.8	677.48	211	181	496	211	466	211	190	30	3" PVC	---	Oct-85	---
MWP-9	Old Ponds - Monitoring	decomm	SA - alluvial	680.2	---	220	179	---	219	---	220	---	40	3" PVC	---	Oct-85	Air Percuss
MWP-10	Old Ponds - Monitoring	Standby	SA - alluvial	675.3	675.81	235	194	482	234	442	235	209	40	3" PVC	---	Jan-86	---
MWP-12	Old Ponds - Monitoring	Standby	SA - alluvial	662.0	663.49	217	96	567	136	527	217	108	40	3" PVC	81' sump	Jan-86	---
MWP-14	Old Ponds - Monitoring	decomm	SA - alluvial	674.1	---	221	206	---	216	---	216	---	10	5" PVC	---	Jun-92	Air Rotary
MWP-15	Old Ponds - Monitoring	decomm	SA - alluvial	676.4	---	290	198	---	208	---	208	---	10	5" PVC	---	Jun-92	Air Rotary
MWP-16	Old Ponds - Monitoring	decomm	SA - alluvial	689.5	---	261	210	---	220	---	222	---	10	5" PVC	---	Jun-92	Air Rotary
OW-1S	CMP - Monitoring	Active	SA - alluvial	547.6	550.21	115	84	467	114	437	114	95	30	2" PVC	---	Nov-04	Rotosonic
OW-1M	CMP - Monitoring	Active	MA - alluvial	547.7	550.45	291	165	385	185	365	186	95	20	2" PVC	---	Sep-04	Rotosonic
OW-1D	CMP - Monitoring	Active	DA - alluvial	547.8	550.48	291	257	293	277	273	277	94	20	2" PVC	---	Sep-04	Rotosonic
OW-2S	CMP - Monitoring	Active	SA - alluvial	546.2	548.88	104	71	478	101	448	101	94	30	2" PVC	---	Dec-04	Rotosonic
OW-2M	CMP - Monitoring	Active	MA - alluvial	545.9	548.59	210	190	359	210	339	210	93	20	2" PVC	---	Dec-04	Rotosonic
OW-2D	CMP - Monitoring	Active	DA - alluvial	546.7	549.15	347	310	239	330	219	340	93	20	2" PVC	10' sump	Dec-04	Rotosonic
OW-3S	IM - Monitoring	Active	SA - alluvial	555.8	558.58	118	86	473	116	443	116	102	30	2" PVC	---	Oct-04	Rotosonic
OW-3M	IM - Monitoring	Active	MA - alluvial	556.2	558.90	202	180	379	200	359	200	103	20	2" PVC	---	Oct-04	Rotosonic
OW-3D	IM - Monitoring	Active	DA - alluvial	555.9	558.63	275	242	317	262	297	273	103	20	2" PVC	10' sump	Oct-04	Rotosonic
OW-5S	CMP - Monitoring	Active	SA - alluvial	549.1	551.83	112	70	482	110	442	110	97	40	2" PVC	---	Nov-04	Rotosonic
OW-5M	CMP - Monitoring	Active	DA - alluvial	549.0	551.81	252	210	342	250	302	250	96	40	2" PVC	---	Nov-04	Rotosonic
OW-5D	CMP - Monitoring	Active	DA - alluvial	549.5	552.33	350	300	252	320	232	350	96	20	2" PVC	30' sump	Nov-04	Rotosonic
P-1	Old Ponds - Monitoring	decomm	SA - alluvial	694.0	---	217	171	---	211	---	217	---	40	3" PVC	6' sump	Feb-86	Air Percuss
P-2	New Ponds - Monitoring	Inactive	DA - alluvial	535.6	537.60	249	239	299	249	289	249	170	10	4" PVC	---	Aug-86	---
PGE-7BR	IM - Monitoring	Active	BR-pTbr	562.6	---	292	249	---	300	---	292	110	51	7"	---	Oct-07	---
CW-1M	CMP - Monitoring	Active	MA - alluvial	563.4	566.16	191	140	426	190	376	190	109	50	2" PVC	---	Jan-05	Rotosonic
CW-1D	CMP - Monitoring	Active	DA - alluvial	563.8	566.57	360	250	317	300	267	320	110	50	2" PVC	20' sump	Jan-05	Rotosonic
CW-2M	CMP - Monitoring	Active	MA - alluvial	546.6	549.37	203	152	397	202	347	206	93	50	2" PVC	---	Feb-05	Rotosonic
CW-2D	CMP - Monitoring	Active	DA - alluvial	546.7	549.64	385	285	265	335	215	355	93	50	2" PVC	20' sump	Jan-05	Rotosonic

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RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

Location ID[1]	Investigation Program[2] & Well Type	Status[3]	Monitoring[4] Zone	Elevation[5] Ground (ft MSL)	Elevation[5] Measure Point (ft MSL)	Boring Total Depth (ft bgs)	Top of Screen[6] Depth (ft bgs)	Top of Screen[6] Elevation (ft MSL)	Base of Screen[6] Depth (ft bgs)	Base of Screen[6] Elevation (ft MSL)	Well Depth[7] (ft bgs)	Approx Depth[8] to Water (ft TOC)	Screen Length (ft)	Well Casing	Sump Length	Date Installed	Drilling Method
Groundwater Monitoring Wells																	
CW-3M	CMP - Monitoring	Active	MA - alluvial	531.5	534.21	223	172	362	222	312	222	78	50	2" PVC	---	Feb-05	Rotosonic
CW-3D	CMP - Monitoring	Active	DA - alluvial	531.5	534.27	360	270	264	320	214	340	77	50	2" PVC	20' sump	Jan-05	Rotosonic
CW-4M	CMP - Monitoring	Active	MA - alluvial	515.8	518.66	170	120	399	170	349	170	62	50	2" PVC	---	Jan-05	Rotosonic
CW-4D	CMP - Monitoring	Active	DA - alluvial	515.9	518.68	337	233	286	283	236	303	62	50	2" PVC	20' sump	Jan-05	Rotosonic
Extraction, Test & Injection Wells																	
IW-2	IM - Injection	Active	MA-DA - alluvial	546.5	550.10	412	170	380	330	220	340	96	160	6" Steel	10' sump	Dec-04	Mud Rotary
IW-3	IM - Injection	Active	MA-DA - alluvial	551.4	554.44	411	160	394	320	234	330	100	160	6" Steel	10' sump	Dec-04	Mud Rotary
PE-1	IM - Extraction	Active	DA - fluvial	457.5	457.52	97	79	379	89	369	99	16	10	6" Steel	10' sump	Mar-05	Rotosonic
PGE-8	TCS - Injection	Inactive	BR-pTbr	595.3	596.01	562	405	191	554	42	562	139	149	6.75" Steel	---	Jun-69	---
PGE-PT-1	New Ponds - Test	Inactive	MA-DA - alluvial	624.5	623.29	280	220	403	260	363	280	168	40	4" Steel	20' sump	Nov-86	Rotosonic
TW-1	IM - Test	Active	SA-MA-DA - alluvial	621.0	620.55	312	169	452	269	352	269	164	100	5" PVC	---	Nov-03	Mud Rotary
TW-2S	IM - Extraction	Standby	SA-MA - alluvial	496.7	499.05	98	43	457	93	407	98	34	50	6" PVC	5' sump	Apr-04	Mud Rotary
TW-2D	IM - Extraction	Standby	DA - alluvial	497.0	493.29	180	113	380	148	345	153	69	35	6" PVC	5' sump	Apr-04	Mud Rotary
TW-3D	IM - Extraction	Active	DA - alluvial	497.3	498.09	158	111	387	156	342	156	46	45	8" PVC	---	Oct-05	Rotosonic
TW-4	IM - Test	Active	DA - alluvial	482.6	484.11	288	210	274	250	234	---	30	40	4" PVC	4' sump	Mar-06	Rotosonic
TW-5	IM - Test	Active	DA - alluvial	495.0	496.30	150	110	386	150	346	---	41	40	4" PVC	---	Apr-06	Rotosonic
Pilot Study Wells																	
PT-1S	ISPT - Monitoring	Active	SA - fluvial	472.1	474.51	---	35	440	45	430	45	---	10	2" PVC	---	Jan-06	Rotosonic
PT-1M	ISPT - Monitoring	Active	MA - fluvial	472.1	474.48	---	60	414	70	404	70	---	10	2" PVC	---	Jan-06	Rotosonic
PT-1D	ISPT - Monitoring	Active	DA - alluvial	472.1	474.49	125	95	379	105	369	105	---	10	2" PVC	---	Jan-06	Rotosonic
PT-2S	ISPT - Monitoring	Active	SA - fluvial	471.5	473.35	---	35	438	45	428	45	---	10	2" PVC	---	Feb-06	Rotosonic
PT-2M	ISPT - Monitoring	Active	MA - alluvial	471.5	473.45	---	60	413	70	403	70	---	10	2" PVC	---	Feb-06	Rotosonic
PT-2D	ISPT - Monitoring	Active	DA - alluvial	471.5	473.48	127	95	378	105	368	105	---	10	2" PVC	---	Feb-06	Rotosonic
PT-3S	ISPT - Monitoring	Active	SA - fluvial	471.6	473.45	---	35	438	45	428	45	---	10	2" PVC	---	Feb-06	Rotosonic
PT-3M	ISPT - Monitoring	Active	MA - alluvial	471.6	473.38	---	60	413	70	403	70	---	10	2" PVC	---	Feb-06	Rotosonic
PT-3D	ISPT - Monitoring	Active	DA - alluvial	471.6	473.39	129	95	378	105	368	105	---	10	2" PVC	---	Feb-06	Rotosonic
PT-4S	ISPT - Monitoring	Active	SA - fluvial	471.6	474.29	---	35	439	45	429	45	---	10	2" PVC	---	Feb-06	Rotosonic
PT-4M	ISPT - Monitoring	Active	MA - fluvial	471.6	474.19	---	60	414	70	404	70	---	10	2" PVC	---	Feb-06	Rotosonic
PT-4D	ISPT - Monitoring	Active	DA - alluvial	471.6	474.19	127	95	379	105	369	105	---	10	2" PVC	---	Feb-06	Rotosonic
PT-5S	ISPT - Monitoring	Active	SA - fluvial	471.1	473.47	---	35	438	45	428	45	---	10	2" PVC	---	Feb-06	Rotosonic
PT-5M	ISPT - Monitoring	Active	MA - alluvial	471.1	473.49	---	60	413	70	403	70	---	10	2" PVC	---	Feb-06	Rotosonic
PT-5D	ISPT - Monitoring	Active	DA - alluvial	471.1	473.65	127	95	379	105	369	105	---	10	2" PVC	---	Feb-06	Rotosonic
PT-6S	ISPT - Monitoring	Active	SA - fluvial	474.3	475.84	---	35	441	45	431	45	---	10	2" PVC	---	Jan-06	Rotosonic
PT-6M	ISPT - Monitoring	Active	MA - alluvial	474.3	475.89	---	60	416	70	406	70	---	10	2" PVC	---	Jan-06	Rotosonic
PT-6D	ISPT - Monitoring	Active	DA - alluvial	474.3	476.08	137	95	381	105	371	105	---	10	2" PVC	---	Jan-06	Rotosonic
PT-7S	ISPT - Monitoring	Active	SA - alluvial	560.5	560.54	---	130	431	155	406	155	---	25	2" PVC	---	May-07	Rotosonic
PT-7M	ISPT - Monitoring	Active	MA - alluvial	560.7	560.66	188	165	396	185	376	185	---	20	2" PVC	---	May-07	Rotosonic
PT-7D	ISPT - Monitoring	Active	DA - alluvial	560.4	560.42	230	177	383	217	343	220	---	40	2" PVC	---	May-07	Rotosonic
PT-8S	ISPT - Monitoring	Active	SA - alluvial	562.2	562.22	---	147	415	152	410	152	---	5	2" PVC	---	May-07	Rotosonic
PT-8M	ISPT - Monitoring	Active	MA - alluvial	562.1	562.10	---	162	400	183	379	182	---	21	2" PVC	---	May-07	Rotosonic
PT-8D	ISPT - Monitoring	Active	DA - alluvial	562.0	562.03	---	190	372	210	352	213	---	20	2" PVC	---	May-07	Rotosonic
PT-9S	ISPT - Monitoring	Active	SA - alluvial	562.0	559.27	---	128	431	148	411	153	---	20	2" PVC	---	Jun-07	Rotosonic
PT-9M	ISPT - Monitoring	Active	MA - alluvial	559.5	559.14	---	163	396	183	376	182	---	20	2" PVC	---	Jun-07	Rotosonic
PT-9D	ISPT - Monitoring	Active	DA - alluvial	559.6	559.11	225	190	369	210	349	213	---	20	2" PVC	---	Jun-07	Rotosonic
PTI-1S	ISPT - Injection	Active	SA - fluvial	472.5	474.90	47	35	440	45	430	45	---	10	4" PVC	---	Jan-06	Rotosonic

TABLE B-1
Drilling and Well Construction Summary for RFI/RI Characterization
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

				Elevation[5]			Top of Screen[6]		Base of Screen[6]								
Location ID[1]	Investigation Program[2] & Well Type	Status[3]	Monitoring Zone[4]	Ground (ft MSL)	Measure Point (ft MSL)	Boring Total Depth (ft bgs)	Depth (ft bgs)	Elevation (ft MSL)	Depth (ft bgs)	Elevation (ft MSL)	Well Depth[7] (ft bgs)	Approx Depth[8] to Water (ft TOC)	Screen Length (ft)	Well Casing	Sump Length	Date Installed	Drilling Method
Pilot Study Wells																	
PTI-1M	ISPT - Injection	Active	MA - alluvial	472.7	474.99	77	60	415	70	405	70	---	10	4" PVC	---	Jan-06	Rotosonic
PTI-1D	ISPT - Injection	Active	DA - alluvial	472.5	474.61	137	95	380	105	370	105	---	10	4" PVC	---	Jan-06	Rotosonic
PTR-1	ISPT - recirculation	Active	MA-DA - alluvial	558.0	---	225	125	---	220	---	220	---	95	6" LCS	---	May-07	Rotosonic
PTR-2	ISPT - recirculation	Active	MA-DA - alluvial	565.0	---	223	118	---	218	---	218	---	100	6" LCS	---	Jun-07	Rotosonic
Water Supply Wells																	
PGE-1	TCS - original supply	decomm	MA - alluvial	555.0	---	176	99	---	177	---	177	---	78	14"	---	Sep-51	---
PGE-2	TCS - original supply	decomm	MA - alluvial	552.0	---	152	98	---	152	---	152	---	54	14"	---	Jul-51	---
PGE-6	TCS - replacement supply	decomm	SA-MA - alluvial	562.3	563.32	180	110	453	180	383	180	107	70	14" Steel	---	Jun-64	---
PGE-7	TCS - replacement supply	Inactive	DA-BR-pTbr	562.6	563.89	330	195	369	330	234	330	107	135	14" Steel	---	Sep-64	---
PGE-9N	TCS - replacement supply	Inactive	MA-DA - fluvial	459.7	462.21	95	25	437	95	367	95	---	70	12" Steel	---	Apr-97	---
PGE-9S	TCS - replacement supply	Inactive	MA-DA - fluvial	459.4	461.99	100	30	432	100	362	100	---	70	12" Steel	---	Apr-97	---
Park Moabi-1	SBC original supply	decomm	---	470.0	---	190	28	---	180	---	190	---	152	10" Steel	---	Mar-61	Cable Tool
Park Moabi-3	SBC supply	Active	MA - alluvial	517.2	518.55	250	80	439	200	319	210	61	120	8" Steel	10' sump	Aug-86	---
Park Moabi-4	SBC supply	Standby	MA - alluvial	485.0	---	145	93	---	140	---	145	---	47	---	---	Oct-06	Mud Rotary
Selected Wells in Arizona																	
Sanders	private supply	Active	SA - alluvial	464.0	464.17	230	48	416	68	396	230	---	20	3"	---	Jun-05	---
Smith	private supply	decomm	SA	505.0	---	80	48	---	68	---	80	---	20	5" PVC	12' sump	Feb-98	---
TMW-6	TM - Monitoring	decomm	SA - fluvial	469.0	468.46	35	12	456	32	436	32	---	20	4" PVC	4' sump	Jan-91	Direct Mud Rotary
TMW-8	TM - Monitoring	decomm	SA - fluvial	465.0	464.23	31	5	459	25	439	25	---	20	4" PVC	4' sump	Jan-91	Direct Mud Rotary
TMW-9	TM - Monitoring	decomm	SA - fluvial	461.0	460.27	31	6	454	31	429	31	---	25	4" PVC	4' sump	Jan-91	Direct Mud Rotary
TMW-10	TM - Monitoring	decomm	SA - fluvial	470.0	470.00	35	10	460	30	440	30	---	20	4" PVC	4' sump	Jan-91	Direct Mud Rotary
TMW-11	TM - Monitoring	decomm	SA - fluvial	468.0	468.14	35	10	458	30	438	30	---	20	4" PVC	4' sump	Jan-91	Direct Mud Rotary
Topock-1	ATSF original supply	decomm	SA - fluvial	505*	---	50	---	---	---	---	50	---	---	16"	---	---	---
Topock-2	City of Needles supply	Active	SA - alluvial	509.1	509.07	150	100	409	140	369	140	53	40	12" Steel	---	Sep-80	---
Topock-3	City of Needles supply	Active	SA - alluvial	510.8	510.80	250	85	426	130	381	150	51	45	12" Steel	20' sump	May-74	---
Exploratory & Test Borings																	
B-25	RFI - Boring	Closed	---	672.0	---	210	---	---	---	---	---	---	---	---	---	Apr-98	Air Rotary
CB-1	Caltrans - Boring I-40	Closed	---	471.0	---	54	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-2	Caltrans - Boring I-40	Closed	---	499.0	---	34	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-3	Caltrans - Boring I-40	Closed	---	504.0	---	37	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-4	Caltrans - Boring I-40	Closed	---	504.0	---	37	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-5	Caltrans - Boring I-40	Closed	---	460.0	---	50	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-6	Caltrans - Boring I-40	Closed	---	460.0	---	20	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-7	Caltrans - Boring I-40	Closed	---	459.0	---	102	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-8	Caltrans - Boring I-40	Closed	---	460.0	---	40	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-9	Caltrans - Boring I-40	Closed	---	461.0	---	105	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-10	Caltrans - Boring I-40	Closed	---	459.0	---	117	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-11	Caltrans - Boring I-40	Closed	---	459.0	---	57	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-12	Caltrans - Boring I-40	Closed	---	458.0	---	125	---	---	---	---	---	---	---	---	---	May-62	---
CB-13	Caltrans - Boring I-40	Closed	---	458.0	---	81	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-14	Caltrans - Boring I-40	Closed	---	458.0	---	110	---	---	---	---	---	---	---	---	---	Mar-62	---
IW-1	IM - Boring	Closed	---	545.0	---	411	---	---	---	---	---	---	---	---	---	Nov-04	Mud Rotary
PE-1A	IM - Boring	Closed	---	461.2	---	90	---	---	---	---	---	---	---	---	---	Feb-05	---
PE-1B	IM - Boring	Closed	---	458.6	---	87	---	---	---	---	---	---	---	---	---	Feb-05	---
PM-B1	SBC Park Maobi - Boring	Closed	---	475*	---	250	---	---	---	---	---	---	---	---	5' sump	Mar-86	Mud Rotary

TABLE B-1

Drilling and Well Construction Summary for RFI/RI Characterization
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

				Elevation [5]			Top of Screen [6]		Base of Screen [6]								
Location ID[1]	Investigation Program[2] & Well Type	Status[3]	Monitoring Zone[4]	Ground (ft MSL)	Measure Point (ft MSL)	Boring Total Depth (ft bgs)	Depth (ft bgs)	Elevation (ft MSL)	Depth (ft bgs)	Elevation (ft MSL)	Well Depth[7] (ft bgs)	Approx Depth[8] to Water (ft TOC)	Screen Length (ft)	Well Casing	Sump Length	Date Installed	Drilling Method
Exploratory & Test Borings																	
PM-B2	SBC Park Maobi - Boring	Closed	---	495*	---	80	---	---	---	---	---	---	---	---	---	Mar-86	Mud Rotary
XMW-9	RFI - Boring	Closed	---	535.6	537.60	78	---	538	---	538	---	---	---	---	---	Jun-97	Rotosonic

Notes:

[1] The location IDs listed are the assigned, abbreviated "posting IDs" for wells and borings used on maps, tables, logs and other displays in the RFI/RI report. The project sampling database utilizes additional formated location IDs (see Table B-2)

[2] Investigation Programs:

CMP	Compliance Monitoring Program, for IM No. 3 injection well field
IM	Interim Measures, includes IM No. 3 investigations and well installation
ISPT	In-situ Pilot Test, includes Floodplain and Upland test areas
New Ponds	TCS evaporation ponds, current operated site with active monitoring WDR
Old Ponds	TCS former, closed evaporation pond site
RFI	RCRA Facility Investigation / Remedial Investigation
SBC	San Bernardino County, Park Moabi water supply
TCS	PGE's Topock Compressor Station, operations facilities
TM	Topock Marina underground storage tank (UST) investigation

[3] Location status (as of October 2007):

Active	Well used in current PGE monitoring, testing, or compliance project
Standby	Existing well (servicable condition) not used in current monitoring
Inactive	Existing well (closed condition)
Decomm	Destroyed, permanently abandoned well
Closed	Exploratory or test boring, closed and sealed after logging
Unknown	Well status unknown

[4] Monitoring zone:

SA	Shallow zone of the Alluvial Aquifer completed in alluvial fan deposits (alluvial) or Colorado River deposits (fluvial)
MA	Mid-depth zone of the Alluvial Aquifer completed in alluvial fan deposits (alluvial) or Colorado River deposits (fluvial)
DA	Deep zone of the Alluvial Aquifer completed in alluvial fan deposits (alluvial) or Colorado River deposits (fluvial)
BR-Tmc	Bedrock well; completed in Miocene Conglomerate
BR-pTbr	Bedrock well; completed in pre-Tertiary metamorphic and igneous bedrock.

[5] Elevations noted with asterisk * are estimated from topographic map.

[6] Screen depths and elevations rounded-off to whole foot

[7] Well depths indicate the location of the bottom of the well casing in feet below the ground surface.

[8] Last Depth of water (through May 2008) in feet below top of well casing (TOC). Water depths rounded-off to whole foot for presentation

Additional Abbreviations:

ATSF	Atchison, Topeka and Santa Fe Railway
MSL	Feet above mean sea level
bgs	Feet below ground surface
PVC	Polyvinyl chloride
---	data not available or not applicable
MLABS	Multilevel Angled Borehole System

TABLE B-2
Survey Location and Elevation Data for RFI/RI Wells and Borings
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

		Elevation		Coordinates[1]			
Location ID	**Date Installed**	**Ground** (ft MSL)	**Measure Point** (ft MSL)	**Northing** (ft)	**Easting** (ft)	**Survey Date**[2]	**Notes**[3]
Groundwater Monitoring Wells							
MW-1	Aug-86	660.3	661.76	2100590.41	7611599.98	02/18/2004	
MW-3	Aug-86	649.1	650.51	2100736.23	7611950.6	02/18/2004	
MW-4	Aug-86	624.3	625.73	2101482.83	7612133.27	02/18/2004	
MW-5	Jun-89	634.8	635.69	2101031.99	7612062.51	02/18/2004	
MW-6	Jun-89	642.4	642.84	2101033.1	7611672.97	02/18/2004	
MW-7	Jun-89	630.2	631.91	2101364.03	7611807.01	02/18/2004	
MW-8	Jun-89	626.7	627.54	2101309.64	7612112.18	02/18/2004	
MW-9	Jul-97	534.1	536.56	2100673.29	7614780.27	02/18/2004	
MW-10	Jun-97	529.3	530.65	2100984.2	7614886.6	02/18/2004	
MW-11	Jun-97	520.8	522.61	2101557.09	7614865.33	05/06/2008	
MW-12	Jul-97	483.1	484.01	2101429.49	7615923.61	02/18/2004	
MW-13	Jul-97	486.8	488.64	2103135.17	7614848.07	02/18/2004	
MW-14	Jul-97	570.2	570.99	2102738.09	7614081.09	02/18/2004	
MW-15	Jul-97	639.7	641.52	2100844.08	7613164.94	02/18/2004	
MW-16	Apr-98	655.4	657.31	2100697.20	7610980.32	02/18/2004	
MW-17	May-98	587.9	589.96	2103135.57	7610243.29	02/18/2004	
MW-18	Apr-98	543.5	545.32	2102894.59	7612598.60	02/18/2004	
MW-19	Mar-98	499.3	499.92	2103007.47	7615587.82	02/18/2004	
MW-20-70	Mar-98	499.1	500.15	2102493.39	7615893.48	02/18/2004	
MW-20-100	Apr-99	499	500.58	2102506.33	7615881.03	02/18/2004	
MW-20-130	Apr-99	499.1	500.66	2102493.68	7615881.52	02/18/2004	
MW-21	May-98	506.1	505.55	2101486.75	7616099.26	02/18/2004	
MW-22	Apr-98	458.2	460.72	2101566.69	7616359.75	02/18/2004	
MW-23	Apr-98	504.6	507.33	2101286.15	7616448.53	02/18/2004	
MW-24A	May-98	564.9	567.16	2101451	7615114.47	05/06/2008	
MW-24B	May-98	562.8	564.76	2101436.41	7615069.38	05/06/2008	
MW-24BR	Apr-98	562.6	563.95	2101480.79	7615060.85	02/18/2004	
MW-25	Apr-99	541	542.9	2102351.22	7615303.59	02/18/2004	
MW-26	Apr-99	502.9	502.22	2101911.86	7615787.7	02/18/2004	
MW-27-20	Apr-99	458.8	460.56	2102294.92	7616557.52	07/17/2007	
MW-27-60	Feb-05	458.37	461.375	2102288.57	7616534.61	07/17/2007	
MW-27-85	Feb-05	458.437	460.993	2102290.53	7616540.22	07/17/2007	
MW-28-25	Apr-99	464.9	466.765	2103003.91	7616280.73	04/16/2007	
MW-28-90	Apr-04	464.9	467.534	2103005.68	7616289.73	04/16/2007	
MW-29	Apr-99	483	485.21	2103657.86	7615895.43	02/18/2004	
MW-30-30	Apr-99	466.2	468.12	2102499.58	7616141.26	02/18/2004	
MW-30-50	Mar-03	466.4	468.81	2102503.83	7616150.98	02/18/2004	
MW-31-60	Apr-99	495.1	496.81	2102876.3	7615812.43	02/18/2004	
MW-31-135	Mar-04	495.1	498.11	2102835.29	7615819.13	05/11/2004	
MW-32-20	Mar-03	459.1	461.51	2102044.81	7616304.82	02/18/2004	
MW-32-35	Mar-03	459.2	461.63	2102034.68	7616306.61	02/18/2004	
MW-33-40	Mar-03	485	487.378	2103280.78	7615916.42	03/08/2005	

TABLE B-2
Survey Location and Elevation Data for RFI/RI Wells and Borings
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

		Elevation		**Coordinates**[1]			
Location ID	**Date Installed**	**Ground** (ft MSL)	**Measure Point** (ft MSL)	**Northing** (ft)	**Easting** (ft)	**Survey**[2] **Date**	**Notes**[3]
Groundwater Monitoring Wells							
MW-33-90	Mar-03	485	487.55	2103287.43	7615914.59	03/08/2005	
MW-33-150	Feb-05	485	487.77	2103302.58	7615906.05	03/08/2005	
MW-33-210	Feb-05	485	487.25	2103295.13	7615909.72	03/08/2005	
MW-34-55	Jun-03	458.9	460.945	2102542.45	7616444.49	03/08/2005	
MW-34-80	Jun-03	459.1	461.197	2102535.25	7616444.98	03/08/2005	
MW-34-100	Jan-05	458.932	460.965	2102530.6	7616452.41	03/08/2005	
MW-35-60	Mar-04	481.1	484.326	2104058.8	7615317.5	04/16/2007	
MW-35-135	Mar-04	481.2	484.242	2104045.82	7615329.76	04/16/2007	
MW-36-20	May-04	466.5	469.328	2102542.57	7616267.1	04/16/2007	
MW-36-40	May-04	466.7	469.591	2102537.2	7616267.58	04/16/2007	
MW-36-50	May-04	466.8	469.617	2102532.17	7616267.47	04/16/2007	
MW-36-70	May-04	466.5	469.265	2102542.67	7616267.18	04/16/2007	
MW-36-90	May-04	466.7	469.642	2102537.34	7616267.63	04/16/2007	
MW-36-100	May-04	466.8	469.65	2102532.37	7616267.51	04/16/2007	
MW-37S	Apr-04	483.5	485.97	2102869.45	7614827.87	05/11/2004	
MW-37D	Apr-04	483.7	486.19	2102882.18	7614825.33	05/11/2004	
MW-38S	Apr-04	522.8	525.51	2101279.65	7614918.75	05/06/2008	
MW-38D	Apr-04	523	525.31	2101264.32	7614918.79	05/06/2008	
MW-39-40	Apr-04	465.2	468.02	2102506.22	7616091.44	05/11/2004	
MW-39-50	Apr-04	465.1	467.93	2102498.75	7616095.96	05/11/2004	
MW-39-60	Apr-04	465.3	468	2102495.05	7616099.45	05/11/2004	
MW-39-70	Apr-04	465.2	468.02	2102506.3	7616091.38	05/11/2004	
MW-39-80	Apr-04	465.1	467.92	2102498.83	7616095.86	05/11/2004	
MW-39-100	Apr-04	465.3	468.12	2102494.95	7616099.3	05/11/2004	
MW-40S	May-04	566.3	566.04	2101861.86	7614386.85	05/11/2004	
MW-40D	May-04	566.5	566.08	2101864.35	7614370.53	05/11/2004	
MW-41S	Nov-04	477.406	480.071	2103518.07	7614588.78	02/15/2005	
MW-41M	Nov-04	477.061	479.835	2103527.41	7614583.19	02/15/2005	
MW-41D	Nov-04	476.877	479.416	2103536.66	7614578.85	02/15/2005	
MW-42-30	Feb-05	461.404	463.736	2102309.31	7616282.1	04/16/2007	
MW-42-55	Feb-05	461.229	463.853	2102303.38	7616278.63	04/16/2007	
MW-42-65	Feb-05	460.969	463.371	2102296.96	7616274.98	04/16/2007	
MW-43-25	Feb-05	462.54	462.54	2101817.50	7616702.79	03/08/2005	
MW-43-75	Feb-05	462.71	462.71	2101821.29	7616698.13	03/08/2005	
MW-43-90	Feb-05	459.94	462.76	2101824.65	7616693.23	03/08/2005	
MW-44-70	Mar-06	470.68	471.9	2102728.39	7616255.61	04/17/2006	
MW-44-115	Mar-06	470.32	472.01	2102723.93	7616261.92	08/22/2006	
MW-44-125	Mar-06	470.68	472.04	2102728.51	7616255.58	08/22/2006	
MW-45-095a	Feb-06	466.63	470.03	2102559.75	7616358.13	03/02/2006	
MW-45-095b	Feb-06	466.63	469.51	2102559.75	7616358.13	03/02/2006	
MW-46-175	Feb-06	480.82	482.16	2102940.02	7616196.86	05/16/2006	
MW-46-205	Feb-06	480.82	482.23	2102940.16	7616196.96	05/16/2006	

TABLE B-2

Survey Location and Elevation Data for RFI/RI Wells and Borings

RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)

PG&E Topock Compressor Station, Needles, California

Location ID	Date Installed	Elevation		Coordinates[1]		Survey[2] Date	Notes[3]
		Ground (ft MSL)	Measure Point (ft MSL)	Northing (ft)	Easting (ft)		
Groundwater Monitoring Wells							
MW-47-55	Mar-06	482.59	484.04	2103450.05	7615629.49	04/17/2006	
MW-47-115	Mar-06	482.59	484.17	2103450.09	7615629.74	04/17/2006	
MW-48	May-06	484.41	486.22	2101435.28	7615915.9	05/16/2006	
MW-49-135	Mar-06	482.57	484.02	2103667.53	7615889.63	05/16/2006	
MW-49-275	Mar-06	482.57	483.95	2103667.52	7615889.88	05/16/2006	
MW-49-365	Mar-06	482.57	484.01	2103667.25	7615889.83	05/16/2006	
MW-50-095	Apr-06	495.05	496.486	2103069.34	7615599.82	04/16/2007	
MW-50-200	Apr-06	495.05	496.349	2103069.62	7615599.82	04/16/2007	
MW-51	Apr-06	501.99	501.559	2101900.11	7615807.51	04/16/2007	
MW-52S	Mar-07	459.524	462.16	2101741.95	7616832.94	05/06/2008	
MW-52M	Mar-07	459.524	462.16	2101743.15	7616855.89	05/06/2008	
MW-52D	Mar-07	459.524	462.16	2101744.35	7616878.84	05/06/2008	
MW-53S	Mar-07	459.822	461.32	2101761.47	7616839.05	05/24/2007	
MW-53M	Mar-07	459.822	461.32	2101761.47	7616960.3	05/24/2007	
MW-53D	Mar-07	459.822	461.32	2101761.47	7617003.6	05/24/2007	
MW-54-85	Mar-08	466.39	466.1	2102958.94	7617082.61	05/06/2008	
MW-54-140	Mar-08	466.39	465.98	2102959.11	7617082.17	05/06/2008	
MW-54-195	Mar-08	466.28	466.32	2102951.91	7617089.25	05/06/2008	
MW-55-45	Apr-08	463.57	463.41	2102605.88	7618326.3	05/06/2008	
MW-55-120	Apr-08	463.57	463.21	2102606.18	7618326.13	05/06/2008	
MW-56S	Apr-08	459.93	461.36	2101569	7617586	05/06/2008	
MW-56M	Apr-08	459.93	461.36	2101569	7617517	05/06/2008	
MW-56D	Apr-08	459.93	461.36	2101569	7617465	05/06/2008	
MWP-1	Jul-85	675	---	2100063	7613730	---	
MWP-2	Jul-85	674.71	---	---	---	---	
MWP-2RD	Jul-85	674	---	2099993	7613427	---	
MWP-3	Jul-85	660.7	---	2099298	7613570	---	
MWP-7	Oct-85	675.1	---	2100068	7614021	---	
MWP-8	Oct-85	676.8	677.48	2100026.29	7613553.1	02/18/2004	
MWP-9	Oct-85	680.2	---	2099815	7613287	---	
MWP-10	1986	675.3	675.81	2099985.14	7613361.94	02/18/2004	
MWP-12	1986	662	663.49	2099175.79	7613717.69	02/18/2004	
MWP-14	Jun-92	674.1	---	2100021	7613476	---	
MWP-15	Jun-92	676.4	---	2099968	7613594	---	
MWP-16	Jun-92	689.5	---	2099721	7613552	---	
OW-1S	Nov-04	547.589	550.205	2103040.48	7613419.2	02/15/2005	
OW-1M	Sep-04	547.746	550.45	2103038.38	7613428.89	02/15/2005	
OW-1D	Sep-04	547.766	550.485	2103030.9	7613420.85	02/15/2005	
OW-2S	Dec-04	546.167	548.876	2103153.89	7613373.77	02/15/2005	
OW-2M	Dec-04	545.871	548.589	2103160.57	7613382.67	02/15/2005	
OW-2D	Dec-04	546.675	549.152	2103142.09	7613374.28	02/15/2005	
OW-3S	Oct-04	555.833	558.577	2103267.64	7612152.99	02/15/2005	

TABLE B-2

Survey Location and Elevation Data for RFI/RI Wells and Borings

RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)

PG&E Topock Compressor Station, Needles, California

Location ID	Date Installed	Elevation		Coordinates[1]		Survey[2] Date	Notes[3]
		Ground (ft MSL)	Measure Point (ft MSL)	Northing (ft)	Easting (ft)		
Groundwater Monitoring Wells							
OW-3M	Oct-04	556.202	558.895	2103276.78	7612157.98	02/15/2005	
OW-3D	Oct-04	555.914	558.625	2103286.35	7612161.22	02/15/2005	
OW-5S	Nov-04	549.124	551.826	2103017.60	7613186.81	02/15/2005	
OW-5M	Nov-04	549.005	551.806	2103008.06	7613185.86	02/15/2005	
OW-5D	Nov-04	549.52	552.33	2102998.32	7613185.55	02/15/2005	
P-1	Feb-86	694	---	---	---	---	
P-2	Aug-86	535.6	537.6	2101228.89	7612324.79	---	
PGE-7BR	Oct-07	562.6	---	2101350.19	7615034.78	---	
CW-1M	Jan-05	563.363	566.157	2102703.17	7613263.12	02/15/2005	
CW-1D	Jan-05	563.774	566.573	2102692.93	7613263.17	02/15/2005	
CW-2M	Feb-05	546.637	549.37	2103106.51	7613795.76	02/15/2005	
CW-2D	Jan-05	546.722	549.64	2103097.47	7613798.05	02/15/2005	
CW-3M	Feb-05	531.547	534.208	2103351.93	7613858.79	02/15/2005	
CW-3D	Jan-05	531.531	534.265	2103348.44	7613849.33	02/15/2005	
CW-4M	Jan-05	515.803	518.656	2103268.73	7612925.43	02/15/2005	
CW-4D	Jan-05	515.905	518.682	2103263.03	7612928.74	02/15/2005	
Extraction, Test & Injection Wells							
IW-2	Dec-04	546.542	550.105	2103104.94	7613363.87	02/15/2005	
IW-3	Dec-04	551.433	554.441	2103007.18	7613237.80	02/15/2005	
PE-1	Mar-05	457.524	457.524	2102550.25	7616345.31	03/08/2005	
PGE-8	Jun-69	595.3	596.01	2100589.66	7614925.89	02/18/2004	
PGE-PT-1	Nov-86	624.5	623.29	2101453	7612166	---	
TW-1	Nov-03	621	620.55	2101173.17	7615150.78	02/18/2004	
TW-2S	Apr-04	496.7	499.05	2102641.02	7615869.56	03/02/2006	
TW-2D	Apr-04	497	493.29	2102633.34	7615861.57	03/02/2006	
TW-3D	Oct-05	497.28	498.094	2102630.41	7615849.61	03/02/2006	
TW-4	Mar-06	482.62	484.11	2103457.17	7615623.69	04/17/2006	
TW-5	Apr-06	494.97	496.3	2103066.15	7615592.99	05/16/2006	
Pilot Study Wells							
PT-1S	Jan-06	472.1	474.51	2102643.69	7616043.57	03/02/2006	
PT-1M	Jan-06	472.1	474.48	2102643.42	7616043.6	03/02/2006	
PT-1D	Jan-06	472.1	474.49	2102643.59	7616043.5	03/02/2006	
PT-2S	Feb-06	471.49	473.35	2102645.89	7616017.9	03/02/2006	
PT-2M	Feb-06	471.49	473.45	2102646.18	7616018.09	03/02/2006	
PT-2D	Feb-06	471.49	473.48	2102646.23	7616017.74	03/02/2006	
PT-3S	Feb-06	471.56	473.45	2102637.31	7616060.88	03/02/2006	
PT-3M	Feb-06	471.56	473.38	2102637.43	7616060.86	03/02/2006	
PT-3D	Feb-06	471.56	473.39	2102637.02	7616061.09	03/02/2006	
PT-4S	Feb-06	471.65	474.29	2102626.76	7616077.37	03/02/2006	
PT-4M	Feb-06	471.65	474.19	2102626.65	7616077.53	03/02/2006	
PT-4D	Feb-06	471.65	474.19	2102626.68	7616077.38	03/02/2006	
PT-5S	Feb-06	471.12	473.47	2102629.73	7616112.06	03/02/2006	

TABLE B-2
Survey Location and Elevation Data for RFI/RI Wells and Borings
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

		Elevation		Coordinates[1]			
Location ID	Date Installed	Ground (ft MSL)	Measure Point (ft MSL)	Northing (ft)	Easting (ft)	Survey[2] Date	Notes[3]
Pilot Study Wells							
PT-5M	Feb-06	471.12	473.49	2102629.70	7616112.29	03/02/2006	
PT-5D	Feb-06	471.12	473.65	2102629.47	7616112.09	03/02/2006	
PT-6S	Jan-06	474.3	475.84	2102673.02	7616074.76	03/02/2006	
PT-6M	Jan-06	474.3	475.89	2102672.69	7616074.74	03/02/2006	
PT-6D	Jan-06	474.3	476.08	2102672.77	7616074.62	03/02/2006	
PT-7S	May-07	560.54	560.54	2101552	7615058.94	05/06/2008	
PT-7M	May-07	560.66	560.66	2101547.4	7615058.02	05/06/2008	
PT-7D	May-07	560.42	560.42	2101551.61	7615058.69	05/06/2008	
PT-8S	May-07	562.22	562.22	2101507.41	7615085.75	05/06/2008	
PT-8M	May-07	562.1	562.1	2101511.31	7615089.23	05/06/2008	
PT-8D	May-07	562.03	562.03	2101507.28	7615085.88	05/06/2008	
PT-9S	Jun-07	562	559.27	2101630.33	7615141.91	05/06/2008	
PT-9M	Jun-07	559.5	559.14	2101631.88	7615136.65	07/17/2007	
PT-9D	Jun-07	559.56	559.11	2101630.53	7615141.87	05/06/2008	
PTI-1S	Jan-06	472.54	474.9	2102648.8	7616067.35	08/22/2006	
PTI-1M	Jan-06	472.73	474.99	2102652.29	7616064.56	08/22/2006	
PTI-1D	Jan-06	472.54	474.61	2102649.26	7616062.3	08/22/2006	
PTR-1	May-07	558	---	2101561	7615044	07/17/2007	
PTR-2	Jun-07	565	---	2101451	7615127	07/17/2007	
Water Supply Wells							
PGE-1	Sep-51	555	---	2101749	7615075	02/08/2008	Elevation and coordinates are estimated
PGE-2	Jul-51	552	---	2101982	7615079	02/08/2008	Elevation and coordinates are estimated
PGE-6	Jun-64	562.3	563.32	2101525.08	7615050.86	02/18/2004	
PGE-7	Sep-64	562.6	563.89	2101350.19	7615034.78	02/18/2004	
PGE-9N	Apr-97	459.7	462.21	2101364.3	7617882.1	02/18/2004	
PGE-9S	Apr-97	459.4	461.99	2101340.52	7617879.85	02/18/2004	
Park Moabi-1	Mar-61	470	---	2104866.07	7608076.97	---	Elevation and coordinates are estimated
Park Moabi-3	Aug-86	517.2	518.55	2103953.94	7607298.24	02/18/2004	
Park Moabi-4	Oct-06	485	---	2105089	7607908	---	Elevation and coordinates are estimated
Selected Wells in Arizona							
Sanders	Jun-05	464	464.17	2101893.74	7619011.01	---	
Smith	Feb-98	505	---	2101771.58	7617985.72	---	
TMW-6	Jan-91	469	468.465	---	---	---	Located in Marina parking area
TMW-8	Jan-91	465	464.232	---	---	---	Located in Marina parking area
TMW-9	Jan-91	461	460.27	---	---	---	Located in Marina parking area
TMW-10	Jan-91	470	470	---	---	---	Located in Marina parking area
TMW-11	Jan-91	468	468.137	---	---	---	Located in Marina parking area
Topock-1		505	---	2102798.55	7619175.44	---	
Topock-2	Sep-80	509.07	509.07	2103733.81	7620366.28	---	
Topock-3	May-74	510.8	510.8	2103732.31	7620357.73	---	
Exploratory & Test Borings							
B-25	Apr-98	672	---	2100483	7613703	---	

TABLE B-2

Survey Location and Elevation Data for RFI/RI Wells and Borings
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station, Needles, California

		Elevation		Coordinates[1]			
Location ID	**Date Installed**	**Ground** (ft MSL)	**Measure Point** (ft MSL)	**Northing** (ft)	**Easting** (ft)	**Survey[2] Date**	**Notes[3]**
Exploratory & Test Borings							
CB-1	Mar-62	471	---	2101752	7616264	---	State of California Public Works Bore Log
CB-2	Mar-62	499	---	2101866	7617554	---	State of California Public Works Bore Log
CB-3	Mar-62	504	---	2101885	7617575	---	State of California Public Works Bore Log
CB-4	Mar-62	504	---	2101876	7617565	---	State of California Public Works Bore Log
CB-5	Mar-62	460	---	2101763	7616418	---	State of California Public Works Bore Log
CB-6	Mar-62	460	---	2101765	7616433	---	State of California Public Works Bore Log
CB-7	Mar-62	459	---	2101805	7616809	---	State of California Public Works Bore Log
CB-8	Mar-62	460	---	2101745	7616520	---	State of California Public Works Bore Log
CB-9	Mar-62	461	---	2101825	7616980	---	State of California Public Works Bore Log
CB-10	Mar-62	459	---	2101843	7617176	---	State of California Public Works Bore Log
CB-11	Mar-62	459	---	2101854	7617385	---	State of California Public Works Bore Log
CB-12	May-62	458	---	2101868	7617399	---	State of California Public Works Bore Log
CB-13	Mar-62	458	---	2101784	7616605	---	State of California Public Works Bore Log
CB-14	Mar-62	458	---	2101799	7616616	---	State of California Public Works Bore Log
IW-1	Nov-04	545	---	2103026.39	7613368.09	11/19/2004	
PE-1A	Feb-05	461.233	---	2102326.16	7616405.15	02/28/2005	
PE-1B	Feb-05	458.639	---	2102210.36	7616424.89	02/27/2005	
PM-B1	Mar-86	475	---	2107040	7609614	---	
PM-B2	Mar-86	495	---	2104788	7606964	---	
XMW-9	Jun-97	535.6	537.6	2100454.1	7614759.4	---	

Notes:

Boring and well constuction logs included in Appendix B

[1] California State Plane, NAD 83, Zone 5, US Feet

[2] All dates represent most recent survey date unless otherwise noted.

[3] Estimated elevations were derived from USGS topographic data. Estimated coordinates were determined using photobased georeferencing methods.

ATSF	Atchison, Topeka and Santa Fe Railway
bgs	Feet below ground surface
MSL	Feet above mean sea level
USGS	United States Geological Survey
---	data not available or not applicable

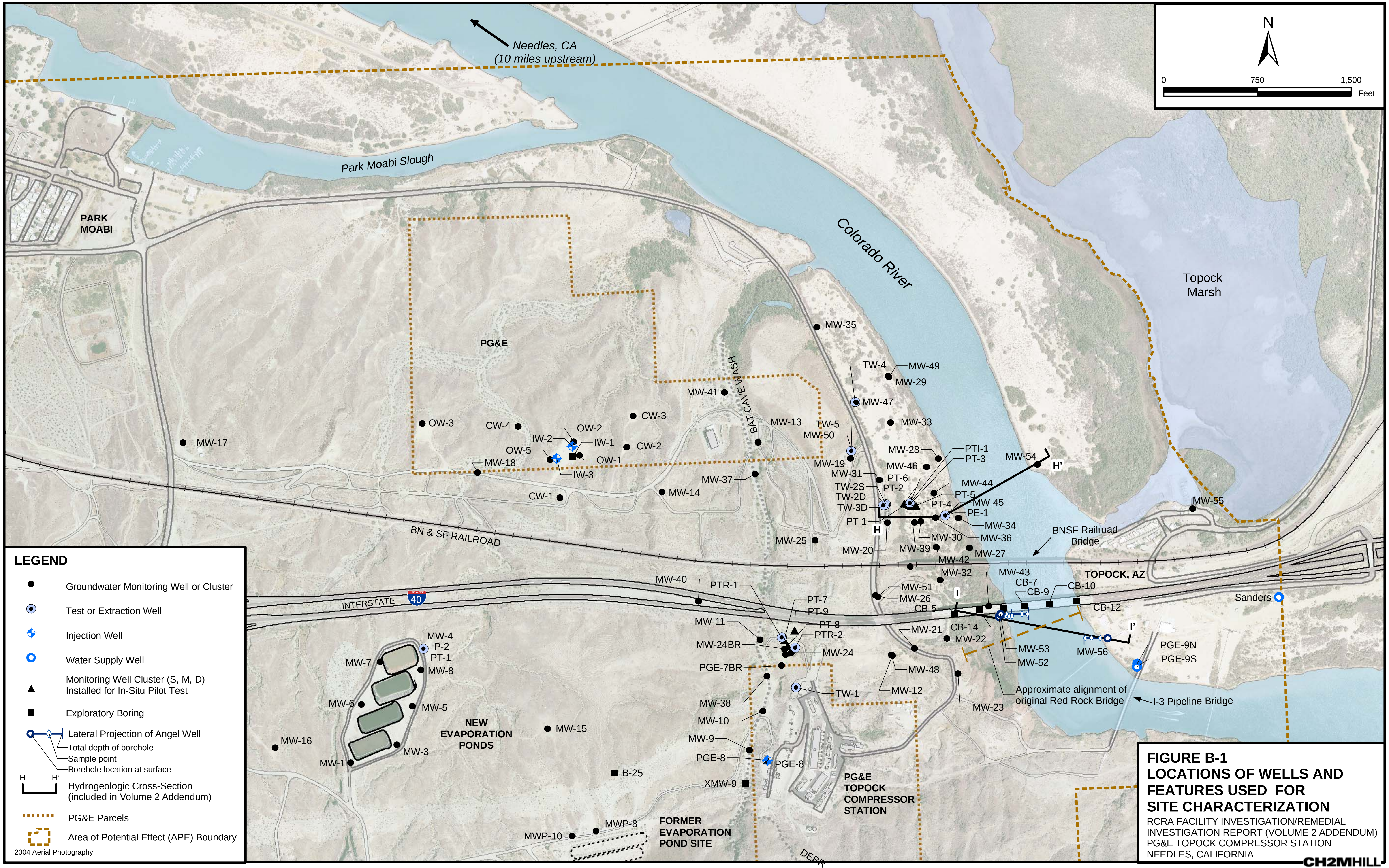


FIGURE B-1
LOCATIONS OF WELLS AND FEATURES USED FOR SITE CHARACTERIZATION

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

BAO \\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2008\RFI\RFI_SITE_CHARACTERIZATION.MXD PJOYCE1 11/5/2008 11:39:08

B2 Boring Logs and Well Construction Data for RFI/RI Wells

Volume 2 Addendum, Appendix B2: Excerpt table from CH2M Hill, 2008b

TABLE 3-1
Depth-Discrete Groundwater Sample Results and Field Measurements
Installation Report for Wells on the Arizona Shore of the Colorado River at Topock, Arizona
PG&E Topock Compressor Station, Needles, California

Isoflow Sample Collection Date						**Analysis Results**			**Isoflow Purge WQ Parameters (final reading)**						**Isoflow Purging Data**				
Sample Interval Angle Boring Depth (feet drilled)	**Vertical Depth (ft)**	**Lateral Distance (ft)**	**Sample Date**	**Sample Time**	**Sample ID**	**Cr (VI) Analysis IM3 Lab (µg/L)**	**Ferrous Iron IM3 Lab (mg/L)**	**Cr(T) Analysis Certified Lab (µg/L)**	**ORP (mV)**	**DO (mg/L)**	**Specific Conduct. (µS/cm)**	**Temp. (°C)**	**pH (pHunits)**	**Turbidity (NTU)**	**Volume Purged (gallons)**	**Average Pumping Rate (gpm)**	**Drawdown (ft from TOC)**	**Specific Capacity (gpm/ft)**	**Remarks**
MW-54																			
27-37	---	---	3/12/2008	1:30 PM	MW54-GGW-01	ND (10) S	ND (0.05) S	NA	-180	1.04	4,440	27.0	7.78	8.91	250	12	0.2	60.00	150 gal of water injected during drilling
37-47	---	---	3/12/2008	3:35 PM	MW54-GGW-02	ND (10) S	ND (0.05) S	NA	-169	0.30	6,140	27.1	7.65	18.6	309	13	10	1.30	180 gal of water injected during drilling
57-67	---	---	3/13/2008	9:31 AM	MW54-GGW-03	ND (10) S	ND (0.05) S	NA	-129	1.11	8,430	26.4	7.47	25.0	500	20	4.9	4.08	300 gal of water injected during drilling
77-87	---	---	3/13/2008	1:05 PM	MW54-GGW-04	ND (10) S	ND (0.05) S	NA	-112	1.68	9,570	25.7	7.48	26.7	430	20	4.5	4.44	300 gal of water injected during drilling
87-97	---	---	3/13/2008	3:50 PM	MW54-GGW-05	ND (10) S	ND (0.05) S	NA	-132	0.43	10,300	26.0	7.29	184	410	20	8.2	2.44	350 gal of water injected during drilling
97-107	---	---	3/14/2008	8:45 AM	MW54-GGW-06	ND (10) S	ND (0.05) S	NA	-130	0.29	10,600	26.0	7.40	---	450	10	9.6	1.04	400 gal of water injected during drilling
107-117	---	---	3/14/2008	12:55 PM	MW54-GGW-07	ND (10) S	ND (0.05) S	NA	-153	0.36	10,300	26.5	7.52	209	560	15	17.0	0.88	500 gal of water injected during drilling
127-137	---	---	3/14/2008	3:40 PM	MW54-GGW-08	ND (10) S	ND (0.05) S	NA	-117	0.79	12,000	25.1	7.87	171	560	20	4.7	4.26	500 gal of water injected during drilling
147-157	---	---	3/15/2008	9:10 AM	MW54-GGW-09	ND (10) S	ND (0.05) S	NA	-156	0.11	15,500	24.9	7.92	69.0	660	15	7.5	2.0	600 gal of water injected during drilling
167-177	---	---	3/15/2008	2:25 PM	MW54-GGW-10	ND (10) S	ND (0.05) S	NA	-181	1.66	18,700	24.8	8.13	38.0	1080	20	16	1.3	1000 gal of water injected during drilling
187-197	---	---	3/16/2008	7:55 AM	MW54-GGW-11	ND (10) S	ND (0.05) S	NA	-244	0.18	19,800	25.3	8.34	144	880	20	13.6	1.5	800 gal of water injected during drilling
207-217	---	---	3/17/2008	7:05 AM	MW54-GGW-12	ND (10) S	ND (0.05) S	NA	-243	0.36	25,100	25.5	8.06	---	330	10	70.4	0.1	250 gal of water injected during drilling
227-237	---	---	3/18/2008	9:25 AM	MW54-GGW-13	ND (10) S	ND (0.05) S	NA	-239	0.21	29,700	27.0	8.00	216	380	6	45.1	0.1	300 gal of water injected during drilling
MW-55																			
27-37	---	---	3/29/2008	3:55 PM	MW55-GGW-01	ND (10) S	ND (0.05) S	NA	-152	3.51	1,480	28.9	7.67	293	380	12	1.8	6.67	200 gal of water injected during drilling
37-47	---	---	3/30/2008	7:20 AM	MW55-GGW-02	ND (10) S	ND (0.05) S	NA	-96	0.36	1,790	28.1	7.64	---	280	15	1.7	8.82	200 gal of water injected during drilling
57-67	---	---	3/30/2008	10:35 AM	MW55-GGW-03	ND (10) S	ND (0.05) S	NA	-120	0.43	1,440	28.6	7.77	417	580	15	9	1.67	500 gal of water injected during drilling
77-87	---	---	3/30/2008	1:25 PM	MW55-GGW-04	ND (10) S	ND (0.05) S	NA	-65	1.05	1,520	28.6	8.14	65.0	555	12	9.5	1.26	450 gal of water injected during drilling
97-107	---	---	3/31/2008	10:20 AM	MW55-GGW-05	ND (10) S	ND (0.05) S	NA	-142	0.54	7,400	30.1	7.90	---	350	12	39.7	0.30	250 gal of water injected during drilling
117-127	---	---	3/31/2008	12:35 PM	MW55-GGW-06	ND (10) S	ND (0.05) S	NA	-77	0.60	9,340	30.5	7.88	---	280	12	21.7	0.55	200 gal of water injected during drilling
MW-56																			
43-53	27	46	4/10/2008	7:01 AM	MW56-GGW-01	ND (10) JS	2.67 S	NA	-237	0.42	1,890	23.2	7.26	11.9	106	2.0	NA	---	27 vertical depth, 46 horizontal
63-73	37	63	4/10/2008	9:00 AM	MW56-GGW-02	ND (10) S	ND (0.05) S	NA	-108	0.81	7,080	22.4	7.26	7.10	262	12	5	7.47	170 gal water injected; 37 vertical depth, 63 horizontal
83-93	47	81	4/10/2008	11:20 AM	MW56-GGW-03	ND (10) JS	0.375 S	NA	-174	0.34	10,300	24.7	7.22	4.00	178	4	9.5	1.31	150 gal of water injected; 47 vertical depth, 81 horizontal
103-113	57	98	4/10/2008	3:37 PM	MW56-GGW-04	ND (10) JS	2.56 S	NA	-198	0.27	13,600	29.3	7.13	63.0	159	0.5	14.4	0.11	150 gal of water injected; 57 vertical depth, 98 horizontal
123-133	67	115	4/11/2008	11:10 AM	MW56-GGW-05	ND (10) S	0.222 S	NA	-146	0.00	14,800	24.4	6.98	14.6	185	2	19.8	0.31	150 gal of water injected; 67 vertical depth, 115 horizontal
143-153	77	133	4/11/2008	2:22 PM	MW56-GGW-06	ND (10) S	0.75 S	NA	-175	0.00	14,700	24.2	7.13	15.4	178	1.7	14.4	0.37	150 gal of water injected; 77 vertical depth, 133 horizontal
163-173	87	150	4/12/2008	7:30 AM	MW56-GGW-07	ND (10) S	0.13 S	NA	-248	0.00	17,000	22.9	7.80	5.72	227	3.5	4.5	2.42	170 gal of water injected; 87 vertical depth, 150 horizontal
183-193	97	167	4/12/2008	10:18 AM	MW56-GGW-08	ND (10) S	0.148 S	NA	-254	0.00	18,600	24.2	7.92	8.26	275	4	15.8	0.79	220 gal of water injected; 97 vertical depth, 167 horizontal
203-213	107	184	4/12/2008	1:11 PM	MW56-GGW-09	ND (10) S	ND (0.05) S	NA	-280	0.00	18,700	25.5	8.07	4.66	350	4.5	12.7	1.10	300 gal of water injected; 107 vertical depth, 184 horizontal

NOTES:

µS/cm	microSiemens per centimeter
°C	degree centigrade
ORP	oxidation reduction potential, results rounded off to whole point
mV	millivolts
µg/L	micrograms per liter
mg/L	milligrams per liter
%	percentage
NTU	Nephelometric Turbidity Unit
ND	not detected at listed reporting limit
J	analyte was present, but reported value was estimated
S	Screening level data
---	not collected

SHEET 1 of 8	**PROJECT NUMBER:** 354948.FP.07.FW	**BORING NUMBER:** *MW-54*

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 237.0	**DRILLING CONTRACTOR:** Boart-Longyear (Dale Osteberg)
SURFACE ELEVATION (NAVD88): 466.8 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,102,951.91	**EASTING (CCS NAD 83 Z 5):** 7,617,089.25	**DATE STARTED:** 3/12/2008 **DATE COMPLETED:** 3/18/2008
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 6" core barrel, 8" casing
LOCATION: Site 1			**LOGGED BY:** A. Brewster

DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: ISOFLOW SAMPLE	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
0						**POORLY GRADED SAND (SP)** - Pale brn (10YR 6/3), 95% subang to subrnd fn sand, 5% fines, poorly graded, predominantly qtz-based, loose, moist.	Soil descriptions based on observation of continuous Rotosonic core. See list of abbreviations at end of log. This log is from the deepest of two borings drilled at Site 1. Monitoring Well MW-54-195 was installed in the deeper boring and nested wells MW-54-85 and MW-54-140 were installed in the shallower boring.
5							
10		10					
15				CS		- SP AS ABOVE: lt yellowish brn (10YR 6/4)	Collect soil sample MW54-CS-15-17
17					SP		
20		10				- SP AS ABOVE: brn (10YR 5/3), sporadic gravel (max clast size = 3 cm); average grain size is larger but still predominantly fine-grained, sand predominantly qtz-based with minor presence of micas and feldspars.	
25				CS			Collect soil sample MW54-CS-25-27
27			MW54-GGW-01				Isoflow #1: 27-37' bgs Water used to drill: 150 gallons Sample ID: MW54-GGW-01
30		10				- SP AS ABOVE: dk greyish brn (10YR 4/2)	
35							

CH2MHILL

SHEET 2 of 8	**PROJECT NUMBER:** 354948.FP.07.FW	**BORING NUMBER:** ***MW-54***

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 237.0	**DRILLING CONTRACTOR:** Boart-Longyear (Dale Osteberg)		
SURFACE ELEVATION (NAVD88): 466.8 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,102,951.91	**EASTING (CCS NAD 83 Z 5):** 7,617,089.25	**DATE STARTED:** 3/12/2008	**DATE COMPLETED:** 3/18/2008	
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 6" core barrel, 8" casing		
LOCATION: Site 1			**LOGGED BY:** A. Brewster		

DEPTH BGS (feet)	SAMPLE INTERVAL	RECOVERY (ft)	ISOFLOW SAMPLE	SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
				CS	SM	**SILTY SAND (SM)** - Yellowish brn (10YR 5/4), 85% subang to subrnd fn sand, 15% fines, poorly graded, sand is predominantly qtz-based with trace feldspar, loose, wet.	Collect soil sample MW54-CS-35-37
							Isoflow #2: 37-47' bgs Water used to drill 37-47': 150 gallons Sample ID: MW54-GGW-02
40		10	MW54-GGW-02				
						- SM AS ABOVE: brn (10YR 4/3); 80% subang-subrnd fn sand, 20% fines, poorly graded, predominately quartz w/ trace feldspar, loose to med density, wet.	
45				CS			Collect soil sample MW54-CS-45-47
50							
		10				- (at 52.5' bgs) SM AS ABOVE: increase in grain size in accordance with a fining-upwards sequence.	
					SW	**WELL GRADED SAND (SW)**- Yellowish brn (10YR 5/4), 5% gravel (up to 1 cm), 95% subrnd sand, well graded, predominantly qtz, 5% feldspars and 5% micas, loose, fining upwards, wet.	
55				CS	SP	**POORLY GRADED SAND (SP)** - Brn (10YR 5/3), 95% fn sand, 5% fines, poorly graded, subrnd to subang, predominantly qtz with trace feldspars and micas, loose to med density, no apparent structure, wet.	Collect soil sample MW54-CS-55-57
							Isoflow #3: 57-67' bgs Water used to drill 47 - 67' bgs: 300 gallons Sample ID: MW54-GGW-03
60		10	MW54-GGW-03		GW	**WELL GRADED GRAVEL (GW)** - Dk yellowish brn (10YR 4/4), 95% rnd-subrnd gravel (up to 11 cm), 5% fn sand, no fines, well graded, no dominant mineral type, loose, no apparent structure, sharp contact with SP sand at 59.75' bgs, wet.	
65					SW/GP	**WELL GRADED SAND with GRAVEL (SW/GP)** - Lt yellowish brn (2.5YR 6/3), 8% gravel (up to 3 cm), 90% rnd-subrnd sand, well graded, no dominant mineral type, loose, no apparent structure, wet.	
				CS	SP	**POORLY GRADED SAND (SP)** - Lt olive brn (2.5YR 5/3), 95% subrnd fn-med sand, 5% fines, poorly graded, predominantly qtz, loose, no apparent structure, wet.	Collect soil sample MW54-CS-65-67
					GW	**WELL GRADED GRAVEL (GW)** - Dk yellowish brn (10YR 4/4), 95% rnd-subrnd gravel (up to 7 cm), 5% fn sand, no fines, well graded, no dominant mineral type, loose, no structure, wet.	
70							

CH2MHILL

SHEET 3 of 8	**PROJECT NUMBER:** 354948.FP.07.FW	**BORING NUMBER:** *MW-54*

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 237.0	**DRILLING CONTRACTOR:** Boart-Longyear (Dale Osteberg)	
SURFACE ELEVATION (NAVD88): 466.8 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,102,951.91	**EASTING (CCS NAD 83 Z 5):** 7,617,089.25	**DATE STARTED:** 3/12/2008	**DATE COMPLETED:** 3/18/2008
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 6" core barrel, 8" casing	
LOCATION: Site 1			**LOGGED BY:** A. Brewster	

DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: ISOFLOW SAMPLE	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
	☒	10			SP	**POORLY GRADED SAND with trace GRAVEL (SP)** - Pale brn (10YR 6/3), 3% gravel (up to 2 cm), 95% subrnd fn sand, 2% fines, poorly graded, predominantly qtz with trace feldspars and micas, loose, no structure, wet.	
75				CS			Collect soil sample MW54-CS-75-77
80	☒	10	MW54-GGW-04				Isoflow #4: 77-87' bgs Water used to drill 67-87' bgs: 300 gallons Sample ID: MW54-GGW-04
85						- 2" clay lens encountered; trace silt content.	
				CS			Collect soil sample MW54-CS-85-87
90	☒	10	MW54-GGW-05		SP	**POORLY GRADED SAND (SP)**- Brn (10YR 5/3), 95% subang-subrnd fn sand, 5% fines, poorly graded, predominantly qtz, loose, no structure, wet.	Isoflow #5: 87-97' bgs. Water used to drill 87-97' bgs: 350 gallons Sample ID: MW54-GGW-05 Formation tougher to drill.
95				CS			Cobbles encountered at 95' bgs. Collect soil sample MW54-CS-95-97
					GW	**WELL GRADED GRAVEL (GW)** - Dk yellowish brn (10YR 4/4), 95% ang-subang gravel (up to 15 cm), 5% fn sand, well graded, no dominant mineral type, loose, no structure, wet.	
100	☒	10	MW54-GGW-06			**COBBLES AND BOULDERS**: Color N/A, 100% ang-rnd gravel, poorly graded, clast supported, largest clast unknown (cored through boulders), various mineralogy (basalt, granite, shocked qtz, feldspars)	Isoflow #6: 97-107' bgs Water used to drill 97-107' bgs: 400 gallons Sample ID: MW54-GGW-06 Drilling continues to be difficult. 97-107 ' bgs interval very tough drilling; boulders recovered Presence of carbide bits in samples.
105							

CH2MHILL

SHEET 4 of 8	**PROJECT NUMBER:** 354948.FP.07.FW	**BORING NUMBER:** ***MW-54***

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 237.0	**DRILLING CONTRACTOR:** Boart-Longyear (Dale Osteberg)	
SURFACE ELEVATION (NAVD88): 466.8 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,102,951.91	**EASTING (CCS NAD 83 Z 5):** 7,617,089.25	**DATE STARTED:** 3/12/2008	**DATE COMPLETED:** 3/18/2008
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 6" core barrel, 8" casing	
LOCATION: Site 1			**LOGGED BY:** A. Brewster	

DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: ISOFLOW SAMPLE	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
					--	**COBBLES AND BOULDERS**: Color N/A, 100% ang-rnd gravel, poorly graded, clast supported, largest clast unknown (cored through boulders), various mineralogy (basalt, granite, shocked qtz, feldspars)	Isoflow #7: 107-117' bgs Water used to drill 107-117' bgs: 500 gallons Sample ID: MW54-GGW-07
110			MW54-GGW-07				
		10					
115				CS	GC	**POORLY GRADED GRAVEL with CLAY (GC/CH)** - Dk greyish brn (2.5Y 4/2), 50% subrnd-subang gravel (up to 10 cm), 10% fn sand, 40% soft clay, poorly graded, no dominant mineralogy, no apparent structure, wet.	Collect soil sample MW54-CS-115-117
					GP	**POORLY GRADED GRAVEL with SAND (GP)** - Brn (10YR 5/3), 50% subang-subrnd gravel (up to 10 cm), 40% med sand, 10% fines, poorly graded, no structure, matrix supported, predominantly qtz, loose, wet.	
120					GW	**WELL GRADED GRAVEL (GW)**- Color N/A, 95% subrnd gravel (> 6 in), 5% fn sand, no fines, well graded, mostly igneous rocks present, loose, no structure, wet.	
125				CS	CH	**CLAY (CH)** - Brn (10YR 4/3), 100% medium stiff clay, finely laminated, wet.	Collect soil sample MW54-CS-125-127 Isoflow #8: 127-137' bgs Water used to drill 117'137' bgs: 500 gallons Sample ID: MW54-GGW-08
		20					
130			MW54-GGW-08		SP	**POORLY GRADED SAND with trace GRAVEL(SP)** - Brn (10YR 4/3), 1% gravel (up to 5 cm), 96% subang med sand, 3% fines, poorly graded, predominantly qtz, trace feldspars and micas, loose, no structure, wet.	
135				CS	CH	**CLAY (CH)** - Brn (10YR 4/3), 100% medium stiff clay, finely laminated, wet.	Collect soil sample MW54-CS-135-137
					GP	**POORLY GRADED GRAVEL with SAND (GP)** - Color N/A, 50% subang-subrnd gravel (up to 8 cm), 30% fn sand, 20% fines, poorly graded, no dominant mineralogy, loose, clast supported, wet.	
140							

CH2MHILL

SHEET 5 of 8	**PROJECT NUMBER:** 354948.FP.07.FW	**BORING NUMBER:** *MW-54*

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 237.0	**DRILLING CONTRACTOR:** Boart-Longyear (Dale Osteberg)	
SURFACE ELEVATION (NAVD88): 466.8 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,102,951.91	**EASTING (CCS NAD 83 Z 5):** 7,617,089.25	**DATE STARTED:** 3/12/2008	**DATE COMPLETED:** 3/18/2008
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 6" core barrel, 8" casing	
LOCATION: Site 1			**LOGGED BY:** A. Brewster	

DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: ISOFLOW SAMPLE	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
						WELL GRADED SAND (SW) - Reddish brn (5YR 4/3), 5% gravel (up to 2 cm), 90% subang sand, 5% fines, well graded, moderate density, no dominant mineral type, no apparent strucutre, wet. Intermittent intervals of sand and clay concentrated zones.	
							Drilling more difficult.
145				CS			Collect soil sample MW54-CS-145-147
		20	MW54-GGW-09				Isoflow #9: 147-157' bgs Water used to drill 137-157' bgs: 600 gallons Sample ID: MW54-GGW-09 Drilling is easier
150							
155				CS			Collect soil sample MW54-CS-155-157
160							
165				CS	SW		Collect soil sample MW54-CS-165-167
		20	MW54-GGW-10				Isoflow #10: 167-177' bgs Water used to drill 157-177' bgs: 1,000 gallons Sample ID: MW54-GGW-10
170							
175							

CH2MHILL

SHEET 6 of 8	**PROJECT NUMBER:** 354948.FP.07.FW	**BORING NUMBER:** *MW-54*

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 237.0	**DRILLING CONTRACTOR:** Boart-Longyear (Dale Osteberg)	
SURFACE ELEVATION (NAVD88): 466.8 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,102,951.91	**EASTING (CCS NAD 83 Z 5):** 7,617,089.25	**DATE STARTED:** 3/12/2008	**DATE COMPLETED:** 3/18/2008
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 6" core barrel, 8" casing	
LOCATION: Site 1			**LOGGED BY:** A. Brewster	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE RECOVERY (ft)	SAMPLE ISOFLOW SAMPLE	SAMPLE SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
				CS		**WELL GRADED SAND (SW)** - Reddish brn (5YR 4/3), 5% gravel (up to 2 cm), 90% subang sand, 5% fines, well graded, moderate density, no dominant mineral type, no apparent strucutre, wet. Intermittent intervals of sand and clay concentrated zones.	Collect soil sample MW54-CS-175-177
180						- lens of lt green clay at 179.5' bgs	
							Driling is difficult in this zone.
185				CS			Collect soil sample MW54-CS-185-187
		20	MW54-GGW-11			- SW AS ABOVE: reddish brn (2.5YR 4/4)	Isoflow #11: 187-197' bgs Water used to drill 177'197' bgs: 800 gallons Sample ID: MW54-GGW-11
190							
195				CS		**SILT (ML)** - Dk reddish brn (5YR 3/4), 1% gravel, 4% subang sand, 95% silt, poorly graded, no dominant mineral type, moderate to hard density, no apparent structure, moist.	Collect soil sample MW54-CS-195-197
200							
205				CS		- 205 to 207' bgs sections are dry and powdered, indicative of consolidated material broken apart by drilling.	Increased rig chatter at 205' bgs. Collect soil sample MW54-CS-205-207
		20					Isoflow #12: 207-217' bgs Water used to drill 197-217' bgs: 250 gallons Sample ID: MW54-GGW-12
210						- more partially consolidated material, moist	

CH2MHILL

SHEET 7 of 8	**PROJECT NUMBER:** 354948.FP.07.FW	**BORING NUMBER:** *MW-54*

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 237.0	**DRILLING CONTRACTOR:** Boart-Longyear (Dale Osteberg)
SURFACE ELEVATION (NAVD88): 466.8 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,102,951.91	**EASTING (CCS NAD 83 Z 5):** 7,617,089.25	**DATE STARTED:** 3/12/2008 **DATE COMPLETED:** 3/18/2008
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 6" core barrel, 8" casing
LOCATION: Site 1			**LOGGED BY:** A. Brewster

DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: ISOFLOW SAMPLE	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
	☒		MW54-GGW-12		ML	**SILT (ML)** - Dk reddish brn (5YR 3/4), 1% gravel, 4% subang sand, 95% silt, poorly graded, no dominant mineral type, moderate to hard density, no apparent structure, moist.	
215				CS			Collect soil sample MW54-CS-215-217
	☒					- minor decomposed rock to clay. Matrix supported. Maximum gravel = 3.5 cm. Gravel is subangular to angular. - appearance of Miocene conglomerate cobble (max dia = 11 cm), matrix supported.	
220							
225				CS			Drill rate 217-227' bgs = 4 minutes. Collect soil sample MW54-CS-225-227
		20	MW54-GGW-13				Isoflow #13: 227-237' bgs Water used to drill: 300 gallons Sample ID: MW54-GGW-13
230				CS	BR	**MIOCENE CONGLOMERATE (BR)** - Reddish brn (2.5YR 4/4), subang-ang, clast composition predominantly metamorphic, consolidated, clast supported, dry. Max clast size = 8 cm.	Collect soil sample MW54-CS-230-232 Drill rate 227-232' bgs = 15 minutes
235							

Boring Terminated at 237 ft

ABBREVIATIONS

cc = continuous core run
brn = brown
lt = light
dk = dark
vf = very fine-grained
fn = fine-grained
med = medium-grained
cse = coarse-grained

SHEET 8 of 8	**PROJECT NUMBER:** 354948.FP.07.FW	**BORING NUMBER:** *MW-54*

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 237.0	**DRILLING CONTRACTOR:** Boart-Longyear (Dale Osteberg)	
SURFACE ELEVATION (NAVD88): 466.8 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,102,951.91	**EASTING (CCS NAD 83 Z 5):** 7,617,089.25	**DATE STARTED:** 3/12/2008	**DATE COMPLETED:** 3/18/2008
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 6" core barrel, 8" casing	
LOCATION: Site 1			**LOGGED BY:** A. Brewster	

DEPTH BGS (feet)	SAMPLE				USCS CODE	SOIL DESCRIPTION	COMMENTS
	INTERVAL	RECOVERY (ft)	ISOFLOW SAMPLE	SOIL SAMPLE		SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
						vc = very coarse-grained *ang = angular* *subang = subangular* *subrnd = subrounded* *rnd = rounded* *br = bedrock formation* *ss = sandstone* *conglom = conglomerate* *comptd = compacted* *qtz = quartz*	

WELL COMPLETION DIAGRAM

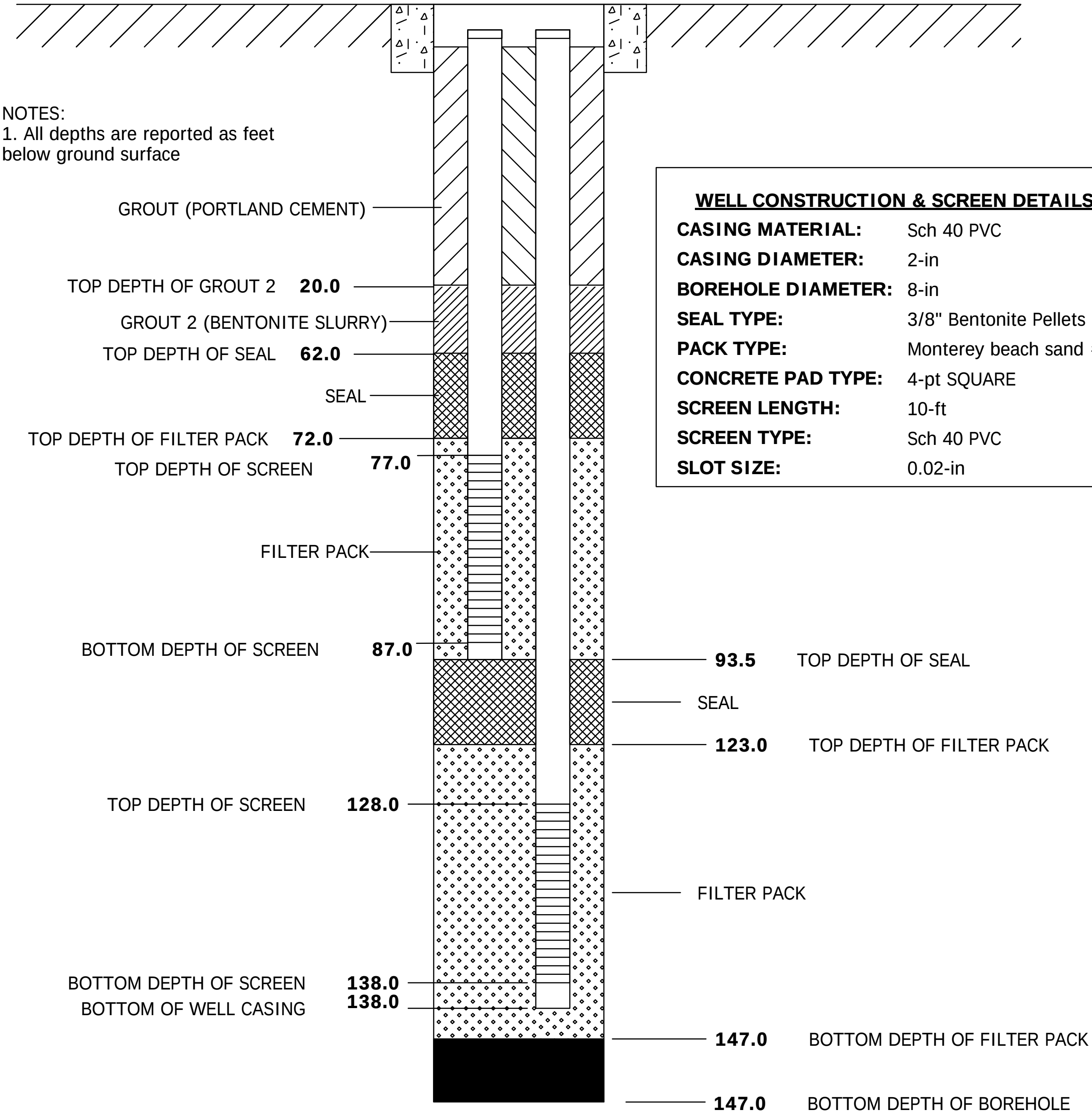
PROJECT NO: 354948.FP.07.FW	**PROJECT:** Topock AZ Drilling	**WELL NO:** ***MW-54-140***

LOCATION: Site 1

DRILLING CONTRACTOR: Boart-Longyear	**DRILLING START:** 3/12/2008 08:10
DRILLING METHOD: Rotosonic	**DRILLING END:** 3/18/2008 17:30
LOGGER: A. Brewster	**WELL COMPLETION DATE:** 3/27/2008
GROUND SURFACE ELEVATION (NAVD 88): 466.76	**GENERAL REMARKS:** MW-54-85 shown as nested well.

LOCKING FLUSH COMPLETION

NOTES:
1. All depths are reported as feet below ground surface



WELL CONSTRUCTION & SCREEN DETAILS

CASING MATERIAL:	Sch 40 PVC
CASING DIAMETER:	2-in
BOREHOLE DIAMETER:	8-in
SEAL TYPE:	3/8" Bentonite Pellets
PACK TYPE:	Monterey beach sand # 3
CONCRETE PAD TYPE:	4-pt SQUARE
SCREEN LENGTH:	10-ft
SCREEN TYPE:	Sch 40 PVC
SLOT SIZE:	0.02-in

WELL DIAGRAM IS NOT TO SCALE

WELL COMPLETION DIAGRAM

PROJECT NO: 354948.FP.07.FW

PROJECT: Topock AZ Drilling

WELL NO: *MW-54-195*

LOCATION: Site 1

DRILLING CONTRACTOR: Boart-Longyear

DRILLING START: 3/12/2008

DRILLING METHOD: Rotosonic

DRILLING END: 3/18/2008

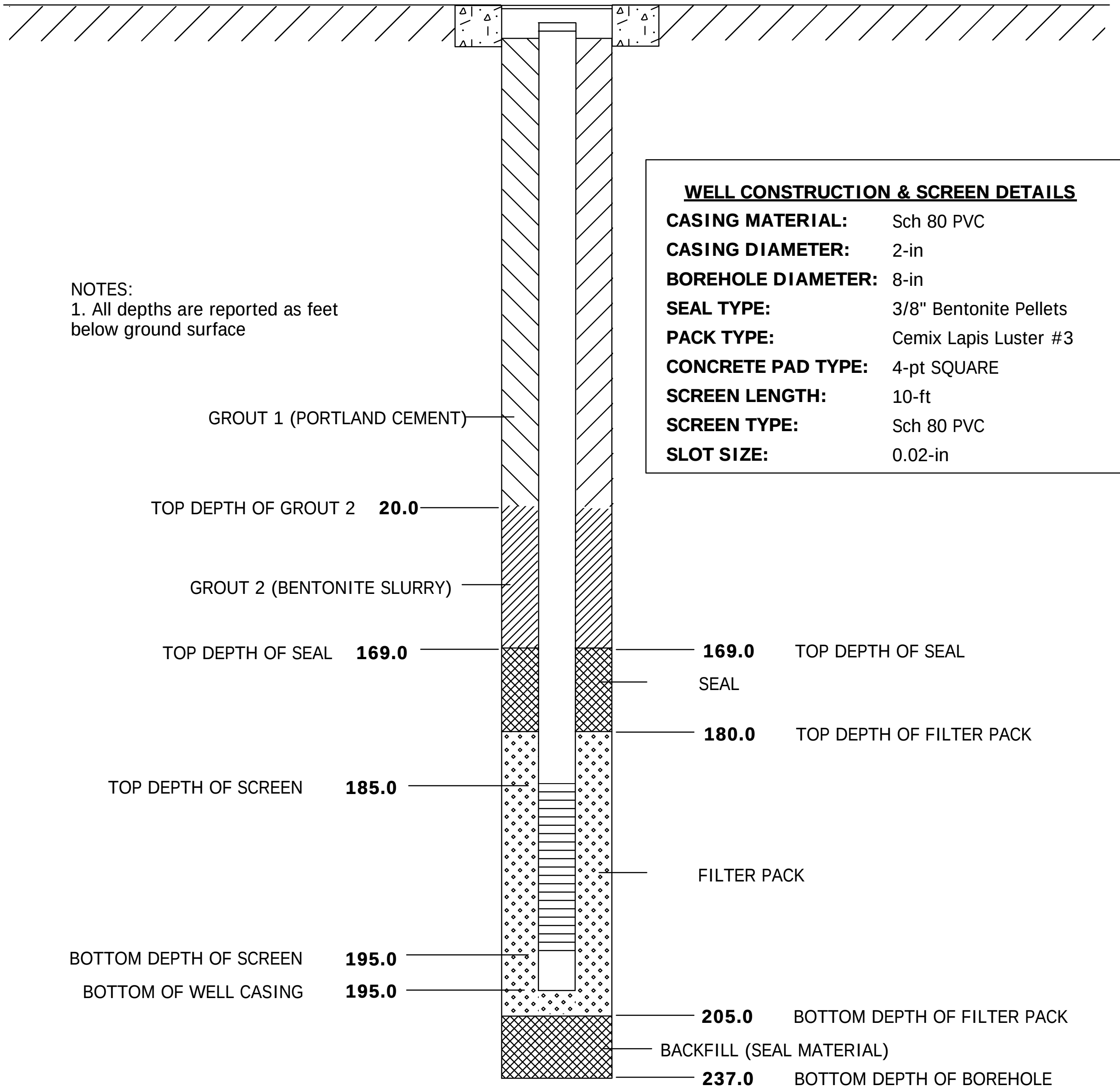
LOGGER: A. Brewster

WELL COMPLETION DATE: 3/18/2008

GROUND SURFACE ELEVATION (NAVD 88): 466.80

GENERAL REMARKS: ---

LOCKING FLUSH COMPLETION



NOTES:
1. All depths are reported as feet below ground surface

WELL CONSTRUCTION & SCREEN DETAILS

CASING MATERIAL:	Sch 80 PVC
CASING DIAMETER:	2-in
BOREHOLE DIAMETER:	8-in
SEAL TYPE:	3/8" Bentonite Pellets
PACK TYPE:	Cemix Lapis Luster #3
CONCRETE PAD TYPE:	4-pt SQUARE
SCREEN LENGTH:	10-ft
SCREEN TYPE:	Sch 80 PVC
SLOT SIZE:	0.02-in

WELL DIAGRAM IS NOT TO SCALE

SHEET 1 of 5

SHEET 1 of 5	**PROJECT NUMBER:** 354948.FP.07.FW	**BORING NUMBER:** *MW-55*

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 137.0	**DRILLING CONTRACTOR:** Boart-Longyear (Dale Osteberg)	
SURFACE ELEVATION (NAVD88): 463.6 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,102,606.18	**EASTING (CCS NAD 83 Z 5):** 7,618,326.13	**DATE STARTED:** 3/29/2008	**DATE COMPLETED:** 3/31/2008
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 6" core barrel, 8" casing	
LOCATION: Site 2 - Alternate			**LOGGED BY:** R. Tweidt	

DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: ISOFLOW SAMPLE	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
0–5					SM	**SILTY SAND with GRAVEL (SM)** - Brn (10YR 4/3), 15% gravel (up to 4 cm), 45% subang-ang fn sand, 40% fines, well graded, gravel is predominantly metamorphic, slightly moist.	Soil descriptions based on observation of continuous Rotosonic core. See list of abbreviations at end of log. Nested wells MW-55-45 and MW-55-120 installed in this borehole.
5–7	X	12		CS			Collect soil sample MW55-CS-6-7
7–11.5					GP	**POORLY GRADED GRAVEL (GP)** - Reddish black (2.5YR 2.5/1), 90% ang-subang gravel (up to 3 cm), 10% fn sand, no fines, poorly graded, semi-consolidated pieces of metamorphic material present, wet. - clayey silt layer present (ML), very dk greyish brn (10YR 3/2), slow dilatency, med plasticity	
11.5–17				CS	SM	**SILTY SAND (SM)** - Dk yellowish brn (10YR 3/4), 10% gravel (up to 2 cm), 60% fn sand, 30% fines, poorly graded, wet. - SM AS ABOVE: (at 12'bgs) dk brn (7.5YR 3/4), 5% rnd-subrnd gravel (up to 2 cm), 75% fn sand, 20% fines. Fluvial sediments. - SM AS ABOVE: 5% rnd-subrnd gravel, 60% fn sand, 35% fines - SM AS ABOVE: increased gravel size, alluvial and fluvial sediments present, gravel is subang. Max clast size = 5 cm.	Collect soil sample MW55-CS-16-17
17–27	X	10		CS		- SM AS ABOVE: gravel is subang, metamorphic and granitic. Max clast size = 11 cm. - SM AS ABOVE: pieces of consolidated sandstone present. 15% subang gravel, 75% fn-med sand, 10% fines	Drill rate 17' to 27' = 1.7 ft/min Collect soil sample MW55-CS-26-27
27–35	X	10	MW55-GGW-01		SM	- SM AS ABOVE: Increased gravel size and content. 20% gravel, 45% fn-med sand, 35% fines. Max clast size = 12 cm. - SM AS ABOVE: 10% gravel, 70% sand, 20% fines - SM AS ABOVE: 10% gravel (up to 4 cm), 60% fn sand, 30% fines, gravel is predominantly sandstone and granitic.	Drill rate 27' to 37' = 1.7 ft/min Isoflow #1: 27-37' bgs Water used to drill: 200 gallons Sample ID: MW55-GGW-01

CH2MHILL

SHEET 2 of 5	**PROJECT NUMBER:** 354948.FP.07.FW	**BORING NUMBER:** *MW-55*

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 137.0	**DRILLING CONTRACTOR:** Boart-Longyear (Dale Osteberg)
SURFACE ELEVATION (NAVD88): 463.6 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,102,606.18	**EASTING (CCS NAD 83 Z 5):** 7,618,326.13	**DATE STARTED:** 3/29/2008 **DATE COMPLETED:** 3/31/2008
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 6" core barrel, 8" casing
LOCATION: Site 2 - Alternate			**LOGGED BY:** R. Tweidt

DEPTH BGS (feet)	SAMPLE				USCS CODE	SOIL DESCRIPTION	COMMENTS
	INTERVAL	RECOVERY (ft)	ISOFLOW SAMPLE	SOIL SAMPLE		SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
				CS		**SILTY SAND (SM)** - Dk yellowish brn (10YR 3/4), 10% gravel (up to 2 cm), 60% fn sand, 30% fines, poorly graded, wet. - (at 35' bgs) SM AS ABOVE: 15% subrnd-subang gravel (up to 5 cm), 65% fn-med sand, 20% fines, gravel is predominantly metamorphic and granitic.	Collect soil sample MW55-CS-36-37 Drill rate 37' to 47' = 1.7 ft/min
40		10	MW55-GGW-02			- SM AS ABOVE: 10% subrnd-ang gravel (up to 3 cm), 50% fn-med sand, 40% fines.	Isoflow #2: 37-47' bgs Water used to drill: 200 gallons Sample ID: MW55-GGW-02
45				CS			Collect soil sample MW55-CS-46-47 Drill rate 47' to 57' = 1.5 ft/min
						SANDY SILT with GRAVEL (ML) - Dk reddish brn (2.5YR 3/4), 5% subang-ang gravel (up to 8 cm), 20% fn sand, 75% fines, well graded, low to med strength, low plasticity, slow to rapid dilatency in pulverized sample, gravel composition is metamorphics and granitics, slightly moist.	
50		10					
55				CS		- ML AS ABOVE: section more cse, 5% gravel (up to 3 cm), 40% fn sand, 55% fines. - ML AS ABOVE: 5% gravel, 20% fn sand, 75% fines. 8 cm piece of Miocene conglomerate in cuttings. - ML AS ABOVE: section more cse, 5% gravel (up to 2.5 cm), 40% fn sand, 55% fines.	Collect soil sample MW55-CS-56-57
60		10	MW55-GGW-03				Isoflow #3: 57-67' bgs Water used to drill: 500 gallons Sample ID: MW55-GGW-03
65				CS			Collect soil sample MW55-CS-66-67
70						- ML AS ABOVE: coarsening of soil. Increased gravel content and max clast size. 25% subang-ang gravel (up to 14 cm), 30% fn sand, 45% fines. Gravel is composed of metamorphics and granitic rocks. Abundant pieces of miocene conglomerate present.	

CH2MHILL

SHEET 3 of 5	**PROJECT NUMBER:** 354948.FP.07.FW	**BORING NUMBER:** *MW-55*

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 137.0	**DRILLING CONTRACTOR:** Boart-Longyear (Dale Osteberg)	
SURFACE ELEVATION (NAVD88): 463.6 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,102,606.18	**EASTING (CCS NAD 83 Z 5):** 7,618,326.13	**DATE STARTED:** 3/29/2008	**DATE COMPLETED:** 3/31/2008
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 6" core barrel, 8" casing	
LOCATION: Site 2 - Alternate			**LOGGED BY:** R. Tweidt	

DEPTH BGS (feet)	SAMPLE INTERVAL	RECOVERY (ft)	ISOFLOW SAMPLE	SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
75		10				**SANDY SILT with GRAVEL (ML)** - Dk reddish brn (2.5YR 3/4), 5% subang-ang gravel (up to 8 cm), 20% fn sand, 75% fines, well graded, low to med strength, low plasticity, slow to rapid dilatency in pulverized sample, gravel composition is metamorphics and granitics, slightly moist.	
80				CS	ML	- ML AS ABOVE: increased concentration of gravel and small cobbles (up to 15 cm) (predominantly composed of Miocene conglomerate fragments and other metamorphic material).	Collect soil sample MW55-CS-76-77 Drill rate 77' to 87' = 1.3 ft/min
85		10	MW55-GGW-04				Isoflow #4: 77-87' bgs Water used to drill: 450 gallons Sample ID: MW55-GGW-04
90				CS			Collect soil sample MW55-CS-86-87 Drill rate 87' to 97' = 0.8 ft/min
95		10					
100				CS		- ML AS ABOVE: Increased fines. 5% subang-ang gravel (up to 3 cm), 25% fn sand, 70% fines. Gravel comprised of metamorphics and minor granitics. **NO RECOVERY (NR)**- Sluff material is the same as core logged above and below this interval	Collect soil sample MW55-CS-96-97 Drill rate 97' to 107' = 0.8 ft/min
105		0	MW55-GGW-05		NR		Isoflow #5: 97-107' bgs Water used to drill: 250 gallons Sample ID: MW55-GGW-05

CH2MHILL

SHEET 4 of 5	**PROJECT NUMBER:** 354948.FP.07.FW	**BORING NUMBER:** *MW-55*

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 137.0	**DRILLING CONTRACTOR:** Boart-Longyear (Dale Osteberg)	
SURFACE ELEVATION (NAVD88): 463.6 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,102,606.18	**EASTING (CCS NAD 83 Z 5):** 7,618,326.13	**DATE STARTED:** 3/29/2008	**DATE COMPLETED:** 3/31/2008
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 6" core barrel, 8" casing	
LOCATION: Site 2 - Alternate			**LOGGED BY:** R. Tweidt	

DEPTH BGS (feet)	SAMPLE				USCS CODE	SOIL DESCRIPTION	COMMENTS
	INTERVAL	RECOVERY (ft)	ISOFLOW SAMPLE	SOIL SAMPLE		SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
				CS		**NO RECOVERY (NR)**- Sluff material is the same as core logged above and below this interval	Collect soil sample MW55-CS-106-107 Drill rate 107' to 117' = 1.1 ft/min
110		10			ML	**SANDY SILT with GRAVEL (ML)** - Dk reddish brn (2.5YR 3/4), 5% subang-ang gravel (up to 3 cm), 25% fn sand, 70% fines, well graded, low to med strength, low plasticity, slow to rapid dilatency in pulverized sample, gravel composition is metamorphics and granitics, slightly moist.	
115				CS	SM	**SILTY SAND WITH GRAVEL (SM)** - Reddish brn (2.5YR 4/3), 10% gravel (up to 3 cm), 50% fn-med subrnd-ang sand, 40% fines, well graded, metamorphic and sedimentary rocks, wet. - SM AS ABOVE: decomposed gravel to clay present - SM AS ABOVE: Becomes more cse, 15% gravel (up to 8 cm), 60% med sand, 25% fines. Cemented sandstone clasts present.	Collect soil sample MW55-CS-116-117 Drill rate 117' to 127' = 1.1 ft/min
120 125		10	MW55-GGW-06	CS	ML	**SANDY SILT with GRAVEL (ML)** - Reddish brn (2.5YR 4/4), 10% subang-ang gravel (up to 12 cm), 25 % fn sand, 65% fines, well graded, predominantly metamorphics, no apparent structure, moist. - 120.5' to 120.75' - clay layer, white (10R 8/1), no apparent structure.	Isoflow #6: 117-127' bgs Water used to drill: 200 gallons Sample ID: MW55-GGW-06 Collect soil sample MW55-CS-126-127
130		8					Heavy rig chatter.
				CS	BR	**MIOCENE CONGLOMERATE (BR)** - Reddish brn (2.5YR 4/4), subang-ang, clast composition predominantly metamorphic. Max clast size = 7 cm, dry.	Collect soil sample MW55-CS-134-135
135		2					

Boring Terminated at 137 ft

ABBREVIATIONS

cc = continuous core run

CH2MHILL

SHEET 5 of 5	**PROJECT NUMBER:** 354948.FP.07.FW	**BORING NUMBER:** *MW-55*

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 137.0	**DRILLING CONTRACTOR:** Boart-Longyear (Dale Osteberg)	
SURFACE ELEVATION (NAVD88): 463.6 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,102,606.18	**EASTING (CCS NAD 83 Z 5):** 7,618,326.13	**DATE STARTED:** 3/29/2008	**DATE COMPLETED:** 3/31/2008
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 6" core barrel, 8" casing	
LOCATION: Site 2 - Alternate			**LOGGED BY:** R. Tweidt	

DEPTH BGS (feet)	SAMPLE				USCS CODE	SOIL DESCRIPTION	COMMENTS
	INTERVAL	RECOVERY (ft)	ISOFLOW SAMPLE	SOIL SAMPLE		SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
						brn = brown *lt = light* *dk = dark* *vf = very fine-grained* *fn = fine-grained* *med = medium-grained* *cse = coarse-grained* *vc = very coarse-grained* *ang = angular* *subang = subangular* *subrnd = subrounded* *rnd = rounded* *br = bedrock formation* *ss = sandstone* *conglom = conglomerate* *comptd = compacted* *qtz = quartz*	

CH2MHILL

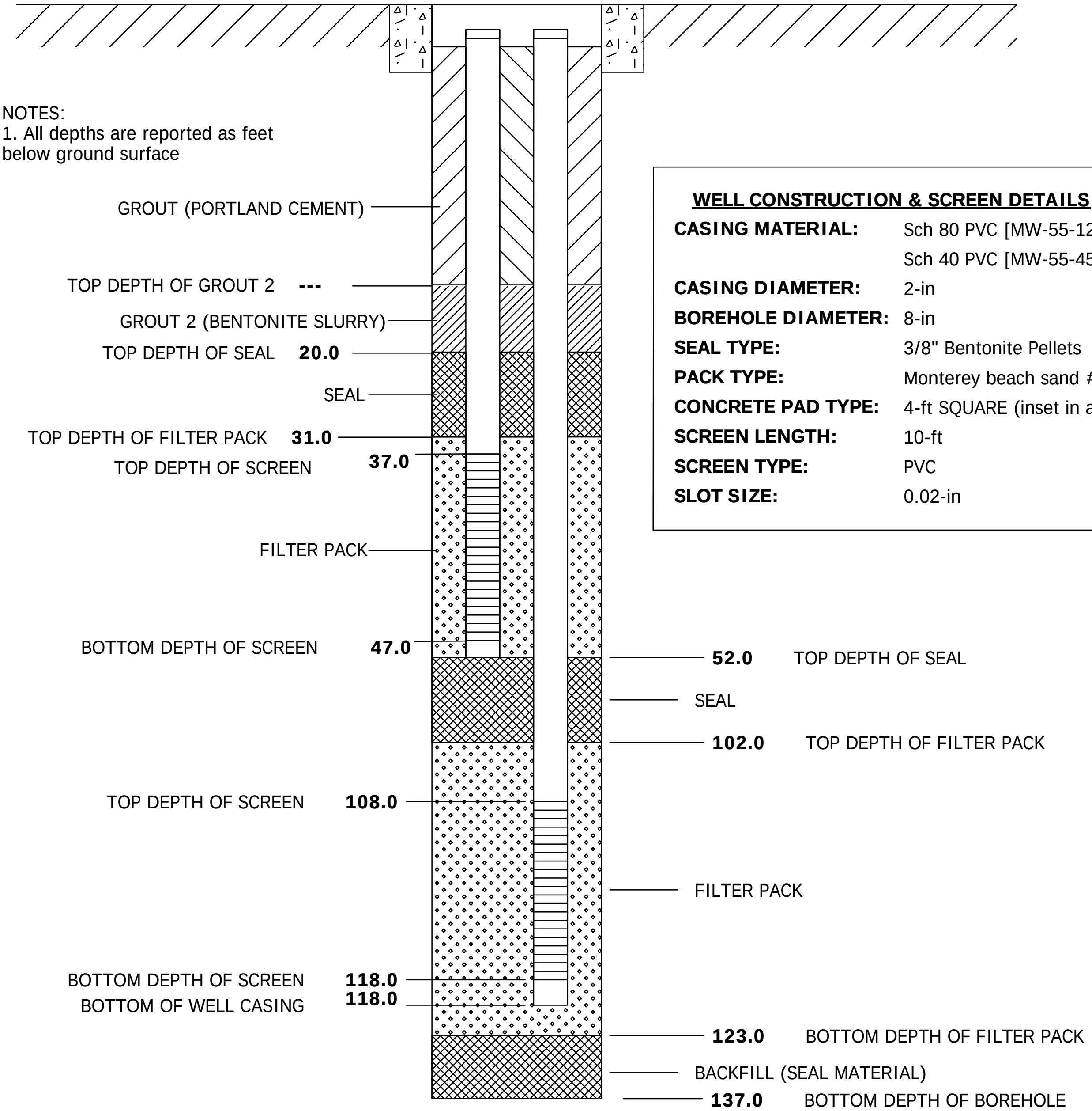
WELL COMPLETION DIAGRAM

PROJECT NO: 354948.FP.07.FW	**PROJECT:** Topock AZ Drilling	**WELL NO:** *MW-55-120* *MW-55-45*

LOCATION: Site 2 - Alternate

DRILLING CONTRACTOR: Boart Longyear	**DRILLING START:** 3/29/2008
DRILLING METHOD: Rotosonic	**DRILLING END:** 3/31/2008
LOGGER: R.Tweidt	**WELL COMPLETION DATE:** 4/2/2008
GROUND SURFACE ELEVATION (NAVD 88): 463.6	**GENERAL REMARKS:** Both wells constructed in one borehole.
NORTHING (CCS NAD 83 Z 5): 2102606.18 / **EASTING (CCS NAD 83 Z 5):** 7618326.13	

12-in DIAMETER WELL VAULT (FLUSH WITH GRADE)



NOTES:
1. All depths are reported as feet below ground surface

WELL CONSTRUCTION & SCREEN DETAILS

CASING MATERIAL:	Sch 80 PVC [MW-55-120] Sch 40 PVC [MW-55-45]
CASING DIAMETER:	2-in
BOREHOLE DIAMETER:	8-in
SEAL TYPE:	3/8" Bentonite Pellets
PACK TYPE:	Monterey beach sand # 3
CONCRETE PAD TYPE:	4-ft SQUARE (inset in asphalt)
SCREEN LENGTH:	10-ft
SCREEN TYPE:	PVC
SLOT SIZE:	0.02-in

WELL DIAGRAM IS NOT TO SCALE

SHEET 1 of 7	**PROJECT NUMBER:** 354948.FP.07.FW	**BORING NUMBER:** ***MW-56***

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 223.0	**DRILLING CONTRACTOR:** Boart-Longyear (Denzil Roberts)	
SURFACE ELEVATION (NAVD 88): 459.9 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,101,569.18	**EASTING (CCS NAD 83 Z 5):** 7,617,644.91	**DATE STARTED:** 4/9/2008	**DATE COMPLETED:** 4/13/2008
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 4" core barrel, 6" casing	
LOCATION: Site AB-2 - Alternate			**LOGGED BY:** C. Kreller	

DEPTH DRILLED (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: ISOFLOW SAMPLE	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
0–6					NR	No recovery	Soil descriptions based on observation of continuous Rotosonic core. See list of abbreviations at end of log. Boring drilled at azimuth 270 and dip of 30 degrees from horizontal.
6–7	6–10	4			SW	**WELL GRADED SAND (SW)**- Dk yellowish brn (10YR 3/6), 5% subrnd-subang fn gravel, 95% subang-subrnd sand	All depths expressed as length drilled and must be corrected for angle to derive elevation. Multi-level angle well MW-56 was installed in this boring.
7–10				CS (9–10)	SP	**POORLY GRADED SAND (SP)**- Yellowish brn (10YR 5/6), 100% fn sand, loose, slightly moist.	Collect soil sample MW56-CS-9-10
10–20	10–20	10		CS (19–20)		- SP AS ABOVE: dk yellowish brn, iron oxide staining present, trace organic material - SP AS ABOVE: very dk greyish brn, 98% fn sand, 2% silt, wet.	Collect soil sample MW56-CS-19-20
20–30	20–30	0				- Very limited recovery from 20' - 30'; saturated fn sand as above,	Drill rate from 20' to 40' = 1.1 ft/min
30–35	30–35						

CH2MHILL

SHEET 2 of 7	PROJECT NUMBER: 354948.FP.07.FW	BORING NUMBER: *MW-56*

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 223.0	**DRILLING CONTRACTOR:** Boart-Longyear (Denzil Roberts)	
SURFACE ELEVATION (NAVD 88): 459.9 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,101,569.18	**EASTING (CCS NAD 83 Z 5):** 7,617,644.91	**DATE STARTED:** 4/9/2008	**DATE COMPLETED:** 4/13/2008
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 4" core barrel, 6" casing	
LOCATION: Site AB-2 - Alternate			**LOGGED BY:** C. Kreller	

DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: ISOFLOW SAMPLE	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
	⊠					**<u>POORLY GRADED SAND (SP)</u>**- Yellowish brn (10YR 5/6), 100% fn sand, loose, slightly moist.	
					SP		
40		20					
			▨				Isoflow sample #1: 43-53' bgs Sample ID: MW56-GGW-01
45			MW56-GGW-01				
				CS			Collect soil sample MW56-CS-49-50
50	⊠					- SP AS ABOVE: yellowish brn (10YR 5/4), increase in med sand [10%med sand, 88% fn sand, 2% silt]	
55		10					
				CS	SP		Collect soil sample MW56-CS-59-60
60	⊠					- SP AS ABOVE: dk yellowish brn (10YR 4/4), wet.	
			▨				Isoflow #2: 63-73' bgs Water used: 170 gallons Sample ID: MW56-GGW-02
65						- POORLY GRADED SAND with GRAVEL (SP): yellowish brown (10YR5/4), 15% subrnd-rnd gravel, 85% fn-cse sand	
		13	MW56-GGW-02				
				CS			Collect soil sample MW56-CS-69-70
70							

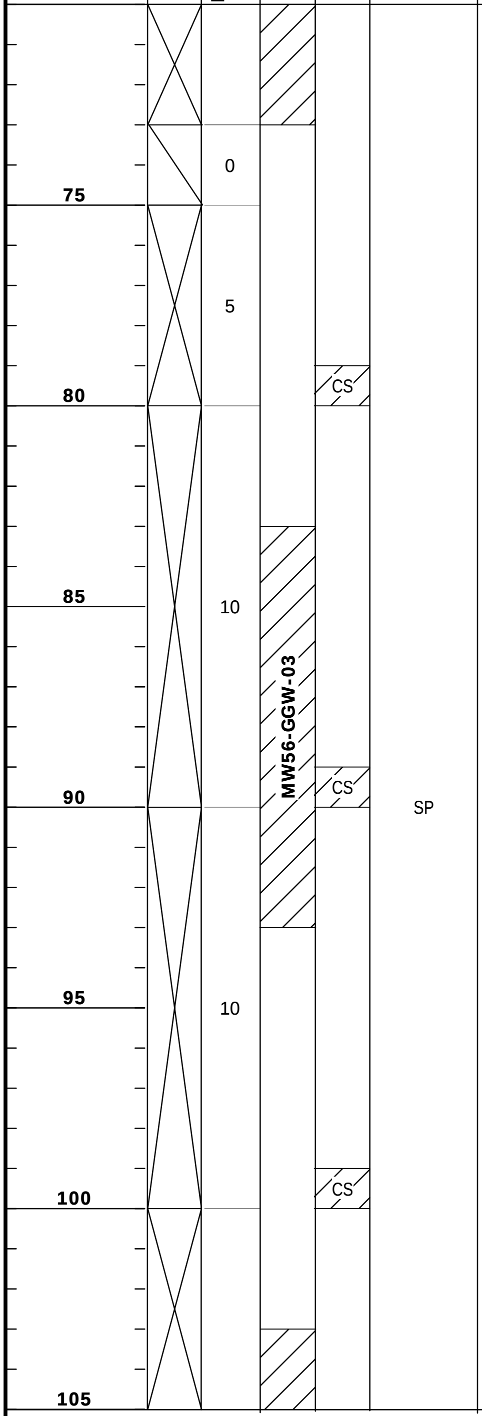
CH2MHILL

SHEET 3 of 7	**PROJECT NUMBER:** 354948.FP.07.FW	**BORING NUMBER:** ***MW-56***

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling	**HOLE DEPTH (ft):** 223.0	**DRILLING CONTRACTOR:** Boart-Longyear (Denzil Roberts)	
SURFACE ELEVATION (NAVD 88): 459.9 ft. MSL **NORTHING (CCS NAD 83 Z 5):** 2,101,569.18	**EASTING (CCS NAD 83 Z 5):** 7,617,644.91	**DATE STARTED:** 4/9/2008	**DATE COMPLETED:** 4/13/2008
DRILLING METHOD: Rotosonic - continuous core		**DRILLING EQUIPMENT:** 4" core barrel, 6" casing	
LOCATION: Site AB-2 - Alternate		**LOGGED BY:** C. Kreller	

DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: ISOFLOW SAMPLE	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.



POORLY GRADED SAND (SP)- Yellowish brn (10YR 5/6), 100% fn sand, loose, slightly moist.

- (at 70'bgs) SP AS ABOVE: 2% subrnd gravel, 98% subrnd sand [10% cse sand, 10% med sand, 78% fn sand], no fines, very moist. Iron oxide staining present.

Collect soil sample MW56-CS-79-80

- SP AS ABOVE: greyish brn (10YR 5/2)

Isoflow #3: 83-93' bgs
Water used: 150 gallons
Sample ID: MW56-GGW-03
Drill rate = 1.1 ft/min
Collect MW56-WOOD-86

- POORLY GRADED SAND with GRAVEL (SP): dk greysih brn (10YR 4/2), composition change to 15% subrnd-rnd fn-cse gravel and 85% fn-cse sand, significant organic (wood) material present.
- SP AS ABOVE: gravel content decreases, predominantly fn-cse sand with trace subrnd-rnd fn-cse gravel (up to 2.5 cm), very moist.

Collect soil sample MW56-CS-89-90

Collect soil sample MW56-CS-99-100

- SP AS ABOVE: Composition change to 85% fn sand, 10% cse sand, 5% fines.
- SP AS ABOVE: dk grey (10YR 4/1) med sand layer

Isoflow #4: 103-113' bgs
Water used: 150 gallons
Sample ID: MW56-GGW-04

SHEET 4 of 7	**PROJECT NUMBER:** 354948.FP.07.FW	**BORING NUMBER:** *MW-56*

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 223.0	**DRILLING CONTRACTOR:** Boart-Longyear (Denzil Roberts)
SURFACE ELEVATION (NAVD 88): 459.9 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,101,569.18	**EASTING (CCS NAD 83 Z 5):** 7,617,644.91	**DATE STARTED:** 4/9/2008 **DATE COMPLETED:** 4/13/2008
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 4" core barrel, 6" casing
LOCATION: Site AB-2 - Alternate			**LOGGED BY:** C. Kreller

DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: ISOFLOW SAMPLE	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
		10	MW56-GGW-04			**POORLY GRADED SAND (SP)**- Yellowish brn (10YR 5/6), 100% fn sand, loose, slightly moist.	
110				CS		- SP AS ABOVE: dk grey (10YR 4/1), 98% fn sand, 2% silt	Collect soil sample MW56-CS-109-110
115		10					
						- SP AS ABOVE: very dk greyish brn (10YR 3/2), 90% fn sand, 10% fines.	
120				CS			Collect soil sample MW56-CS-119-120
						- SP AS ABOVE: very dk greyish brn (10YR 3/2), with very dk grey (10YR 4/1) mottling throughout, wet.	
			MW56-GGW-05				Isoflow #5: 123-133' bgs Water used: 150 gallons Sample ID: MW56-GGW-05
125		10			SP	- SP AS ABOVE: less fines, presence of organic (wood) material, 85% fn sand, 10% med sand, 5% fines, very moist.	
130				CS		- SP AS ABOVE: greysih brn (10YR 5/2)	Collect soil sample MW56-CS-129-130
135		10				- SP AS ABOVE: dk greyish brn (10YR 4/2), 5% subrnd gravel (up to 5 cm), 85% fn sand, 10% fines, organic (wood) material present, wet.	
140				CS			Collect soil sample MW56-CS-139-140

CH2MHILL

SHEET 5 of 7	**PROJECT NUMBER:** 354948.FP.07.FW	**BORING NUMBER:** *MW-56*

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 223.0	**DRILLING CONTRACTOR:** Boart-Longyear (Denzil Roberts)
SURFACE ELEVATION (NAVD 88): 459.9 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,101,569.18	**EASTING (CCS NAD 83 Z 5):** 7,617,644.91	**DATE STARTED:** 4/9/2008 · **DATE COMPLETED:** 4/13/2008
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 4" core barrel, 6" casing
LOCATION: Site AB-2 - Alternate			**LOGGED BY:** C. Kreller

DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: ISOFLOW SAMPLE	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
	X					**POORLY GRADED SAND (SP)**- Yellowish brn (10YR 5/6), 100% fn sand, loose, slightly moist.	
						- SP AS ABOVE: dk greyish brn (10YR 4/2); very moist. Small lenses of very dk grey (2.5YR 3/1) present, wood present at 142' and 144'.	Collect MW-56-142 wood sample Sample ID: MW56-GGW-03 Collect MW-56-144 wood sample
145						- SP AS ABOVE: Increase in concentration of cse sand.	
		13	MW56-GGW-06			- POORLY GRADED SAND with GRAVEL (SP): Composition change to 20% subrnd-rnd fn-cse gravel (up to 7.5 cm), 80% fn sand.	Isoflow #6: 143-153' bgs Water used: 150 gallons Sample ID: MW56-GGW-06
150				CS			Collect soil sample MW56-CS-149-150
						- SP AS ABOVE: dk grey (10YR4/1)	Collect MW-56-151 wood sample
	X	0				- Poor recovery from 153' to 155'	
155	X	5				- SP AS ABOVE: dk grey (10YR 3/1), 78% fn sand, 20% med sand, 2% subrnd-rnd gravel (up to 2.5 cm), moist.	
160				CS	SP		Collect soil sample MW56-CS-159-160
	X						Isoflow #7: 163-173' bgs Water used: 170 gallons Sample ID: MW56-GGW-07
165		13	MW56-GGW-07			- 6-inch interval of organic material (wood)	Collect MW-56-164 wood sample
170				CS		- SP AS ABOVE: very dk grey (10YR 3/1), 2% subrnd-rnd gravel (up to 6.5 cm), 98% fn-med sand, moist. 6-inch interval of organic material (wood) present.	Collect soil sample MW56-CS-169-170
						- 6-inch interval of black organic material (wood)	Collect MW-56-172 wood sample
175	X					No recovery	

CH2MHILL

	PROJECT NUMBER: 354948.FP.07.FW	**BORING NUMBER:** ***MW-56***

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 223.0	**DRILLING CONTRACTOR:** Boart-Longyear (Denzil Roberts)	
SURFACE ELEVATION (NAVD 88): 459.9 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,101,569.18	**EASTING (CCS NAD 83 Z 5):** 7,617,644.91	**DATE STARTED:** 4/9/2008	**DATE COMPLETED:** 4/13/2008
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 4" core barrel, 6" casing	
LOCATION: Site AB-2 - Alternate			**LOGGED BY:** C. Kreller	

DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: ISOFLOW SAMPLE	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
180 185		0	MW56-GGW-08		NR	No recovery	Drill rate = 1.5 ft/min Isoflow #8: 183-193' bgs Water used: 220 gallons Sample ID: MW56-GGW-08
190		3		CS	SP	**<u>POORLY GRADED SAND with GRAVEL (SP)</u>**- Very dk greyish brn (2.5YR 3/2), 15% gravel (up to 6 cm), 80% fn sand, 5% fines, loose, slightly moist.	Collect soil sample MW56-CS-189-190
195 200		10		CS	GM	**<u>SILTY GRAVEL (GM)</u>** - Very dk brn (10YR 2/2), 60% ang-subang gravel (up to 10 cm), 10% fn sand, 30% fines, poorly graded, gravel becomes well rnd with depth	Drill rate from 193-213' = 5.0 ft/min Collect soil sample MW56-CS-199-200
205 210		10	MW56-GGW-09	CS			Isoflow #9: 203-213' bgs Water used: 300 gallons Sample ID: MW56-GGW-09 Collect soil sample MW56-CS-209-210

SHEET 7 of 7	**PROJECT NUMBER:** 354948.FP.07.FW	**BORING NUMBER:** ***MW-56***

SOIL BORING LOG

PROJECT NAME: Topock AZ Drilling		**HOLE DEPTH (ft):** 223.0	**DRILLING CONTRACTOR:** Boart-Longyear (Denzil Roberts)
SURFACE ELEVATION (NAVD 88): 459.9 ft. MSL	**NORTHING (CCS NAD 83 Z 5):** 2,101,569.18	**EASTING (CCS NAD 83 Z 5):** 7,617,644.91	**DATE STARTED:** 4/9/2008 **DATE COMPLETED:** 4/13/2008
DRILLING METHOD: Rotosonic - continuous core			**DRILLING EQUIPMENT:** 4" core barrel, 6" casing
LOCATION: Site AB-2 - Alternate			**LOGGED BY:** C. Kreller

DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: ISOFLOW SAMPLE	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
	☒	10	▨		SW	**WELL GRADED SAND WITH GRAVEL (SW)**- Yellowish brn (10YR), 10% gravel (up to 3 cm), 90% subang-subrnd sand, no fines, well graded, sand is fining upwards, wet.	
215					BR	**MIOCENE CONGLOMERATE (BR)** - Reddish brn (2.5YR 4/4), consoilidated, dry. - Pulverized by drilling.	Drill rate from 213-219' = 0.4 ft/min Drill rate from 219-223' = 0.2 ft/min Collect soil sample MW56-CS-219-220
				CS			
220	☒	3					

Boring Terminated at 223 ft

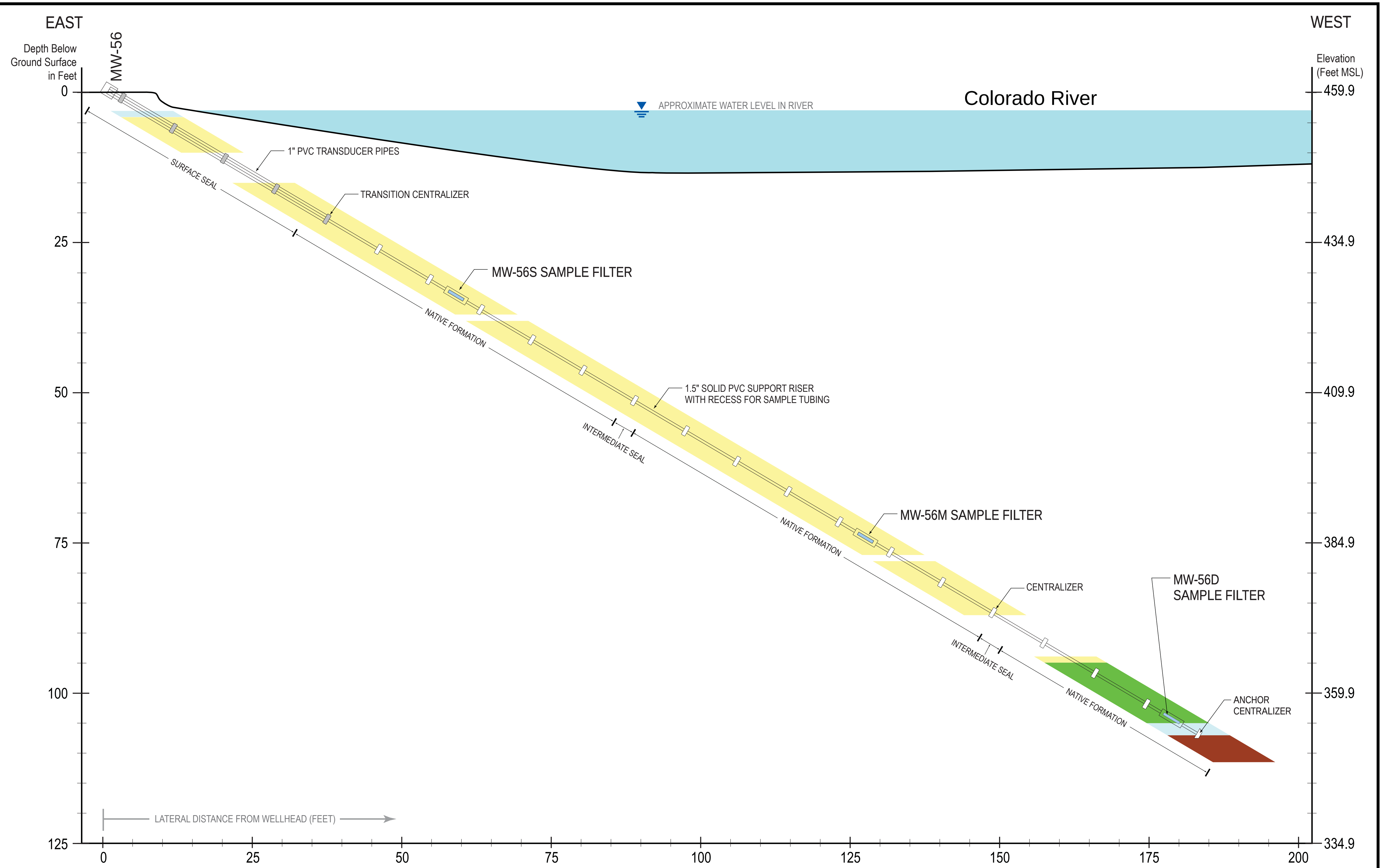
ABBREVIATIONS

cc = continuous core run
brn = brown
lt = light
dk = dark
vf = very fine-grained
fn = fine-grained
med = medium-grained
cse = coarse-grained
vc = very coarse-grained
ang = angular
subang = subangular
subrnd = subrounded
rnd = rounded
br = bedrock formation
ss = sandstone
conglom = conglomerate
comptd = compacted
qtz = quartz

CH2MHILL

% Gravel --	% Sand Cse	% Sand Med	% Sand Fne	% Fine --	USCS
					NR
5	31	32	32		SW
			100		SP
			98	2	SP
					NR
			98	2	SP
		10	88	2	SP
15			85		SP
2	10	10	78		SP
2	10	10	78		SP
10			90		SP
10			85	5	SP
			90	10	SP
		10	85	5	SP
5			85	10	SP
20			80		SP
2		20	78		SP
					NR
15			80	5	SP
60			10	30	GM
10	30	30	30		SW
					BR

Contacts are generalized.
Refer to boring log for precise depths
and description.



LEGEND

- 🟨 SP
- ⬜ SW
- 🟩 GM
- 🟥 BR
- ☐ NR - No Recovery

Well Construction Information

Drilling Contractor: Prosonic/Boart-Longyear (Driller-Denzil Roberts)
Drilling Method: Rotosonic
Drilling Start: April 9, 2008
Drilling End: April 13, 2008
Well Installation Complete: April 20, 2008
Logged By: Rob Tweidt (Northstar)

Borehole Diameter: 6 inches
Borehole Angle: 30 Degrees from Horizontal
Borehole Azimuth: 270 Degrees
Drilled Borehole Depth: 223 feet
Annular Materials:
Native Formation – Native sands and gravels as logged.
Intermediate Seal – Native sands and gravels with bentonite slurry grout (10 gallons injected at depths indicated).
Surface Seal – Portland cement grout.
Completion Type: 10" steel monument casing placed at an angle within 3'x3'x4" concrete pad.

Notes:
1. Drawing scale is approximate.
2. Lithology is conceptual. Color bands should not be interpreted as laterally extensive stratigraphic units.
3. River bed depth estimated from "Transect B" of July 2005 Riverbed Survey.

MULTI-LEVEL MONITORING WELL CONSTRUCTION DIAGRAM MW-56 LOCATION

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Appendix C
Geophysical Logging and Seismic Investigation Data

C1 Case-hole Geophysical Logs for Arizona Wells

welenco

5201 Woodmere Drive, Bakersfield, CA 93313-- www.welenco.com--(800) 445-9914
California Contractor's License No. 722373

INDUCTION-GAMMA RAY LOG

FILING NO.

COMPANY CH2M Hill

WELL MW 54-195

FIELD PG&E Topock

STATE Arizona COUNTY Mohave

LOCATION:

OTHER SERVICES:

JOB NO. 8972

SEC: 5 TWP: 7N RGE: 24E LAT.: 34° 43' 13.1" LONG.: 114° 29' 13.8" MERIDIAN.: San Bernardino

Permanent Datum: Ground Level **, Elev.** ____ **Ft.** **Elev.: K.B.** ____ **Ft.**

Log Measured From: ____ **,** ____ **Ft. Above Perm. Datum** **D.F.** ____ **Ft.**

Drilling Measured From: ____ **G.L.** ____ **Ft.**

Date	Mar. 25, 2008	Mar. 25, 2008	Mar. 25, 2008	
Type Of Log	Resistivity	Induction	Gamma Ray	
Run	One			
Depth-Driller	237.3 Ft	237.3 Ft	237.3 Ft	Ft
Depth-Logger	194 Ft	194 Ft	194 Ft	Ft
Top Logged Interval	0 Ft	0 Ft	0 Ft	Ft
Btm. Logged Interval	194 Ft	194 Ft	194 Ft	Ft
Type Fluid In Hole	water	water	water	
Fluid Level	15 Ft	15 Ft	15 Ft	Ft
Max Temp	°F	°F	°F	°F
Operating Rig Time	Hr	Hr	Hr	Hr
Van No. / Location	L-15 / Bfld	L-15 / Bfld		
Recorded By	Z. Bobinski	Z. Bobinski		
Witnessed By	Barry Collom	Barry Collom		

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	TYPE	FROM	TO
1	In	Ft	Ft	In		Ft	Ft
2	In	Ft	Ft	2 In	PVC	0 Ft	199 Ft
3	In	Ft	Ft	In		Ft	Ft

Miscellaneous Information

Remarks:

A recreational GPS accurate to +/- 45 feet set for Datum NAD27 was used to calculate Latitude, Longitude & Elevation values. The Section, Township, and Range then determined using the TRS program (TRS accuracy is not guaranteed). The TRS program converts Latitude and Longitude to Section, Township, and Range. The NOTICE at the bottom of this heading also applies.

Perforated Intervals:

Line Speed:

	Run #7: , Down FPM, ______
Run #2: , Down FPM, ______	Run #8: , Down FPM, ______
Run #3: , Down FPM, ______	Run #9: , Down FPM, ______
Run #4: , Down FPM, ______	Run #10: , Down FPM, ______
Run #5: , Down FPM, ______	Run #11: , Down FPM, ______
Run #6: , Down FPM, ______	Run #12: , Down FPM, ______

Borehole Volume Calculations:

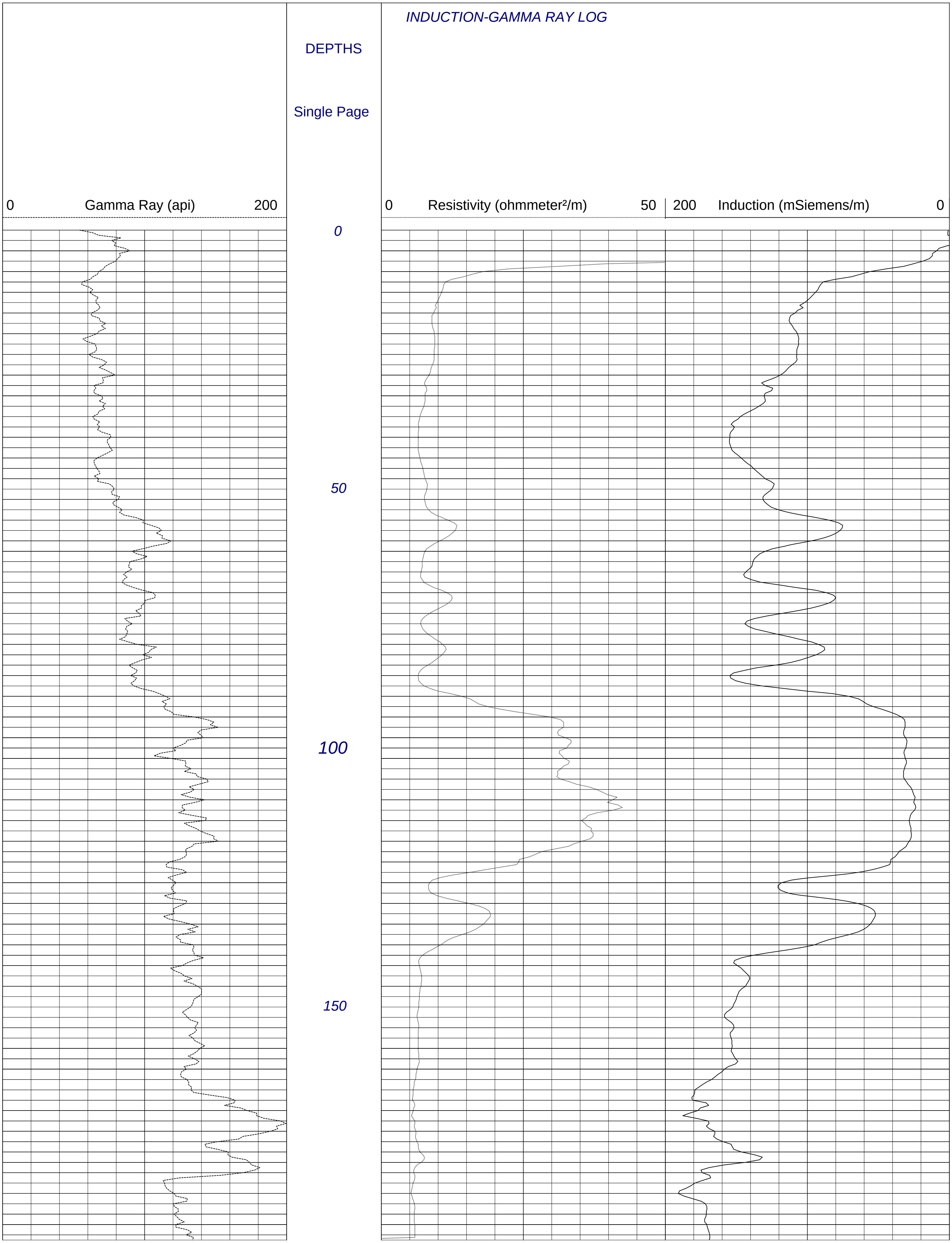
Other Information:

: Bottom of Access Pipe Ft.	

NOTICE: All interpretations are opinions based on inferences from electrical and other measurements and we do not guarantee the accuracy or correctness of any verbal or written interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretation made by one of our officers, agents or employees. These interpretations are also subject to our General Terms and Conditions as set out in our current Price Schedule.

welenco, inc. July 10, 2008

INDUCTION-GAMMA RAY LOG



PACIFIC SURVEYS

INDUCTION LOG
GAMMA-RAY

Job No. 13982	Company	CH2M HILL
	Well	MW-55-120
	Field	TOPOCK
	County	MOJAVE State AZ

Location:

MW-55 TOPOCK MARINA PARKING LOT

Sec. Twp. Rge.

Other Services:

NONE

Permanent Datum	G.L.		Elevation above perm. datum	Elevation
Log Measured From	G.L.	0'		K.B.
Drilling Measured From	G.L.			D.F. G.L.

Date	6/19/2008		
Run Number	ONE		
Depth Driller	120'		
Depth Logger	120'		
Bottom Logged Interval	119'		
Top Log Interval	0'		
Pump Set @	NA		
Time Pumping Prior to Survey	NA		
Density / Viscosity	NA		
Max. Recorded Temp.	NA		
Pump Rate (GPM)	NA		
Time Well Ready	12:00 PM		
Time Logger on Bottom	12:30 PM		
Equipment Number	PS-3		
Location	L.A.		
Recorded By	ABREAU		
Witnessed By	COLLOM		

Borehole Record				Tubing Record			
Run Number	Bit	From	To	Size	Weight	From	To

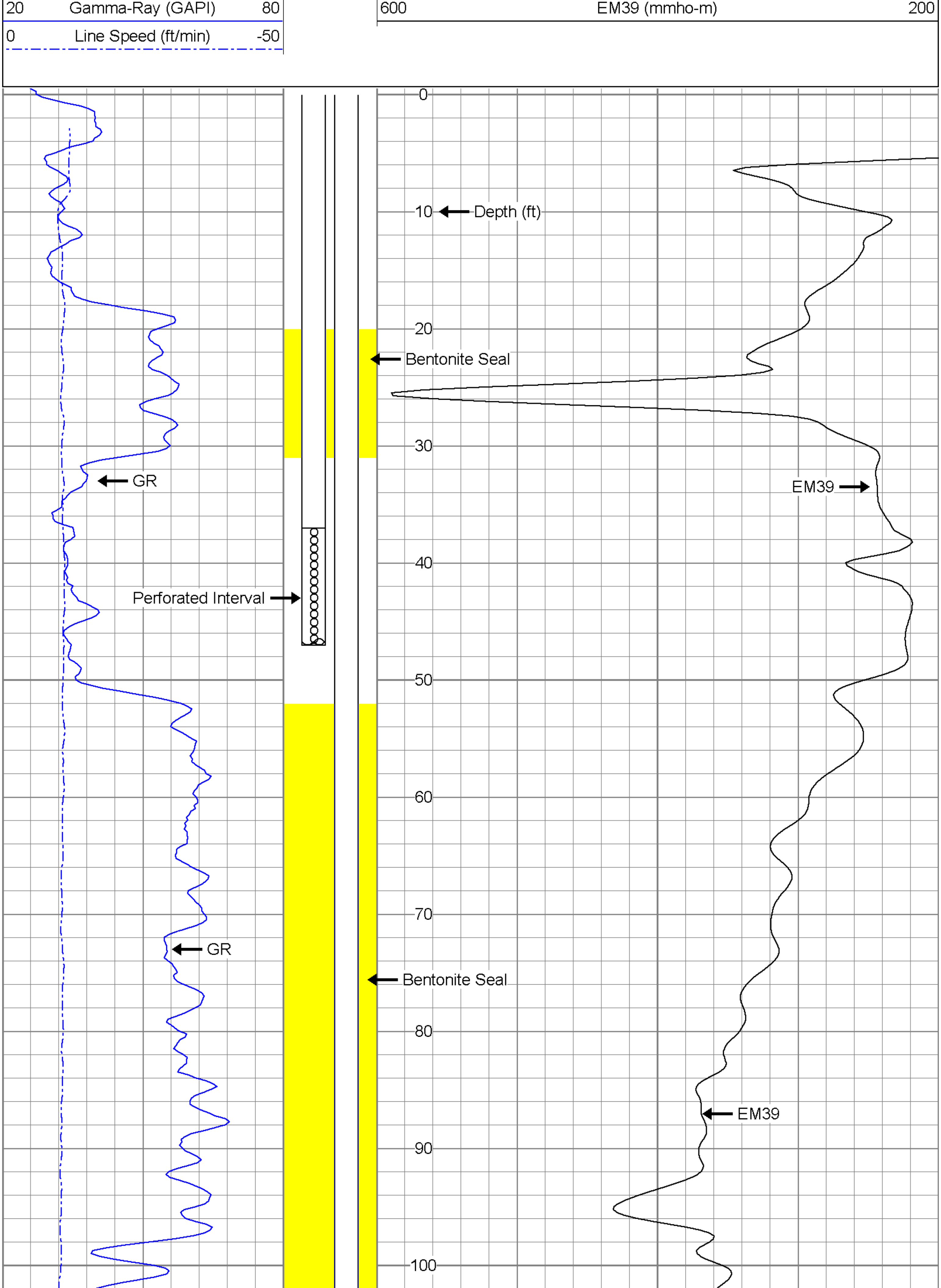
Casing Record	Size	Wgt/Ft	Top	Bottom
Surface String				
Prot. String				
Production String	2"	SCH 80	0'	120'
Liner				

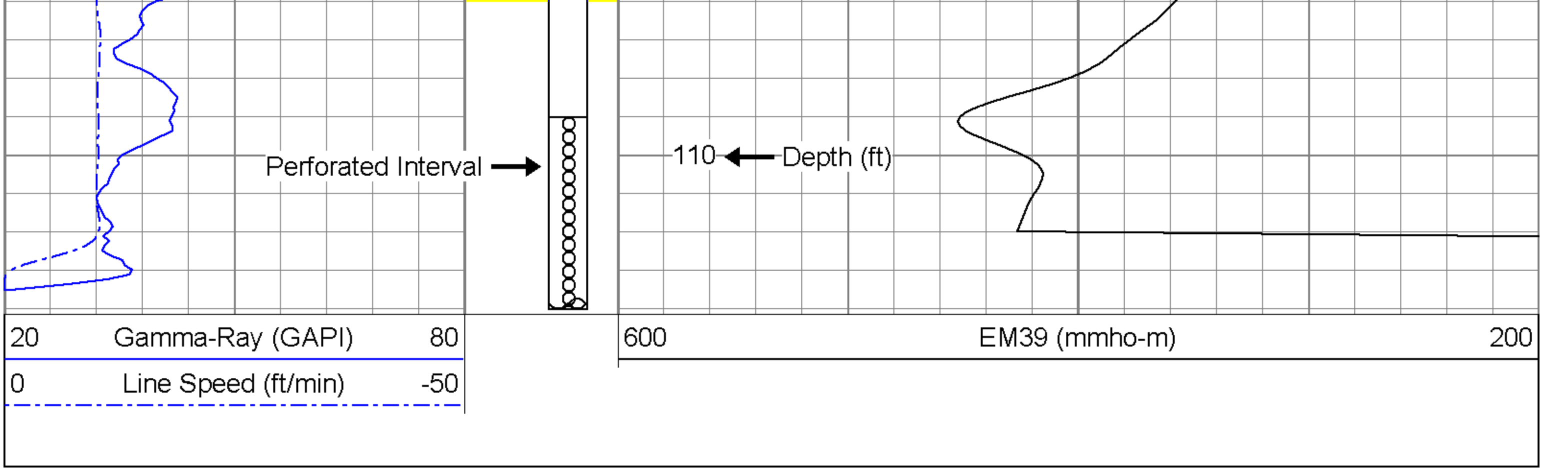
<<< Fold Here >>>

All interpretations are opinions based on inferences from electrical or other measurements and Pacific Surveys cannot and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to Pacific Surveys' general terms and conditions set out in our current Price Schedule.

Comments

Database File:	14012.db
Dataset Pathname:	Ch2m/well/run1/em39
Presentation Format:	dil-gr
Dataset Creation:	Wed Jul 02 11:04:30 2008 by Log Open-Cased 071220
Charted by:	Depth in Feet scaled 1:120


20
Gamma-Ray (GAPI)
80
0
Line Speed (ft/min)
-50
600
EM39 (mmho-m)
200
0
10
Depth (ft)
20
Bentonite Seal
30
GR
EM39
40
Perforated Interval
50
60
70
GR
Bentonite Seal
80
EM39
90
100



Perforated Interval
110
Depth (ft)
20
Gamma-Ray (GAPI)
80
0
Line Speed (ft/min)
-50
600
EM39 (mmho-m)
200

C2 Selected Seismic Lines from USGS 2007 Seismic Survey (Unpublished)

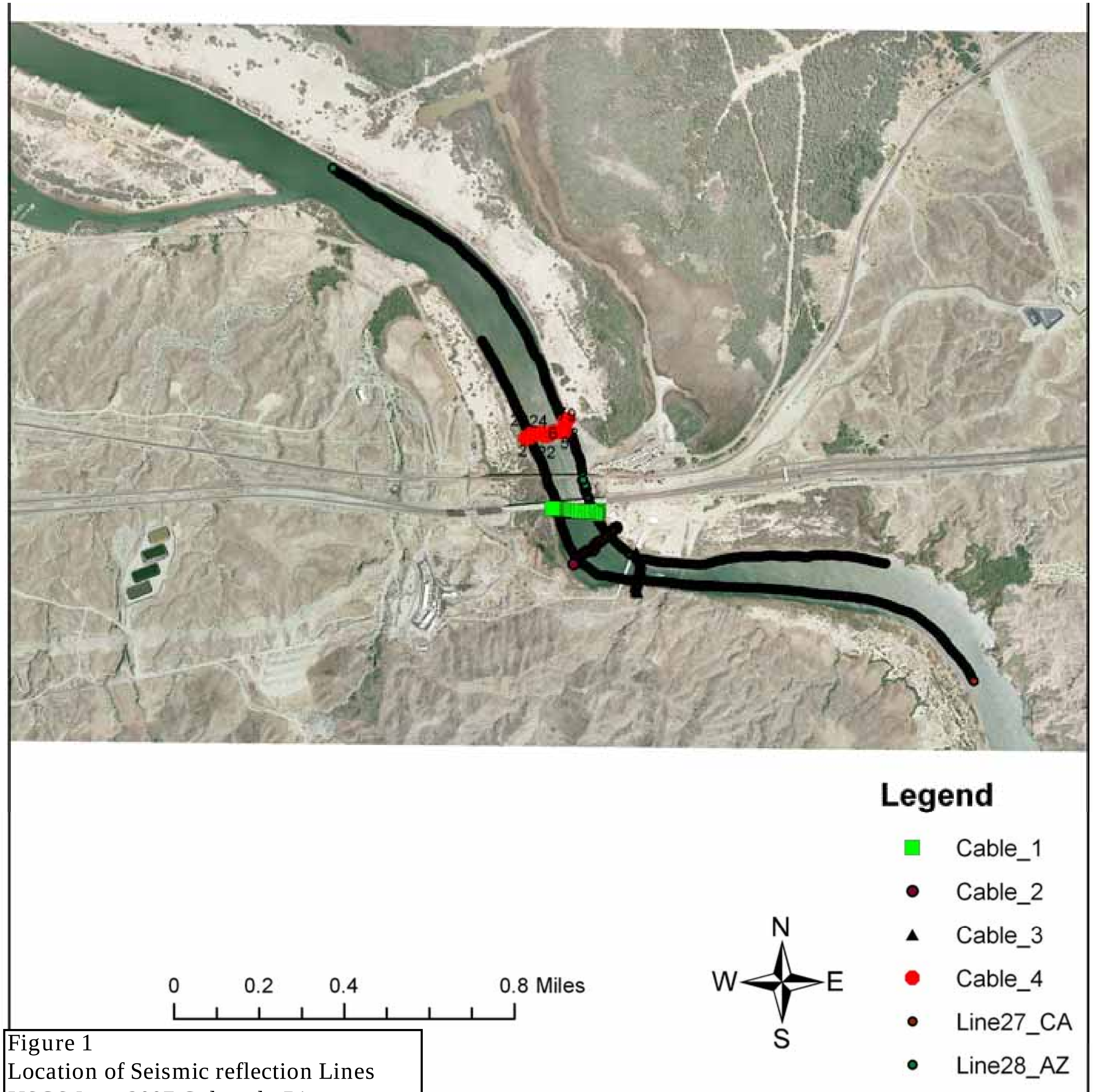


Figure 1
Location of Seismic reflection Lines
USGS June 2007 Colorado River
Seismic Survey

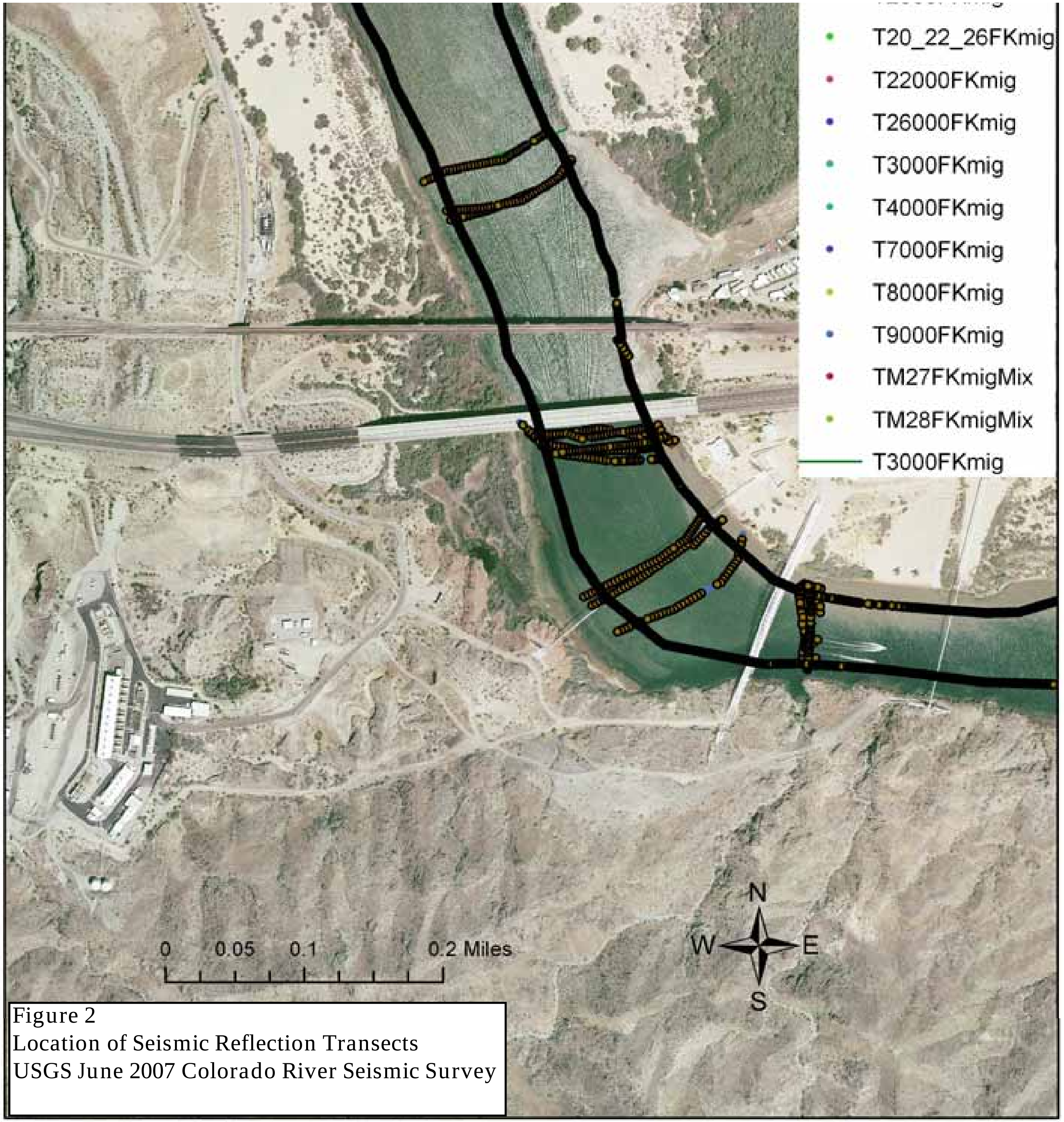
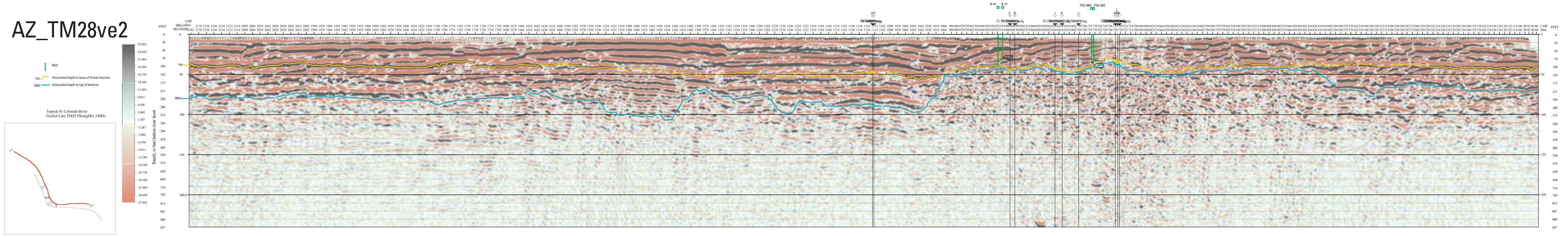


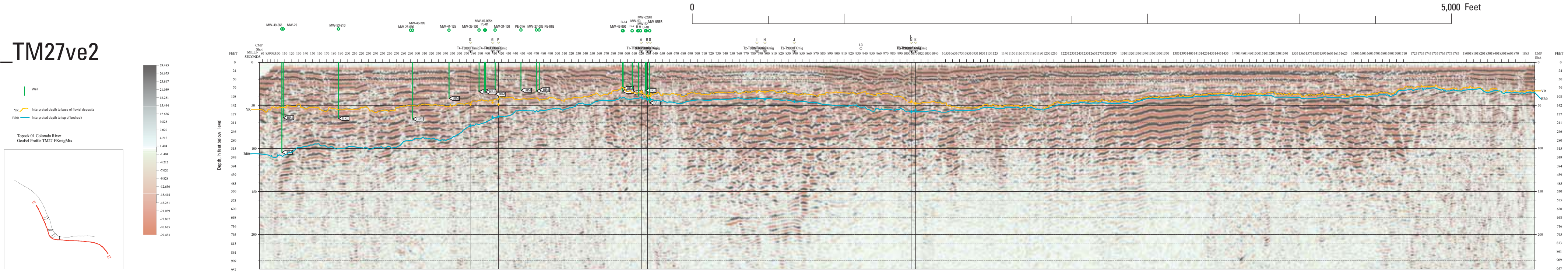
Figure 2
Location of Seismic Reflection Transects
USGS June 2007 Colorado River Seismic Survey

AZ_TM28ve2



* This figure presents the results of the 2007 seismic survey obtained by download from the USGS FTP site. This interpretation of the seismic results has not been previously published or presented. This seismic survey was directed by USGS and the data were collected and processed by a subcontractor to USGS.

CA_TM27ve2



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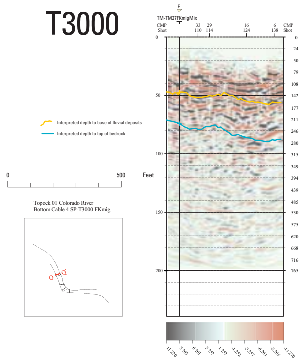

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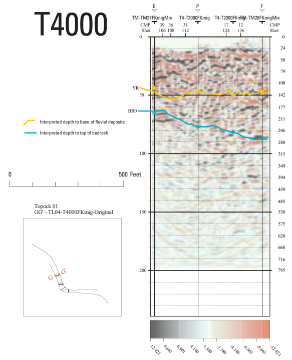

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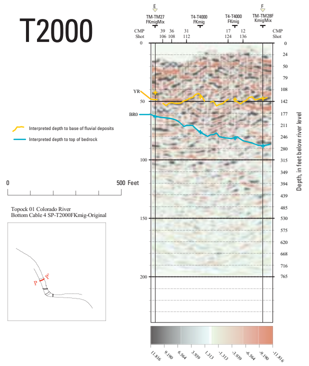

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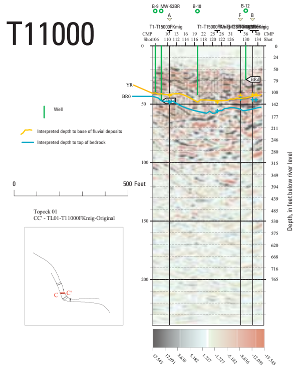

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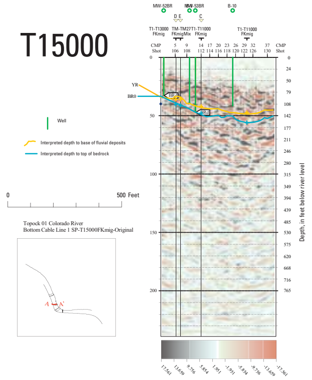

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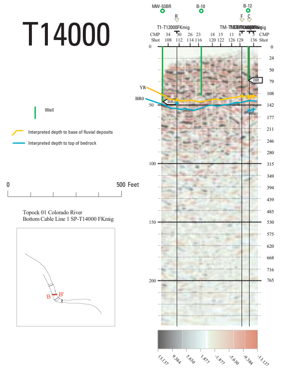

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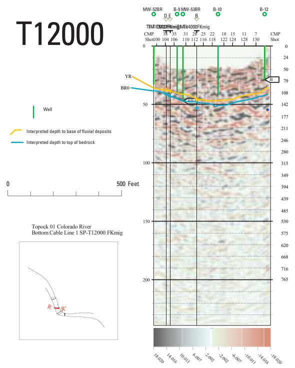

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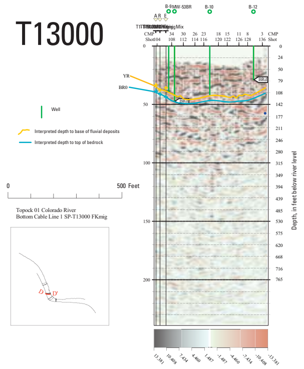

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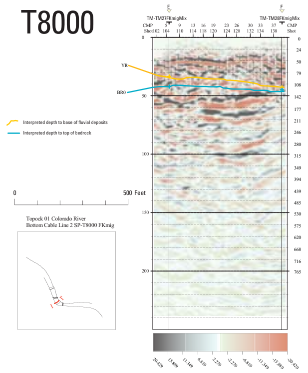

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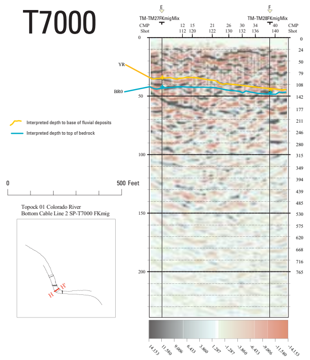

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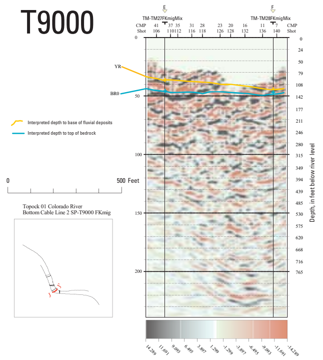

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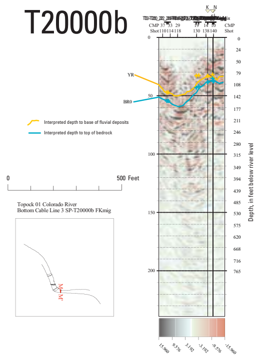

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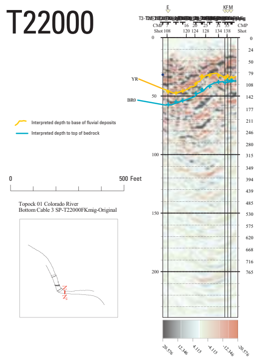

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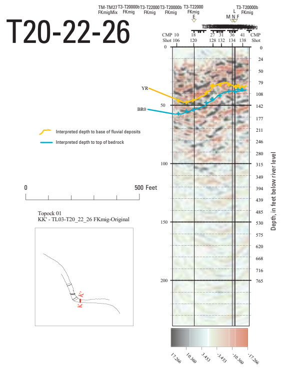
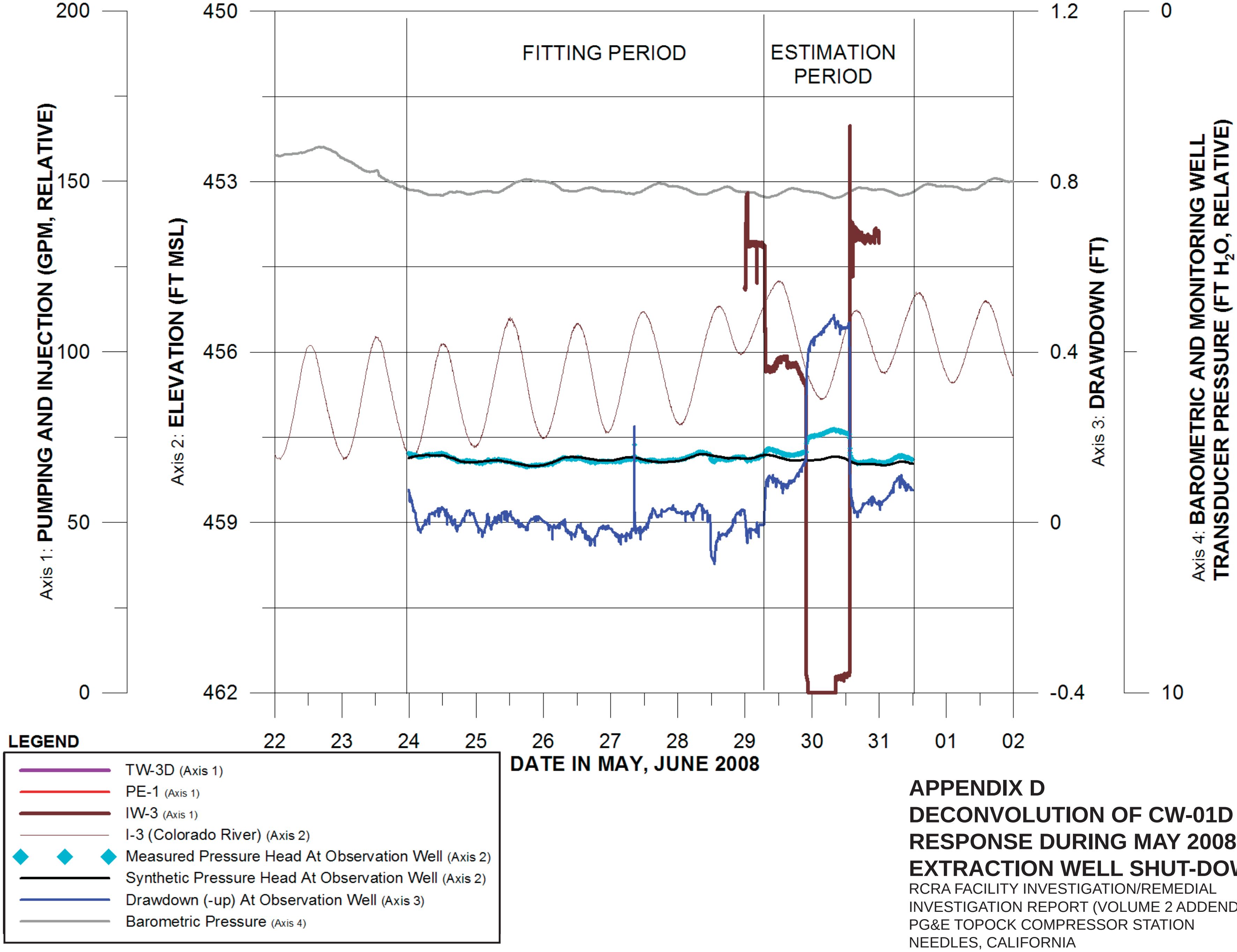


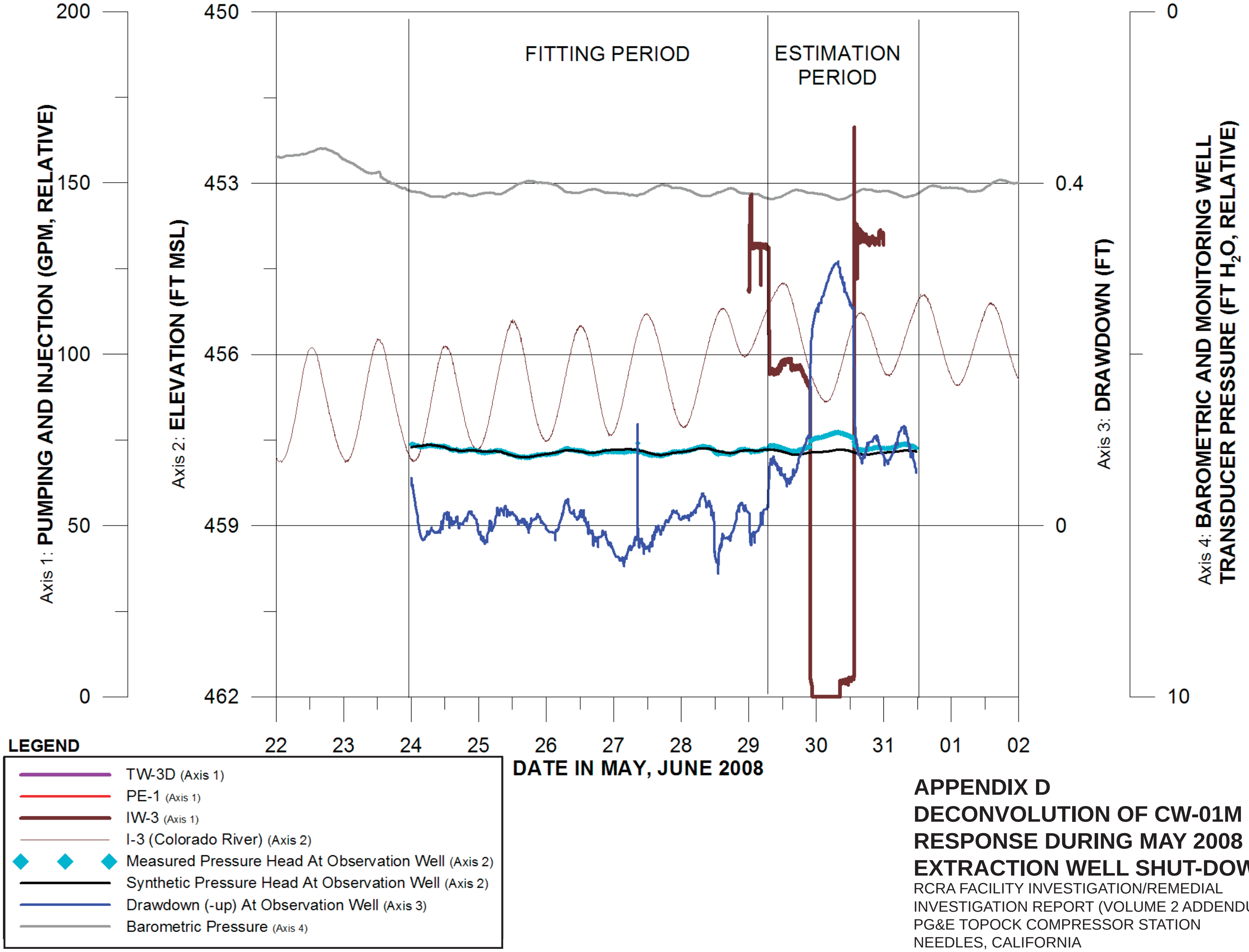
Appendix D
Aquifer Test Well Responses

D1 May 2008 Test



APPENDIX D
DECONVOLUTION OF CW-01D RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

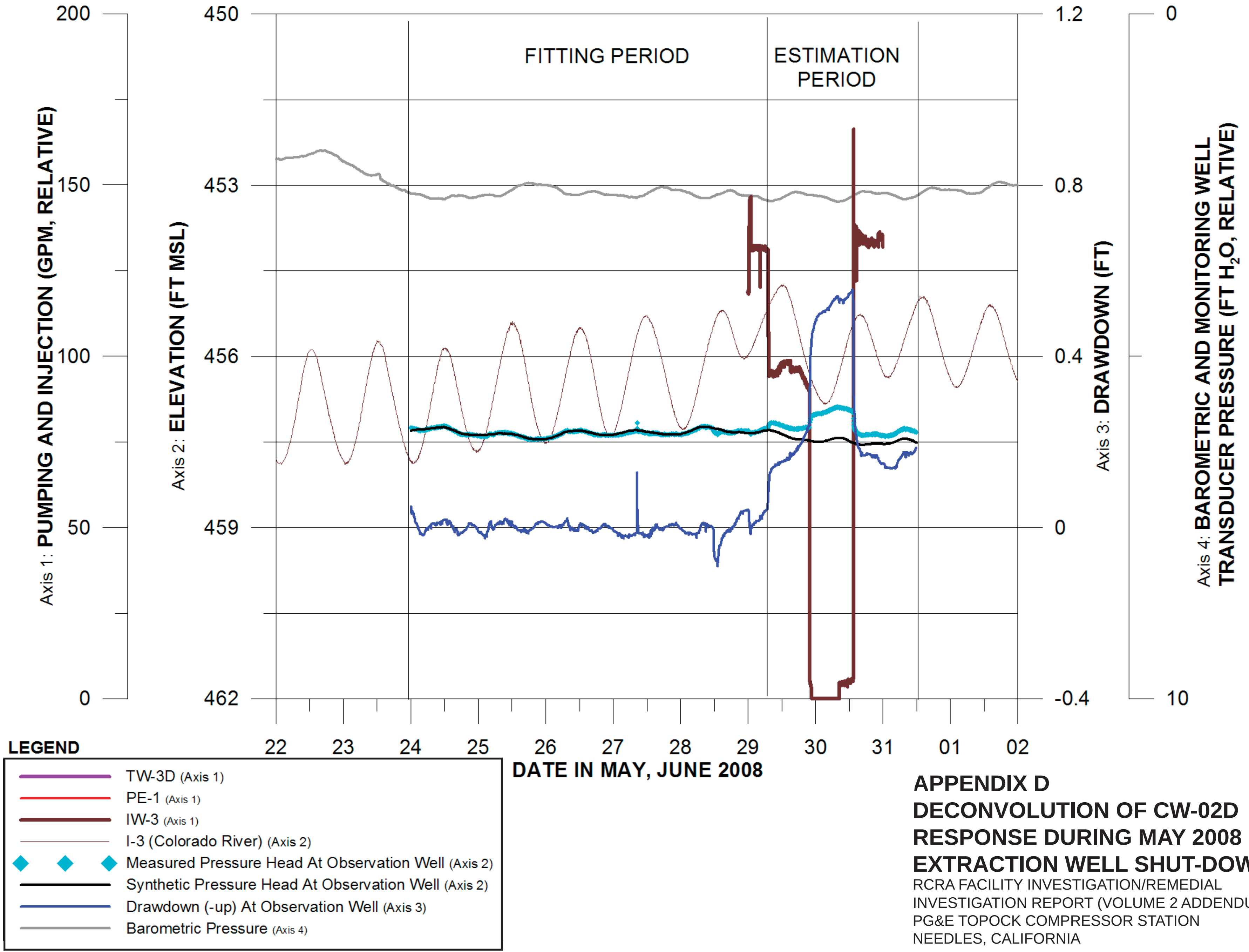
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



APPENDIX D
DECONVOLUTION OF CW-01M RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

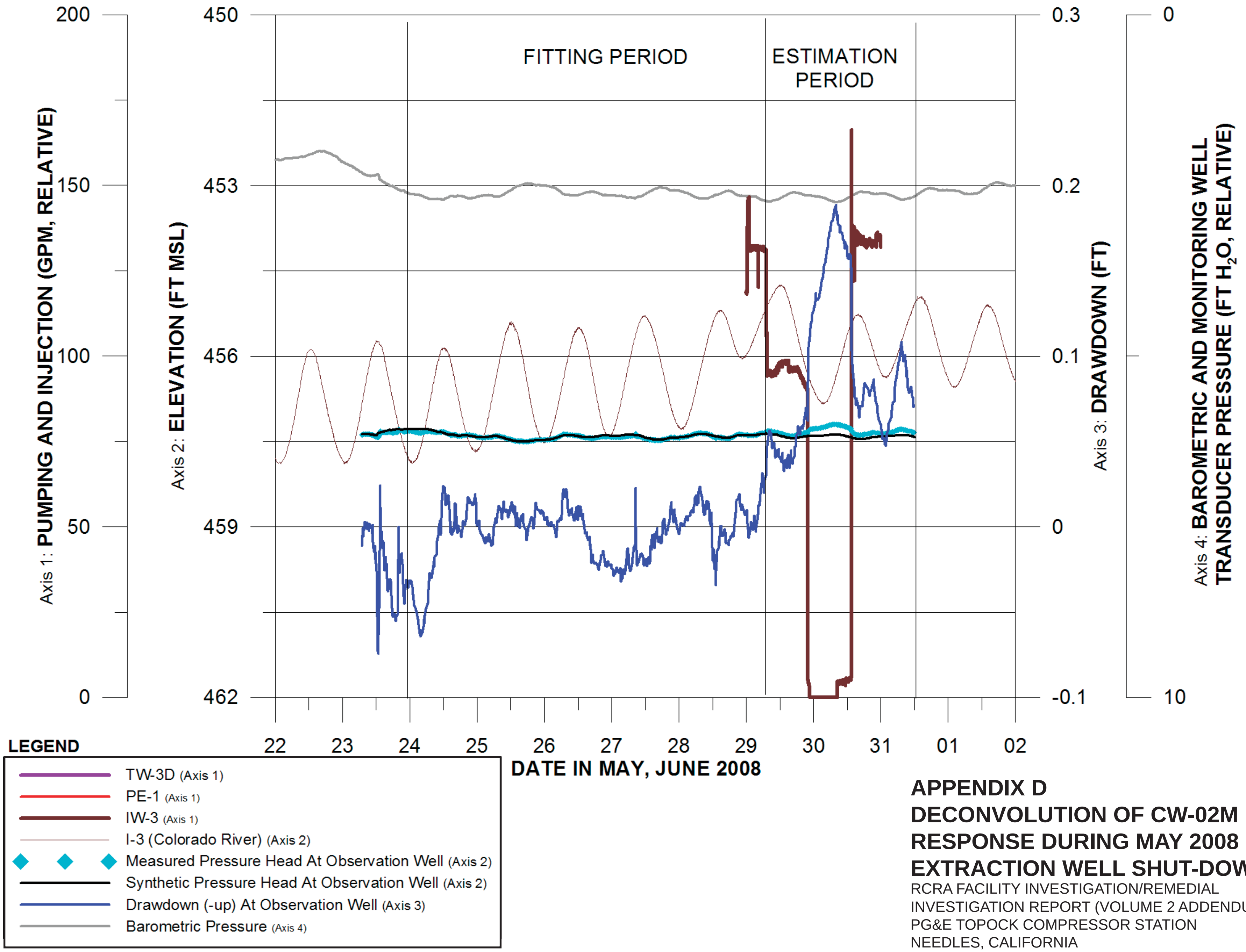
CH2MHILL



APPENDIX D
DECONVOLUTION OF CW-02D RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

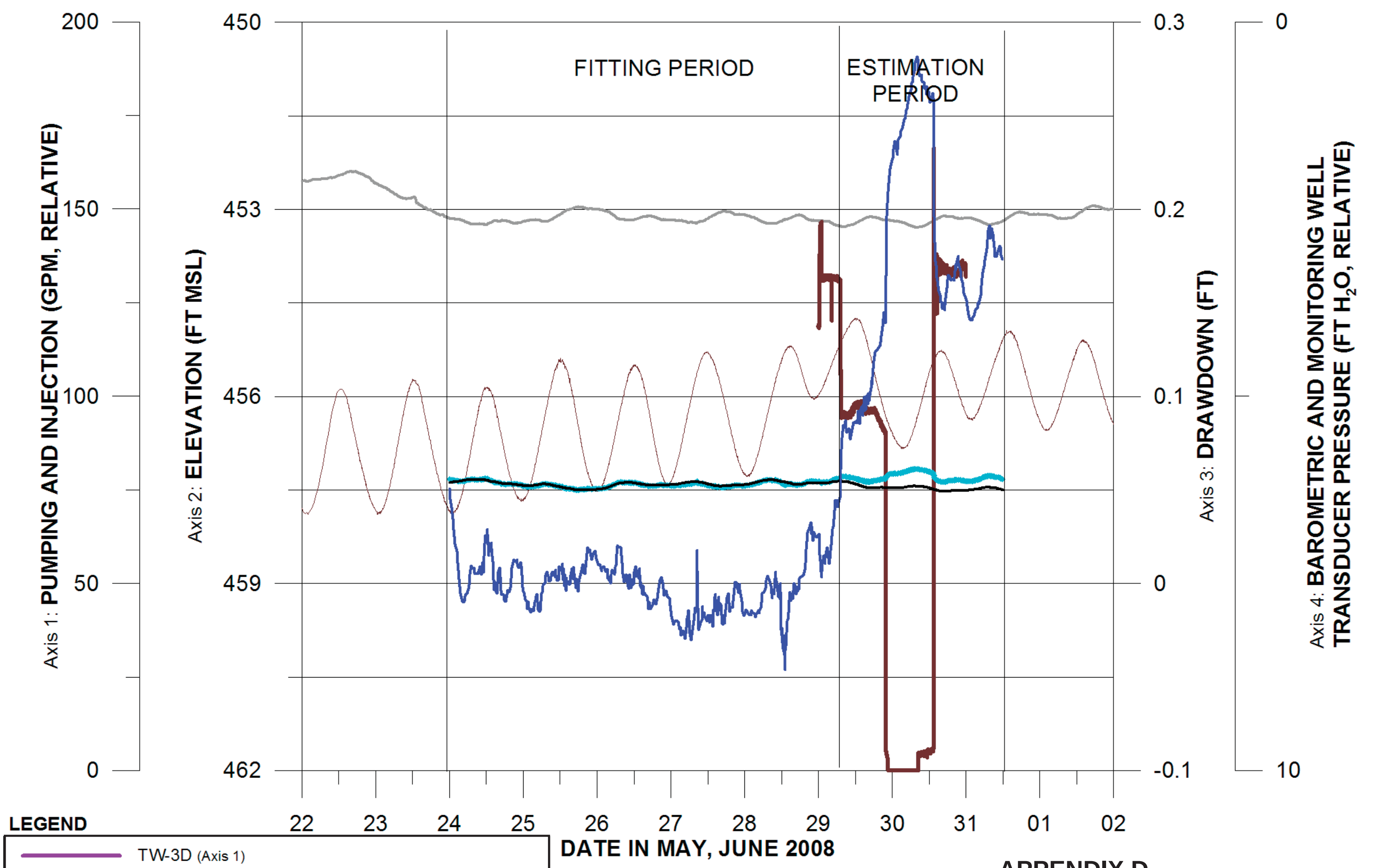
CH2MHILL



APPENDIX D
DECONVOLUTION OF CW-02M RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



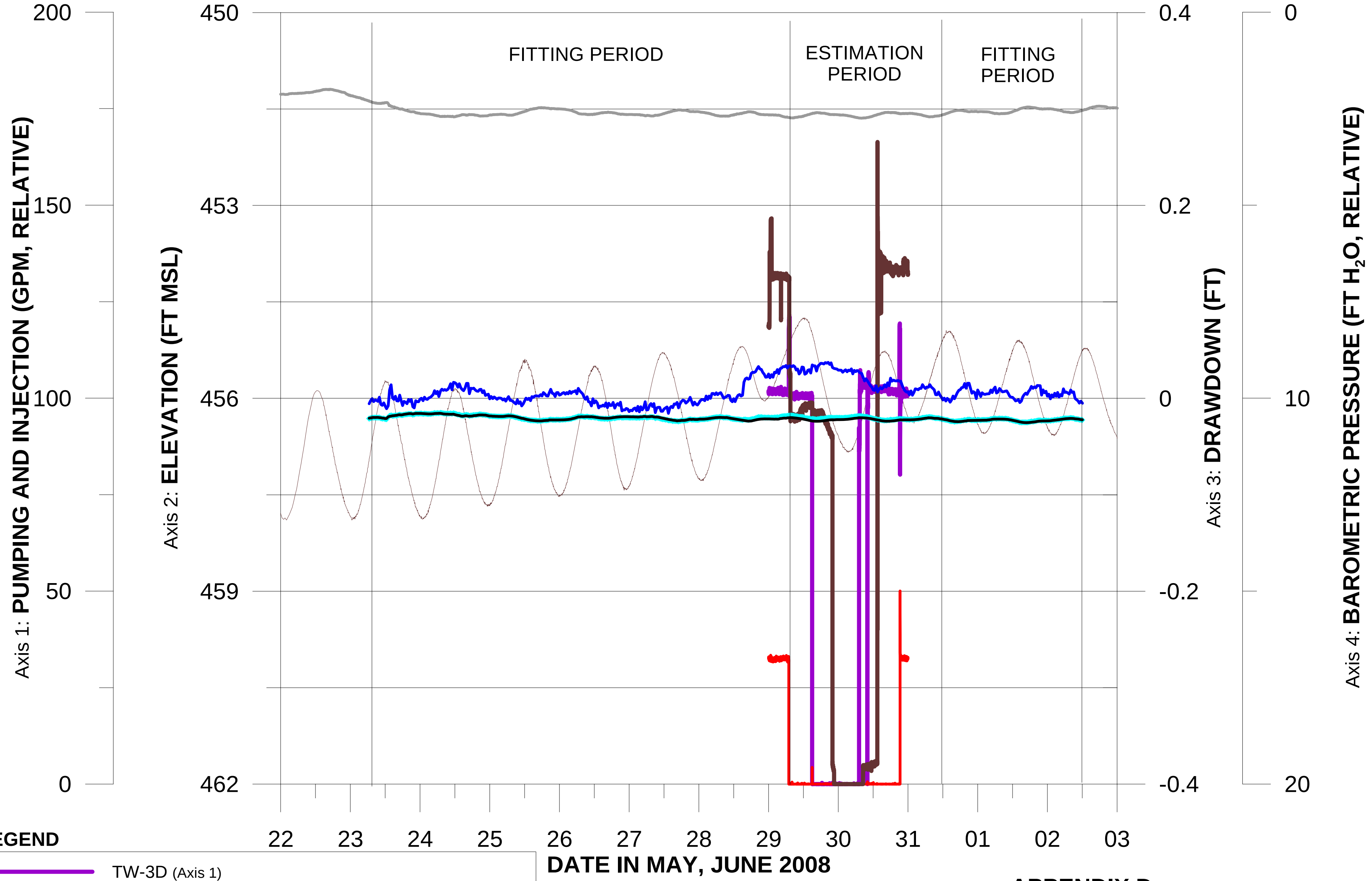
LEGEND

▬	TW-3D (Axis 1)
▬	PE-1 (Axis 1)
▬	IW-3 (Axis 1)
▬	I-3 (Colorado River) (Axis 2)
◆ ◆ ◆	Measured Pressure Head At Observation Well (Axis 2)
▬	Synthetic Pressure Head At Observation Well (Axis 2)
▬	Drawdown (-up) At Observation Well (Axis 3)
▬	Barometric Pressure (Axis 4)

APPENDIX D
DECONVOLUTION OF CW-03M RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



LEGEND

- TW-3D (Axis 1)
- PE-1 (Axis 1)
- IW-3 (Axis 1)
- ◆ ◆ ◆ Measured Pressure Head At Observation Well (Axis 2)
- Synthetic Pressure Head At Observation Well (Axis 2)
- I-3 (Colorado River) (Axis 2)
- Drawdown (-up) At Observation Well (Axis 3)
- Barometric Pressure (Axis 4)

APPENDIX D
DECONVOLUTION OF MW-12 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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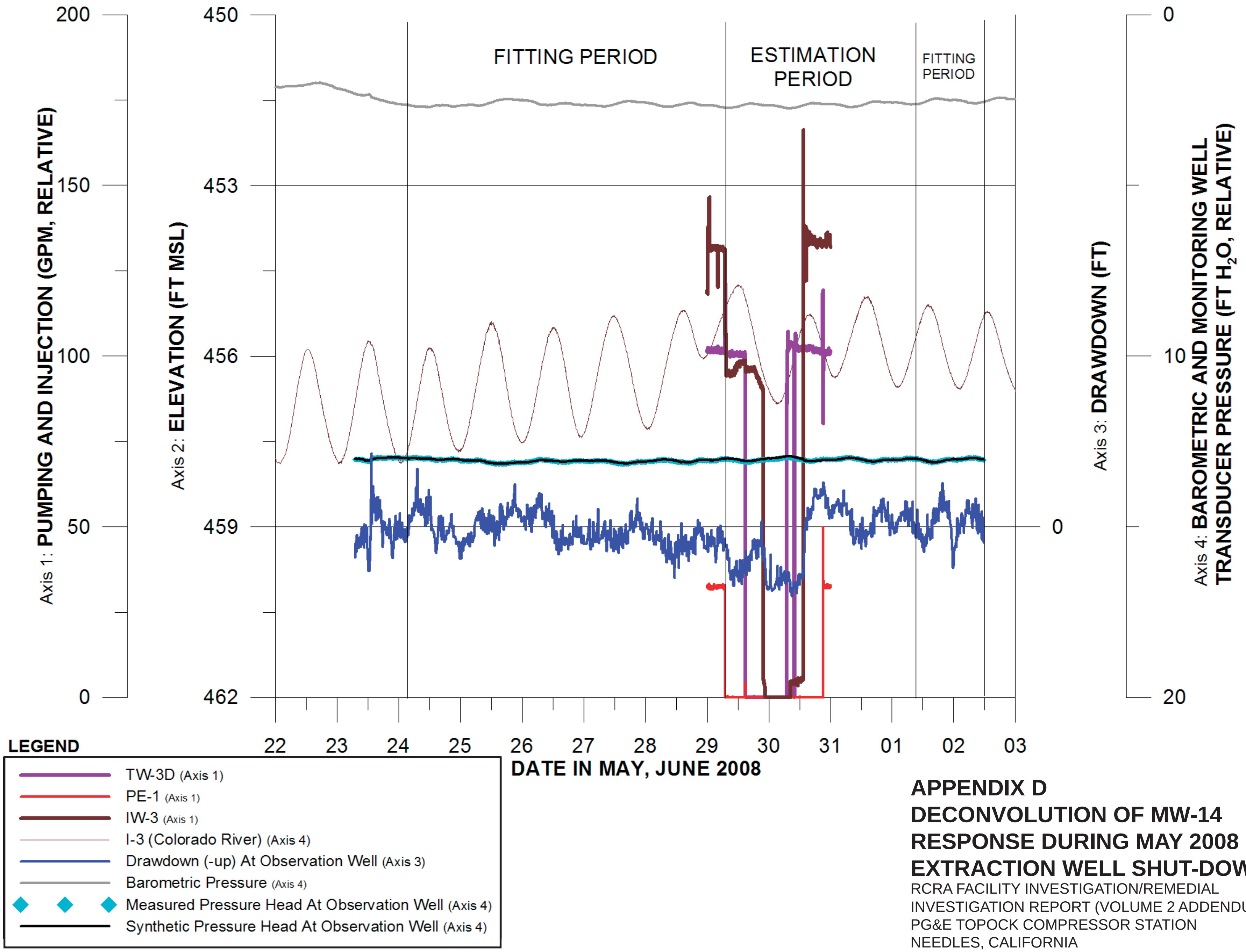

APPENDIX D
DECONVOLUTION OF MW-14 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN
RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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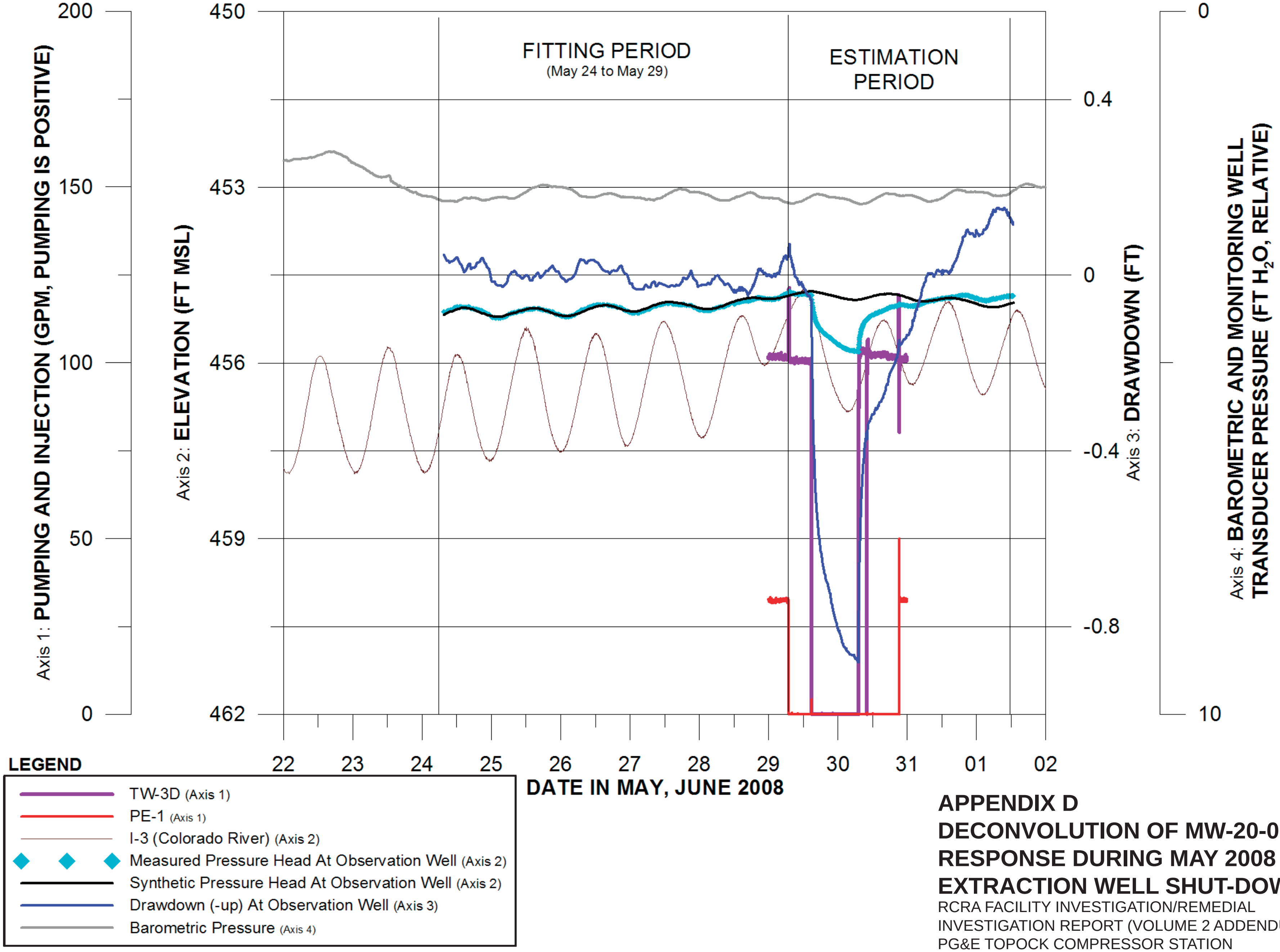
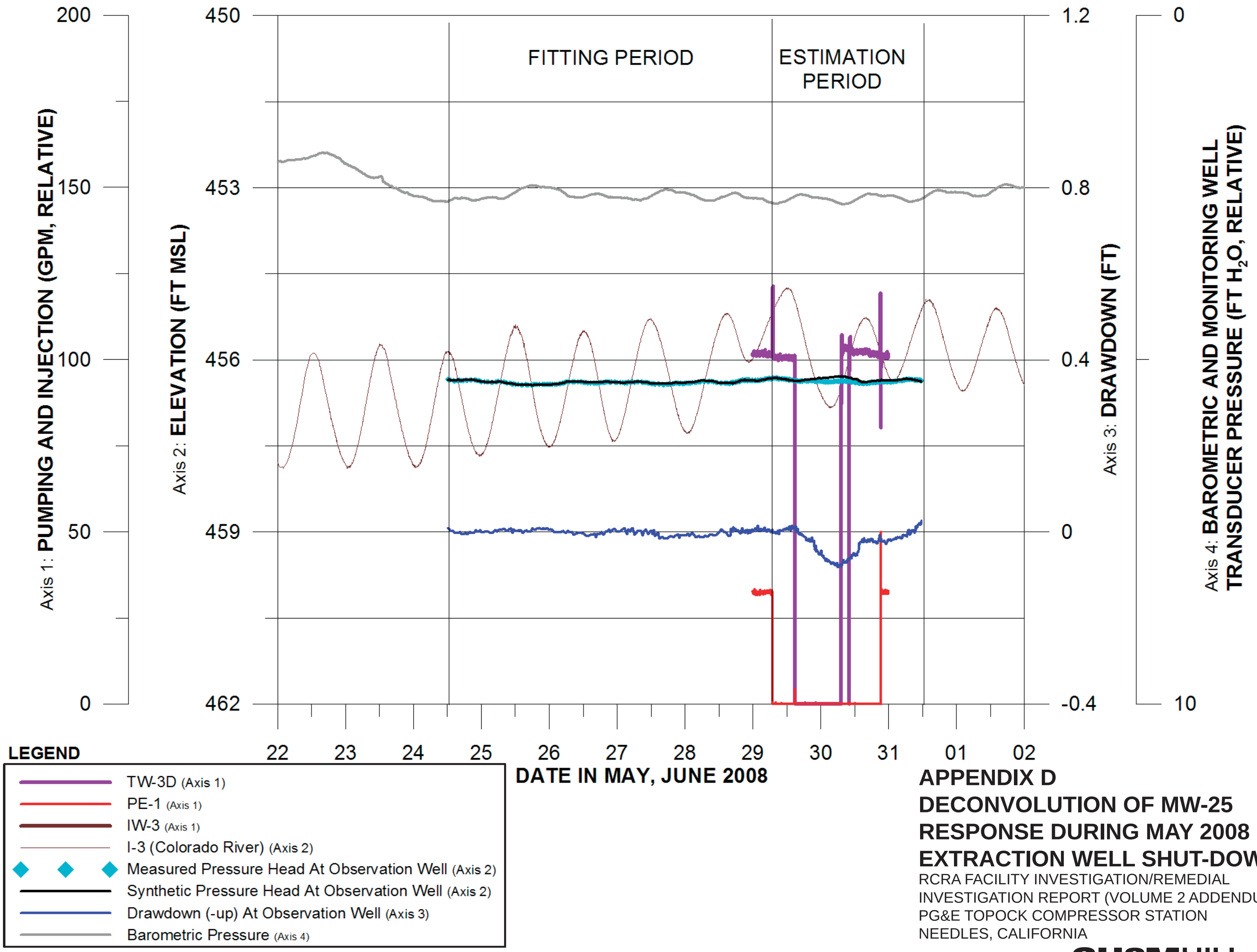


APPENDIX D
DECONVOLUTION OF MW-20-070 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

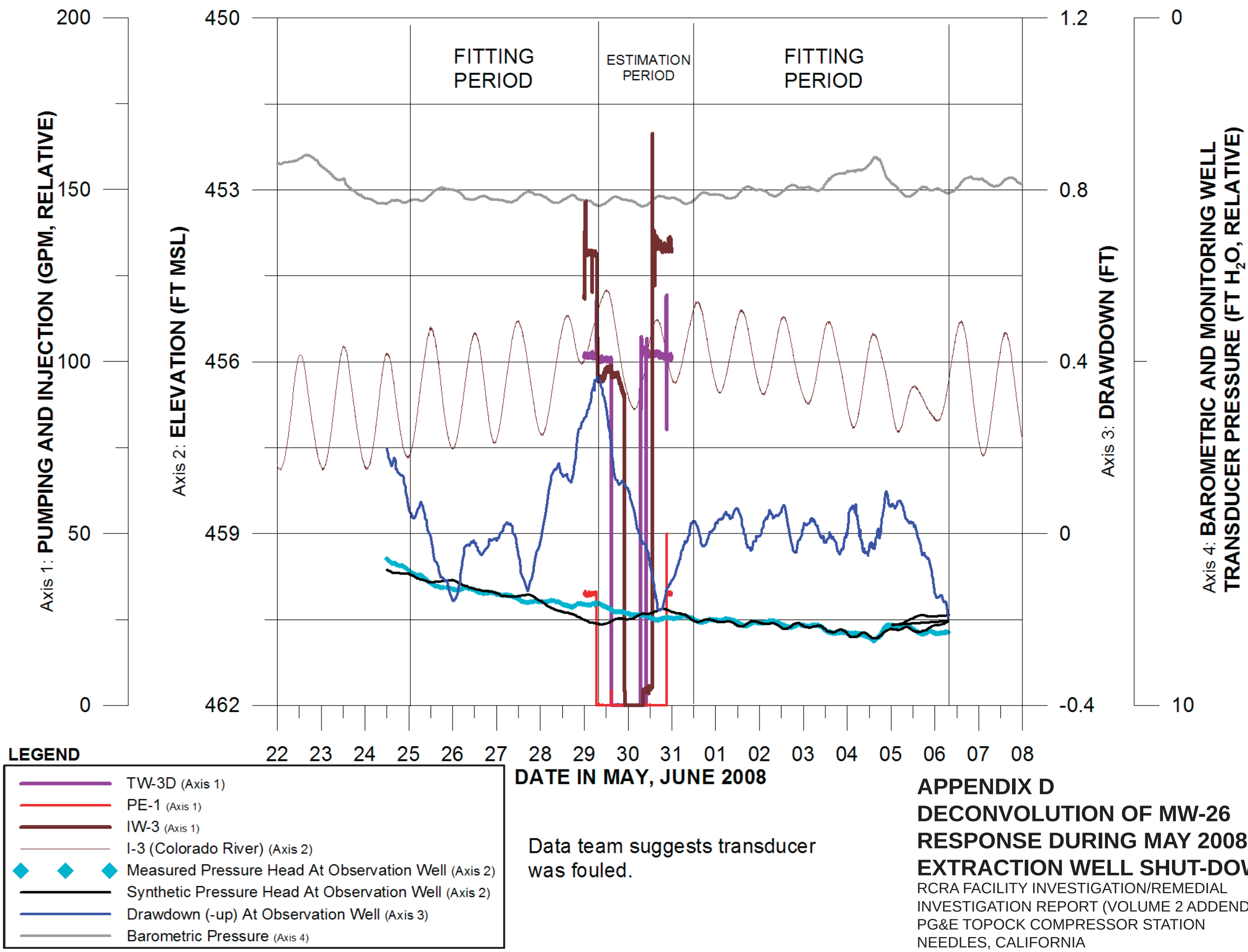
CH2MHILL



APPENDIX D
DECONVOLUTION OF MW-25 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

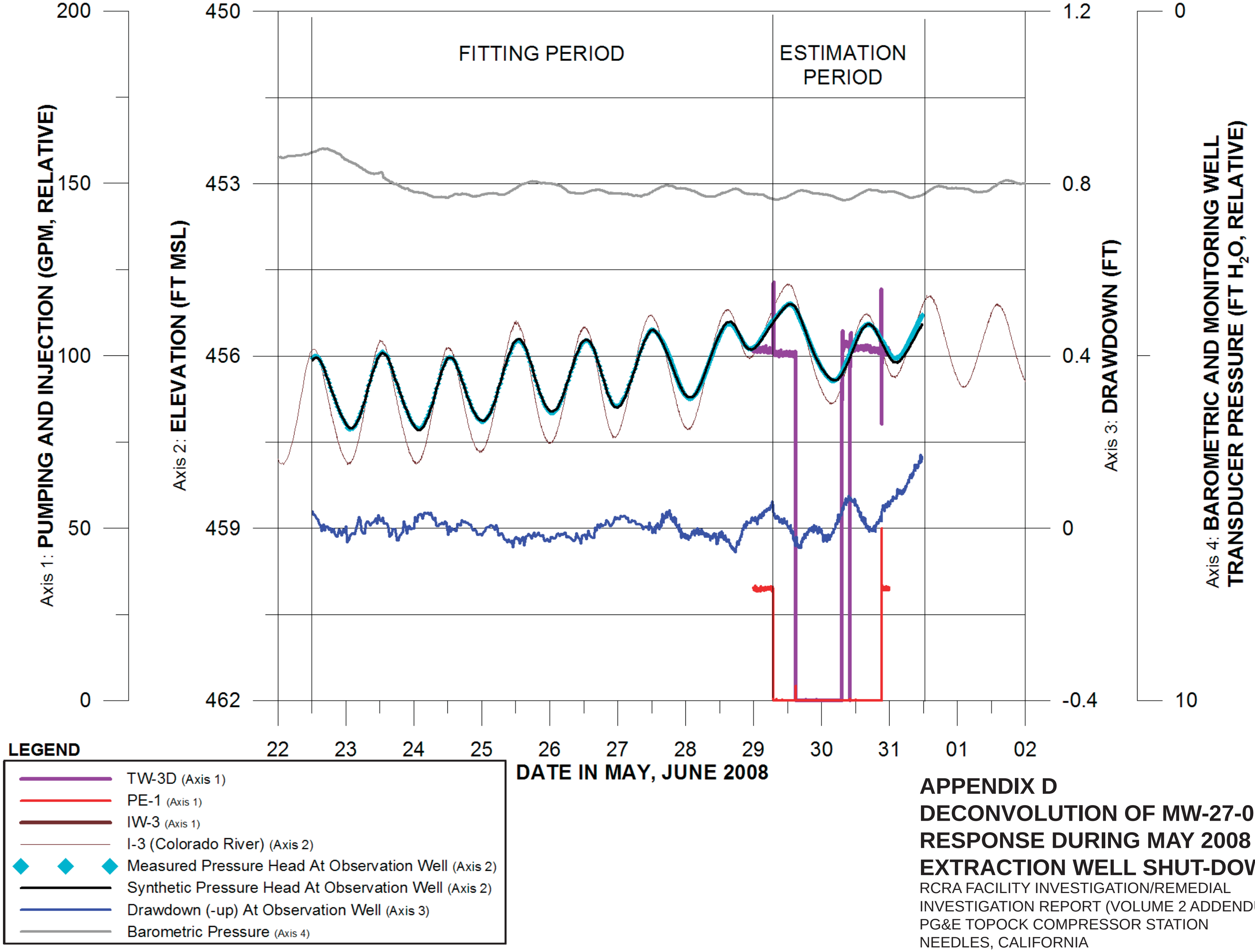


Data team suggests transducer was fouled.

APPENDIX D
DECONVOLUTION OF MW-26 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



APPENDIX D
DECONVOLUTION OF MW-27-060 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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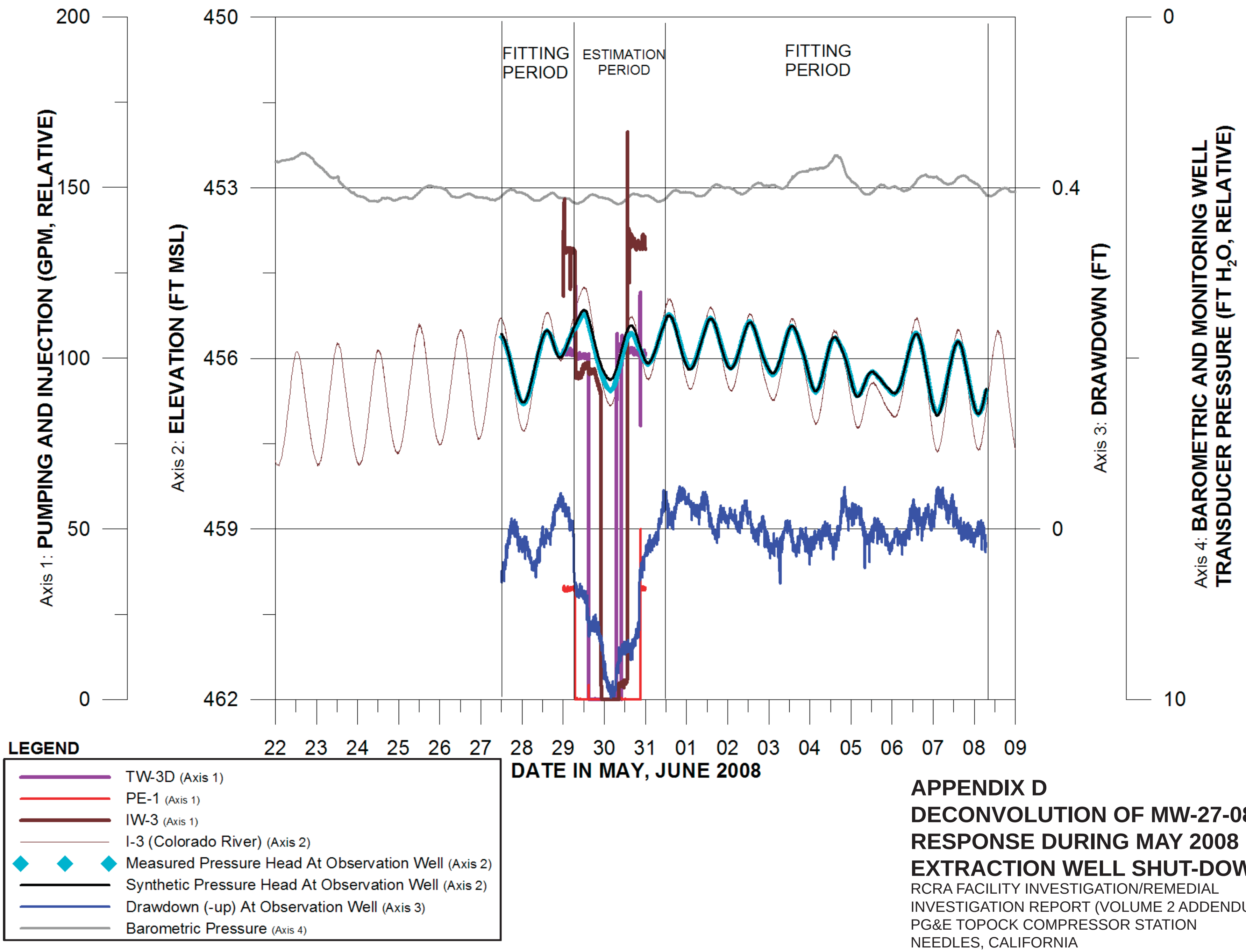
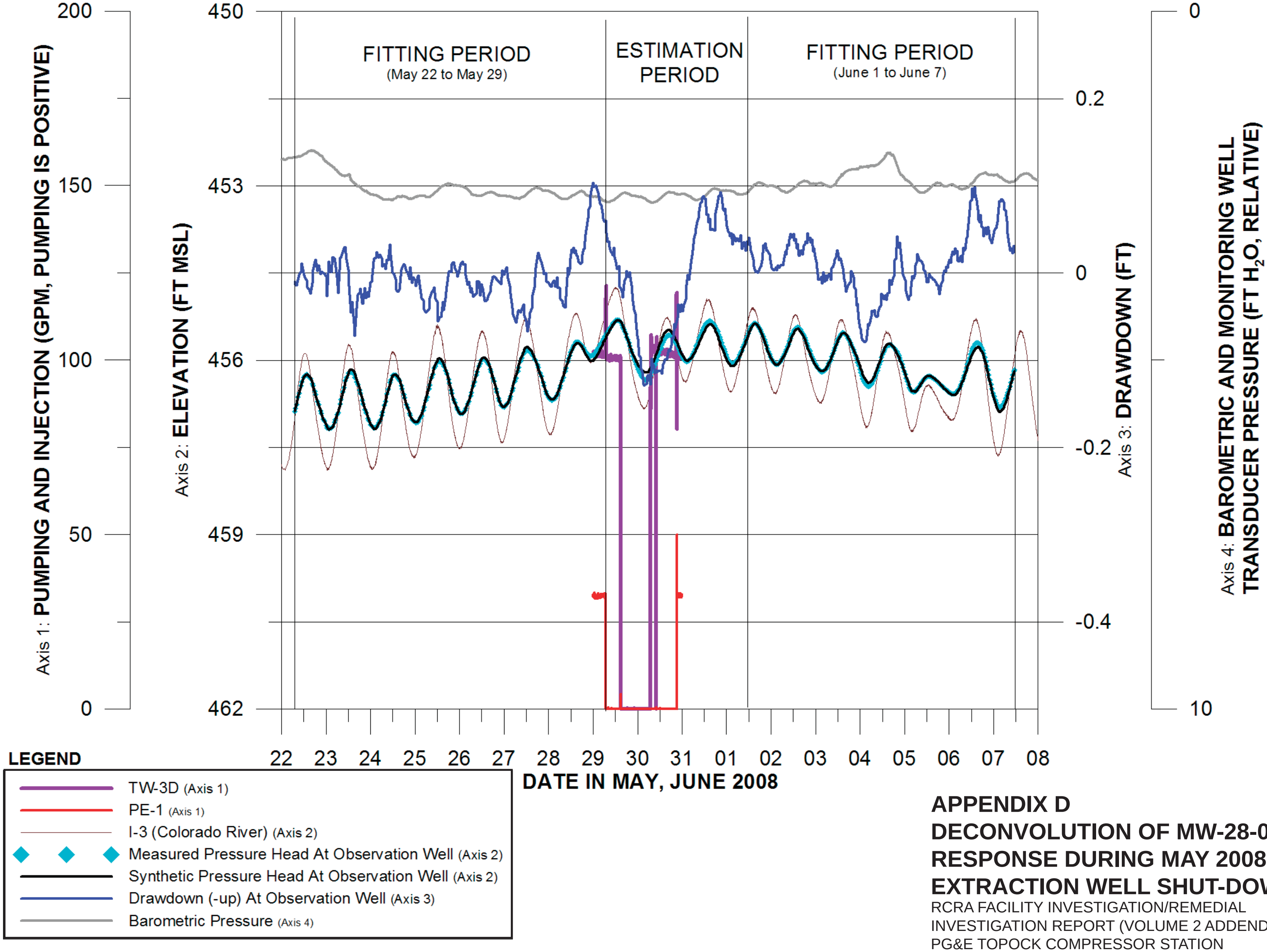


APPENDIX D

DECONVOLUTION OF MW-27-085 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

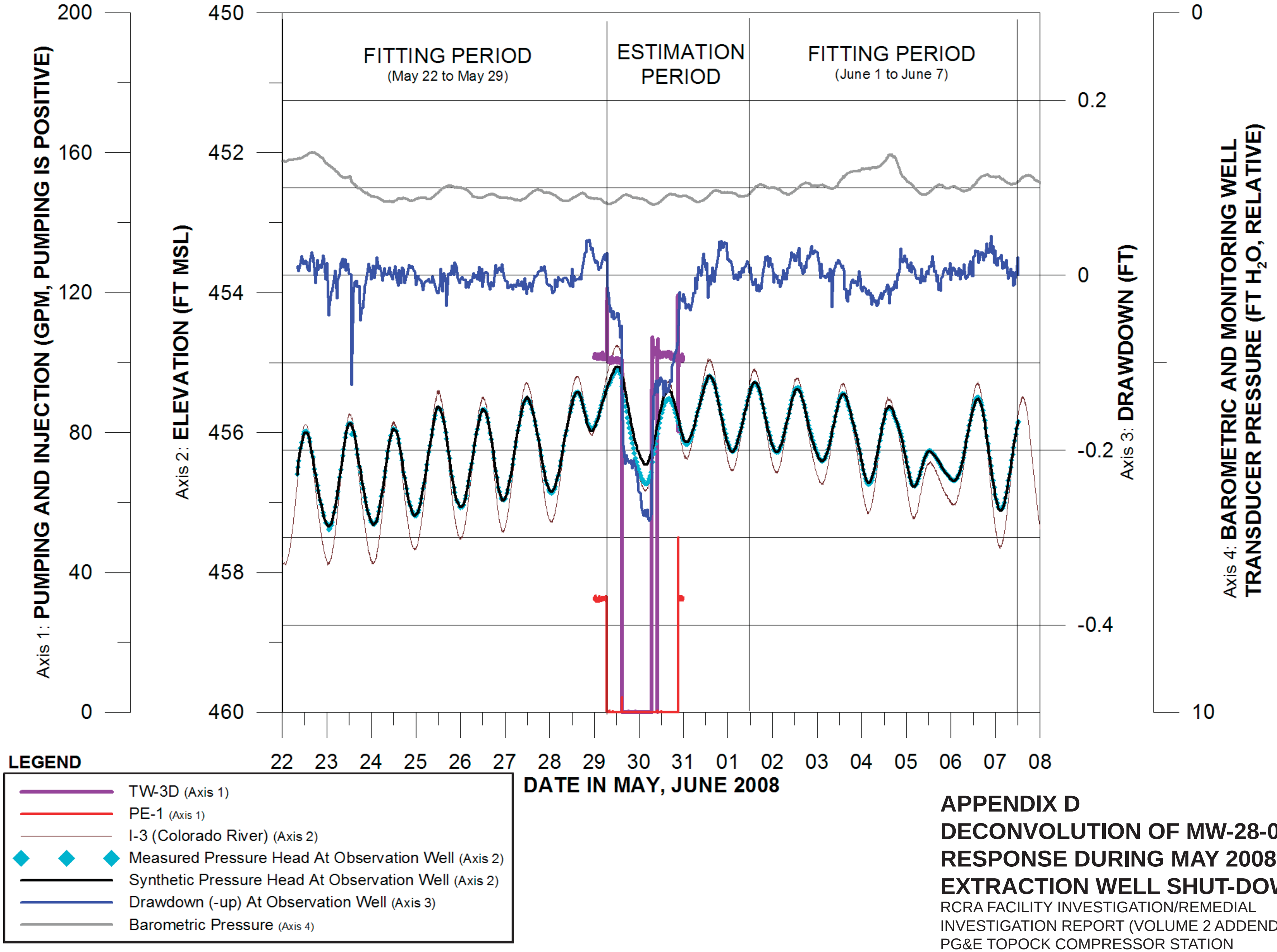
RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



APPENDIX D
DECONVOLUTION OF MW-28-025 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



APPENDIX D
DECONVOLUTION OF MW-28-090 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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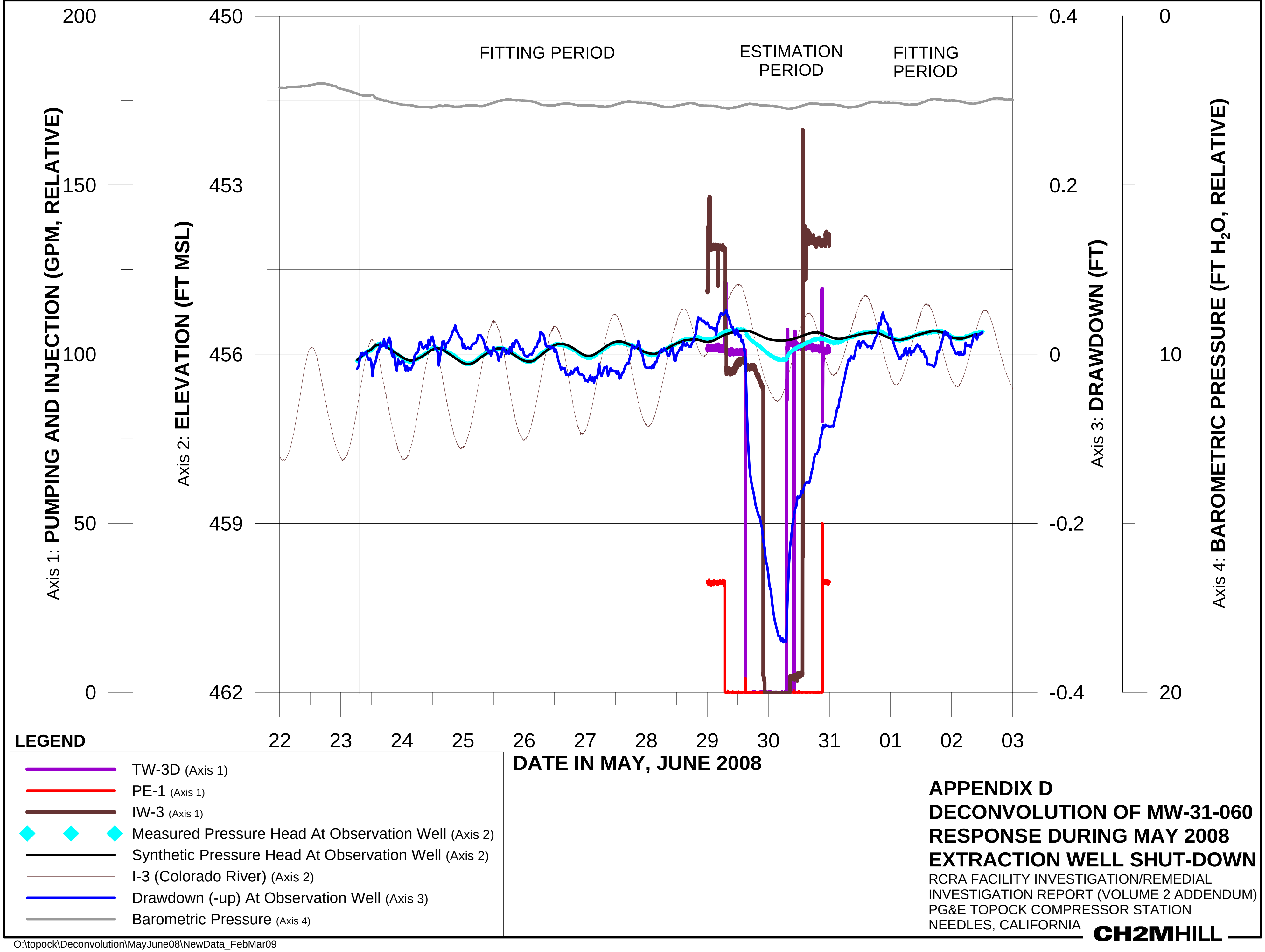

APPENDIX D
DECONVOLUTION OF MW-31-060 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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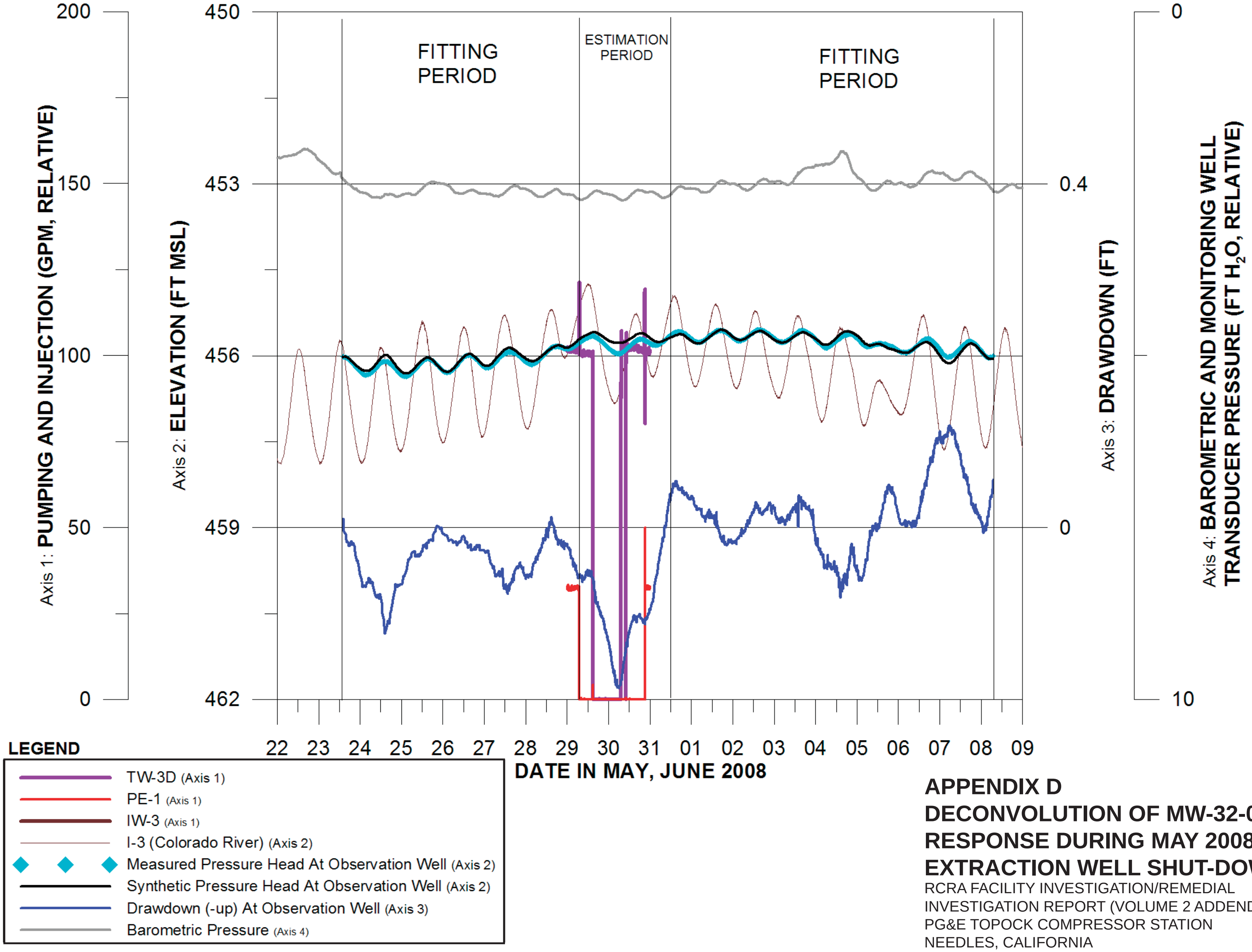
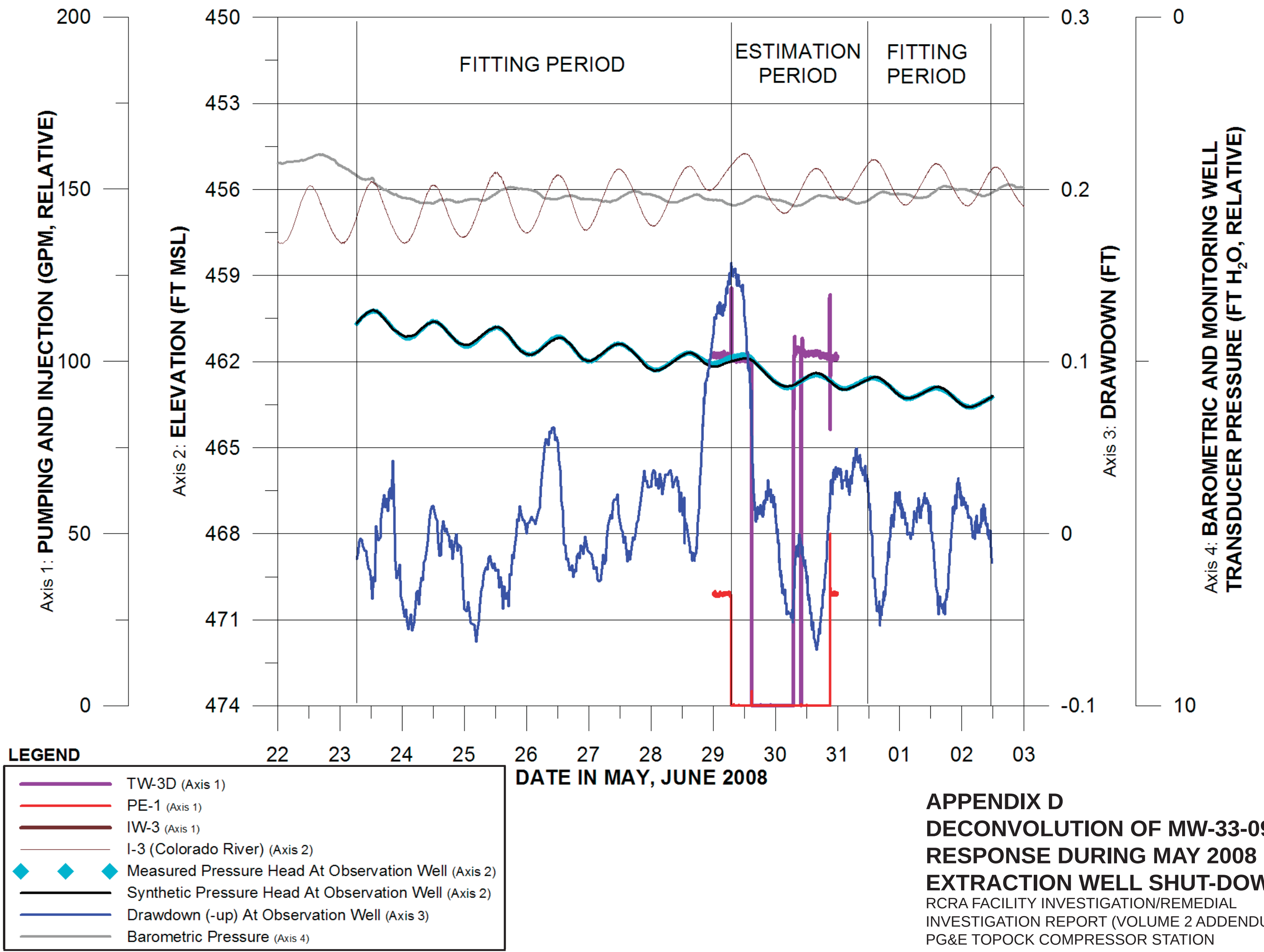


APPENDIX D
DECONVOLUTION OF MW-32-020 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

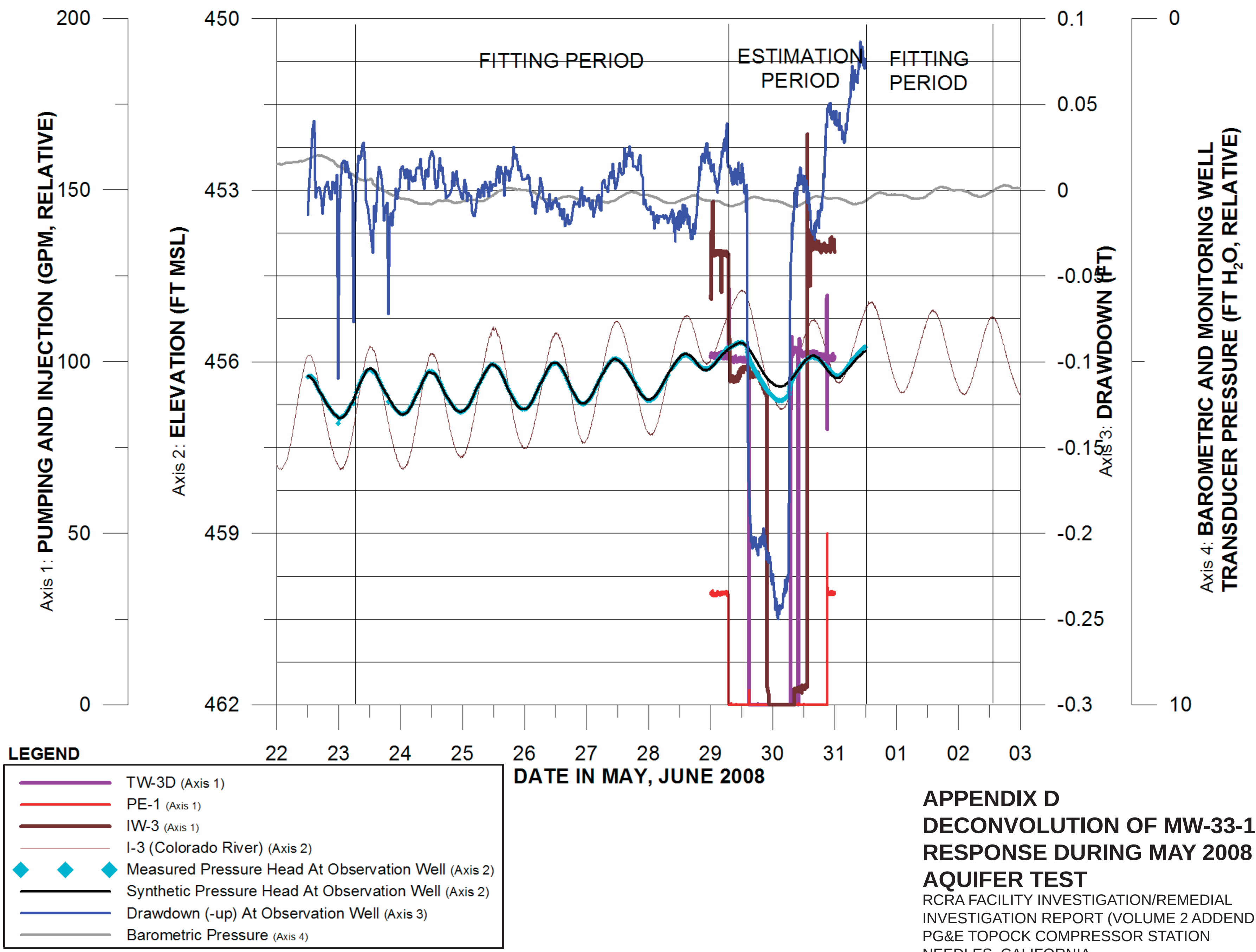
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



APPENDIX D
DECONVOLUTION OF MW-33-090 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

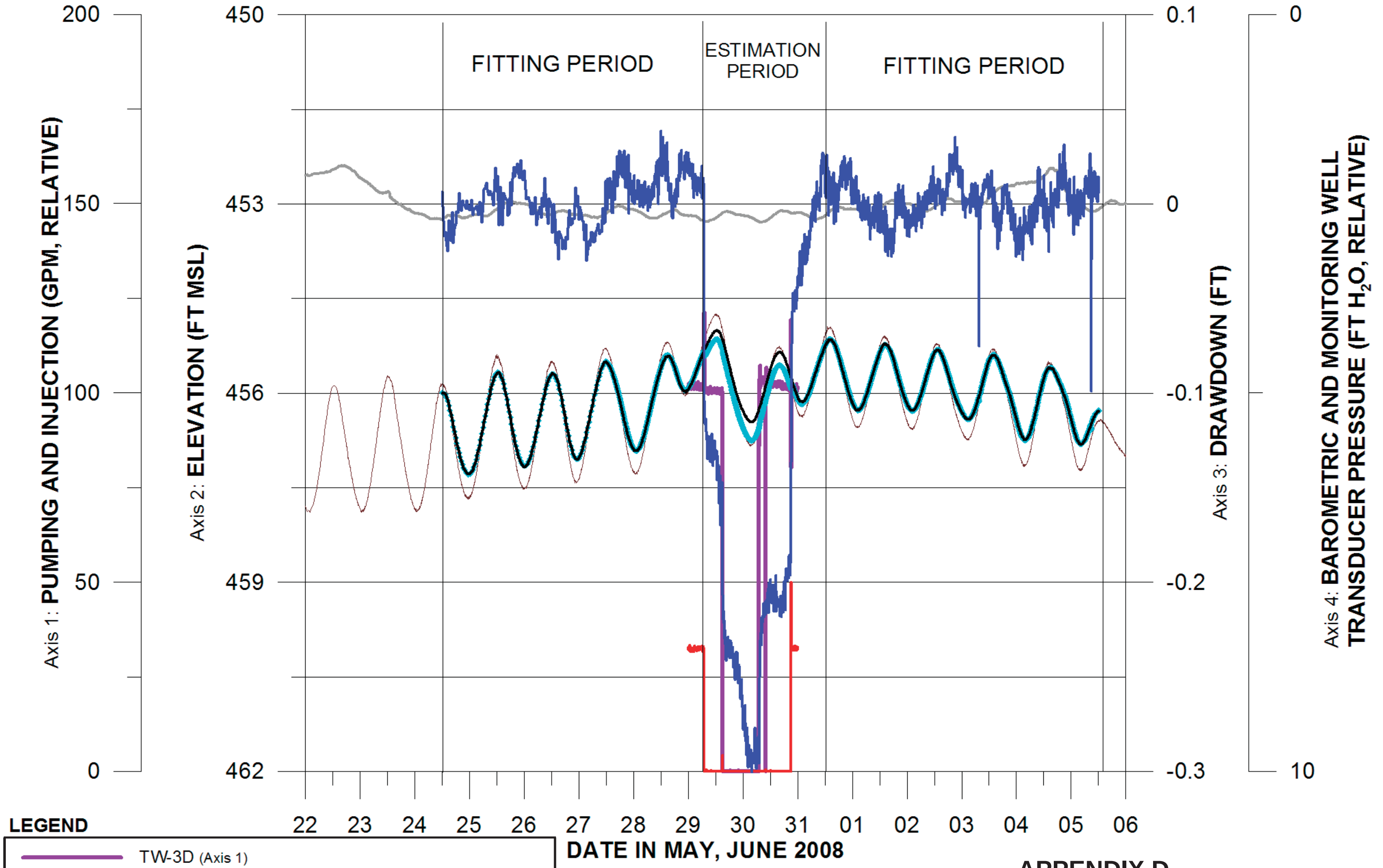
CH2MHILL



APPENDIX D
DECONVOLUTION OF MW-33-150 RESPONSE DURING MAY 2008 AQUIFER TEST

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



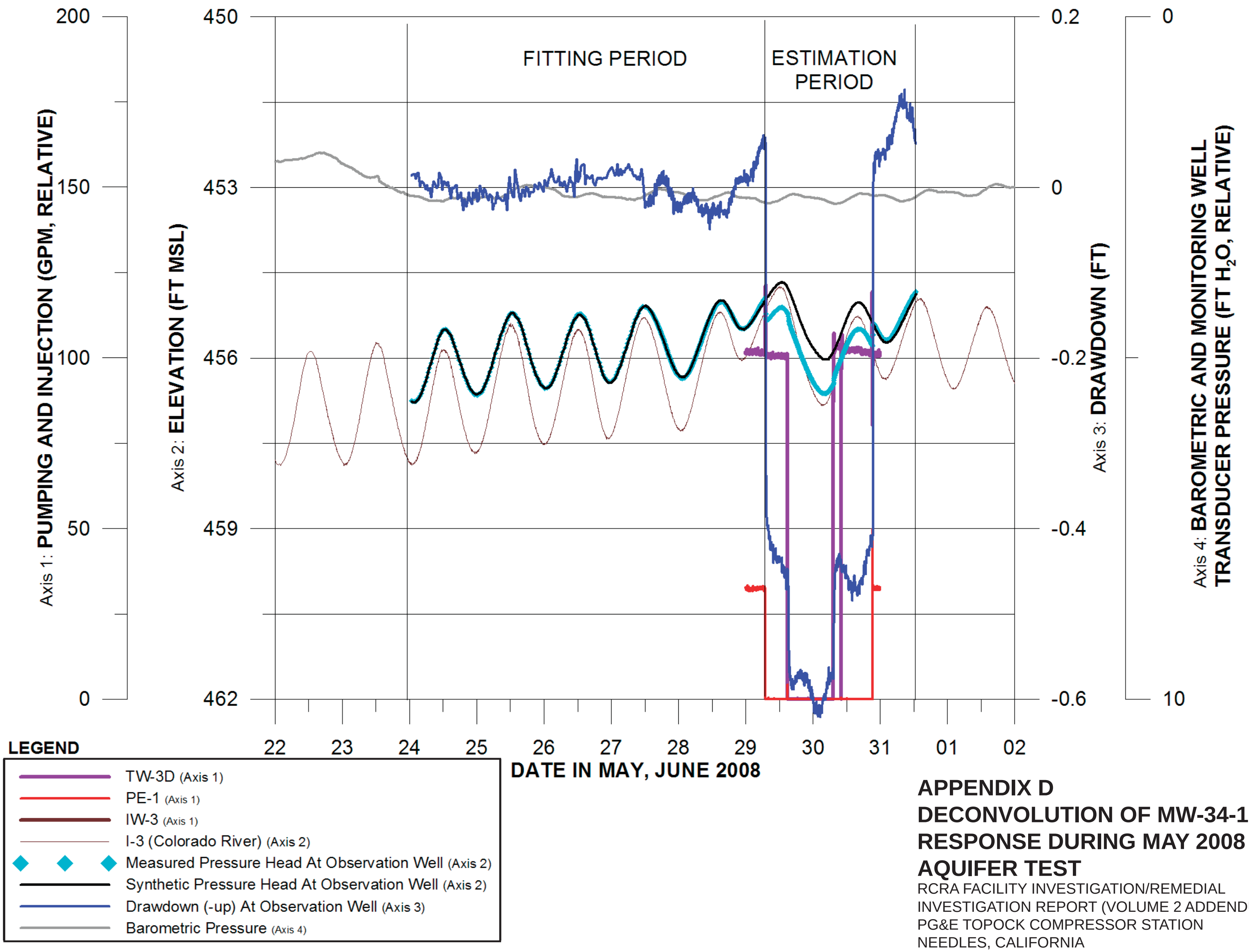
LEGEND

▬	TW-3D (Axis 1)
▬	PE-1 (Axis 1)
▬	IW-3 (Axis 1)
─	I-3 (Colorado River) (Axis 2)
◆ ◆ ◆	Measured Pressure Head At Observation Well (Axis 2)
▬	Synthetic Pressure Head At Observation Well (Axis 2)
▬	Drawdown (-up) At Observation Well (Axis 3)
▬	Barometric Pressure (Axis 4)

APPENDIX D
DECONVOLUTION OF MW-34-055 RESPONSE DURING MAY 2008 AQUIFER TEST

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



APPENDIX D
DECONVOLUTION OF MW-34-100 RESPONSE DURING MAY 2008 AQUIFER TEST

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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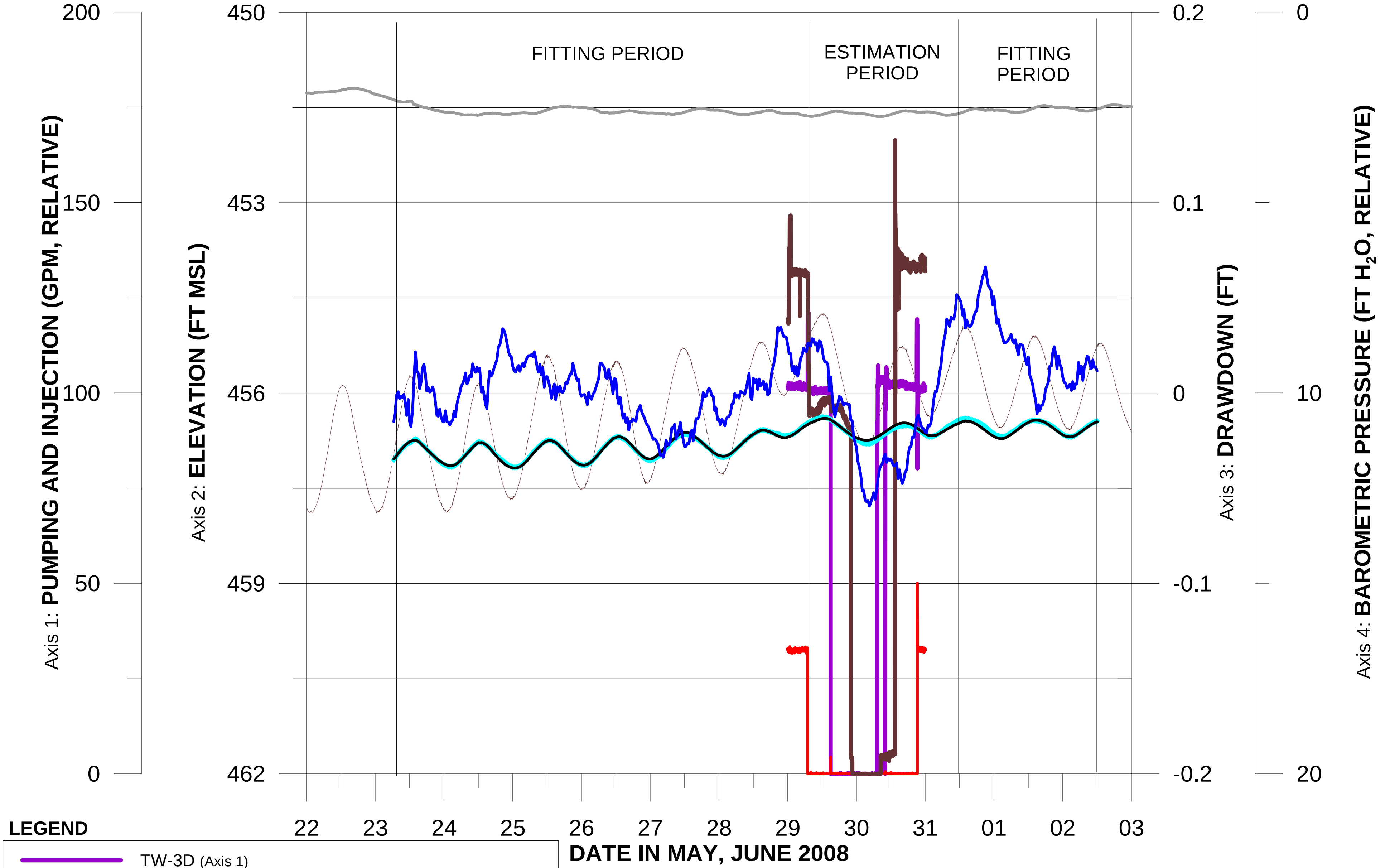

APPENDIX D
DECONVOLUTION OF MW-35-135 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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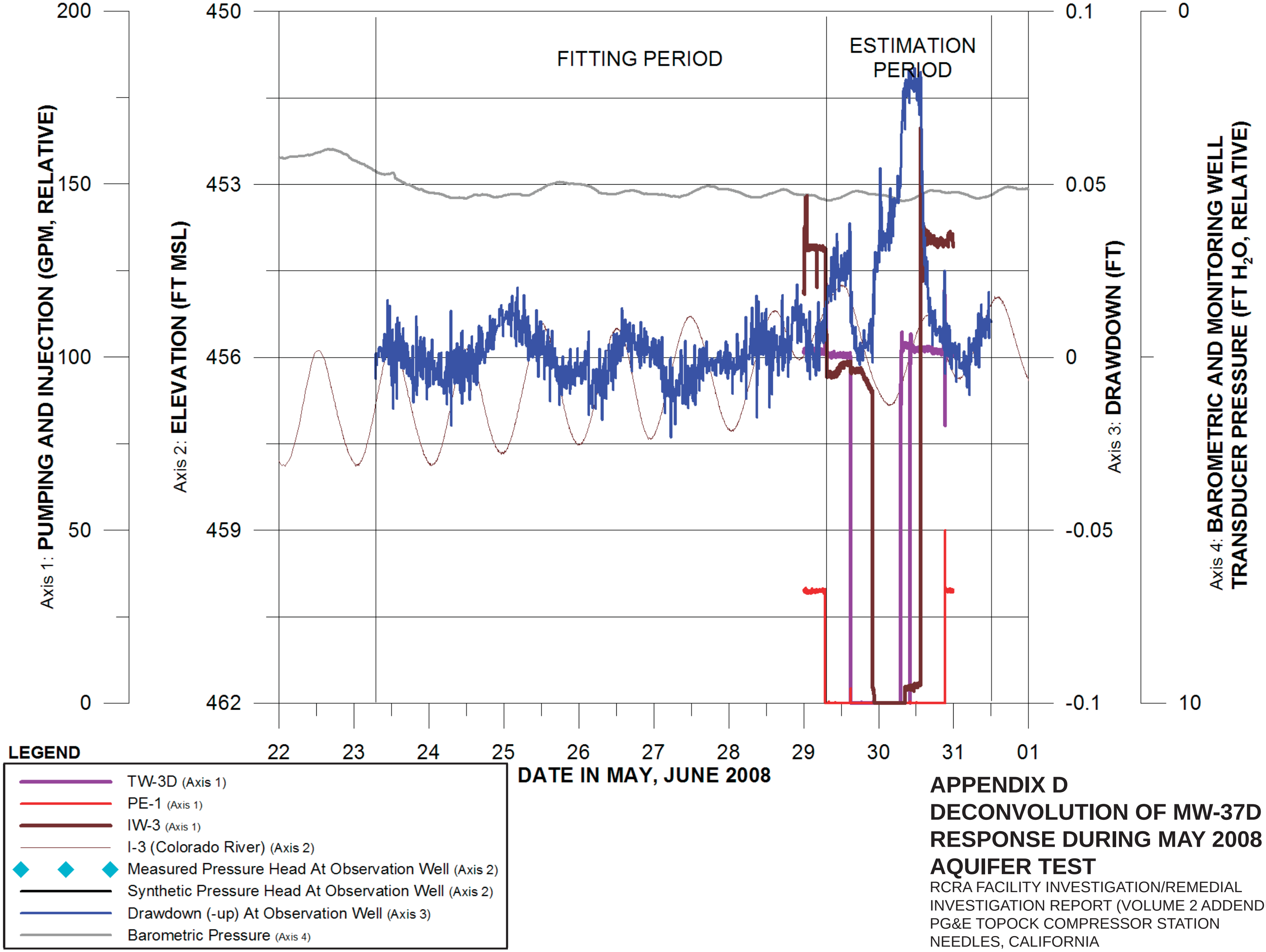
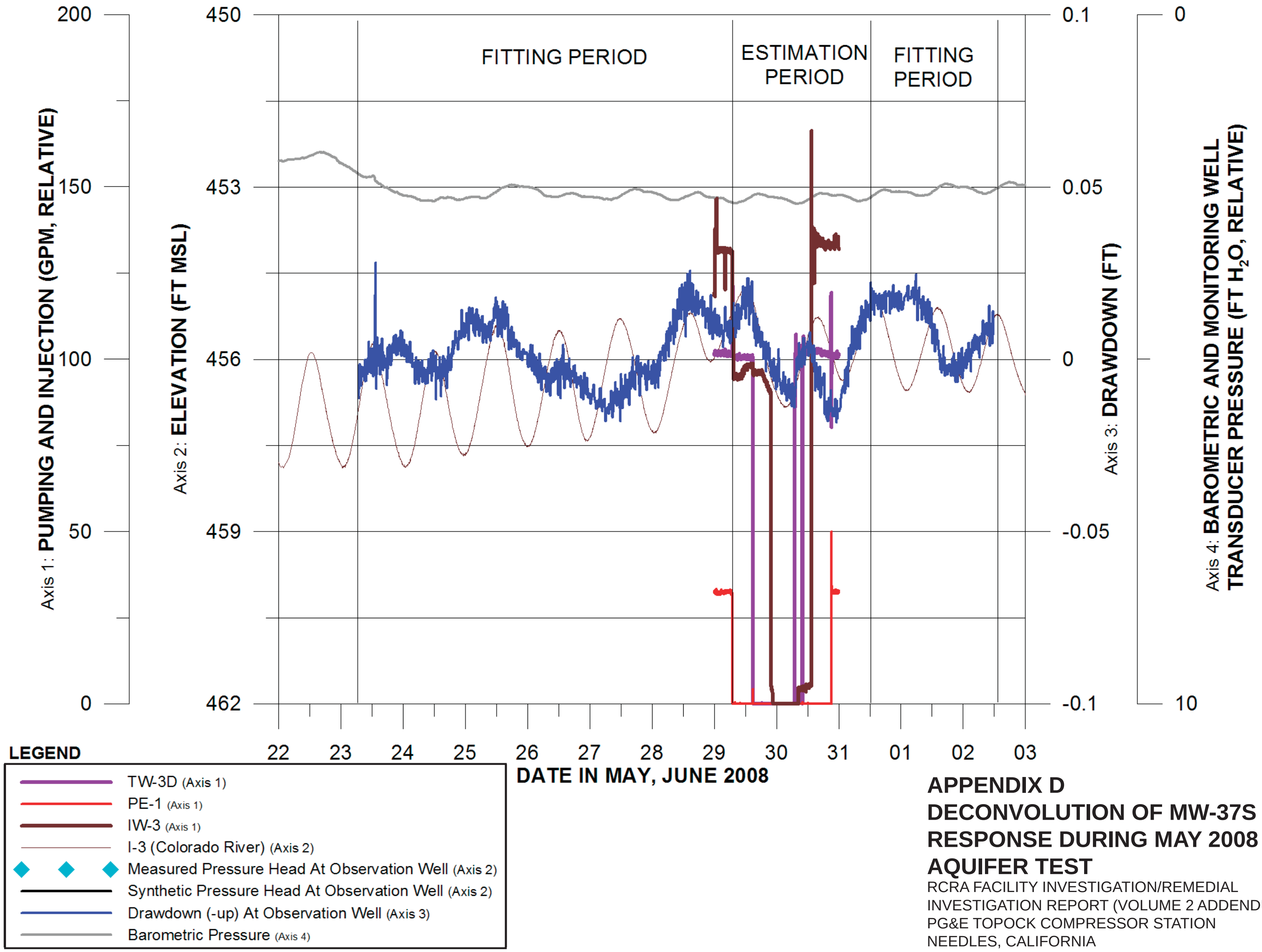


APPENDIX D
DECONVOLUTION OF MW-37D RESPONSE DURING MAY 2008 AQUIFER TEST

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



APPENDIX D
DECONVOLUTION OF MW-37S RESPONSE DURING MAY 2008 AQUIFER TEST

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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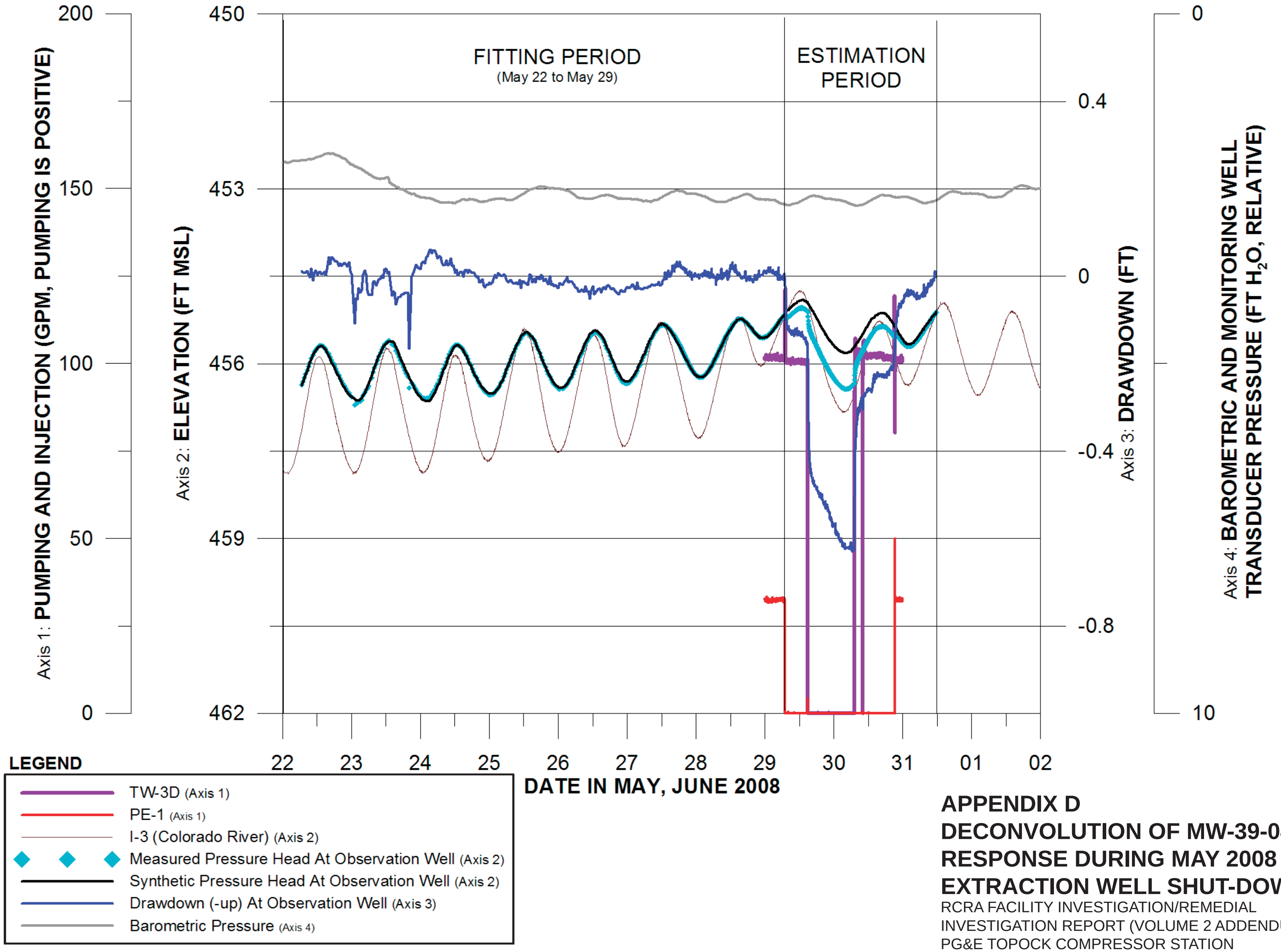

APPENDIX D
DECONVOLUTION OF MW-39-040 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN
RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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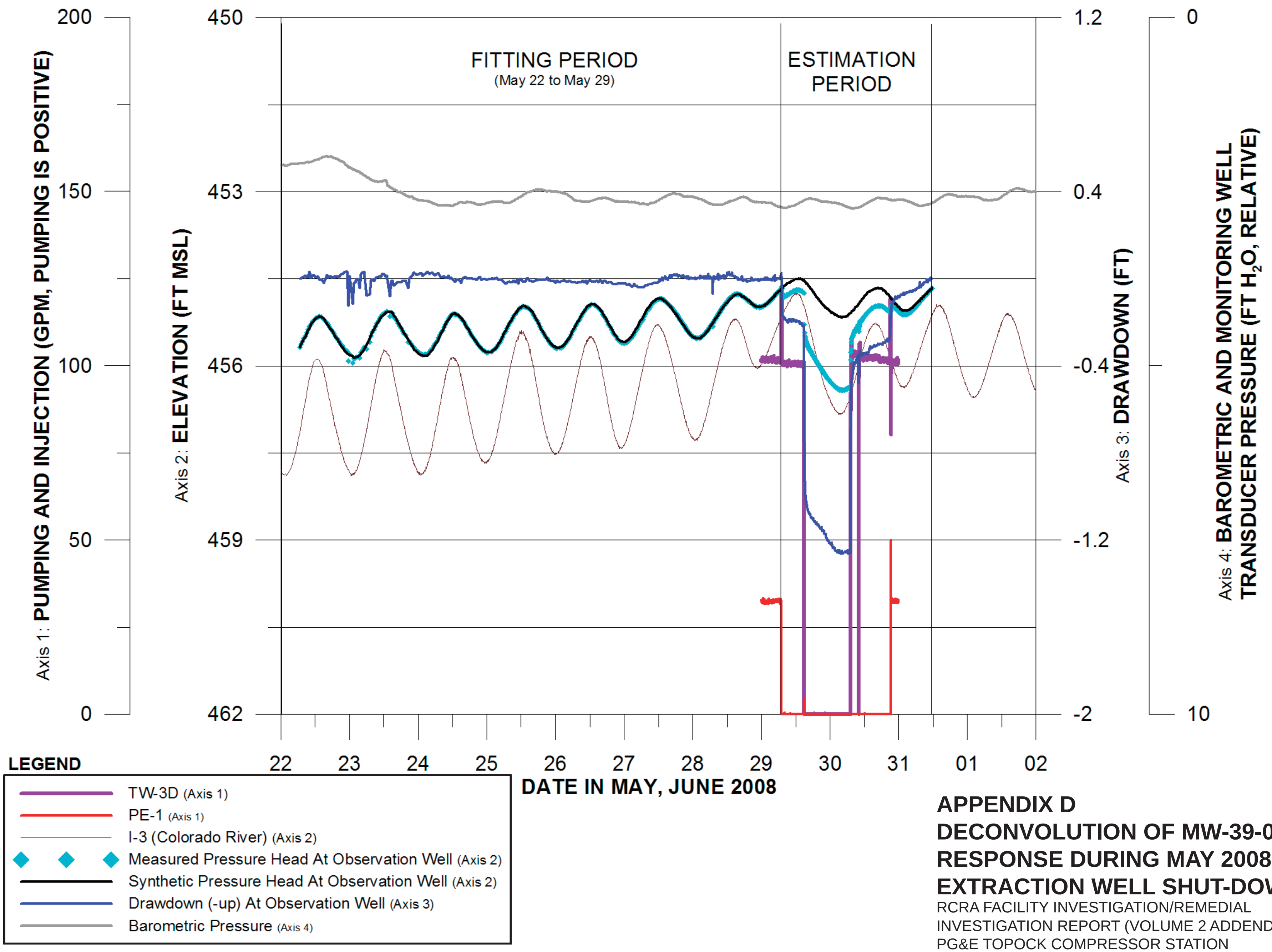

APPENDIX D
DECONVOLUTION OF MW-39-080 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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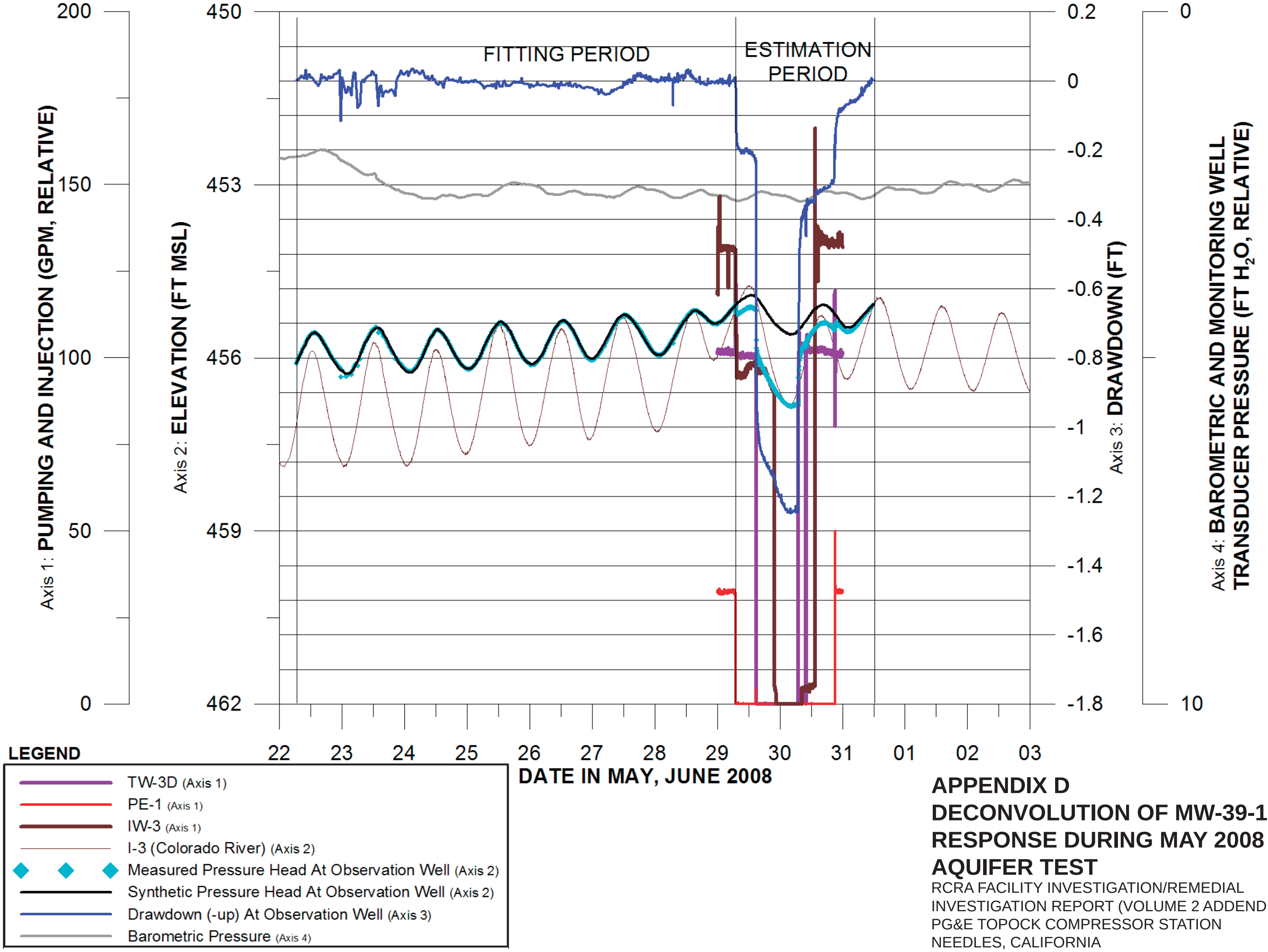

APPENDIX D
DECONVOLUTION OF MW-39-100 RESPONSE DURING MAY 2008 AQUIFER TEST

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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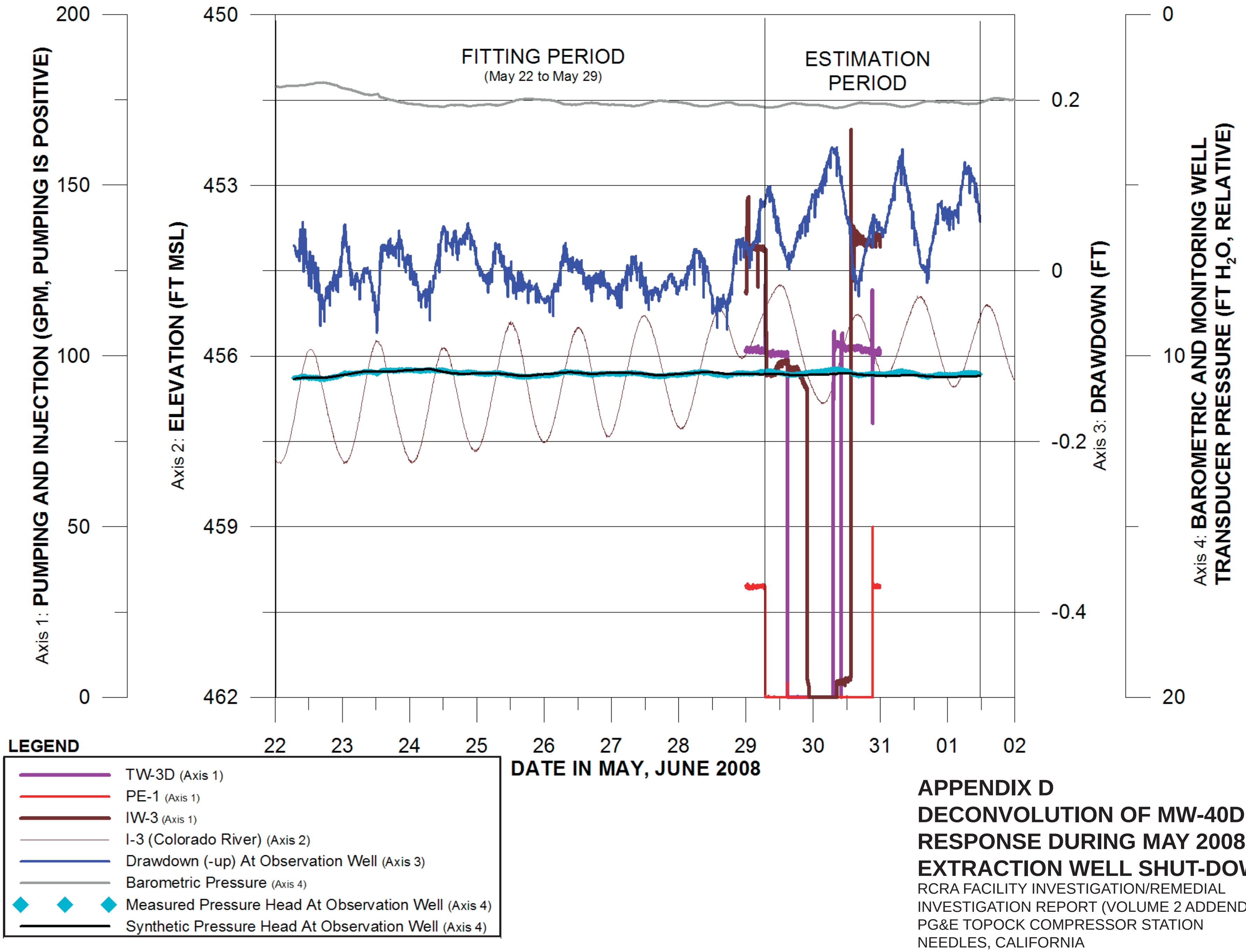
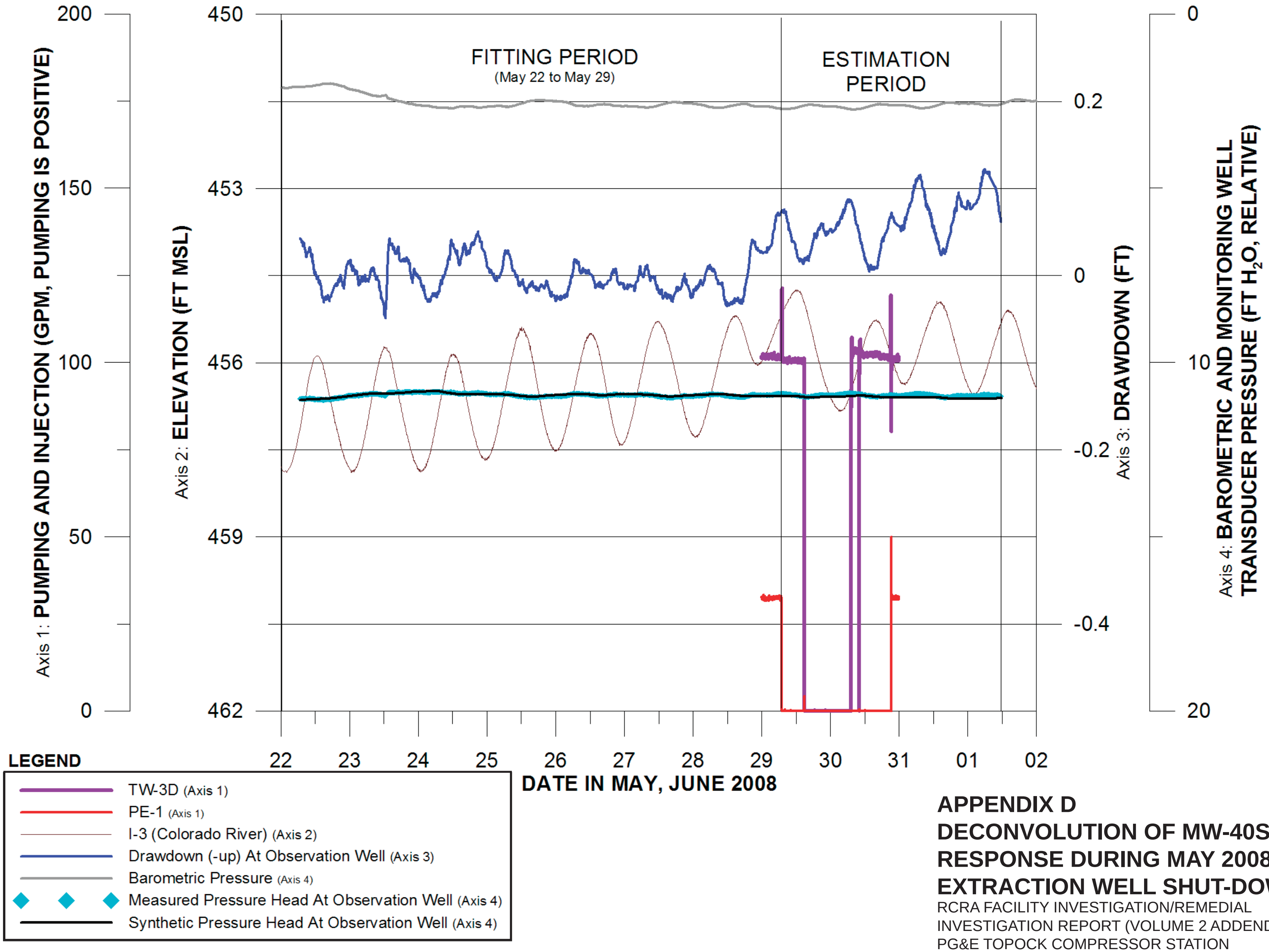


APPENDIX D
DECONVOLUTION OF MW-40D RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

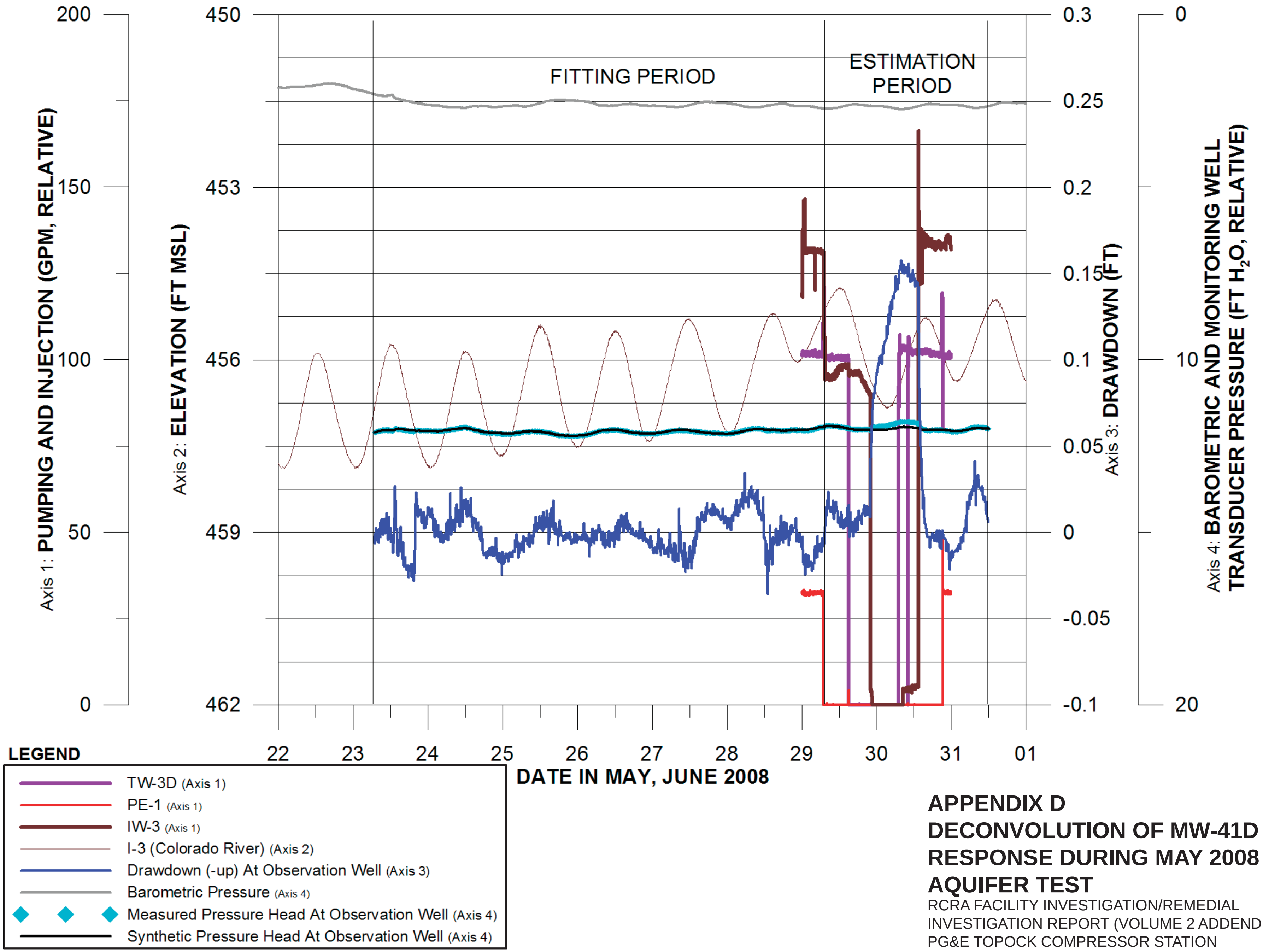
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



APPENDIX D
DECONVOLUTION OF MW-40S RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

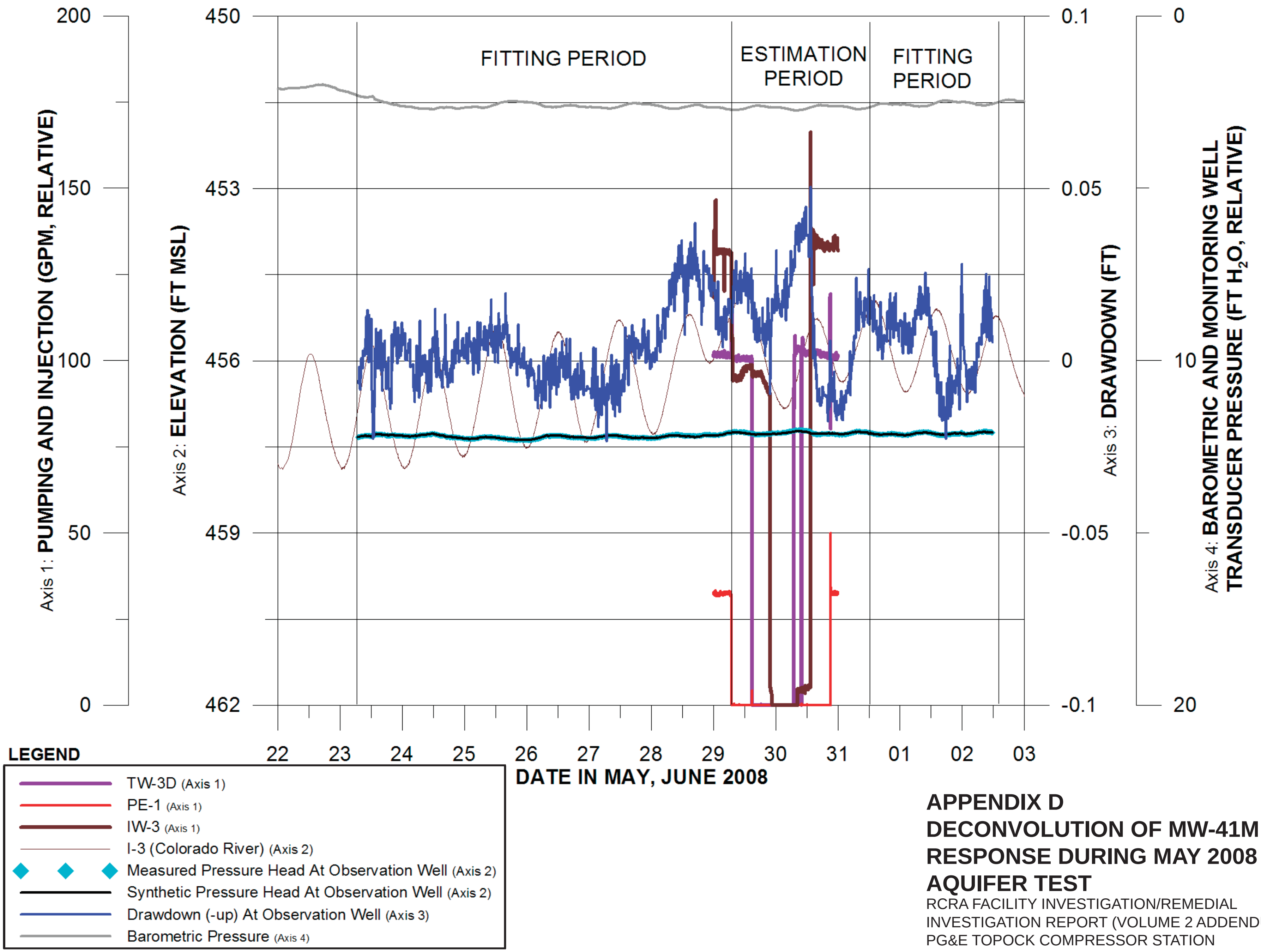
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



APPENDIX D
DECONVOLUTION OF MW-41D RESPONSE DURING MAY 2008 AQUIFER TEST

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

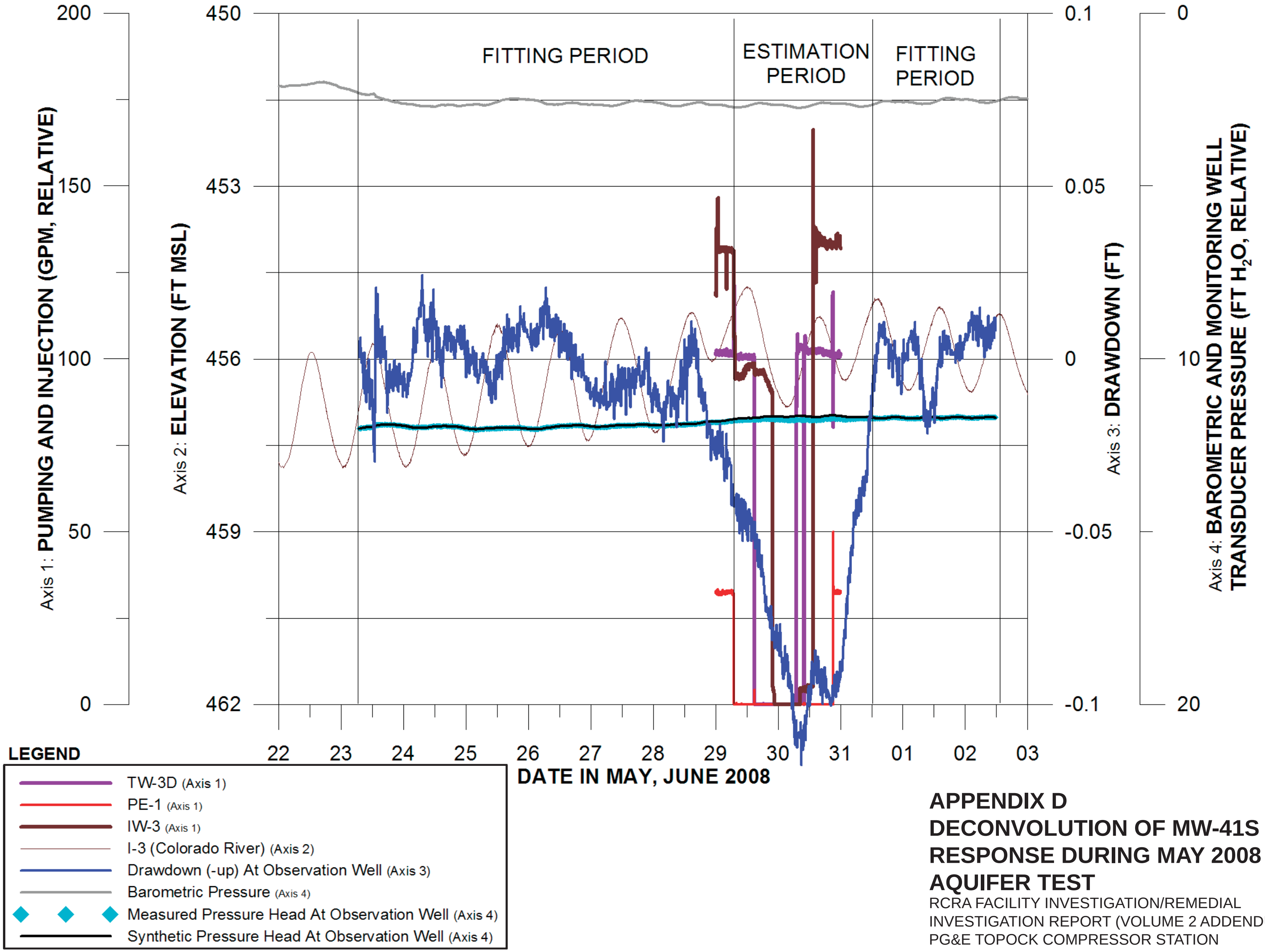
CH2MHILL



APPENDIX D
DECONVOLUTION OF MW-41M RESPONSE DURING MAY 2008 AQUIFER TEST

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

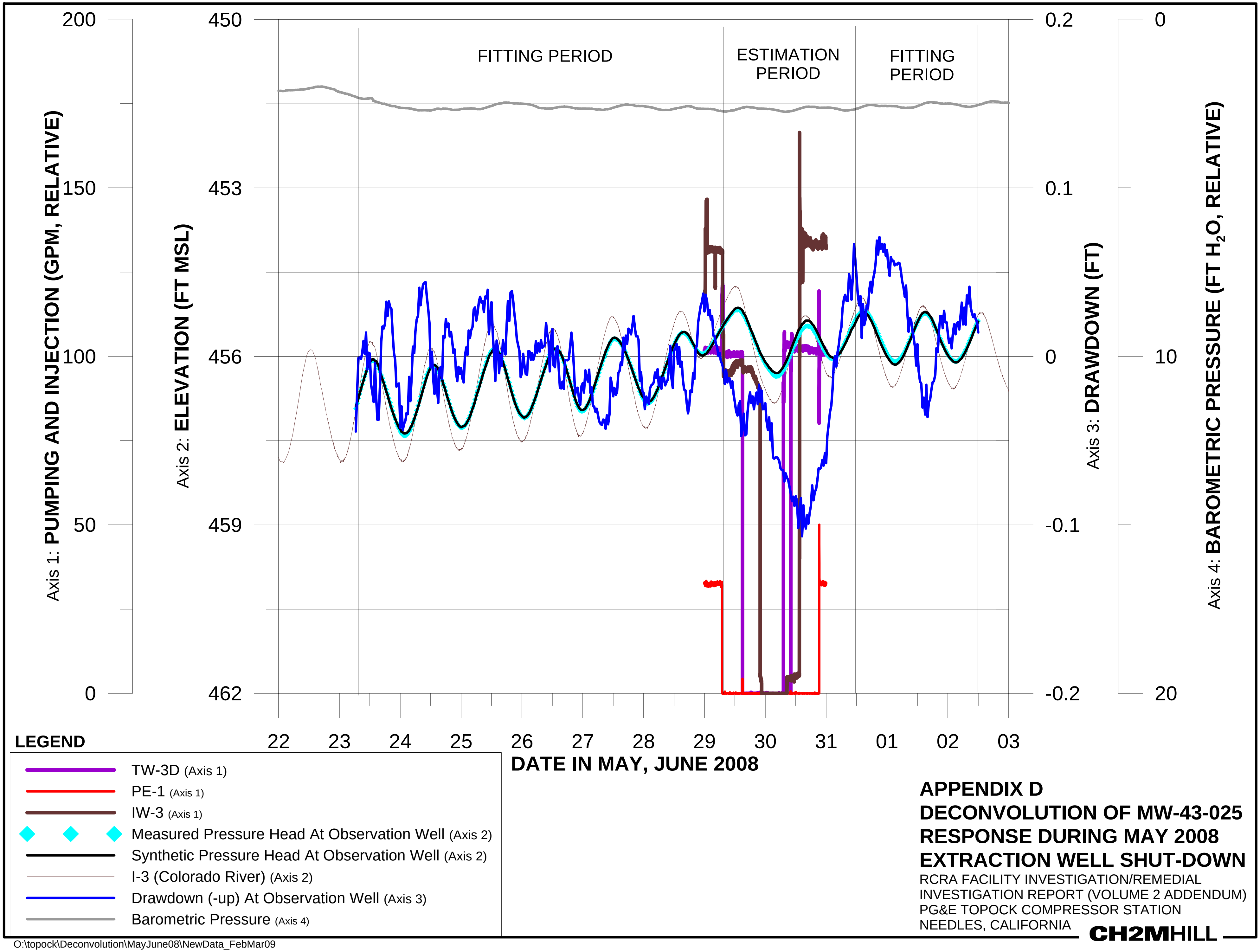
CH2MHILL



APPENDIX D
DECONVOLUTION OF MW-41S RESPONSE DURING MAY 2008 AQUIFER TEST

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



APPENDIX D
DECONVOLUTION OF MW-43-025 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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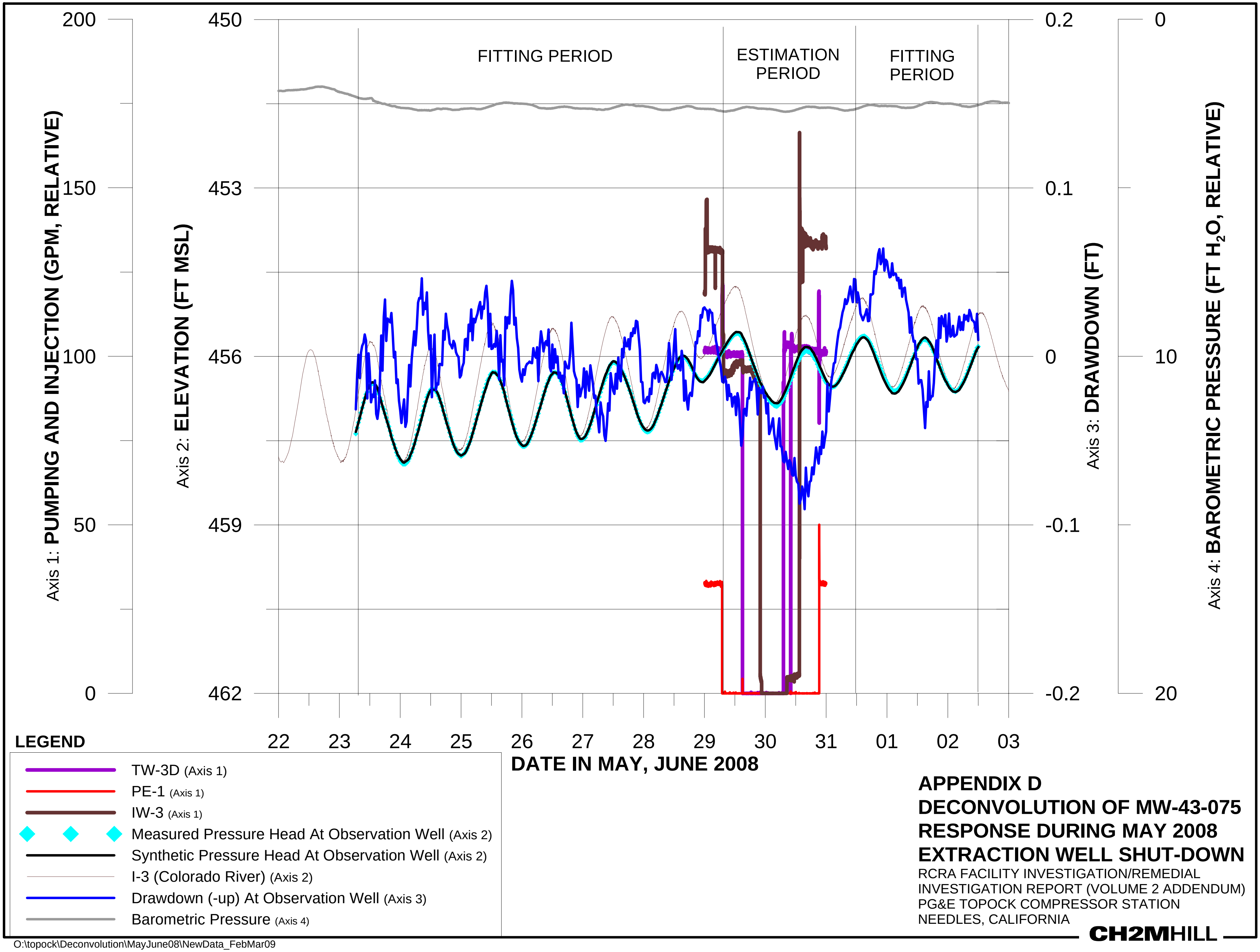

APPENDIX D
DECONVOLUTION OF MW-43-075 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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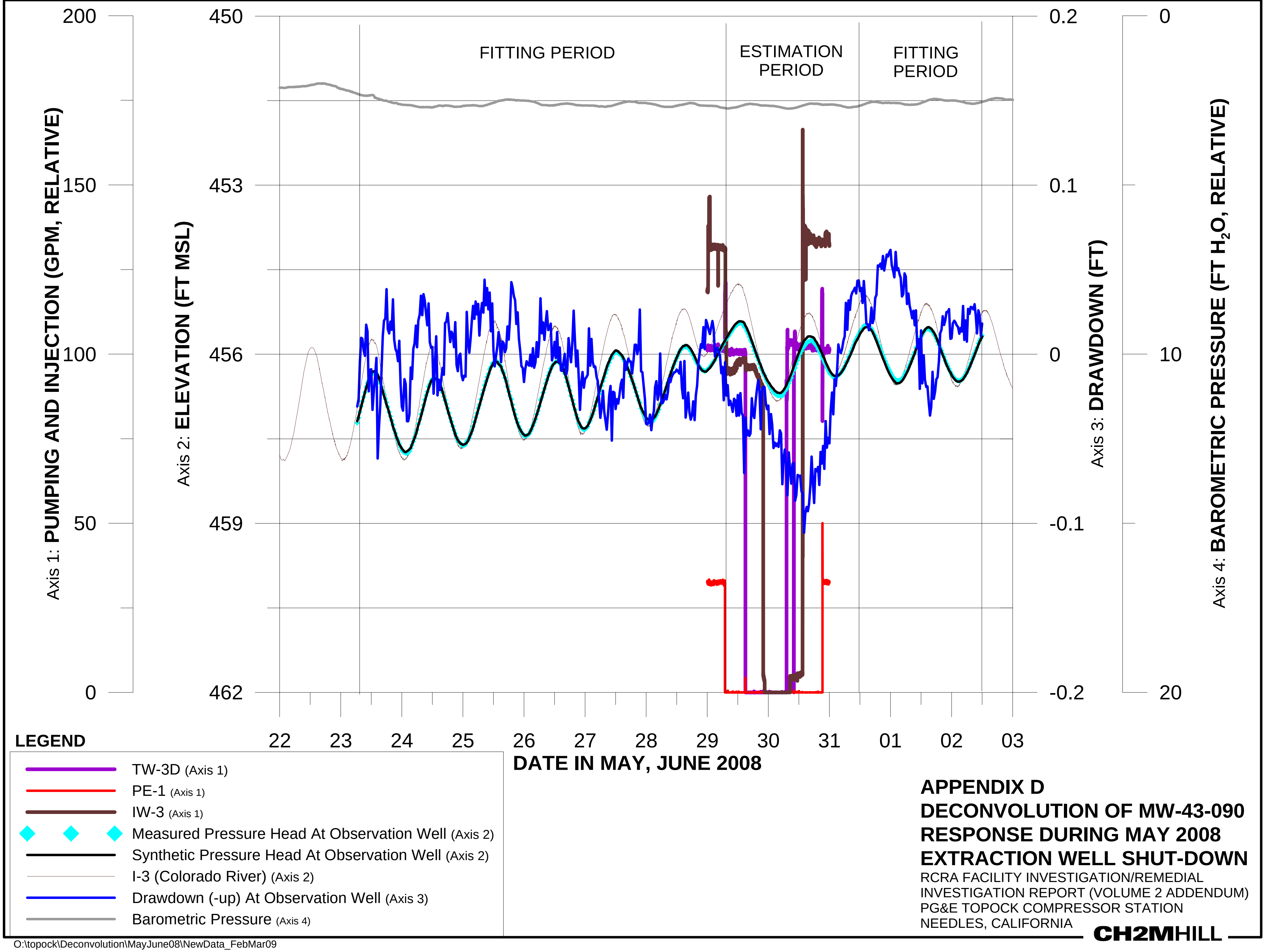

APPENDIX D
DECONVOLUTION OF MW-43-090 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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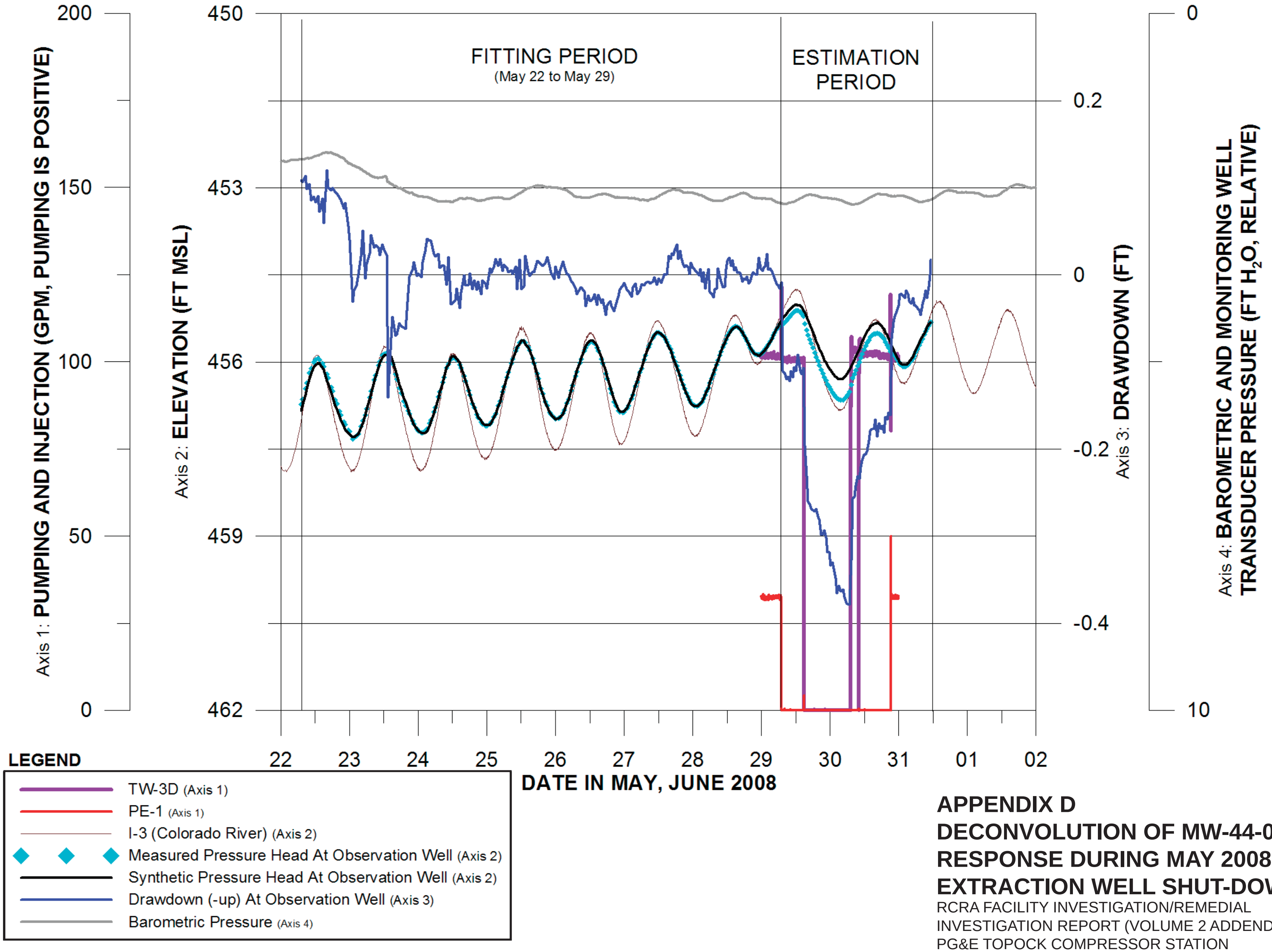

APPENDIX D
DECONVOLUTION OF MW-44-070 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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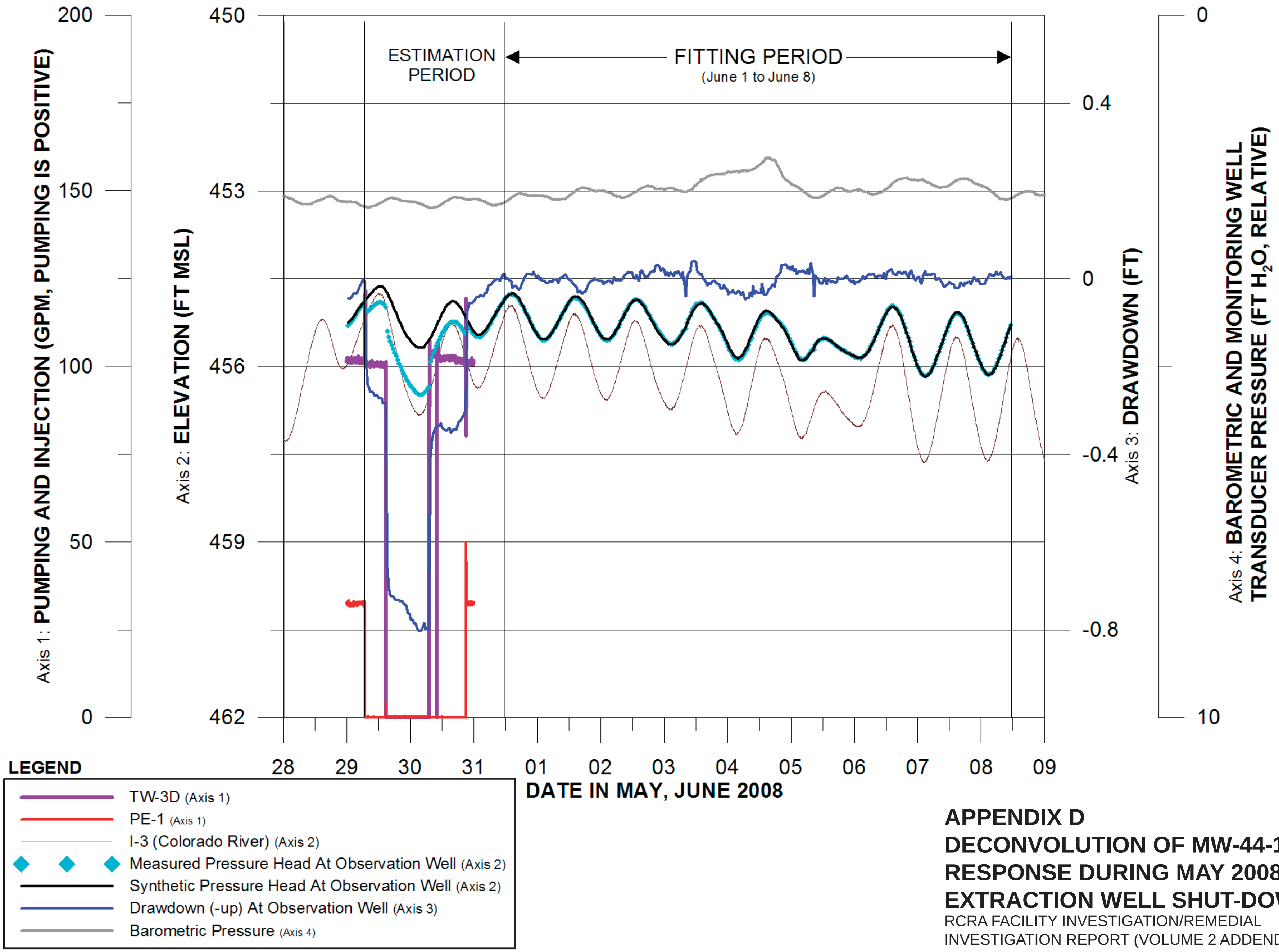

APPENDIX D
DECONVOLUTION OF MW-44-115 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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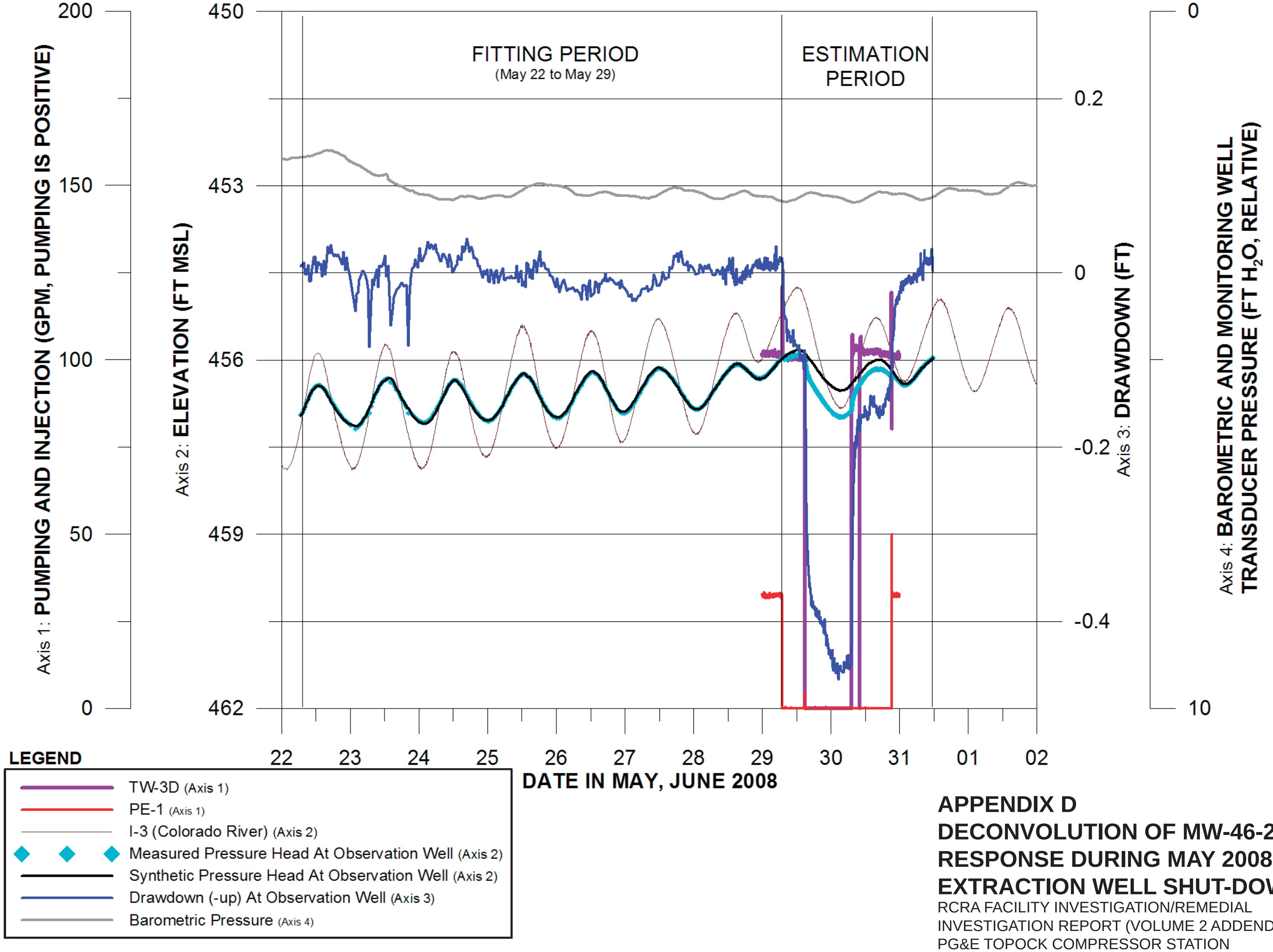
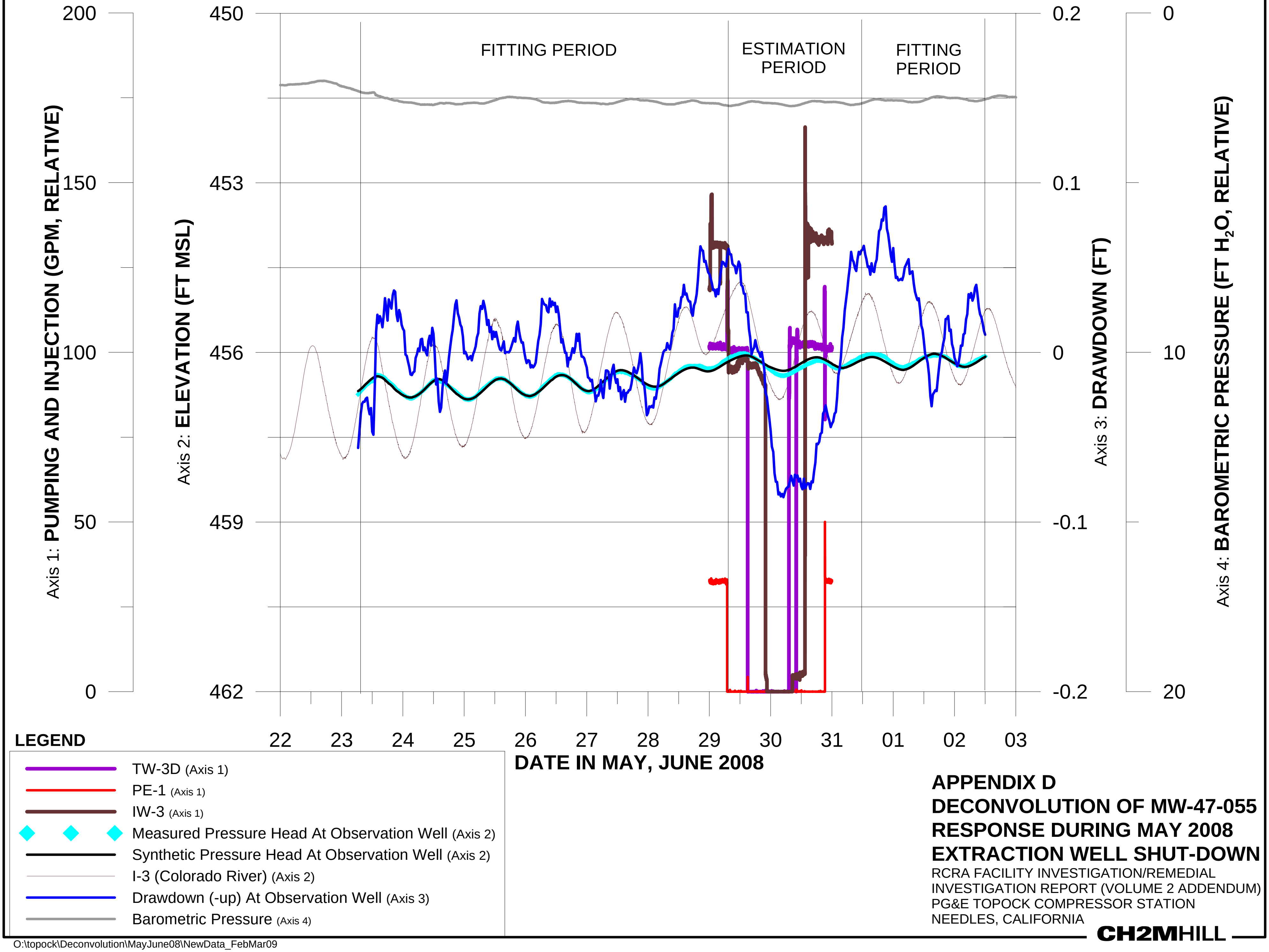


APPENDIX D
DECONVOLUTION OF MW-46-205 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



APPENDIX D
DECONVOLUTION OF MW-47-055 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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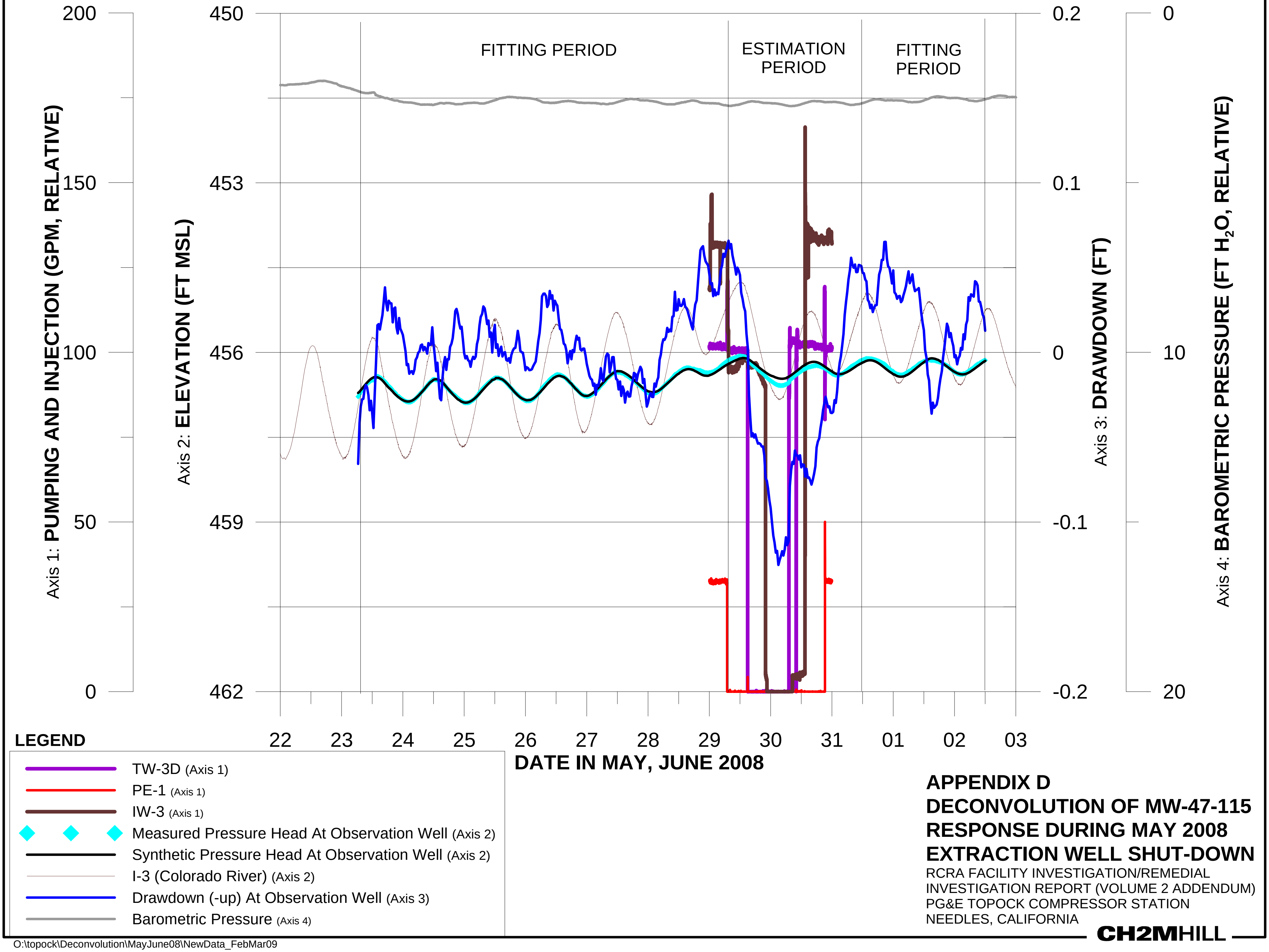

APPENDIX D
DECONVOLUTION OF MW-47-115 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
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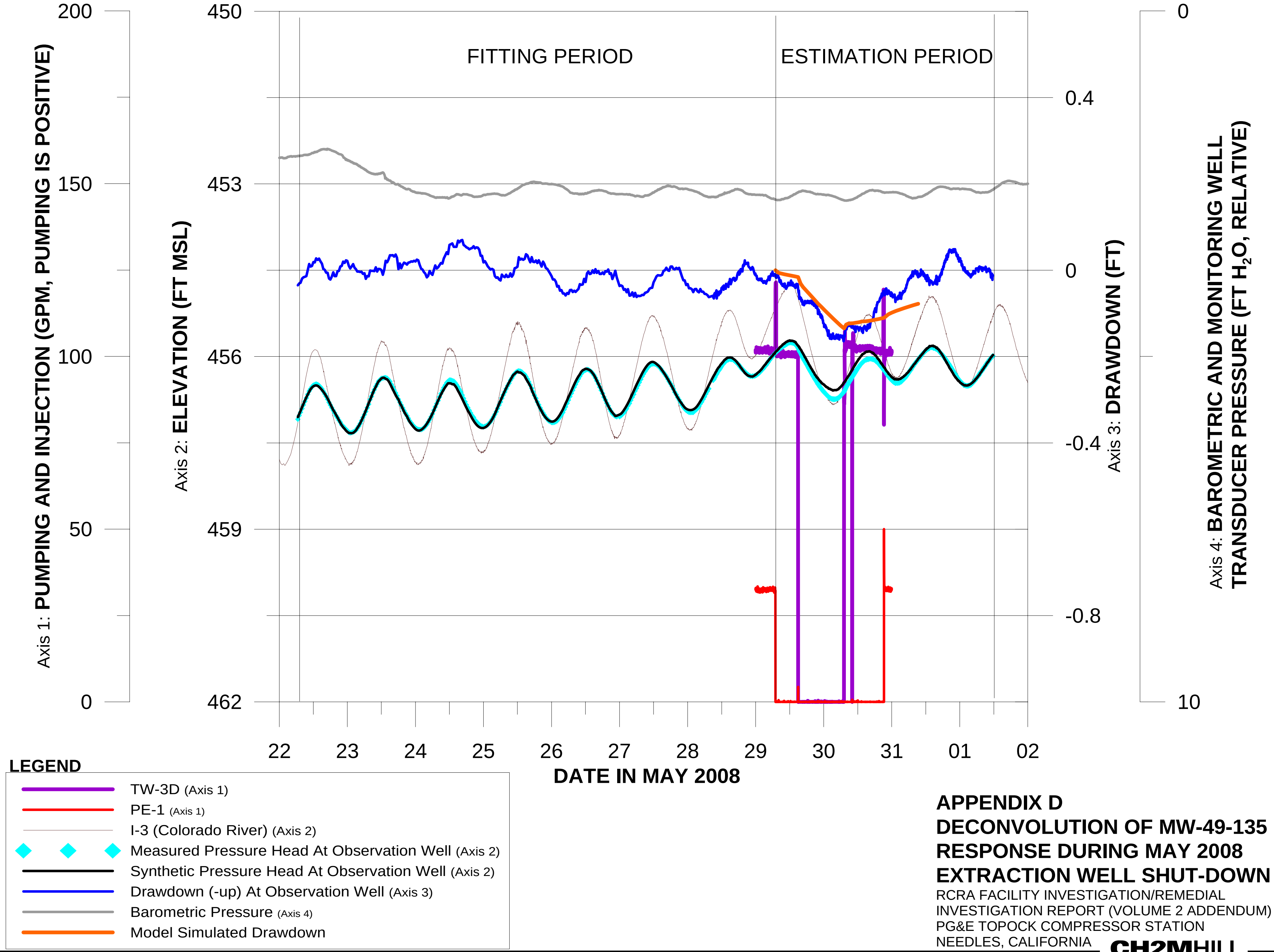

APPENDIX D
DECONVOLUTION OF MW-49-135 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
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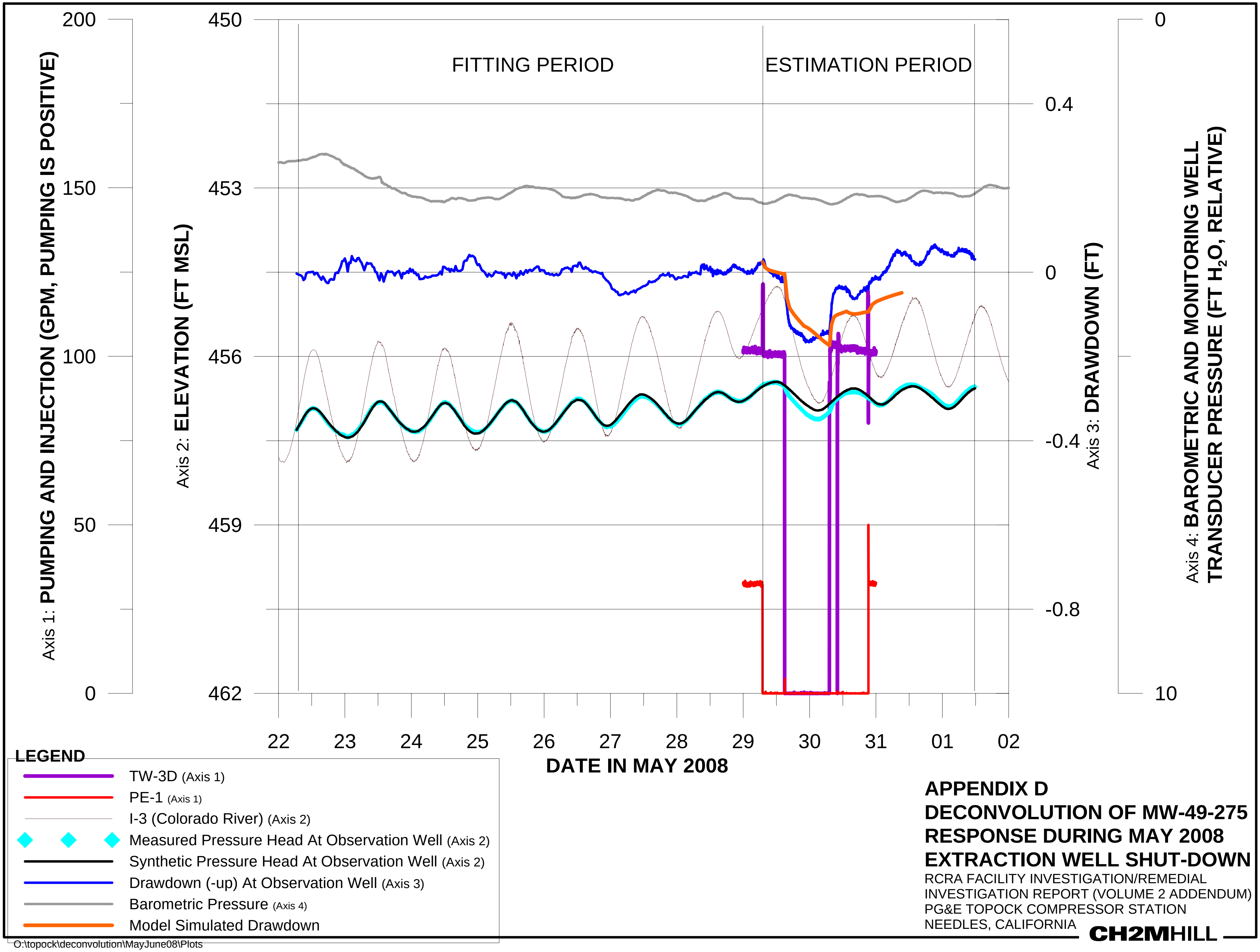

APPENDIX D
DECONVOLUTION OF MW-49-275 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
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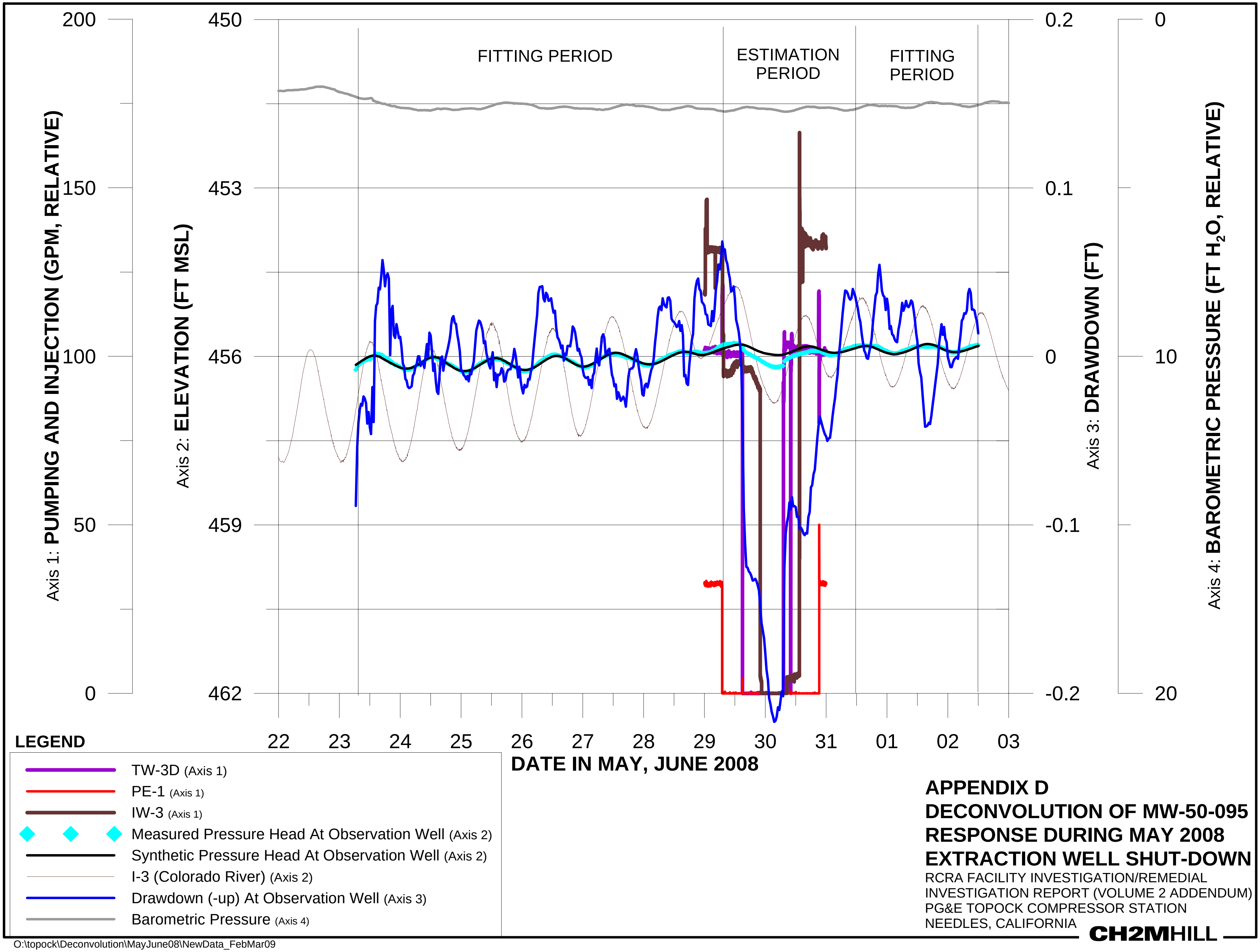

APPENDIX D
DECONVOLUTION OF MW-50-095
RESPONSE DURING MAY 2008
EXTRACTION WELL SHUT-DOWN
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
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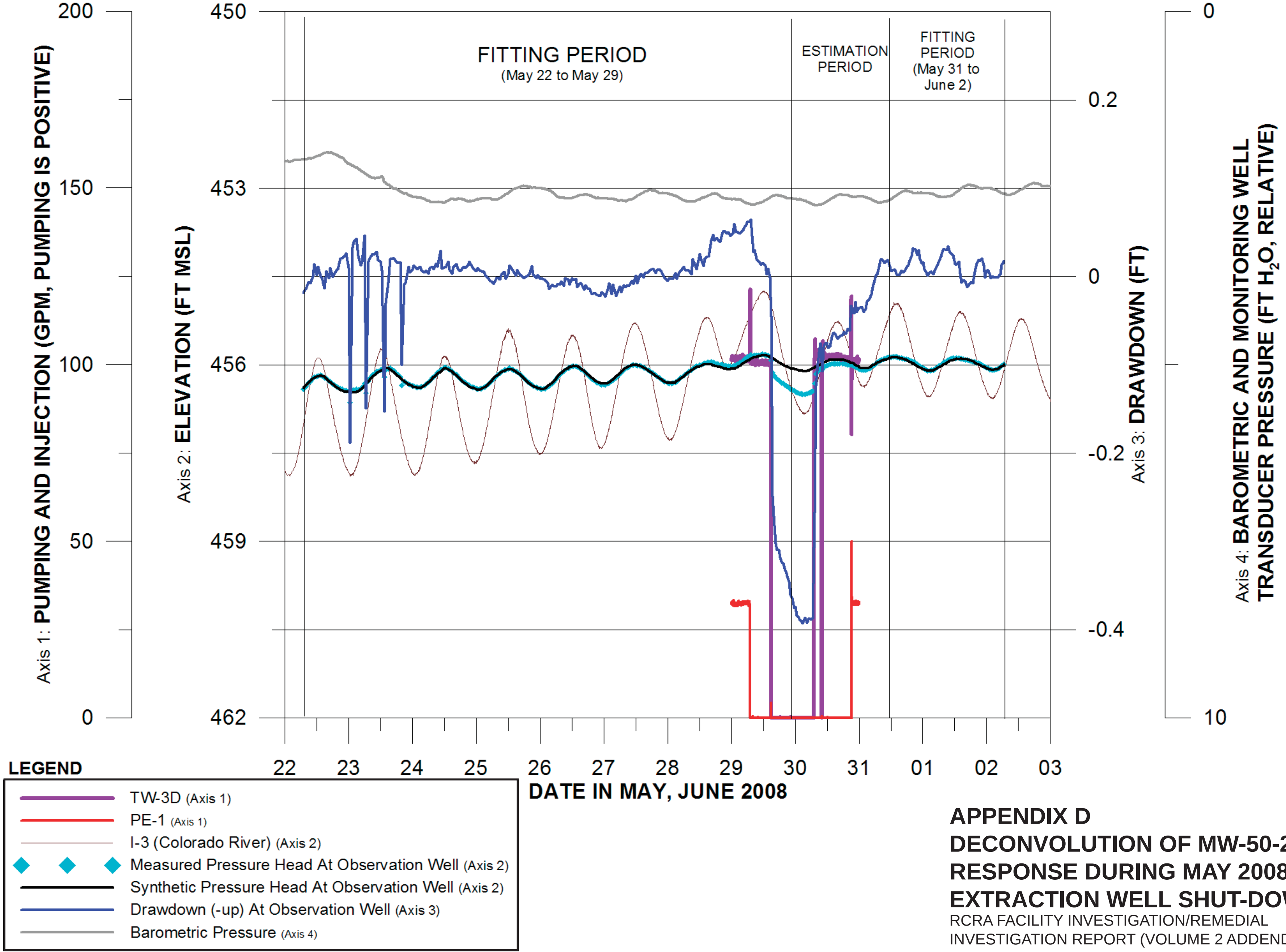

APPENDIX D
DECONVOLUTION OF MW-50-200 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

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INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
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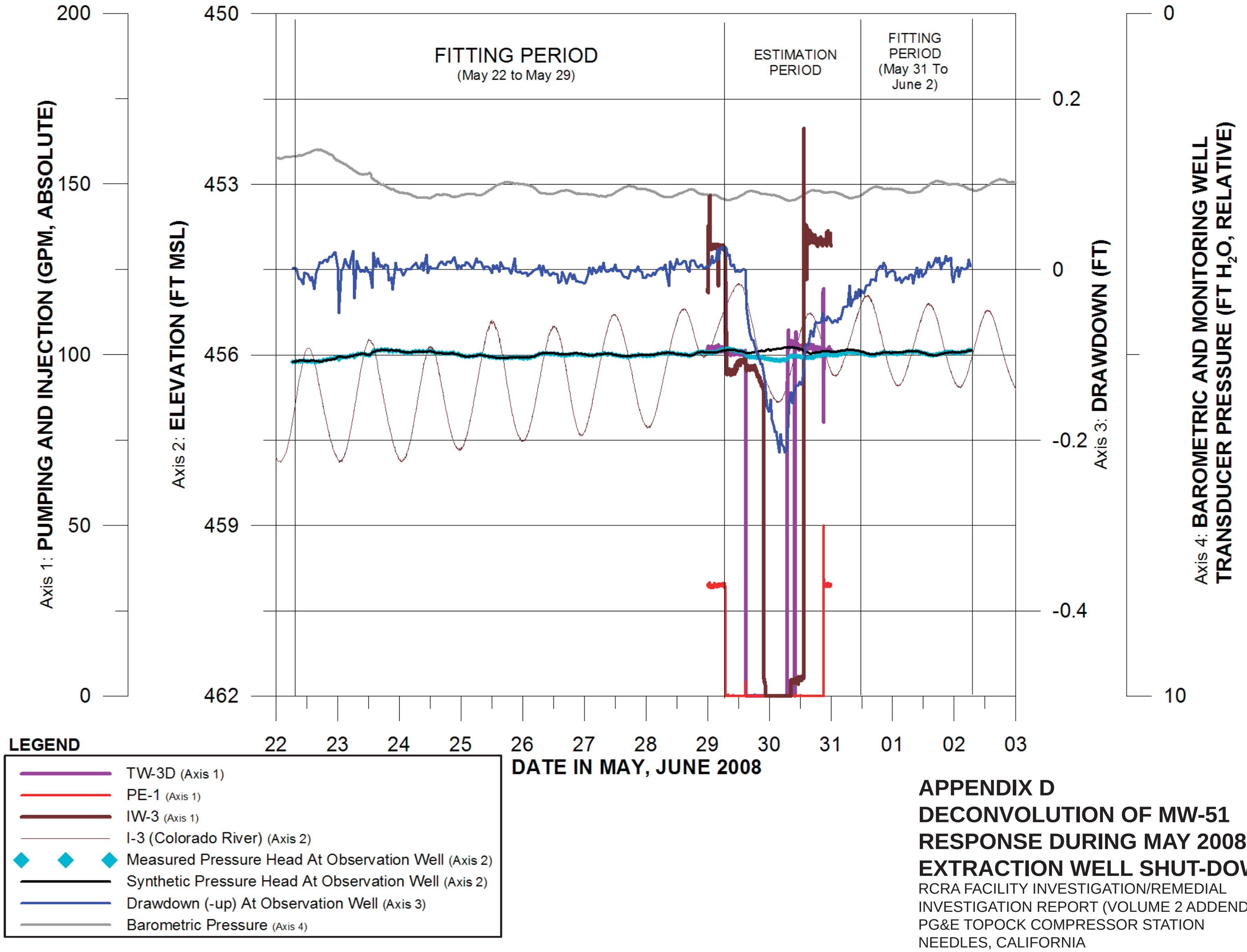

APPENDIX D
DECONVOLUTION OF MW-51 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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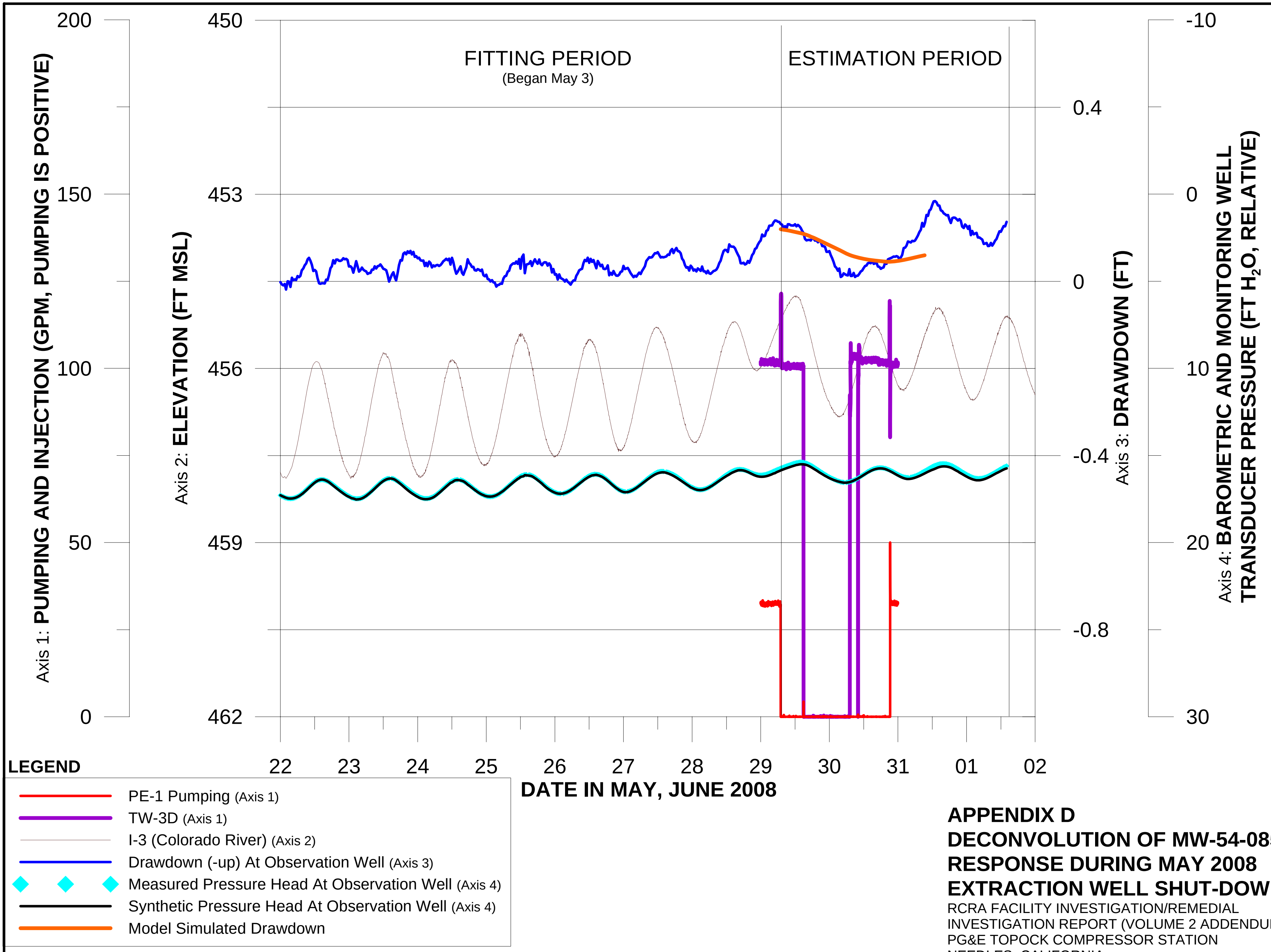

APPENDIX D
DECONVOLUTION OF MW-54-085 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
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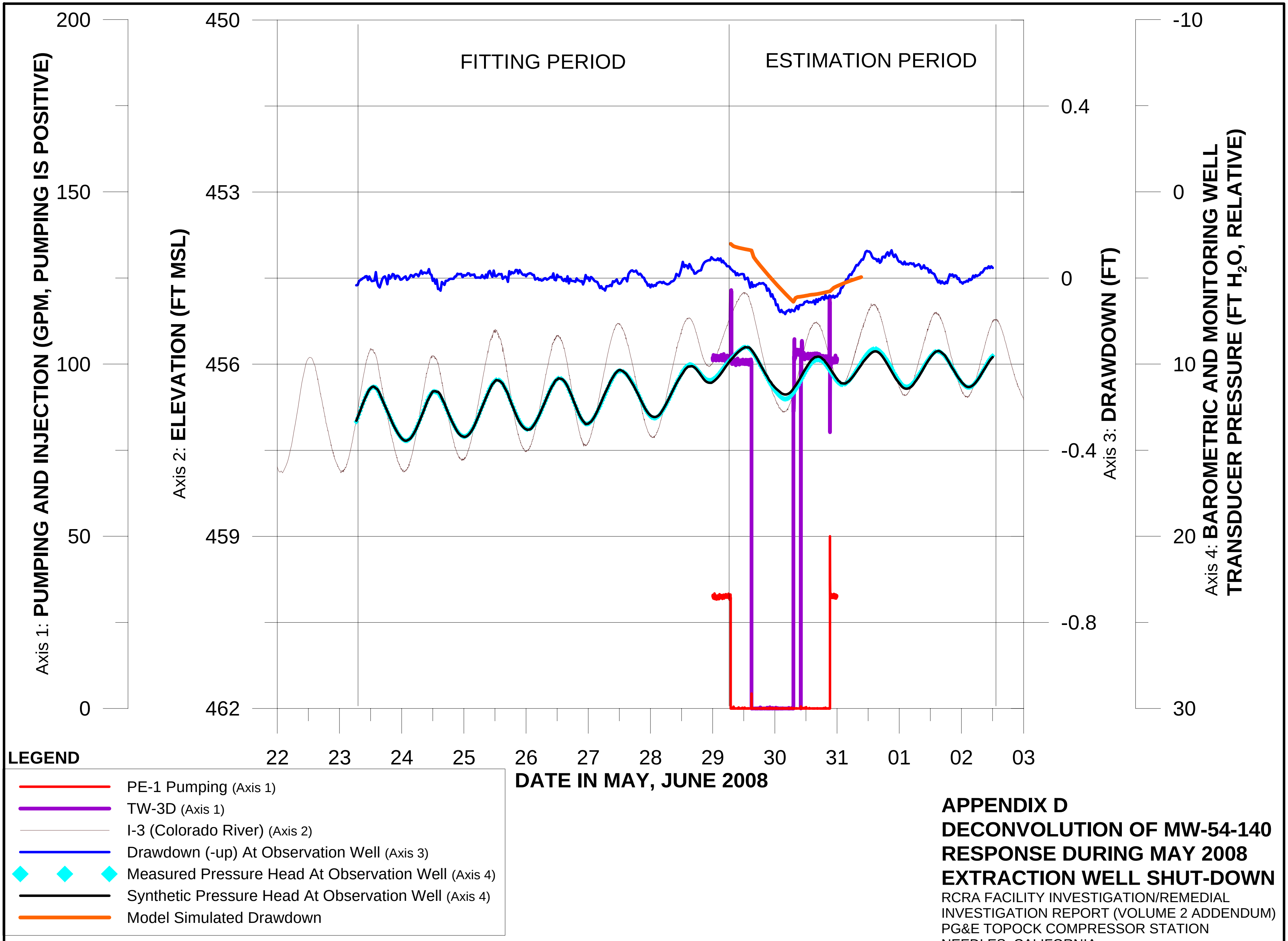

APPENDIX D
DECONVOLUTION OF MW-54-140 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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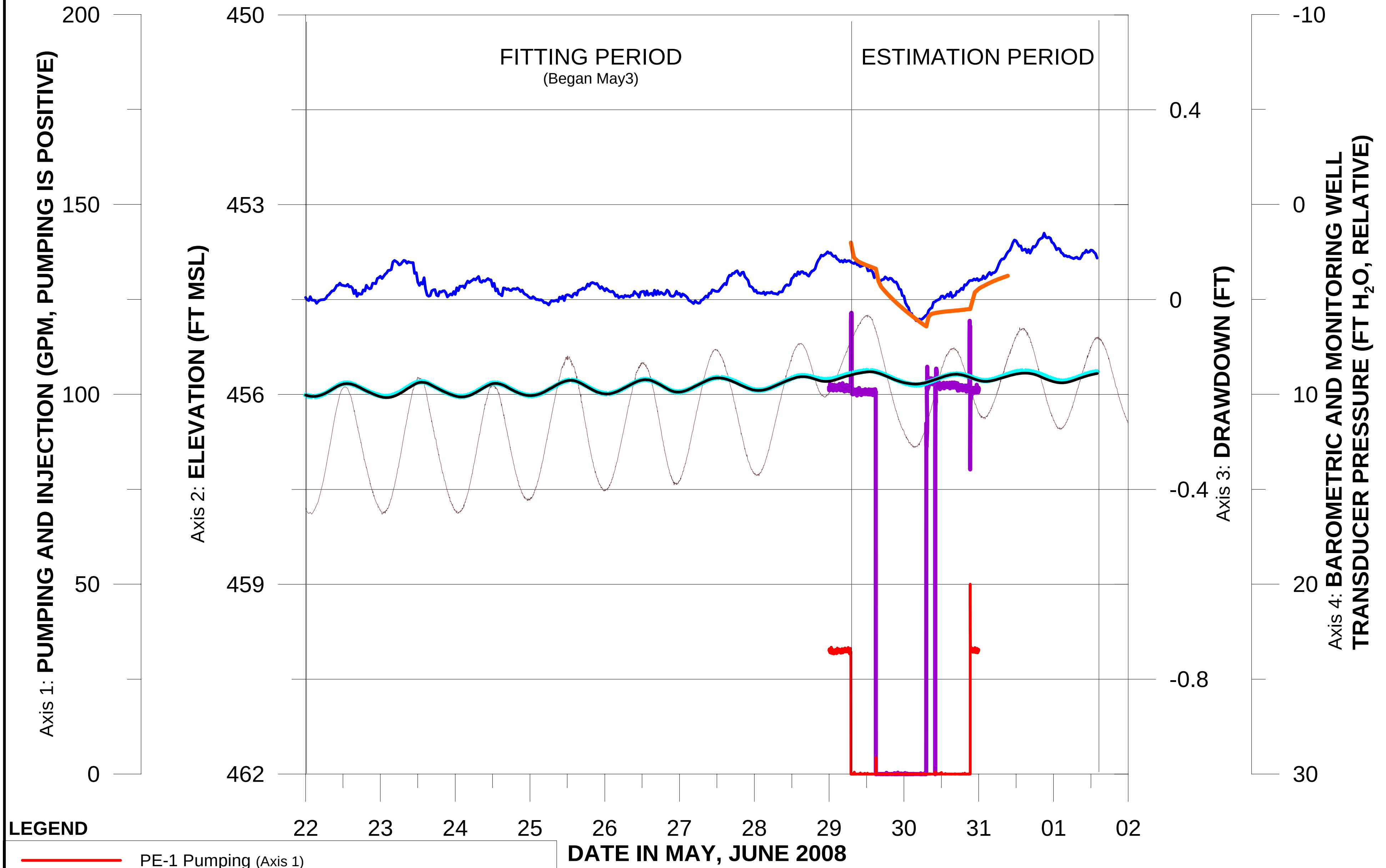

LEGEND

- PE-1 Pumping (Axis 1)
- TW-3D (Axis 1)
- I-3 (Colorado River) (Axis 2)
- Drawdown (-up) At Observation Well (Axis 3)
- ◆ ◆ ◆ Measured Pressure Head At Observation Well (Axis 4)
- Synthetic Pressure Head At Observation Well (Axis 4)
- Model Simulated Drawdown

APPENDIX D
DECONVOLUTION OF MW-54-195 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
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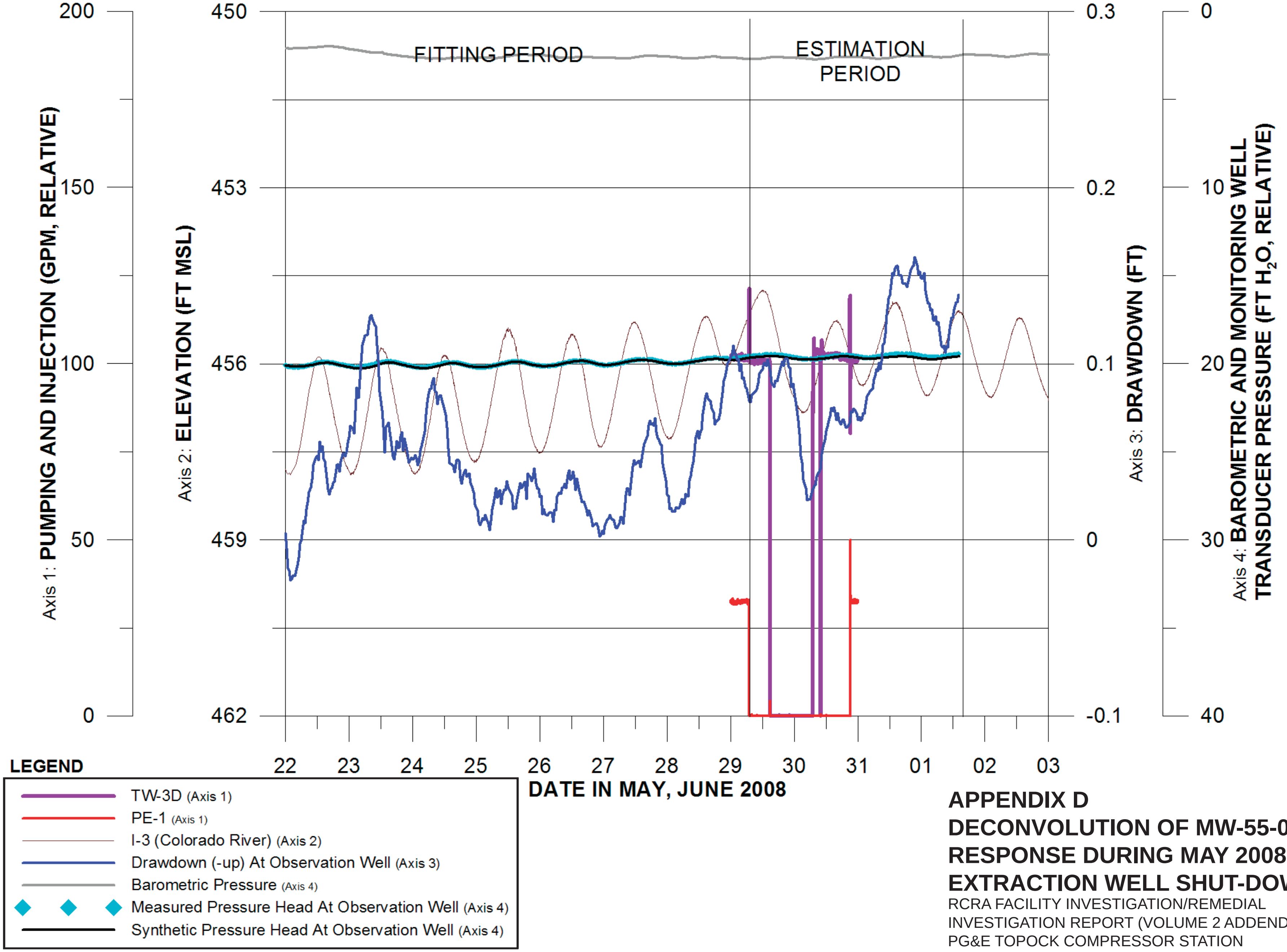

APPENDIX D
DECONVOLUTION OF MW-55-045 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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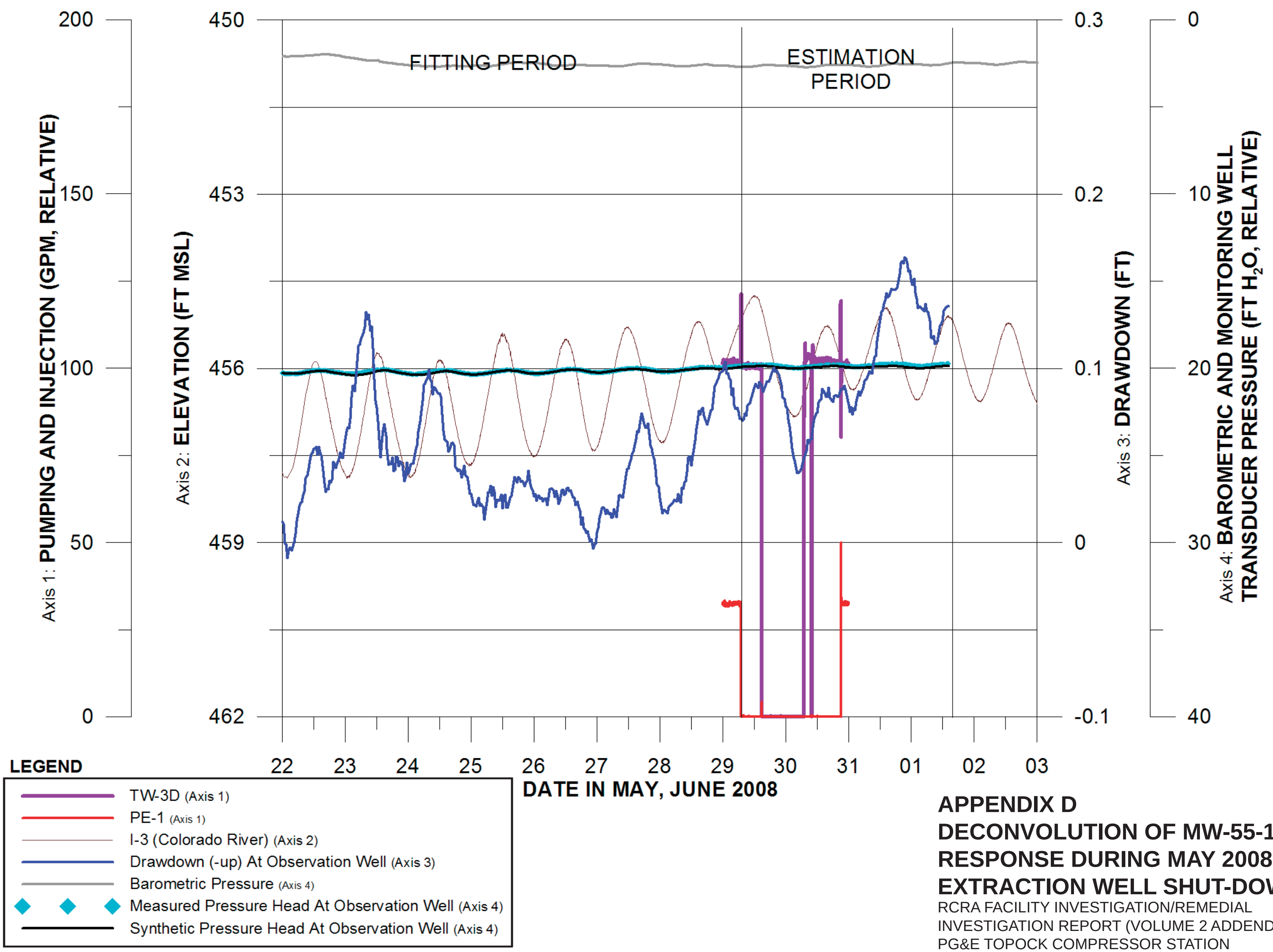
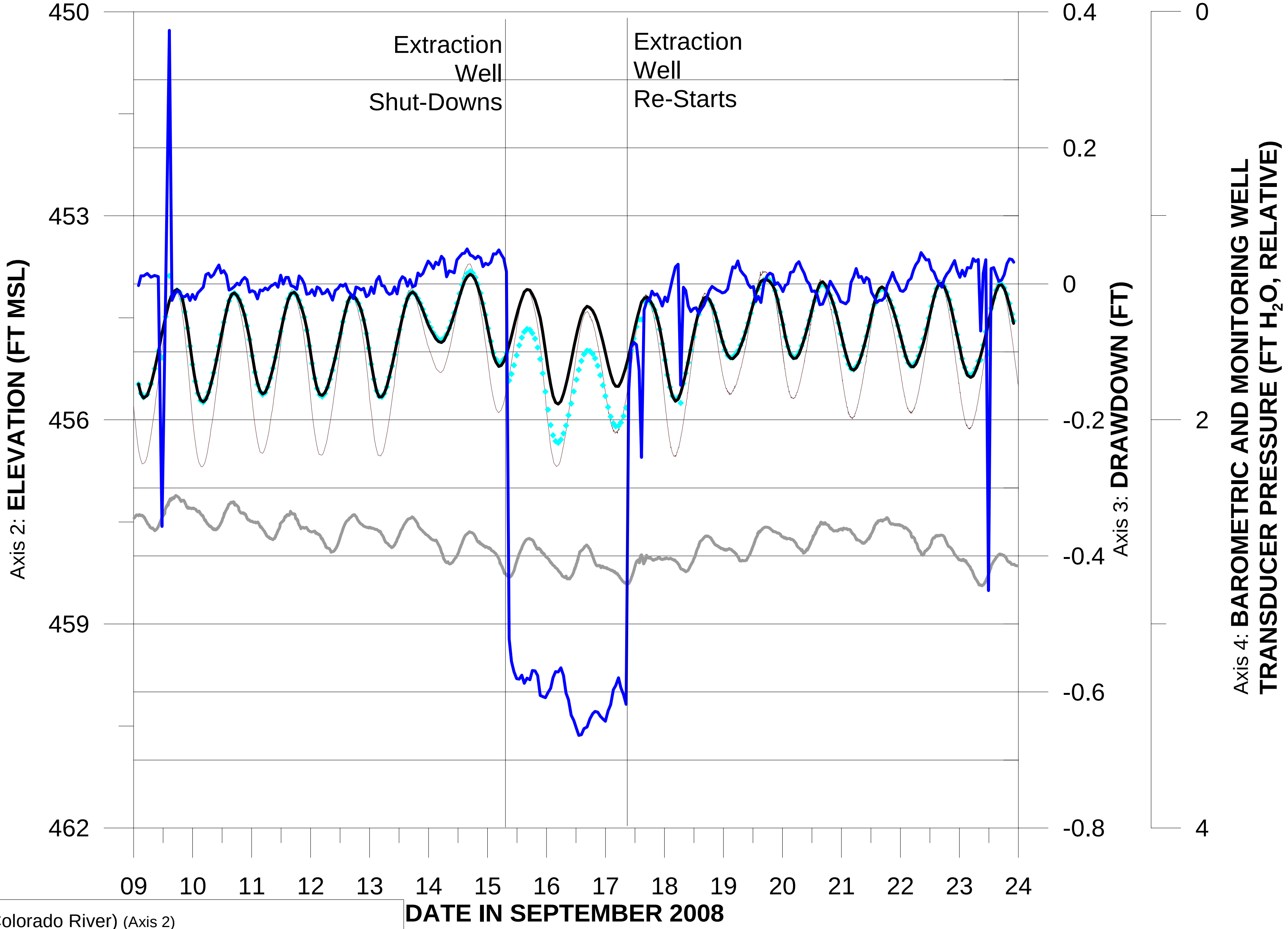


APPENDIX D
DECONVOLUTION OF MW-55-120 RESPONSE DURING MAY 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

D2 September 2008 Test



LEGEND

- I-3 (Colorado River) (Axis 2)
- ◆ ◆ ◆ Measured Pressure Head At Observation Well (Axis 2)
- Synthetic Pressure Head At Observation Well (Axis 2)
- Drawdown (-up) At Observation Well (Axis 3)
- Barometric Pressure (Axis 4)

APPENDIX D
DECONVOLUTION OF MW-34-100 RESPONSE DURING SEPTEMBER 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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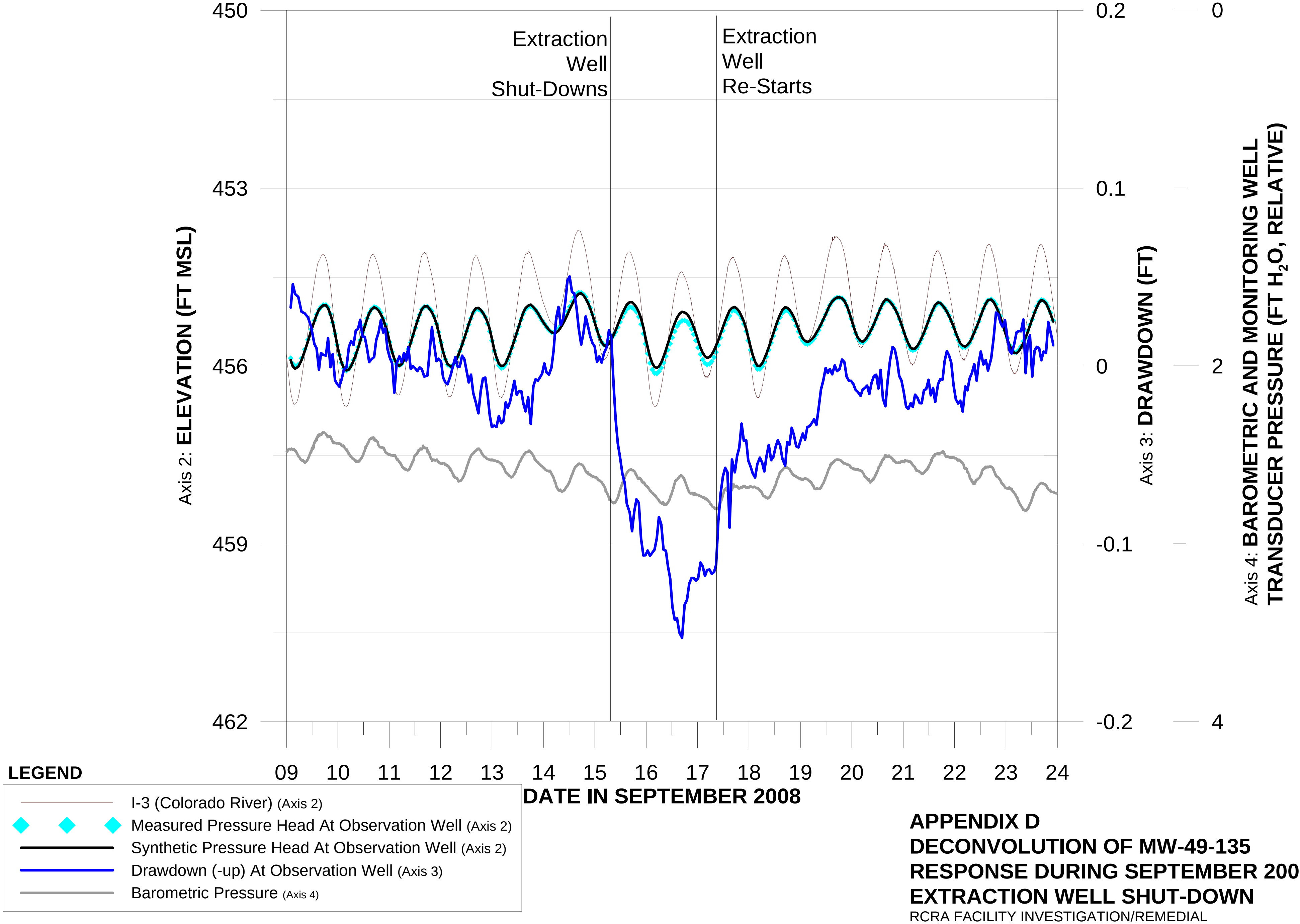

APPENDIX D
DECONVOLUTION OF MW-49-135 RESPONSE DURING SEPTEMBER 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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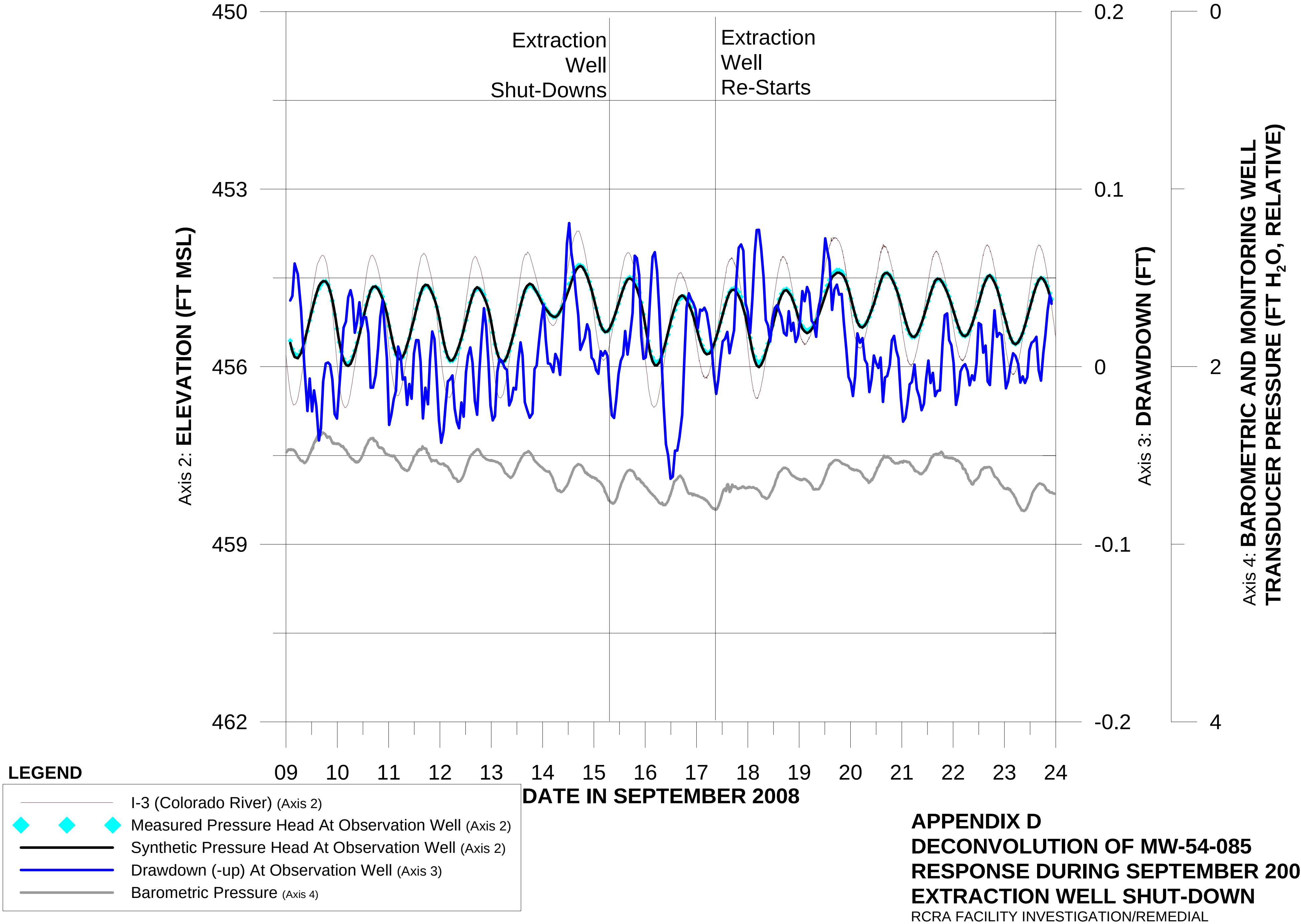

APPENDIX D
DECONVOLUTION OF MW-54-085 RESPONSE DURING SEPTEMBER 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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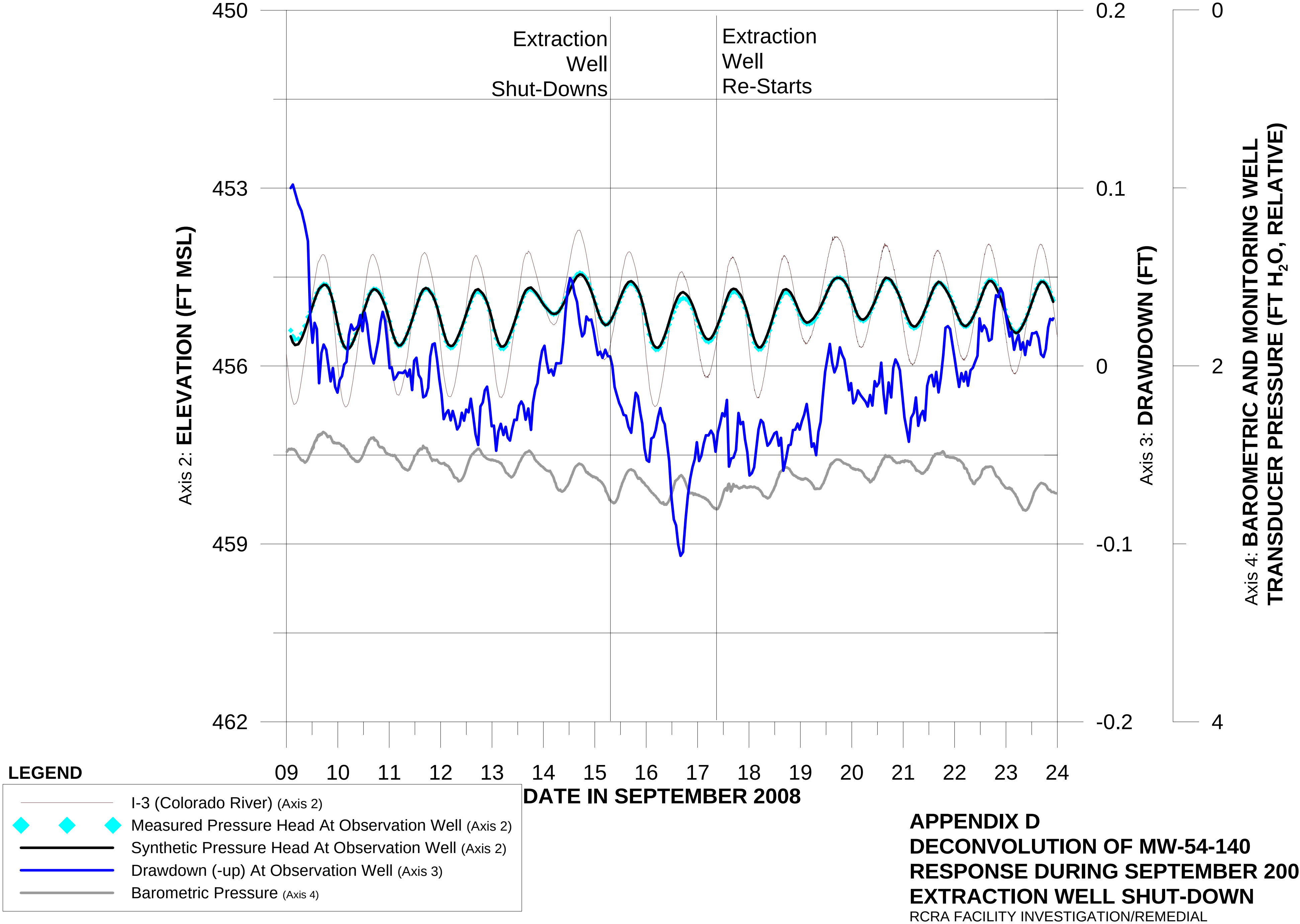

APPENDIX D
DECONVOLUTION OF MW-54-140 RESPONSE DURING SEPTEMBER 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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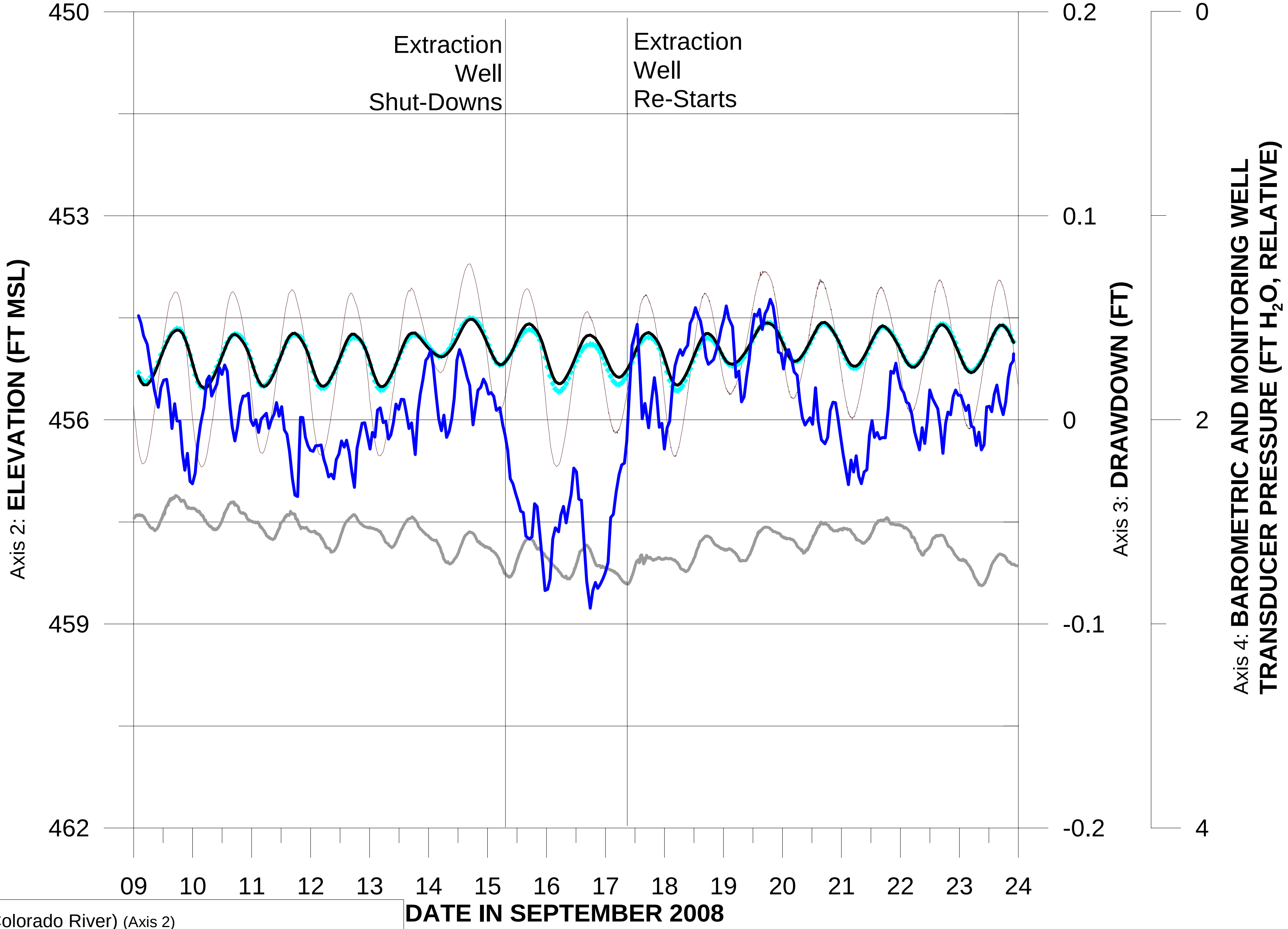

APPENDIX D
DECONVOLUTION OF MW-54-195 RESPONSE DURING SEPTEMBER 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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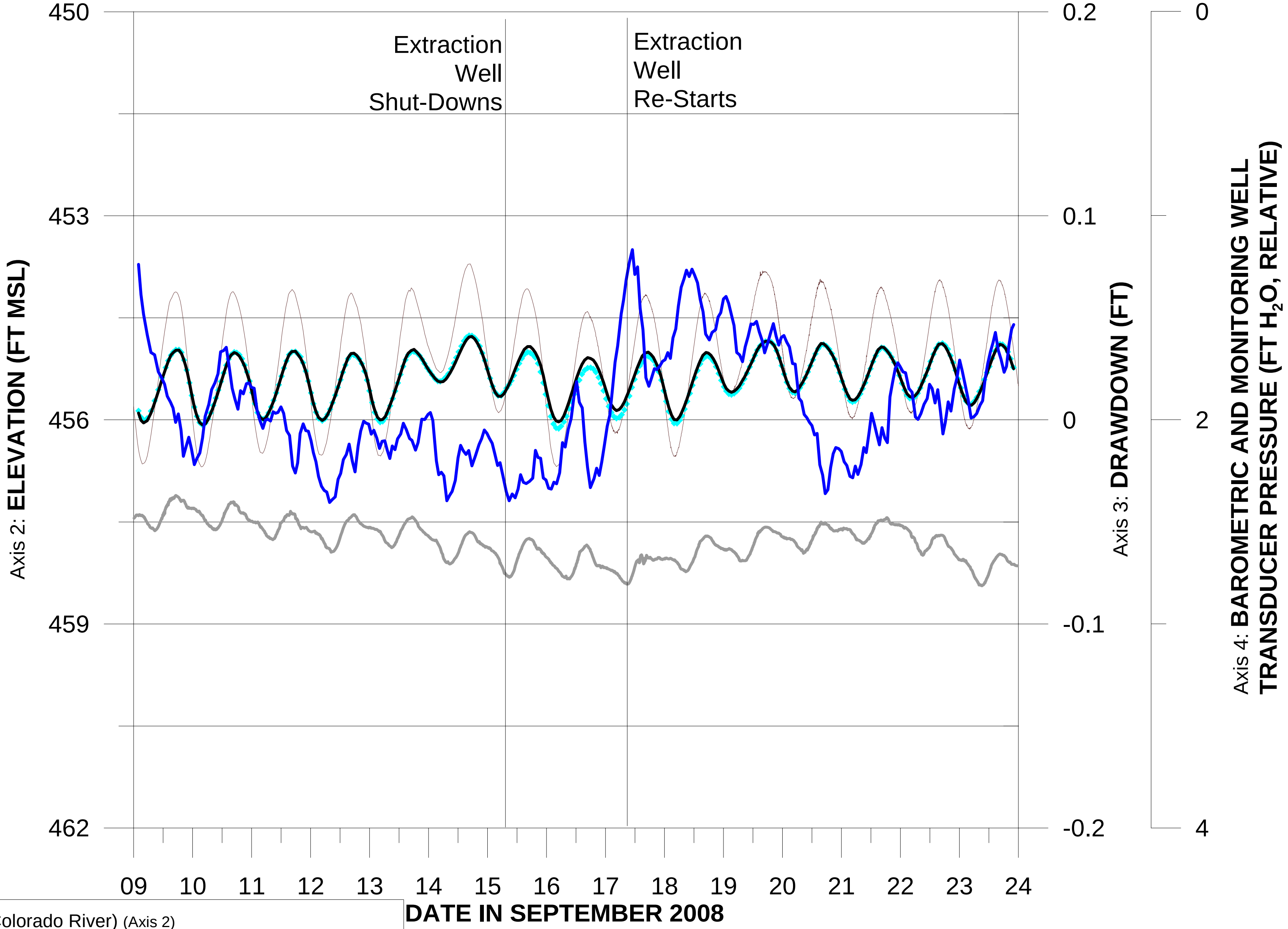
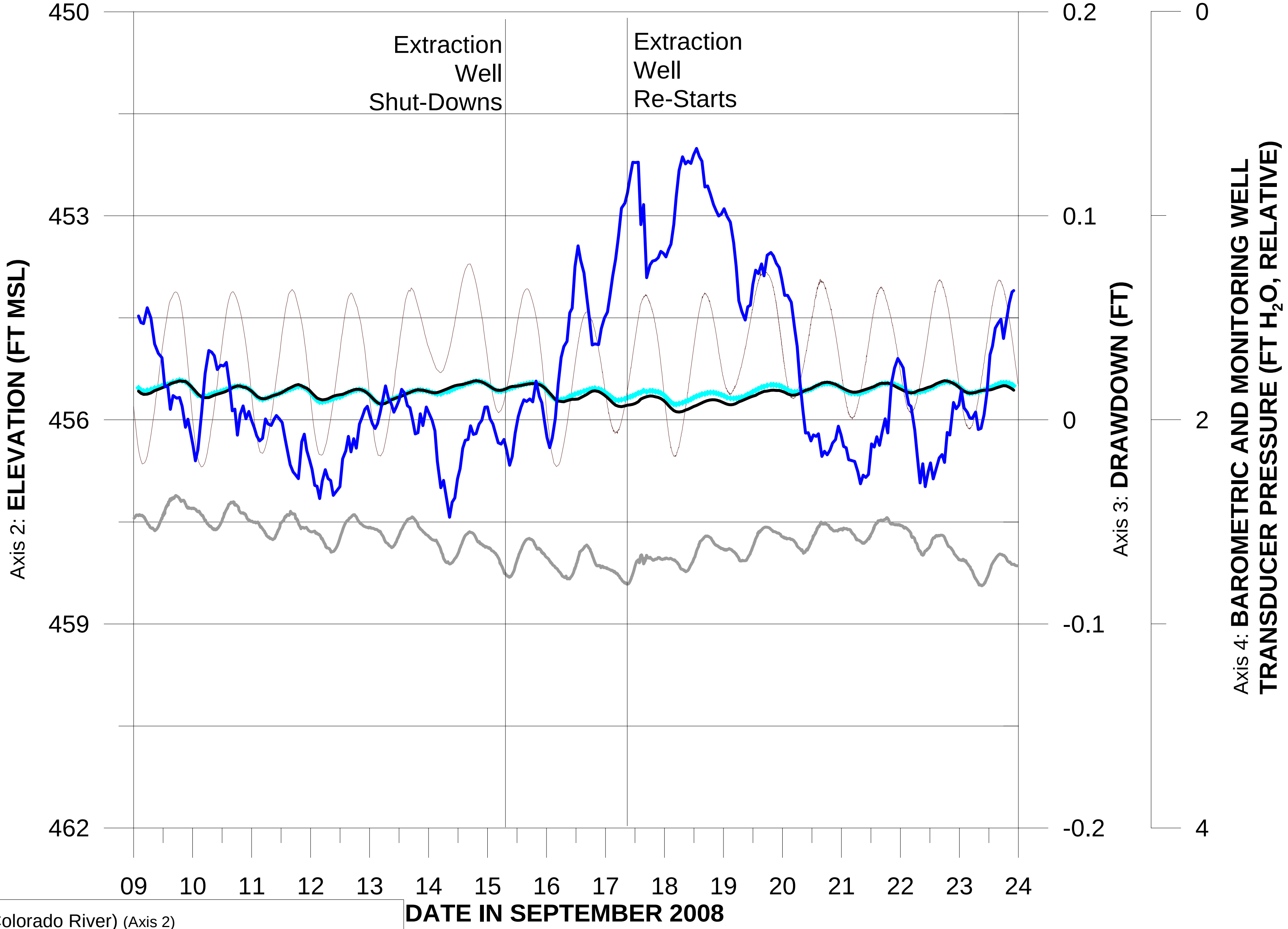


APPENDIX D
DECONVOLUTION OF MW-55-045 RESPONSE DURING SEPTEMBER 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



APPENDIX D
DECONVOLUTION OF MW-55-120 RESPONSE DURING SEPTEMBER 2008 EXTRACTION WELL SHUT-DOWN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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Appendix E
Addendum Groundwater Analytical Data

(Provided Only on CD-ROM)

Appendix F
Response to Comments

F1 Tribal Comments on the November 2008 Draft RFI/RI Volume 2 Addendum Report

Agency	Comment Number	Section	Comment	Response
Fort Mojave Indian Tribe Comments				
Hargis + Associates, Inc. (on behalf of the Fort Mojave Indian Tribe)	H+A-1	General	While Figure 2-6 summarizes the maximum response of each well during the shutdown of the extraction injection system wells, we would also like to see a graphical representation of the time-series response in the affected Arizona and California wells. This would be an inclusion that would help readers understand the nature of the hydraulic influence.	The time-series response figures have been added as a new Appendix D to the Addendum. The groundwater analytical data have been renamed Appendix E.
Hargis + Associates, Inc. (on behalf of the Fort Mojave Indian Tribe)	H+A-2	Sec. 3.3	Under Section 3.3 Conclusions, the statement is made that "No additional groundwater characterization is needed to complete the groundwater RFI/RI as addressed and presented in the RFI/RI Volume 2 Report." The Tribe is wondering whether the IM-3 testing data will assist in further numerical groundwater calibrations.	The statement cited was made with regard to level of characterization needed for the purposes of the RFI/RI – that is to determine the nature and extent of contamination of the media addressed. Further numerical modeling may be useful in the selection and design of the remedial actions, and the IM-3 testing data could be used to assist in further numerical groundwater calibrations as the commenter suggests. Text in Sections 2.2.3 and 3.1 has been revised accordingly. At present, the previously-calibrated 5-layer groundwater model is being used in the CMS/FS.

F2 Agency and Stakeholder Comments on the December 2008 RFI/RI Volume 2 Addendum Report

Agency	Comment Number	Section	Comment	PG&E Response	DTSC Response
General Comments					
Department of Toxic Substances Control	DTSC-1	General	As stated in the RCRA Facility Investigation/ Remedial Investigation (RFI/RI) Volume 2 Report, an analysis of specific conductance and hexavalent chromium relationships over time in site alluvial wells will be conducted and included as part of the RFI/RI Volume 2 Addendum.	Agreed. The analysis of specific conductance and hexavalent chromium over time will be presented in an appendix to the RFI/RI Volume 2 Addendum.	NRR (No Response Required)
Department of Toxic Substances Control	DTSC-2	General	Recent versions of the RFI/RI Volume 2 Report introduced discussion of nitrate variability within groundwater at the Topock Compressor Station area. The GSU's evaluation of nitrate data contained in the RFI/RI Volume 2 Report Appendix indicates that nitrate occurs within the chromium plume at concentrations exceeding Maximum Contaminant Levels and regional background, and therefore, appears to be a Constituent of Potential Concern (COPC) to be carried forward through the RCRA/CERCLA process. To better assess this conclusion, it is recommended that the Addendum contain a section on nitrate occurrence at the site and include a figure like those for the trace metals to illustrate its distribution.	Understood. A section discussing nitrate distribution will be added to the Addendum as requested. In addition, a discussion on manganese, antimony, and beryllium will be added to be consistent with the February 2009 RFI/RI Volume 2 Report: During final preparation of that report, some corrections were made on noting the frequency of UTL exceedances. As a result, these three metals were added to the COPC discussion. In the Addendum report, the exceedance criteria for inclusion of analytes into the COPC discussion will be revised to be consistent with the RFI/RI Volume 2 Report and the specific text below is proposed to be added: Manganese, Beryllium, and Antimony These metals were discussed in RFI/RI Volume 2, where it was concluded that none of their distributions suggested a plume associated with SWMU-1 /AOC 1 or SWMU-2. Additional data were collected for these metals during the Addendum period, and are summarized below. The Addendum data support the conclusions of the RFI/RI Volume 2 Report. In the Addendum data set, manganese was only analyzed in samples from the Arizona well clusters MW-54, MW-55 and MW-56. All samples were below the background UTL of 1,320 µg/L with the exception	DTSC concurs with the additional text proposed for inclusion in the revised document.

Agency	Comment Number	Section	Comment	PG&E Response	DTSC Response
				of the sample from MW-54-140, which had a concentration of 1,410 µg/L. This well is screened in fluvial material and has shown reducing conditions since installation. These findings are consistent with those of the RFI/RI Volume 2 report, which noted that naturally occurring manganese concentrations above UTL were nearly exclusively found in floodplain wells under reducing conditions. Beryllium was only detected in one sample out of 41 in the Addendum data set. The one detection was 1.1 µg/L, just slightly above the reporting limit of 1 µg/L, in a sample from well MW-43-25. The other two samples from this well analyzed for beryllium were below reporting limit. The data are consistent with those reported in the RFI/RI Volume 2 report, and therefore the conclusions remain unchanged. Antimony was not detected in any of the 41 samples in the addendum data set. The conclusions of the RFI/RI Volume 2 Report regarding antimony are supported by these data.	
Envirometrix (on behalf of the Colorado River Indian Tribe)	EMC-1	General	CRIT is one of two potentially affected downstream Tribes in the immediate pathway for any surface water that may carry contamination and we will be directly affected by any contamination emanating from the PG&E Topock Compressor Station. Any contamination entering the Colorado River will directly affect and impact our health and well being. CRIT is not only concerned for their Tribe and other downstream Tribes but are also concerned for the millions of people of Southern California and Arizona who rely on the Colorado River as a primary source of drinking water, agricultural water supply and recreational use. We would like to be clear that no other Tribe has ever been authorized to speak on behalf of CRIT. Our concerns should not be marginalized or treated as secondary. While a number of existing settlement agreements are in place, CRIT is not limited or bound to any of those	Thank you for your comment. Please be assured that PG&E understands that each Tribe speaks only for itself. In that same vein, we take care to consider and to address the comments and concerns of all stakeholders with an equal measure of respect, and in good faith. We recognize that the CRIT is not a party to any of the settlement agreements in place regarding this site, and thus is not bound by those agreements. Our commitment to protect the Colorado River is for the benefit of all who use this unique resource, without regard to affiliation or location.	NRR

Agency	Comment Number	Section	Comment	PG&E Response	DTSC Response
			terms and conditions.		
Metropolitan Water District	MWD-1	General	CH2M-Hill's conceptual hydrogeologic interpretations from the additional investigations are stated as consistent with the interpretations in the RFI/RI Volume 2 report. Information, though, provided in the historical review of the bridge pier construction identified somewhat more complex hydrogeology beneath the river than inferred. In particular, on the east side of the river at depth, pier construction identified through direct visual observation during construction, fine to coarse gravel underlain by "large boulders and gravel" that mantle bedrock (see figure 3 of CH2M-Hill's report, Technical Memorandum – Summary of Colorado River Bridge Pier Construction and Hydrogeologic Assessment). These boulders were not identified in PG&E's slant boring MW-56 drilled on the Arizona side of the river, although this boring reportedly was drilled to bedrock. The historical records also provide documentation that the small-diameter investigation borings drilled for the bridge piers in this area also did not identify boulders at the base of the fluvial section, but rather were terminated on what was interpreted as "bedrock." During the pier construction the "bedrock" identified at a shallower depth by drilling were actually boulders. This led to a large claim by the pier construction contractor due to the increased pier depth and dealing with boulders. The shallower depth to bedrock and lack of basal boulders inferred by CH2M-Hill from their MW-56 boring should be re-assessed with respect to the hydrogeology reported in the historical record provided for the bridge piers. This understanding is likely an important element of the hydrogeologic interpretation of the alluvial fan/fluvial sediments beneath the river as the presence of boulders and cobbles would likely affect the variability of the hydraulic conductivity of the deep sediments. As a point of reference, it should be remembered that the original MW- 34 boring on the California flood plain	Based on drilling logs/information for the MW-56 slant boring and other, PG&E believes the MW-56 slant boring encountered Miocene (Tmc) bedrock based on the following observations and considerations: 1) The MW-56 core log/photos show at least 9 feet recovery of dry pulverized cemented Miocene conglomerate material (lithologically consistent with all other Tmc bedrock intervals logged in 2005-2007 cored borings). 2) The BNSF bridge is located over 500' north of the MW-56 slant location, and the eastern pier that encountered large boulders and gravel is over 300' from the AZ shoreline (slant boring MW-56 extended approximately 170' from shoreline). Bedrock structure and the nature of the basal fluvial deposits at these separate locations are not expected to be identical. 3) Boulders were also encountered at a depth of about 64 feet during pier construction at the former Red Rocks bridge approximately 200 feet upstream from the MW-56 location. The report on the Red Rock Cantilever Bridge indicates that the boulders were made up of "pure quartz, gneiss, porphyry, trap and the various types of volcanic rock and some very fair specimens of natural concrete" and that "red breccia" was encountered at a depth of 80.7'. At least 9 feet of red Miocene conglomerate was cored from the bottom of MW-56. The color and character of this rock is consistent with what was found below the boulder bed at the bridge pilings and is not consistent with the boulder bed. In comparison, at MW-34-80, less than a foot of hard rock was cored at the bottom of the borehole. The lithologic sequence at MW-56 is very similar to the nearby PGE-9N/S boring locations which also didn't encounter coarse gravel and boulders on Tmc bedrock.	DTSC awaits the additional data and text associated with the September 2008 shutdown test. DTSC also awaits revised language pertaining to the distinction between hydraulic capture and influence so that it can be reviewed and approved.

Agency	Comment Number	Section	Comment	PG&E Response	DTSC Response
			was terminated on what was originally interpreted as bedrock and that redrilling this hole to a deeper depth identified what was originally thought to be bedrock as a cobble layer and that bedrock was much deeper. The deeper drilling at MW-34 also drastically changed the interpretation of the extent of the chromium plume, which was found at greater concentration below the original MW-34 boring. The assessment of the influence of the IM No. 3 extraction appears to be over stated in its affect on the Arizona side of the river in several sections of the report. For the new Arizona wells, only the deepest piezometer of the MW-54 cluster shows a hydraulic influence of about 1/10th of a foot in response to the shutdown of TW-3D and PE-1 extractions. This is expected as the deepest interval is likely the most confined hydrogeologically and pressure pulses can eminent large distances in confined aquifers. The report should be careful to differentiate between groundwater capture and a hydraulic pressure influence as they are not equal in an aquifer such as at Topock where the natural discharge is southward into the gorge. The verbiage in the report appears to equate hydraulic response and capture, which do not necessarily have the same hydrogeologic meaning relative to the transport of hexavalent chromium. These statements should be further clarified.	The conceptual hydrogeologic interpretations as stated in the additional investigations are consistent with the RFI/RI Volume 2 report. Text and a figure will be added showing deconvolution of a second shutdown test, conducted in September 2008, which more clearly quantified response in the deepest of the MW-54 wells (MW-54-195). The distinction between hydraulic influence and hydraulic capture related to the pumping wells will be clarified.	
Envirometrix (on behalf of the Colorado River Indian Tribe)	EMC-2	General	CRIT includes and is composed of four distinct Tribes, the Mohave, Chemehuevi, Hopi, and Navajo. There are currently approximately 4,000 active CRIT Tribal members who represent one of the largest Tribal Nations in the immediate vicinity of the PG&E Topock Compressor Station. The CRIT reservations stretches along many miles of the Colorado River on both sides of the California and Arizona Side and includes approximately 300,000 acres of land with the Colorado River servicing the focal point and lifeblood of the area. The primary economic activity on the CRIT Reservation has always been farming and	Thank you for the comment and background information regarding the CRIT Nation. As stated previously, it has never been, nor ever will be, PG&E's practice to assign a diminished importance to any stakeholder interest in the Topock cleanup, but rather to consider the viewpoint of each stakeholder in a manner that embodies the full measure of good faith and genuine respect.	NRR

Agency	Comment Number	Section	Comment	PG&E Response	DTSC Response
			agriculture. The water from the Colorado River is relied on from everything from food to cooking to Tribal traditions and ceremonies. Therefore, the views, comments, and concerns presented by CRIT should be treated as significant, meaningful, and giving their proportional full weight and consideration.		
Regional Water Quality Control Board	RWQCB-2	General	Regional Board staff agrees with the Applicable, or Relevant and Appropriate Requirements (ARARs) and Constituents of Potential Concern (COPCs) described in the RFI Vol. 2 Addendum for the remedial activities discussed. If the remediation alternatives selected result in a discharge to land and/or surface waters, however, then that discharge will also need to comply with the Water Quality Objectives specified in the Regional Board's Water Quality Control Plan (Basin Plan).	Comment noted, please refer to the CMS/FS for a discussion of the remediation alternatives and compliance with ARARs. No changes to the RFI/RI Volume 2 Addendum are proposed in response to this comment.	Please ensure this ARAR comment is addressed in the revised CMS/FS Report.
Executive Summary					
Department of Toxic Substances Control	DTSC-3	ES.2.2, Page ES-2, Last Paragraph	The Addendum should clarify how the hydraulic response to IM 3 pumping in well MW-54 cluster in Arizona was detected, yet not quantifiable. Conclusions regarding the response in this well may need to be qualified.	The reasons for lack of quantifiable response to the May shutdown will be more fully explained. See also response to MWD-1.	DTSC awaits the revised language so that it can be reviewed and approved.

Agency	Comment Number	Section	Comment	PG&E Response	DTSC Response
Regional Water Quality Control Board	RWQCB-1	ES.2.2	The RFI Vol. 2 Addendum should not imply that extraction wells on the California side of the Colorado River have a capture zone that extends to the Arizona side of the river, as suggested in the Executive Summary, section 2.2, page ES-2, third paragraph, which is quoted in relevant part below: "Data further suggest that the groundwater in the deep zone is captured by IM No. 3 extraction wells PE-1 and TW-3D, also in agreement with numerical model predictions." The above statement appears to be in response to hydraulic-response testing conducted during May 2008. The report also states in section 2.2.3, page 2-6, last paragraph: "The maximum response of each well to the shutdown is presented in Figure 2-6. This map illustrates the extent of influence of the IM No. 3 system. Responses of the MW-54 cluster wells in Arizona were identified but were less than the remnant noise from the river fluctuations in the post-deconvolution data; therefore, these responses could not be accurately quantified." Figure 2-6 indicates that the water level responses on the Arizona side of the river were less than the estimated detection limit, as indicated by the use of the symbol, "<." Data from hydraulic responses to pumping (or shutdown) that cannot be quantified should not be used to infer a capture zone. That data only suggest that the extract wells may slightly influence groundwater flow on the Arizona side of the river.	See responses to MWD-1 and DTSC-3.	DTSC awaits revised language so that it can be reviewed and approved.

Agency	Comment Number	Section	Comment	PG&E Response	DTSC Response
Department of Toxic Substances Control	DTSC-4	ES.2.3, Page ES-3, Paragraph 4, Line 8	The following sentence from the Addendum should be modified as identified below as it currently contains inaccurate information. "Although modest concentration increases and decreases were noted in a few wells for these trace metals, the observed distributions of concentrations are generally consistent with those observed in the RFI/RI Volume 2 Report and support the conclusions made in the report. ~~, i.e. that none of the trace metal distributions are related to past discharge activities to SWMU 1/AOC 1.~~	Agreed.	NRR
U.S. Department of the Interior	DOI-1	Sec. ES.3, page ES-4, last paragraph, last sentence	Either delete the last sentence or revise it to reflect that additional groundwater characterization for the East Ravine is planned under a separate effort.	The last sentence will be revised to state "No additional groundwater characterization is needed to complete the groundwater RFI/RI for SWMU 1/AOC 1."	DTSC agrees with DOI that the RFI/RI Volume 2 addendum should specify~~ic~~ East Ravine as a separate area of groundwater investigation even though RFI/RI Volume 2 and its addendum are only for SWMU 1, 2 and AOC 1. Please include language indicating current plans for characterizing and potentially remediating the recently detected contamination found within the East Ravine.
Metropolitan Water District	MWD-2	ES.3, page ES-4	In the top paragraph, the statement "… indicate the IM No.3 extraction influence extends into Arizona." As stated above, this influence does not necessarily infer capture. This should be revised.	Agreed. See response to MWD-1.	DTSC awaits revision of this paragraph so that it can be reviewed and approved.
Section 1					
Department of Toxic Substances Control	DTSC-5	Sec. 1, Page 1-1, Paragraph 1, Line 1 (and elsewhere throughout the report)	Please update references to the July 2008 RFI/RI Volume 2 Report with the revised, approved version.	Agreed. The Volume 2 Addendum will be updated throughout to cite the February 2009 revised Final RFI/RI Volume 2 Report.	NRR
Section 2					
Envirometrix (on behalf of the Colorado River	EMC-3	Sec. 2.2.2.	*The maximum response of each well to the shutdown is presented in Figure 2-6. This map illustrates the extent of the influence of the IM No. 3 system.*	A hatched line marking the extent of the test influence is not recommended, as it could be easily inferred to be the capture zone of the pumping wells. The distinction	DTSC awaits revision of this paragraph so that it can be reviewed and approved.

Agency	Comment Number	Section	Comment	PG&E Response	DTSC Response
Indian Tribe)			*Responses of the MW-54 cluster wells in Arizona were identified but were less than the remnant noise from the river fluctuations in the post-deconvolution data; therefore, these responses could not be accurately quantified. Overall, the data indicates that the resolvable influence of IM No. 3 pumping extends to nearly 1,000 feet.* A line or hatches area on Figure 2-6 that indicates the resolvable influence of IM No. 3 would be helpful.	between test influence and capture zone will be further explained; see response to MWD-1.	
Department of Toxic Substances Control	DTSC-6	Sec. 2.2.3, Page 2-5, Paragraph 6	The section indicates that 104 wells were outfitted with pressure transducers to record water levels during the shutdown of IM 3 pumping and that 40 wells were selected for analysis. Calculation of estimated water level increases/decreases for the other wells fitted with transducers is requested to better assess hydraulic effects to the north and south of the pumping area as well as to evaluate the sensitivity/variability of the resultant hydraulic calculations across the site.	The primary purpose of the aquifer test was to provide a set of data that could be used to calibrate the groundwater model. The 40 wells that have analyzed provide adequate coverage across the site and through the various depths of the aquifer. Deconvolution of the remaining 64 wells requires a significant amount of time and effort, and the redundant data analysis would produce results that may not be needed or useful for model calibration Rather than expend the considerable effort to analyze all 64 wells, PG&E will work with DTSC to select a subset of key wells that will satisfy the concern behind this comment.	DTSC concurs with PG&E's proposal and awaits revision of the section so that it can be reviewed and approved. PG&E: As agreed upon during a February 19, 2009 technical conference call with DTSC, PG&E performed deconvolution of 9 additional wells. Figure 2-6 and Appendix D1 present the data from these additional wells, along with the original set of 40 wells.
Metropolitan Water District	MWD-3	Sec. 2.2.3, page 2-6	The last paragraph of the section concludes with "… the resolvable influence of IM No. 3 pumping extends to nearly 1,000 feet". The measurements at MW-54 are below the limits of detection. Therefore, the influence all the way to MW-54 cannot be inferred. The influence is stated as "1,000 feet". From where is the 1,000 feet measured? These statements should be clarified.	Text will be modified in a manner consistent with the response to MWD-1.	DTSC awaits revision of this paragraph so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-2	Sec. 2.3.1	The phrasing of the 2nd paragraph seems unnecessarily evasive about the fact that Cr(VI) and Cr(T) were detected once each at low concentrations in well MW-55-120. Most readers will know about the one-time detections (they prompted a notification to the well owner) and will expect to see some reference to it, given the importance of the AZ wells to bounding of the eastern extent of the Cr(VI) plume.	Agreed. The Cr(VI) and Cr(T) text will be revised as suggested. The observed ORP range will be reflected in the text. See response to comment MWD-4.	DTSC awaits revision of this paragraph so that it can be reviewed and approved.

Agency	Comment Number	Section	Comment	PG&E Response	DTSC Response
			The discussion should state that Cr(VI) and Cr(T) concentrations in samples from the AZ wells were all below reportable concentrations with the exception of low level detections (1.17 and.0.614 µg/L, respectively) in MW-55-120 in September 2008. These detected concentrations were well below the UTLs. Also, the text states that ORP values ranged from -118 to -228 mV, however the result from September 2008 was -81.8 mV.		
Envirometrix (on behalf of the Colorado River Indian Tribe)	EMC-4	Sec. 2.3.1	*Table 2-2 presents the laboratory analytical results of hexavalent chromium [Cr(VI)], total chromium [Cr(T)], and field water quality measurements for the eight monitoring wells installed for the Arizona groundwater investigation. In the five groundwater monitoring rounds completed between April and September 2008, neither Cr(VI) nor Cr(T) were detected in groundwater samples above the calculated background upper tolerance limit (UTL) from the eight new monitoring locations in Arizona, as shown in Table 2-2.* Of the eight monitoring wells installed in Arizona, only one well reported any detectable concentrations of Cr(T) or Cr(VI). MW-55-120 reported Cr(T) @ 1.17 ug/L and Cr(VI) 0.614 ug/L, These results may provide a more accurate approximation of groundwater levels in the fluvial aquifer. We do not agree that the natural background groundwater conditions should be equally applied from the upland area to the fluvial aquifer near the Colorado River. The background value for Cr(VI) in the fluvial aquifer would most likely be very low. Contouring the extent of groundwater to a value near the detection limit would seem reasonable and appropriate. We also question the validity of the upland calculated background concentrations.	It will be made clear in the text that MW-55-120 is an alluvial well, not a fluvial well. The boring log showed alluvial material throughout the entire aquifer at this well. Cr(VI) concentrations in MW-55-120 can not be considered representative of the fluvial aquifer. As stated in DTSC's December 24, 2008 letter, the "Groundwater background concentrations have been established and shared with stakeholders (CH2MHill, 2008a/2008b) and comments have been previously received by CWG members. DTSC believes that PG&E utilized proper statistical methodologies in developing the hexavalent chromium background value of 32 ug/L for the alluvial portions of the aquifer, but that it has limitations when applied to the fluvial formation waters where lower concentrations are anticipated. DTSC has requested that PG&E contour the data to 32 ug/L [for the RFI/RI Volume 2 Report], but that fluvial wells with detectable hexavalent chromium concentrations be identified on a figure to allow adequate assessment."	DTSC awaits revision of this paragraph so that it can be reviewed and approved. Discussion of the isotopic data for well MW-55-120 should be included in the alluvial/fluvial well discussion.
Metropolitan Water	MWD-4	Sec. 2.3.1,	The top paragraph states "Field Measurements of	The cited text in 2.3.1 will be corrected to reference	DTSC concurs with PG&E's proposals and awaits

Agency	Comment Number	Section	Comment	PG&E Response	DTSC Response
District		page 2-7	oxygen reduction potential (ORP) collected during the three groundwater sample collection events were all negative, ranging from -118 millivolts (mV) to - 228 mV …" There are five groundwater sampling events included in Table 2-2. MW-55-120 sampled on September 3, 2008, had an ORP of -81.8. The range should be changed to include this result or describe why only 3 of the sampling events were considered. In the third paragraph it discusses the extent of the chromium plume and presents data from two sampling events (October 2007 and May 2008). There are additional sampling events and data. Why are only these sampling dates included? The last paragraph discusses Figures 2-7a, 2-7b, and 2-7c, which depict the shallow, mid, and deep depth for wells sampled in May 2008. It states that only limited data is included because many wells were not sampled in May. It would be better if these figures showed more data over a broader period, so additional wells can be displayed. Perhaps the data could be presented as ranges over a particular time period.	ORP readings for the 5 sampling events listed in Table 2-2. One of the objectives of the Volume 2 Addendum was to incorporate new groundwater data from the newly installed Arizona wells and the California floodplain to supplement the October 2007 chromium plume delineation presented in the Volume 2 Report. During the period up through September 2008 (the Addendum data cut-off date), the May 2008 sampling event was the only GMP sampling event where the majority of the California floodplain wells were sampled. Hence, this event was chosen as the most contemporaneous sampling data to post with the June 2008 Arizona wells results. The chromium distribution maps (Figures 2-7a, 2-7b, and 2-7c) provided in the December 2008 Addendum were prepared prior to finalizing the plume maps to be issued in the final version of RFI/RI Volume 2. The Cr(VI) distribution maps in the Addendum will be revised to post the October 2007 well results and plume contours (both in grey shade), and post the May/June 2008 sampling results from the Arizona wells and other wells. Plotting concentration ranges over time would complicate the Cr(VI) distribution maps issued in the RFI/RI report.	revision of the section so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-3	Sec. 2.3.2.3	DOI reserves comment pending review of the final revisions to Volume 2 regarding trace metals as COPCs for SWMU 1/AOC 1 discharges, particularly for Mo and Se	Agreed. No specific changes to the RFI/RI Volume 2 Addendum are proposed in response to this comment. PG&E notes that the discussions of molybdenum and selenium will be updated in response to DTSC comments DTSC-9, 10, 11, 12, 13, and 16.	NRR
Department of Toxic Substances Control	DTSC-7	Sec. 2.3.2.3, Page 2-11, Paragraph 4	The following paragraph should be deleted from the Addendum as it does not accurately reflect conclusions from the RFI/RI Volume 2 Report. ~~"The RFI/RI Volume 2 Report presented a discussion of trace metals in Section 6.2.2.1. In that discussion, it was concluded that although isolated concentrations above background were observed at the site, the~~	Agreed.	NRR

Agency	Comment Number	Section	Comment	PG&E Response	DTSC Response
			~~distributions of the metals do not suggest an anthropogenic source associated with Bat Cave Wash discharge.”~~		
U.S. Department of the Interior	DOI-4	Section 2.3.2.3, 2nd paragraph, sentences 3 through 5	This discussion and wherever it appears elsewhere in the document is a Data Quality issues and there should be some text discussing the impact to the conclusion in this report. If there is no adverse impact it should be stated; if there is some sort of impact it should be discussed. Just stating that there was some issues with detections and reporting limits adds some uncertainty to the conclusions.	The high reporting limits were taken into account when interpreting the results. They are not believed to have had an adverse impact on the conclusions, and text will be added to discuss this point.	DTSC awaits revision of this paragraph so that it can be reviewed and approved.
Department of Toxic Substances Control	DTSC-8	Sec. 2.3.2.3, Page 2-12, Paragraph 4 – Arsenic	The conclusion for arsenic has been revised to be consistent with that in the RFI/RI Volume 2 Report as indicated in the redline text below. “The conclusions regarding arsenic distribution in groundwater made in the RFI/RI Volume 2 Report are confirmed by the additional data collected between October 2007 and September 2008. The source of arsenic in the vicinity of MW-12 is unknown, but may be associated with herbicides commonly used during the time when that area was adjacent to railroad and highway right-of-way, or with refractory materials/debris that have been observed in the fill used to create the former railroad grade. Note that wells near these transportation corridors in Arizona (e.g., Sanders well) also show elevated levels of arsenic. Whatever the actual source of arsenic in the vicinity of MW-12, it does not appear to be associated with ~~the~~ a source in Bat Cave Wash. Outside of this area, the concentration distribution of arsenic shown on Figure 2-12 is inconsistent, and not suggestive of a plume distribution associated with the Bat Cave Wash discharge with the possible exception of arsenic at well MW-10 (as postulated by DTSC). Arsenic is therefore not recommended for consideration as a COPC in groundwater related to SWMU 1/AOC 1.”	Agreed.	NRR
Department of Toxic Substances	DTSC-9	Sec. 2.3.2.3, Page 2-13,	The conclusion for molybdenum has been revised to be consistent with that in the RFI/RI Volume 2 Report	Because this text was written prior to reevaluation of molybdenum data in the RFI/RI Volume 2 Report,	

Agency	Comment Number	Section	Comment	PG&E Response	DTSC Response
Control		Paragraphs 3 and 4 - Molybdenum	as indicated in the redline text below (the majority of the inserted text is lifted from the RFI/RI Volume 2 Report). There is no established ARAR for molybdenum. The elevated average molybdenum concentrations at the site are found at shallow well MW-10, near the site of the historical Cr(VI) discharge, and at deep wells in the MW-38 cluster (Bat Cave Wash) and MW-44 and MW-46 clusters (floodplain), as shown on Figure 2-13. In the large area between these well locations there are variable molybdenum concentrations between the reporting limit and 70 µg/L. If a large release of molybdenum had occurred in the Bat Cave Wash area along with the ~~of~~ Cr(VI) discharge, molybdenum would be expected to travel relatively conservatively with groundwater, since the molybdate anion is similar geochemically to the chromate anion. Because this is not the case, a large and continuous ~~the~~ molybdenum release at Bat Cave Wash ~~source scenario~~ does not appear plausible. However, the use of molybdenum at the facility, its detection in more recent wastewater samples, and its presences above the UTL in a number of site wells suggest that it merits further assessment. While the elevated molybdenum distribution within the plume areas is inconsistent, with very low levels in wells down the wash from SWMU 1, there are enough plume wells with elevated molybdenum to suggest that the potential for facility contribution to groundwater cannot be ruled out at this time. Molybdenum is therefore recommended to remain a COPC in groundwater related to SWMU 1/AOC 1, consistent with the conclusions regarding molybdenum distribution in groundwater made in the RFI/RI Volume 2 Report. ~~are confirmed by the additional data collected between October 2007 and September 2008. The elevated average molybdenum concentrations at the site do not appear to be associated with the Bat Cave Wash discharges.~~	PG&E suggests eliminating these final two paragraphs of the molybdenum section and replacing them with the following language, all from the RFI/RI Volume 2 Report: ~~There is no established ARAR for molybdenum. The elevated average molybdenum concentrations at the site are found at shallow well MW-10, near the site of the historical Cr(VI) discharge, and at deep wells in the MW-38 cluster (Bat Cave Wash) and MW-44 and MW-46 clusters (floodplain), as shown on Figure 2-13. In the large area between these well locations there are variable molybdenum concentrations between the reporting limit and 70 µg/L. If a release of molybdenum had occurred in the Bat Cave Wash area of Cr(VI) discharge, molybdenum would be expected to travel relatively conservatively with groundwater, since the molybdate anion is similar geochemically to the chromate anion. Because this is not the case, the Bat Cave Wash source scenario does not appear plausible.~~ ~~The conclusions regarding molybdenum distribution in groundwater made in the RFI/RI Volume 2 Report are confirmed by the additional data collected between October 2007 and September 2008. The elevated average molybdenum concentrations at the site do not appear to be associated with the Bat Cave Wash discharge.~~ "While the elevated molybdenum distribution within the plume area is inconsistent, with very low levels in wells down the wash from SWMU 1, there are enough plume wells with elevated molybdenum to suggest that the potential for facility contribution to groundwater cannot be ruled out at this time. As discussed in the RFI/RI Volume 2 Report, several incidental spills have occurred at the facility, resulting in wastewater being temporarily released in Bat Cave Wash. The molybdenum concentration in the only available wastewater sample was 6,700 µg/L (Table 3-14 in CH2M HILL, 2007). Unlike arsenic, molybdenum	The revised version must include some of the original language describing the occurrence of elevated molybdenum. The paragraphs should read as follows: "The elevated average molybdenum concentrations at the site are found at shallow well MW-10, near the site of the historical Cr(VI) discharge, and at deep wells in the MW-38 cluster (Bat Cave Wash) and MW-44 and MW-46 clusters (floodplain), as shown on Figure 2-13. While the elevated molybdenum distribution within the plume area is inconsistent, with very low levels in wells down the wash from SWMU 1, there are enough plume wells with elevated molybdenum to suggest that the potential for facility contribution to groundwater cannot be ruled out at this time. As discussed in the RFI/RI Volume 2 Report, several incidental spills have occurred at the facility, resulting in wastewater being temporarily released in Bat Cave Wash. The molybdenum concentration in the only available wastewater sample was 6,700 µg/L (Table 3-14 in CH2M HILL, 2007). Unlike arsenic, molybdenum is mobile under the geochemical conditions in the unsaturated zone, and would be expected to move with the water with relatively minimal attenuation. Although molybdenum concentrations in numerous non-plume wells also exceed the UTL (Figure 2-13), it cannot be eliminated as a COPC in groundwater associated with SWMU 1/AOC 1. The data collected for the Addendum Report therefore support the conclusions of the RFI/RI Volume 2 Report."

Agency	Comment Number	Section	Comment	PG&E Response	DTSC Response
				is mobile under the geochemical conditions in the unsaturated zone, and would be expected to move with the water with relatively minimal attenuation. Although molybdenum concentrations in numerous non-plume wells also exceed the UTL (Figure 2-13), it cannot be eliminated as a COPC in groundwater associated with SWMU 1/AOC 1. The data collected for the Addendum Report therefore support the conclusions of the RFI/RI Volume 2 Report."	
Department of Toxic Substances Control	DTSC-10	Sec. 2.3.2.3, Page 2-13, Paragraph 5, Lines 1 and 2 - Selenium	The sentences discuss selenium concentrations in well TW-1. The following language is suggested to be added to the section to indicate that notable fluctuations in chromium concentrations were noted to occur in well TW-1 and that the selenium concentrations tracked with the chromium changes. The chromium/selenium relationship that exists in well TW-1 suggests the two may be related to a common source. **Selenium**. Concentrations of selenium remained consistent with previous ranges. Well TW-1 remained the only site well with concentrations significantly above the UTL of 10.3 µg/L and ARAR of 50 µg/L, although none of the post-October 2007 samples from this well exceeded the well's previous maximum concentration of 155 µg/L (Table 2-5). Evaluation of the TW-1 chromium and selenium data contained within Table 2-5 indicates that the notable fluctuations in chromium concentrations tracked with changing selenium concentrations over time.	Suggest altering the text addition as shown below. **Selenium**. Concentrations of selenium remained consistent with previous ranges. Well TW-1 remained the only site well with concentrations significantly above the UTL of 10.3 µg/L and ARAR of 50 µg/L, although none of the post-October 2007 samples from this well exceeded the well's previous maximum concentration of 155 µg/L (Table 2-5). Evaluation of the TW-1 chromium and selenium data contained within Table 2-5 indicates that the fluctuations in chromium concentrations tracked with changing selenium concentrations in the four samples collected between December 2007 through October 2008.	As the October 2008 data is not included in Table 2-5 the following modification is suggested: **Selenium**. Concentrations of selenium remained consistent with previous ranges. Well TW-1 remained the only site well with concentrations significantly above the UTL of 10.3 µg/L and ARAR of 50 µg/L, although none of the post-October 2007 samples from this well exceeded the well's previous maximum concentration of 155 µg/L (Table 2-5). Evaluation of the TW-1 chromium and selenium data contained within Table 2-5 indicates that the fluctuations in chromium concentrations tracked with changing selenium concentrations~~ in the four samples collected between December 2007 through October 2008~~.
Department of Toxic Substances Control	DTSC-11	Sec. 2.3.2.3, Page 2-13, Paragraph 5 - Selenium	The discussion on selenium concentrations detected in well MW-24A needs to indicate when reductant injections began for the Upland In Situ Pilot Test to allow appropriate interpretation of the selenium data. It is assumed that the reductant would reduce selenium concentrations within the oxidizing environment surrounding the MW-24A pre-injection area. A similar insert to the MW-24A arsenic topic is also requested.	Timing of *in situ* pilot study injection will be discussed in context with observed selenium and arsenic concentration changes in MW-24A.	Concur. DTSC awaits the discussion language proposed in PG&E's response.

Agency	Comment Number	Section	Comment	PG&E Response	DTSC Response
Department of Toxic Substances Control	DTSC-12	Sec. 2.3.2.3, Page 2-13, Paragraph 6 - Selenium	A paragraph should follow this discussion summarizing the overall distribution of selenium. This new paragraph must mention that six of the nine wells with selenium elevated above background concentrations are located within the plume and that these elevated wells coincide with the axis of the core of the chromium plume.	Additional text will be added to compare the number of wells with average selenium above UTL inside and outside the plume. The locations of these elevated selenium concentration within the plume are TW-1, MW-24A/B, MW-26/51, and MW-20-130. They are wells that are central to the plume area and that will be described in text and the figures, but do not correspond to well locations with the highest chromium concentrations, so use of the terms “axis” or “core” may be misleading.	The wells with elevated selenium within the chromium plume (TW-1, MW-24A/B, MW-26/51, and MW-20-130) correlate with some of the highest or highest chromium concentrations on the site in the shallow, middle, and deep zones. All of these wells have chromium concentrations greater than 1,000 ug/L (See Figure 6-12a, b, and c of the February 2009 RFI Volume 2) that defines the center of the chromium plume. Please incorporate all the information above into the requested paragraph so that it can be reviewed and approved by DTSC.
Department of Toxic Substances Control	DTSC-13	Sec.2.3.2.3, Page 2-14, Paragraph 1 - Selenium	This paragraph makes concluding remarks regarding selenium and needs to be revised as based on the selenium comments above. It is requested the paragraph be modified as indicated below. “Contrary to ~~The~~ conclusions in the RFI/RI Volume 2 Report, the additional selenium data presented in the Addendum possibly form a pattern that suggests a plume. ~~regarding selenium distribution in groundwater made in the RFI/RI Volume 2 report are confirmed by the additional data collected between October 2007 and September 2008. As shown on Figure 2-14, the distribution of selenium elevated above UTL is not consistent with a plume source. The vast majority of the elevated samples are between the UTL (10.3 µg/L) and 20 µg/L, and so are not far removed from Background Study values and are well below the ARAR for selenium.~~ “This further supports DTSC’s direction to consider selenium as a COPC related to SWMU 1/ AOC 1 activities. The additional Title 22 metals data that have been collected and reported in the Addendum support considering selenium as a COPC related to SWMU 1/ AOC 1 activities and carrying it forward through the RCRA/CERCLA process.”	PG&E respectfully disagrees that the three new wells showing selenium above the UTL is a basis for re-interpreting the selenium distribution. There is only one new location represented in the addendum data set as two of these three wells are co-located (MW-51 and MW-26) and the third (MW-24A) is co-located with a previous result above the UTL (MW-24B). Nonetheless, PG&E has agreed with DTSC’s conclusion that selenium should be a COPC and does not object to DTSC furthering its discussion. Suggested text is provided below: ~~“The conclusions regarding selenium distribution in groundwater made in the RFI/RI Volume 2 report are confirmed by the additional data collected between October 2007 and September 2008. As shown on Figure 2-14, the distribution of selenium elevated above UTL is not consistent with a plume source. The vast majority of the elevated samples are between the UTL (10.3 µg/L) and 20 µg/L, and so are not far removed from Background Study values and are well below the ARAR for selenium.~~ “As stated in the RFI/RI Volume 2 Report, PG&E interprets the pattern of average selenium concentrations as influenced by colloidal material and not suggesting a clear source. DTSC interprets additional selenium results in the	DTSC concurs with PG&E’s suggested text. Also see Comment DTSC-12.

Agency	Comment Number	Section	Comment	PG&E Response	DTSC Response
				Addendum data set to possibly form a pattern that suggests a plume (see Figure 2-14). DTSC postulates that the updated average values further support their conclusion that selenium is a COPC related to SWMU 1/ AOC 1 activities, and has directed PG&E to designate selenium as such. The additional Title 22 metals data that have been collected and reported in the Addendum and the conclusion to consider selenium as a COPC related to SWMU 1/ AOC 1 activities and carry it forward through the RCRA/CERCLA process has not changed."	
Department of Toxic Substances Control	DTSC-14	Sec. 2.3.2.3, Page 2-14, Paragraph 3, Line 1 - Vanadium	The following sentence should be deleted from the Addendum as vanadium distribution was described in the RFI/RI Volume 2 Report. ~~"Vanadium distribution in groundwater was not described in the RFI/RI Volume 2 Report due to its low frequency of UTL exceedances.~~	Agreed.	NRR
Envirometrix (on behalf of the Colorado River Indian Tribe)	EMC-5	Figures 2-7a,b, c	The sampling results and distribution of chromium in groundwater for the May 2008 sampling round are shown on Figures 2-7a, 2-7b, and 2-7c. The May 2008 groundwater quarterly monitoring event was selected for the figures to show a current distribution of chromium data that incorporates the eight new monitoring locations in Arizona (June 3-4, 2008 sampling results). While not based on scientific or technical rationale, when you overlay Figures 2-7a, b and c to try to visualize a 3-D representation of the extent of contamination, the shallow aquifer has a larger plume, the mid a smaller plume and the deep a larger plume. We have the impression that they may have been contoured independently. Based on where we are in the site investigation process, we suggest that consideration be given to providing representations of the plume in a 3-dimensional view. As we near the remedy stage, it is important that we fully understand the 3-dimensional configuration and view of the extent	The chromium distributions presented in RFI/RI Volume 2 Addendum were developed to take depth variation into consideration. Specifically, the chromium contour maps shown on Figures 2-7a, 2-7b, and 2-7c were not contoured independently but were prepared by contouring sampling results for wells in each of the depth intervals and extrapolating between depth intervals to provide additional control for depicting plume contours. For example, data from wells completed in the shallow and deep intervals were extrapolated (or vertically projected) to constrain the contouring in the mid-depth interval. Additionally, the depth and thickness variations of the Alluvial Aquifer were used for the developing the plume depiction. PG&E feels that this plume depiction approach is well-supported by site data and sufficiently detailed for the purpose of delineating the lateral and vertical extent of the plume in the Alluvial Aquifer. Developing additional 3-D depiction is not warranted for completing the RFI/RI and CMS/FS phases of the project.	Although DTSC believes that a 3D rendering of the plume may provide visual clarity, it does not provide any further understanding of the plume based on existing data. DTSC may request PG&E to provide such rendering for clarity to non-technical audiences for future meetings, but agrees with PG&E that it is not warranted for the completion of the RFI/RI.

Agency	Comment Number	Section	Comment	PG&E Response	DTSC Response
			of groundwater contamination.		
Section 3					
U.S. Department of the Interior	DOI-5	Sec. 3.1	To the extent reasonable, please compare the numerical model predictions of IM-3-related drawdown on the AZ side of the river, with observations of water level recovery during the IM-3 shutdown test. Is the model predicting a magnitude of drawdown on the AZ side that is reasonable and consistent with the observations?	The model prediction of test influence will be provided for comparison to observed data. It will be shown that model predictions of water level changes on the Arizona side of the river are consistent with the observed data.	DTSC awaits the additional discussion and data so that it can be reviewed and approved.
Metropolitan Water District	MWD-5	Sec. 3.1, page 3-1 and 3-2	The third paragraph on page 3-1 states “Hydraulic data collected following installation of monitoring wells on the Arizona side of the Colorado River indicate the IM No. 3 extraction influence extends into Arizona”. It also goes on to state that this is supported by the May 2008 IM No. 3 system shutdown. The results of influence from IM No. 3 were marginally detectable at the Arizona wells. As stated above in the general comments, the influence cannot be inferred to include capture. This paragraph should be revised. On page 3-2 in the top paragraph it states “The Arizona groundwater investigation has further documented the nature and extent of natural reducing condition in the saturated fluvial and alluvial sediments …” As we commented in the RFI/RI Volume 2 report, the extent of the natural reducing conditions has not been quantified. The natural reducing conditions exist, but there is not enough data to determine capacity throughout the area. This paragraph should be revised.	Text on page 3-1 will be modified in a manner consistent with the response to MWD-1. Text will be added to remind the reader that the full extent of effective reducing material in the fluvial sediments has not been fully characterized.	DTSC awaits revision of the cited paragraphs so that they can be reviewed and approved.
Department of Toxic Substances Control	DTSC-15	Sec. 3.3, Page 3-2, Paragraph 3, Line 4	The following sentence should be modified as similarly requested for the RFI/RI Volume 2 Report, “Except for selenium, the additional data and information collected between October 2007 and September 2008 and presented in this Addendum do not modify the conclusions of the RFI/RI Volume 2 Report. The additional information presented in this	PG&E suggests altering the inserted text as shown below. “Except for selenium, the additional data and information collected between October 2007 and September 2008 and presented in this Addendum do not modify the conclusions of the RFI/RI Volume 2 Report. Newly collected selenium data was interpreted	DTSC concurs with the suggested modifications.

Agency	Comment Number	Section	Comment	PG&E Response	DTSC Response
			Addendum confirms that the only medium that appears to be affected by SWMU 1/AOC 1 activities at the Topock Compressor Station is groundwater.1”	by DTSC to further support its previous conclusion that selenium is a site COPC. The additional information presented in this Addendum confirms that the only medium that appears to be affected by SWMU 1/AOC 1 activities at the Topock Compressor Station is groundwater.”	
U.S. Department of the Interior	DOI-6	Section 3.3, 1st paragraph, 2nd sentence	Replace the second sentence with “The additional information presented in this Addendum confirms that, of the media assessed for the RFI/RI Volume 2 (i.e., groundwater, surface water, pore water, and river sediment), only groundwater appears to be affected by the Topock Compressor Station.” Delete the footnote	Agreed.	To accommodate responses to Comments DTSC-15 and DOI-6, the following modifications are suggested. “Except for selenium, the additional ~~data and~~ information ~~collected between October 2007 and September 2008 and~~ presented in this Addendum do not modify the conclusions of the RFI/RI Volume 2 Report. ~~The additional~~ Additionally, the information ~~presented in this Addendum~~ confirms that, of the media assessed for the RFI/RI Volume 2 (i.e., groundwater, surface water, pore water, and river sediment), only groundwater appears to be affected by SWMU 1/AOC 1 activities at the Topock Compressor Station. Newly collected selenium data was interpreted by DTSC to further support its previous conclusion that selenium is a site COPC. ~~The additional information presented in this Addendum confirms that the only medium that appears to be affected by SWMU 1/AOC 1 activities at the Topock Compressor Station is groundwater.”~~
U.S. Department of the Interior	DOI-7	Section 3.3, 1st paragraph, 3rd sentence	DOI reserves comment pending review of the final revisions to Volume 2 regarding trace metals as COPCs for SWMU 1/AOC 1 discharges, particularly for Mo and Se	Agreed. No specific changes to the RFI/RI Volume 2 Addendum are proposed in response to this comment.	NRR
Department of Toxic Substances Control	DTSC-16	Sec. 3.3, Page 3-2, Paragraph 3, Line 7	The following sentence from the Addendum should be modified as identified below, “Given the consistency of trace metal concentration distribution presented in this Addendum compared with the analogous information in the RFI/RI Volume 2 Report, the conclusion of the RFI/RI Volume 2 Report that Cr(VI), ~~and~~ Cr(T), molybdenum, and selenium are the COPCs for groundwater related to SWMU 1/AOC 1 is unchanged.”	Agreed.	NRR

Agency	Comment Number	Section	Comment	PG&E Response	DTSC Response
U.S. Department of the Interior	DOI-8	Section 3.3, 2^{nd} paragraph, last sentence	Revise the final sentence to read "No additional groundwater characterization is needed to complete the groundwater RFI/RI for SWMU 1/AOC 1 and SWMU 2.	Agreed.	NRR
Department of Toxic Substances Control	DTSC-17	Sec. 3.3, Table 2-5	Please include the background UTLs on the table along with the ARAR values.	Agreed.	NRR
Tables and Figures					
Metropolitan Water District	MWD-6	Table 2-6	Footnote 4 states "Only the hexavalent chromium and total chromium results included in the Addendum data set were used in the calculation." Why was the dataset limited to the Addendum dataset only? How does this compare to the calculations made in the RFI/RI Volume 2 report?	The Addendum dataset is from July 1997 through September 2008 and includes the RFI/RI Volume 2 data. The footnote will be revised to state "Only the hexavalent chromium and total chromium results included in the Addendum dataset (July 1997 – September 2008) were used in the calculations. This includes results from the Arizona wells and the Title 22 metals data, but not other data collected during the same time period that are not discussed in the Addendum, such the Compliance Monitoring Program data."	DTSC concurs with the suggested modifications.
U.S. Department of the Interior	DOI-9	Figures	There are some minor inconsistencies in the cross section figures such as the symbols on the cross sections don't match the explanation at the bottom of the figure.	The following inconsistencies were noted and will be addressed: Figure 2-2: The bedrock color in the legend is much darker than its color on the section; Figure 2-3: the CB borings are dashed in the legend and solid on the section.	NRR

F3 DTSC Comments on the March 2009 Redline RFI/RI Volume 2 Addendum Report

Agency	Comment Number	Section	Comment	Response
General				
Department of Toxic Substances Control	DTSC-1	General	It is requested that nitrate be carried forward through the RCRA/CERCLA risk assessment evaluation and if necessary into the corrective measure study/ feasibility study process as a constituent of concern (COC) and that the Addendum reflect this in Sections 2.3.3.1 (Nitrate) and 3.3 (Conclusions). As illustrated in Figure 2-16, all the nitrate values exceeding regional background limits and MCLs are contained within the confines of the chromium plume (excluding elevated nitrates ringing the active ponds). It is noted that the majority of the active pond data is "J" flagged and, therefore, can only be viewed as estimates. Wells MW-15 and MW-16 are located east and west of the active ponds and do not exhibit the elevated nitrate that is postulated in Section 2.3.3.1 of the Addendum to originate from mountain front recharge/local precipitation. DTSC considers that discharge of cooling tower water and/or discharges from some of the former or current septic systems at the Topock Compressor Station could account for the elevated nitrate occurring within the limits of the chromium groundwater plume.	Although PG&E does not necessarily agree with DTSC's interpretation of data in the New Ponds area as described in this comment, it is not possible to disprove that facility discharge at SWMU 1/AOC 1 contributed to elevated nitrate concentrations in portions of the groundwater. Text will be revised in the following manner: Section ES.3 – add text (shown in red) to the last paragraph DTSC has directed PG&E to carry nitrate forward as a COPC on the basis of its interpretation of nitrate concentration distribution and potential sources from the facility presented in this Addendum. Overall, the additional data and information collected between October 2007 and September 2008 and presented in this Addendum do not further modify the conclusions and recommendations of the RFI/RI Volume 2 Report. Section 2.3.3.1 – new paragraph at end of section "DTSC concludes that nitrate is a COPC related to SWMU 1/ AOC 1 activities, and has directed PG&E to designate nitrate as such. Although multiple potential sources exist for elevated nitrate in groundwater, it cannot be eliminated as a COPC." Section 3.3 – add text (shown in red) to the 1st paragraph: …Given the consistency of trace metal concentration distribution presented in this Addendum compared with the analogous information in the RFI/RI Volume 2 Report, the conclusion of the RFI/RI Volume 2 Report that Cr(VI), Cr(T), molybdenum, and selenium are the COPCs for groundwater related to SWMU 1/AOC 1 is unchanged. In addition, DTSC has directed PG&E to carry nitrate forward as a COPC on the basis of its interpretation of nitrate concentration distribution and

Agency	Comment Number	Section	Comment	Response
				potential sources from the facility presented in this Addendum. The additional wells installed on the Arizona side of the Colorado River and associated analytical data presented in this report provide field measured confirmation concerning previous estimates about the eastern extent of Cr(VI) and Cr(T) in groundwater.
Specific Comments				
Department of Toxic Substances Control	DTSC-1	Page 2-15, Paragraph 2	Delete the following sentence as data does exist from a July 18, 2007 sampling event (2007 Arcadis Upland Baseline) and is included in the Appendix H database within the RFI Volume 2 Report: ~~Well MW-24A had not previously been analyzed for selenium.~~	The following text is suggested to replace the sentence: "The only previous selenium analysis for well MW-24A was for an unfiltered sample collected in July 2007 as baseline data for the Upland in situ Pilot Study. The reported unfiltered concentration was 3.36 µg/L."
Department of Toxic Substances Control	DTSC-2	Sec. 3.2, Page 3-2	The following edit is requested to accurately depict site conditions, *It is noted that the full extent and capacity of effective reducing material in the fluvial sediments in the floodplain areas on both sides of the river have not been fully characterized, and although the vast majority of the monitoring wells in the upper- and middle-depth fluvial sediments show reducing conditions, there ~~may be pockets or~~ have been wells that encountered ~~zones of~~ non-reducing material present in the fluvial sediments~~ that have been missed by the monitoring wells~~*.	The following text (shown in red) is suggested for the passage in question: "It is noted that the full extent and capacity of effective reducing material in the fluvial sediments in the floodplain areas on both sides of the river have not been fully characterized, and although the vast majority of monitoring wells screened in the upper- and middle-depth fluvial sediments show reducing conditions, there have been 2 fluvial wells (MW-30-50 and MW-39-50) that encountered non-reducing material.~~present in the fluvial sediments that have been missed by the monitoring wells~~" In the December 5, 2008 Addendum Report, there were errors in Table B-1 in well designations of alluvial versus fluvial. Table B-1 has been revised as follows: • Five prior alluvial wells were classified to fluvial wells (MW-27-20, MW-27-60, MW-27-85, PT-3S, and PTI-1S) • 13 prior fluvial wells were classified to alluvial wells (MW-33-90, MW-39-60, PT-1D, PT-2M, PT-2D, PT-4D, PT-5M, PT-5D, PT-6M, PT-6D, PTI-1M, PTI-1D and Sanders).

Agency	Comment Number	Section	Comment	Response
				The previous number of fluvial wells may have lead DTSC to conclude that there were more non-reducing fluvial wells than there actually were. There are only 2 non-reducing shallow and mid-depth fluvial wells: MW-30-50 and MW-39-50. In addition, the well designation corrections affected minimal portions of the Final RFI/RI Volume 2 Report: Table 4-2, Table B-1, text page 6-26, and Figures 5-2, 5-7, 5-22, and 6-13. These errors have been corrected and can be found as an errata Appendix H in this Addendum Report. Figure 2-2 in the Addendum has also had the same correction made since it is very similar to Figure 5-7 in Volume 2. None of the minor corrections affect the conclusions or recommendations of the RFI/RI Volume 2 Report or the Addendum Report.
Department of Toxic Substances Control	DTSC-3	Figure 2-4	This figure will need to be revised based on recent data collected during the investigation of the East Ravine. At a minimum, the Addendum should acknowledge that the figure is planned to be changed.	Text will be added in Section 2.2.1 to indicate that the bedrock contour map incorporating results of the East Ravine investigation will be revised in the RFI/RI Volume 3 Report and/or other reports. In addition, text has been revised in the Executive Summary and Section 3 related to the reporting of East Ravine results.
Department of Toxic Substances Control	DTSC-4	Appendix G	Figure G-1 illustrates that chromium and specific conductance (SC) track very well together in well MW-12 suggesting that the chromium plume is associated with elevated salts in the MW-12 area. Figure G-1 also illustrates an exceptional inverse relationship between chromium and SC in well MW-10. This relationship was not acknowledged in the Appendix. The GSU has previously postulated that fresh water infiltration may be leaching residual chromium from soil in the vicinity of well MW-10. Figure G-3 graphs for wells MW-25 and MW-26 also suggest (to a lesser extent) positive correlation between SC and chromium that was not identified in the Appendix. While there are some positive correlations between SC and chromium, these correlations are not exhibited throughout the chromium plume.	Relationships between Cr(VI) and specific conductance in wells MW-10, MW-25, and MW-26 were not discussed in Appendix G because the statistical correlation was not significant at the 95% level, as shown in Table G-1. The aim of the analysis was to use an objective statistical tool to interpret the data as opposed to subjective tools such as visual analysis. PG&E feels the Spearman Correlation Coefficient used in Appendix G provides an unbiased view of the relationships in each well, and formed the basis of the discussions provided in the text.

Appendix G
Specific Conductance and Hexavalent Chromium Time Series Plots

Pacific Gas and Electric Company

Yvonne J. Meeks
Manager

Environmental Remediation
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March 4, 2009

Aaron Yue
Senior Hazardous Substance Engineer
California Department of Toxic Substances Control
5796 Corporate Avenue
Cypress, California 90630

Subject: Specific Conductance and Hexavalent Chromium Time Series Plots Technical Memorandum, RFI/RI Volume 2 Addendum Report, PG&E Topock Compressor Station, Needles, California

Dear Mr. Yue:

Enclosed is the *Specific Conductance and Hexavalent Chromium Time Series Plots Technical Memorandum* that is intended to become a new appendix to the upcoming final RFI/RI Volume 2 Addendum Report. These time series plots were created in response to DTSC's comment on the RFI/RI Volume 2 Report. We are submitting this technical memorandum in advance of the final Addendum report to provide an opportunity to review this additional detail along with the responses to comments that was submitted on February 18, 2009.

Please contact me at (805) 234-2257 if you have any questions on this technical memorandum or the RFI/RI.

Sincerely,

Yvonne Meeks

Yvonne Meeks
Topock Remediation Project Manager

Cc: Christopher Guerre, DTSC
Pam Innis, DOI

Enclosure

Specific Conductance and Hexavalent Chromium Time Series Plots

PREPARED FOR:	Department of Toxic Substances Control
PREPARED BY:	CH2M HILL for Pacific Gas and Electric Company
DATE:	March 4, 2009

At the request of DTSC during review of the RFI/RI Volume 2 report, time series graphs have been made for the RFI/RI Volume 2 dataset showing both specific conductance (SC) and hexavalent chromium, Cr(VI), for each plume well screened in the alluvial portion of site groundwater. The purpose of these plots is to check for any apparent relationship between the two constituents. The time series plots are provided in Figures G-1 through G-9. Field-measured SC was used in the analysis, as this was the most plentiful data compared to laboratory-measured SC and total dissolved solids (TDS).

A statistical correlation test was used to evaluate the relationship between SC and Cr(VI) at each alluvial plume well. Because natural variation produces numerous outliers, the non-parametric Spearman's rank correlation coefficient was used. The Spearman coefficient has been cited as providing a superior analysis of geological data over the standard Pearson correlation coefficient (a comparison is presented in Swan and Sandilands, 1995).

The data were sorted to provide only samples in which field SC and Cr(VI) analysis were both available. For each well, the significance of the Spearman correlation was evaluated by calculating the probability that the Spearman correlation coefficient is caused by random variation, based on the number of samples analyzed for that well. Values of Spearman probability below 0.05 (5%) were considered significant correlations. Table G-1 lists the wells used in the analysis, and for each well the number of samples and results of the test.

TABLE G-1
Spearman's Rank Correlation Test Between Specific Conductance and Hexavalent Chromium Among Alluvial Plume Well
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station

Well	Number of Samples	Spearman Correlation Coefficient	Spearman Probability	Spearman Significance	Positive or Negative Correlation
MW-09	20	0.522	0.018	Significant	Positive
MW-10	23	-0.413	0.050	Not Significant	
MW-11	19	-0.209	0.391	Not Significant	
MW-12	22	0.914	0.000	Significant	Positive
MW-19	19	-0.418	0.075	Not Significant	
MW-20-070	24	0.682	0.000	Significant	Positive
MW-20-100	24	-0.754	0.000	Significant	Negative
MW-20-130	22	-0.526	0.012	Significant	Negative

TABLE G-1
Spearman's Rank Correlation Test Between Specific Conductance and Hexavalent Chromium Among Alluvial Plume Well
RCRA Facility Investigation/Remedial Investigation Report (Volume 2 Addendum)
PG&E Topock Compressor Station

Well	Number of Samples	Spearman Correlation Coefficient	Spearman Probability	Spearman Significance	Positive or Negative Correlation
MW-24A	19	-0.090	0.713	Not Significant	
MW-24B	19	0.574	0.010	Significant	Positive
MW-25	19	0.334	0.163	Not Significant	
MW-26	22	0.283	0.201	Not Significant	
MW-31-060	23	0.515	0.012	Significant	Positive
MW-31-135	14	0.314	0.274	Not Significant	
MW-37D	12	0.266	0.404	Not Significant	
MW-38D	9	-0.350	0.356	Not Significant	
MW-38S	10	0.285	0.425	Not Significant	
MW-39-050	16	-0.223	0.405	Not Significant	
MW-39-060	15	-0.250	0.369	Not Significant	
MW-39-070	24	0.176	0.412	Not Significant	
MW-39-080	38	-0.077	0.647	Not Significant	
MW-39-100	36	-0.461	0.005	Significant	Negative
MW-40D	12	0.806	0.002	Significant	Positive
MW-44-115	28	0.208	0.289	Not Significant	
MW-44-125	28	0.215	0.271	Not Significant	
MW-46-175	27	0.463	0.015	Significant	Positive
MW-47-055	7	-0.607	0.148	Not Significant	
MW-50-095	6	-0.371	0.468	Not Significant	
MW-50-200	7	-0.143	0.760	Not Significant	
MW-51	6	-0.203	0.700	Not Significant	
PGE-06	4	-0.200	0.800	Not Significant	
TW-02D	7	-0.036	0.939	Not Significant	
TW-02S	8	0.333	0.420	Not Significant	
TW-04	5	0.800	0.104	Not Significant	

Out of 34 wells tested, 24 did not show significant correlation, seven showed significant positive correlation, and three showed significant negative correlation. The wells with positive correlation were MW-9, MW-12, MW-20-70, MW-24B, MW-31-60, MW-40D, and MW-46-175. Those wells with negative correlations were MW-20-100, MW-20-130, and MW-39-100.

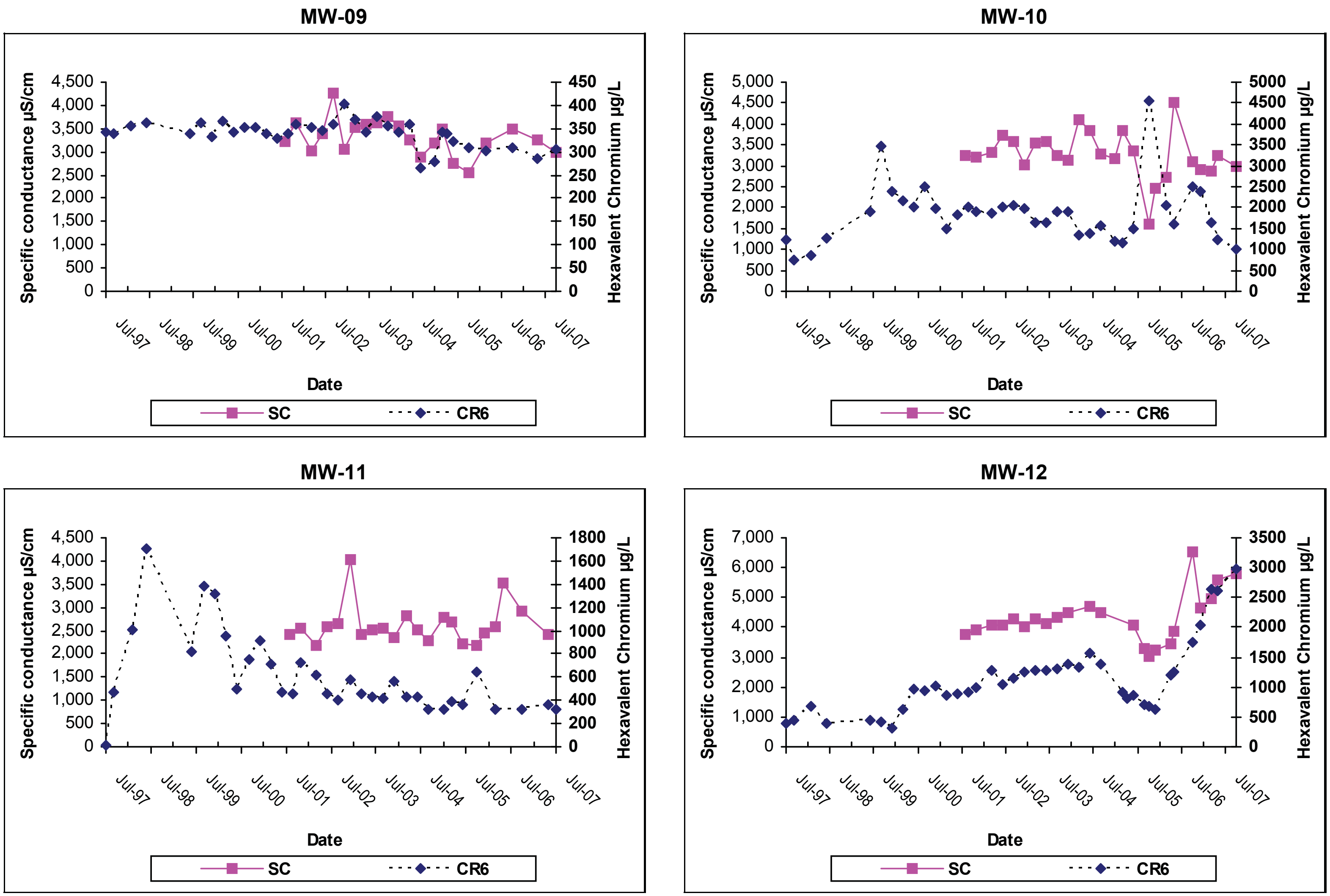
The drop in SC in wells MW-20-100 and MW-20-130 corresponds to the commencement of Interim Measures extraction in early 2004. There is a concomitant rise in Cr(VI) at that time, and the upward trend continued to recent time. Extraction on the 20-bench since 2004 has been primarily from the deep zone that is screened by MW-20-130. This pumping has shifted groundwater flow dramatically in the 20-bench area. Lower SC water in shallower alluvial zones was drawn downward within the influence of the extraction wells, resulting in the observed trend of lower SC in MW-20-130, and to a lesser extent in MW-20-100. Concentrations of Cr(VI) in the upper zone well MW-20-70 were significantly higher than those of MW-20-130 prior to extraction, supporting the observation of increasing Cr(VI) in the deeper well. The data support the conceptual model of deep zone extraction drawing shallow, higher-Cr(VI), lower-TDS water downward to the lower alluvial groundwater zone. The positive correlations observed for MW-20-70 and MW-31-60 appear to be driven by the data prior to Interim Measures extraction (Figures G-2 and G-4). SC has been relatively stable in these wells since extraction began, while Cr(VI) concentration has decreased.

Similarly, the MW-39 cluster has been strongly influenced by Interim Measures extraction (Figures G-5 and G-6), with lower-TDS water from the shallow fluvial zone, located closer to the river, being drawn landward into this well cluster. The MW-39 wells are located in the floodplain a few hundred feet east of the 20-bench. Stable isotope data support this conclusion, as discussed in the RFI/RI Volume 2 report. There has been a steep decline in Cr(VI) in these wells, as the water drawn into the wells by extraction is not only low-chromium but also chemically reducing, acting to dilute and reduce the Cr(VI) around this cluster. The negative correlation observed for the lower zone well MW-39-100 is due to higher-TDS water being drawn by extraction from shallow fluvial groundwater (exemplified by nearby well MW-30-30).

In summary, two-thirds of the alluvial plume wells did not show significant correlation between Cr(VI) and SC over time. Of the one-third that did, more than half are located within the influence of Interim Measures extraction, and their correlations are likely the result of different water being drawn into the well areas by the extraction. The overall conclusion is that SC and Cr(VI) trends do not appear to be related in the main body of the plume.

Reference

Swan, A.R.H. and M. Sandilands. 1995. *Introduction to Geological Data Analysis*. Blackwell Science, 446 pp.



Notes:
µS/cm: Microsiemens per centimeter
µg/L: Micrograms per liter

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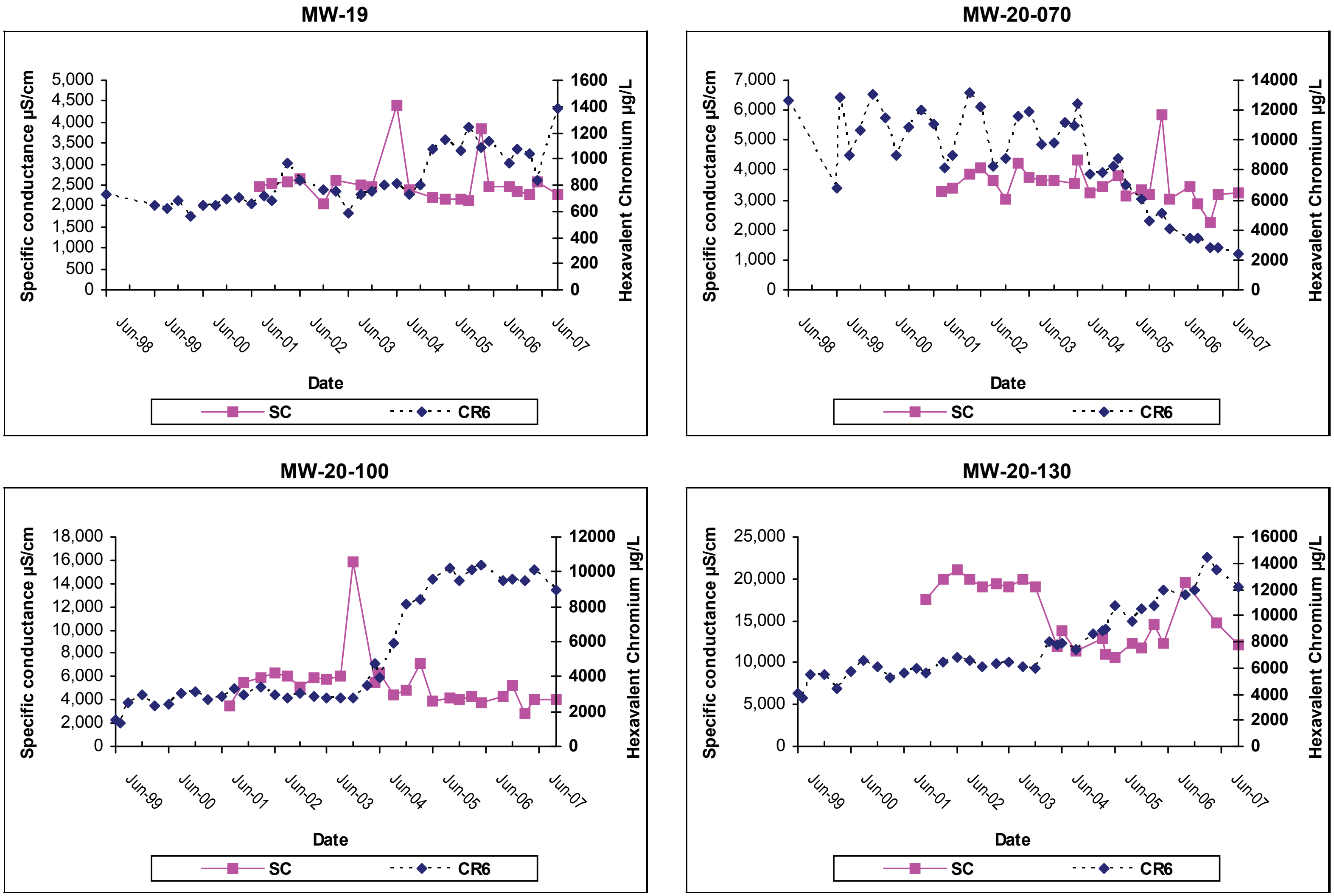
FIGURE G-1
SPECIFIC CONDUCTANCE AND HEXAVALENT CHROMIUM TIME TRENDS IN ALLUVIAL PLUME WELLS

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



Notes:
µS/cm: Microsiemens per centimeter
µg/L: Micrograms per liter

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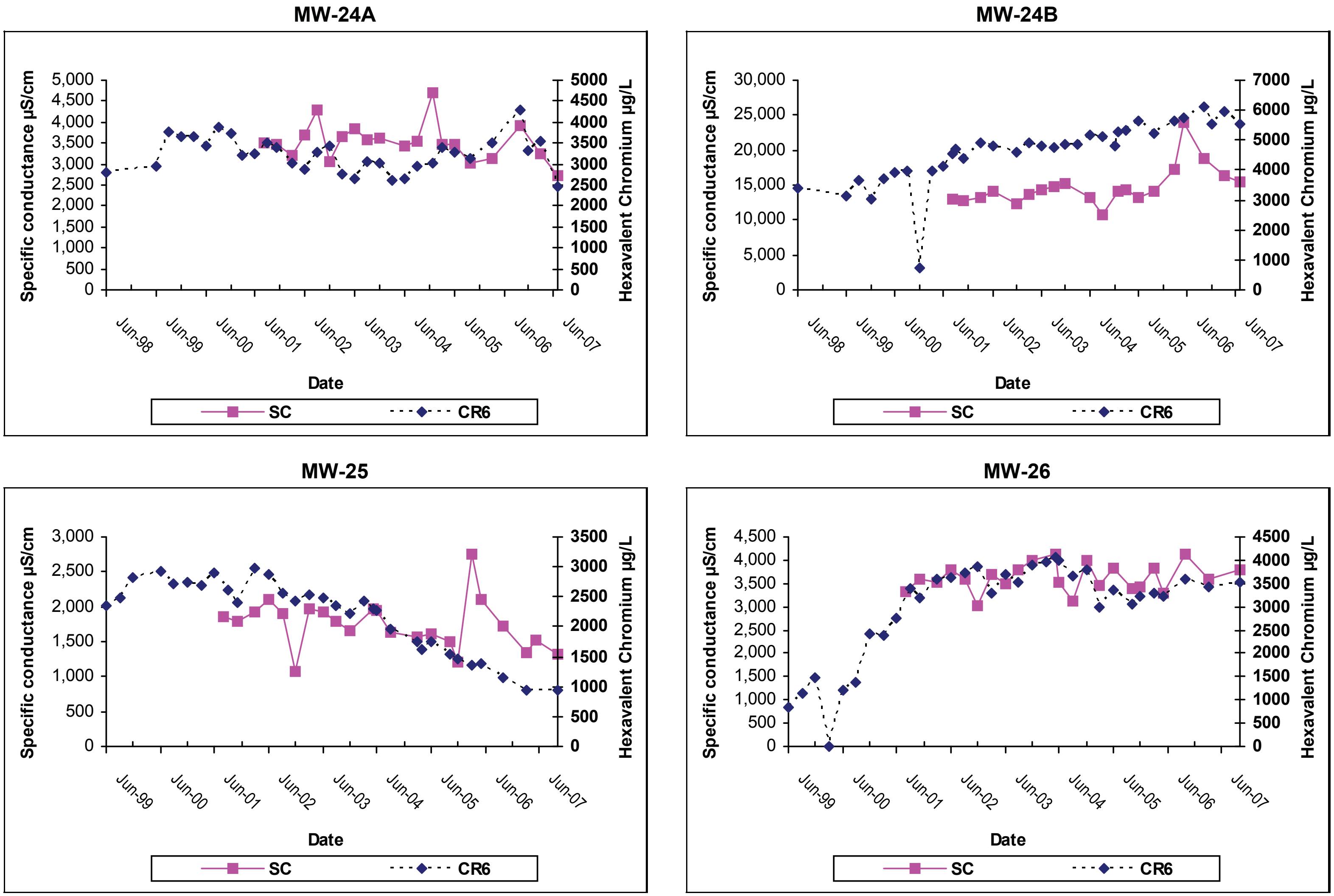
FIGURE G-2
SPECIFIC CONDUCTANCE AND HEXAVALENT CHROMIUM TIME TRENDS IN ALLUVIAL PLUME WELLS

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



Notes:
µS/cm: Microsiemens per centimeter
µg/L: Micrograms per liter

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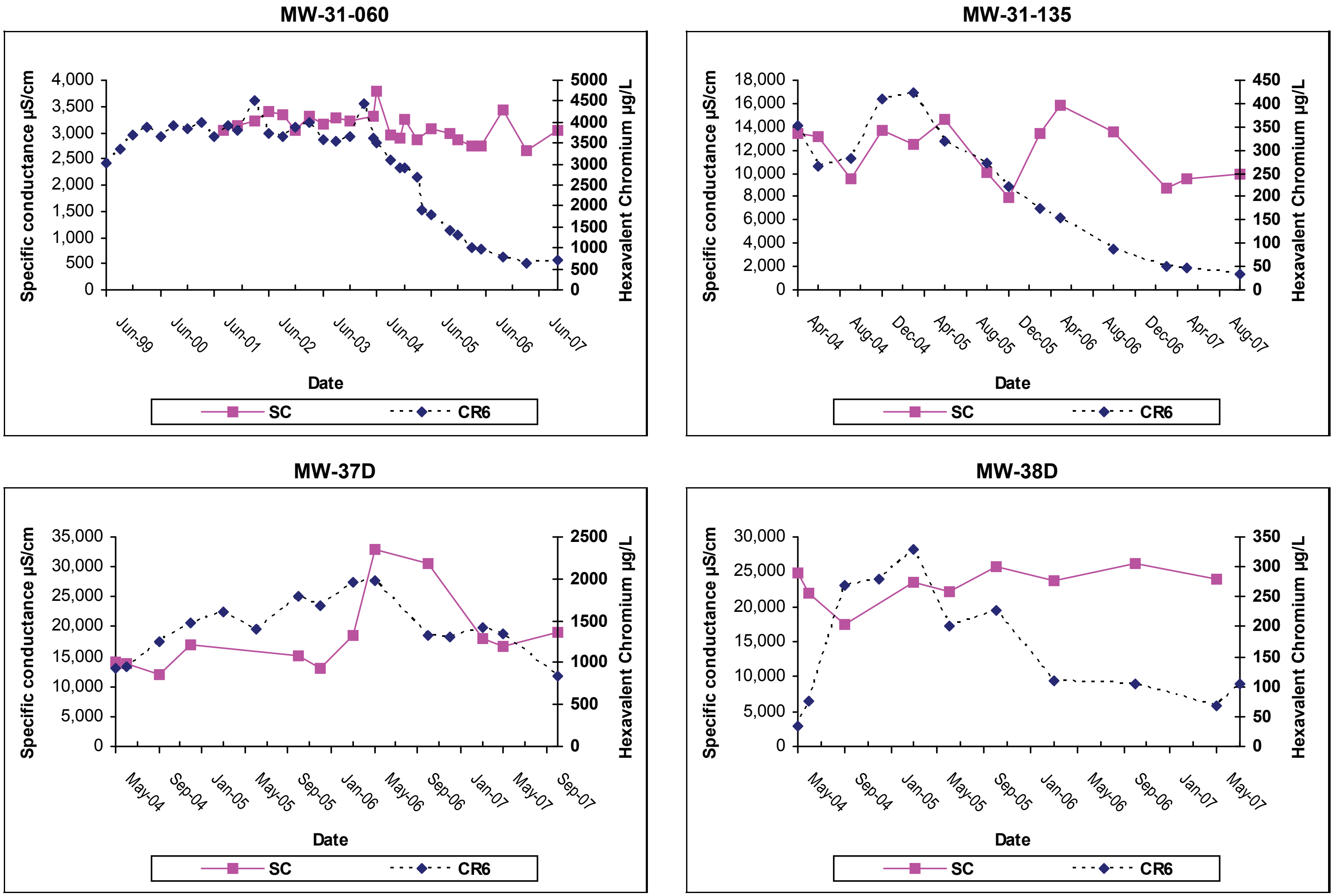
FIGURE G-3
SPECIFIC CONDUCTANCE AND HEXAVALENT CHROMIUM TIME TRENDS IN ALLUVIAL PLUME WELLS

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



Notes:
µS/cm: Microsiemens per centimeter
µg/L: Micrograms per liter

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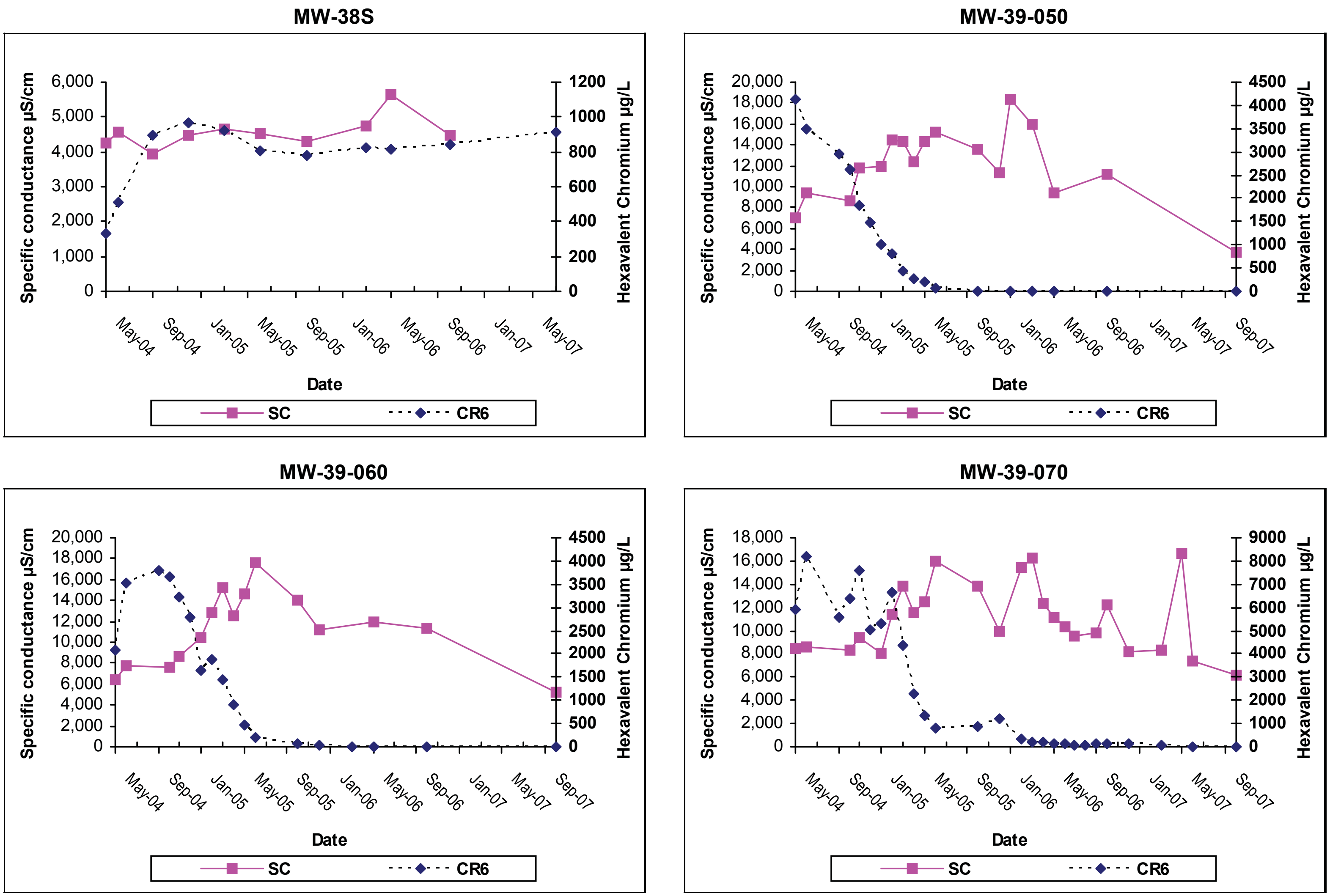
FIGURE G-4
SPECIFIC CONDUCTANCE AND HEXAVALENT CHROMIUM TIME TRENDS IN ALLUVIAL PLUME WELLS

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



Notes:
µS/cm: Microsiemens per centimeter
µg/L: Micrograms per liter

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FIGURE G-5
SPECIFIC CONDUCTANCE AND HEXAVALENT CHROMIUM TIME TRENDS IN ALLUVIAL PLUME WELLS

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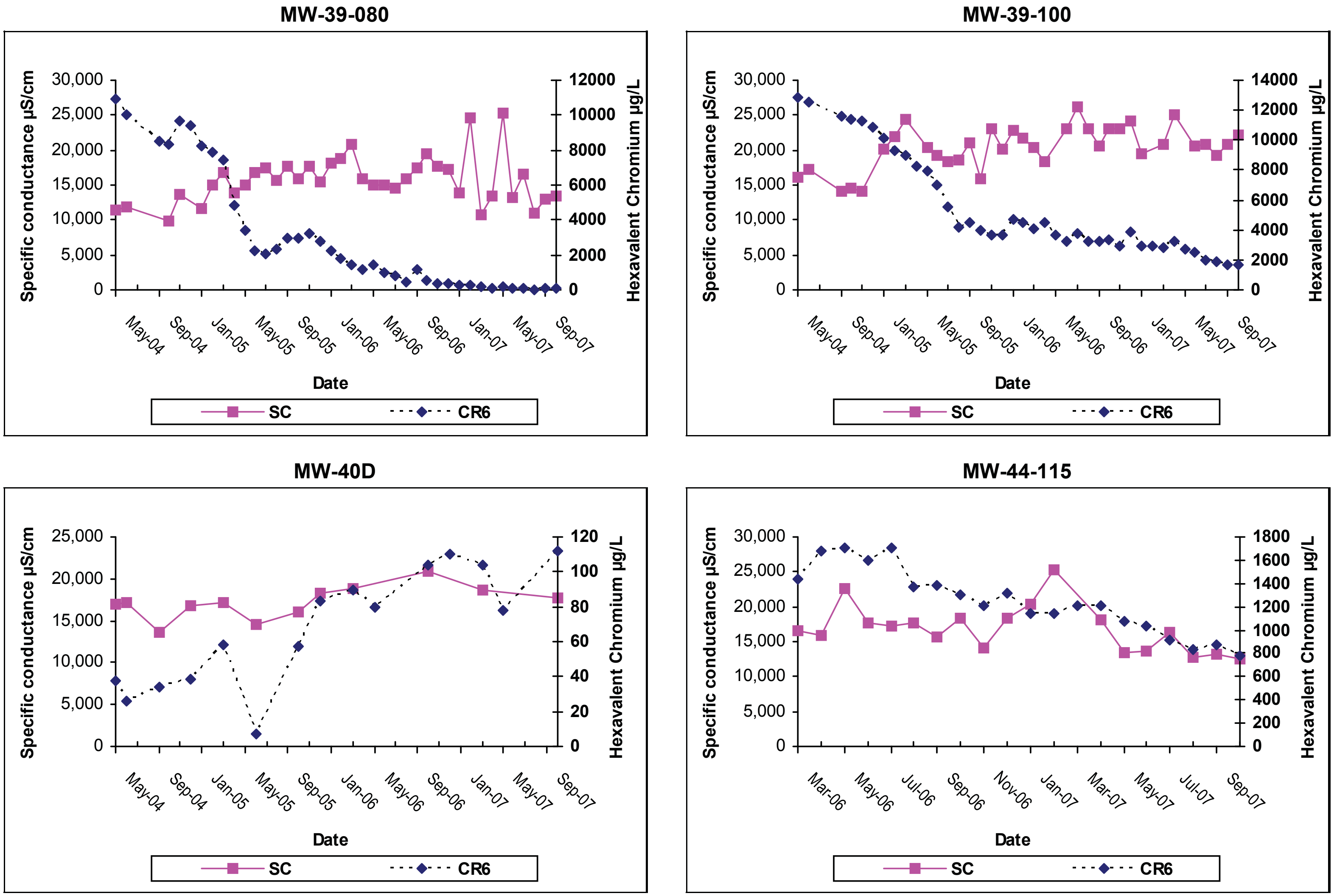
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



Notes:
µS/cm: Microsiemens per centimeter
µg/L: Micrograms per liter

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FIGURE G-6
SPECIFIC CONDUCTANCE AND HEXAVALENT CHROMIUM TIME TRENDS IN ALLUVIAL PLUME WELLS

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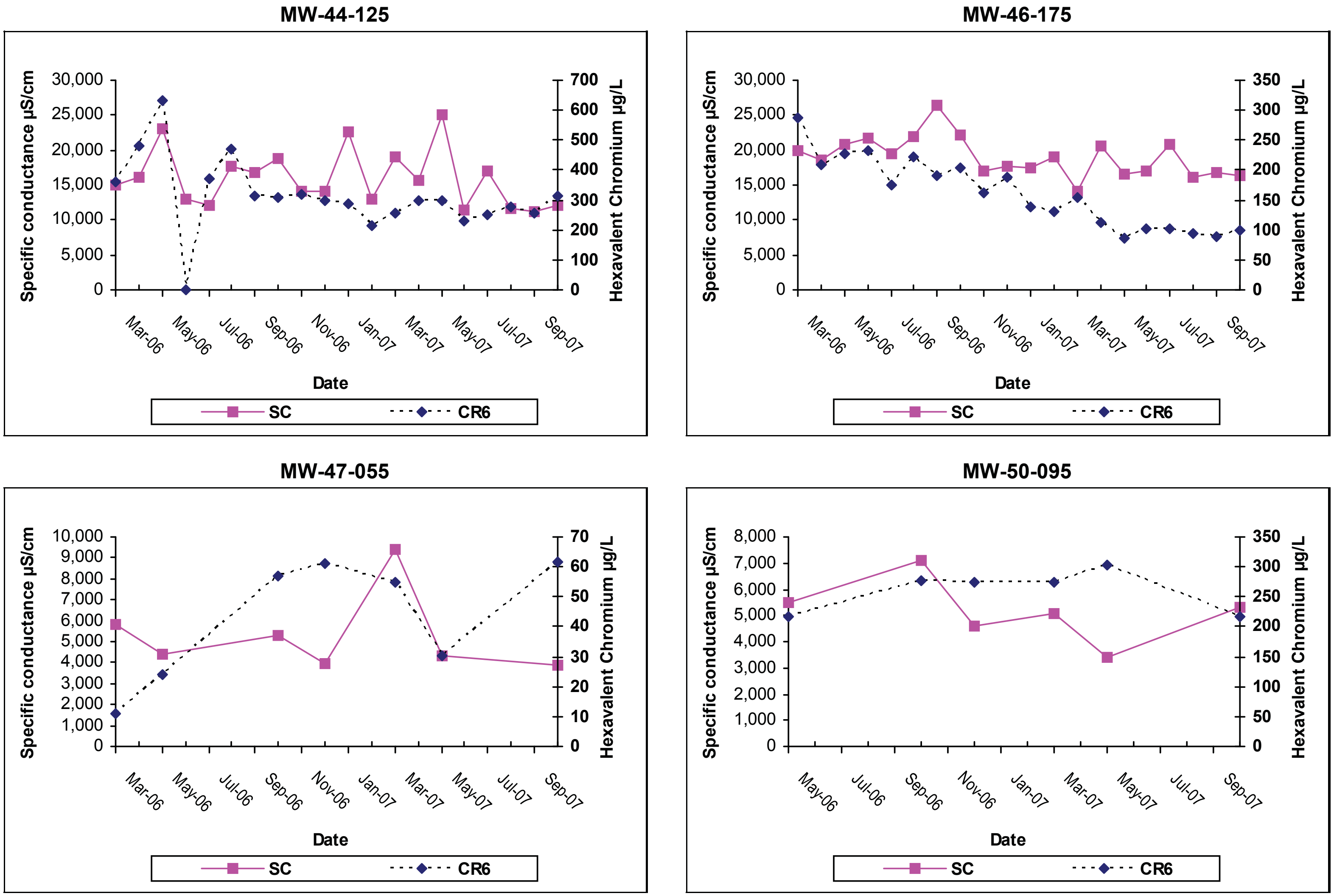
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL


MW-44-125

MW-46-175

MW-47-055

MW-50-095

Notes:
µS/cm: Microsiemens per centimeter
µg/L: Micrograms per liter

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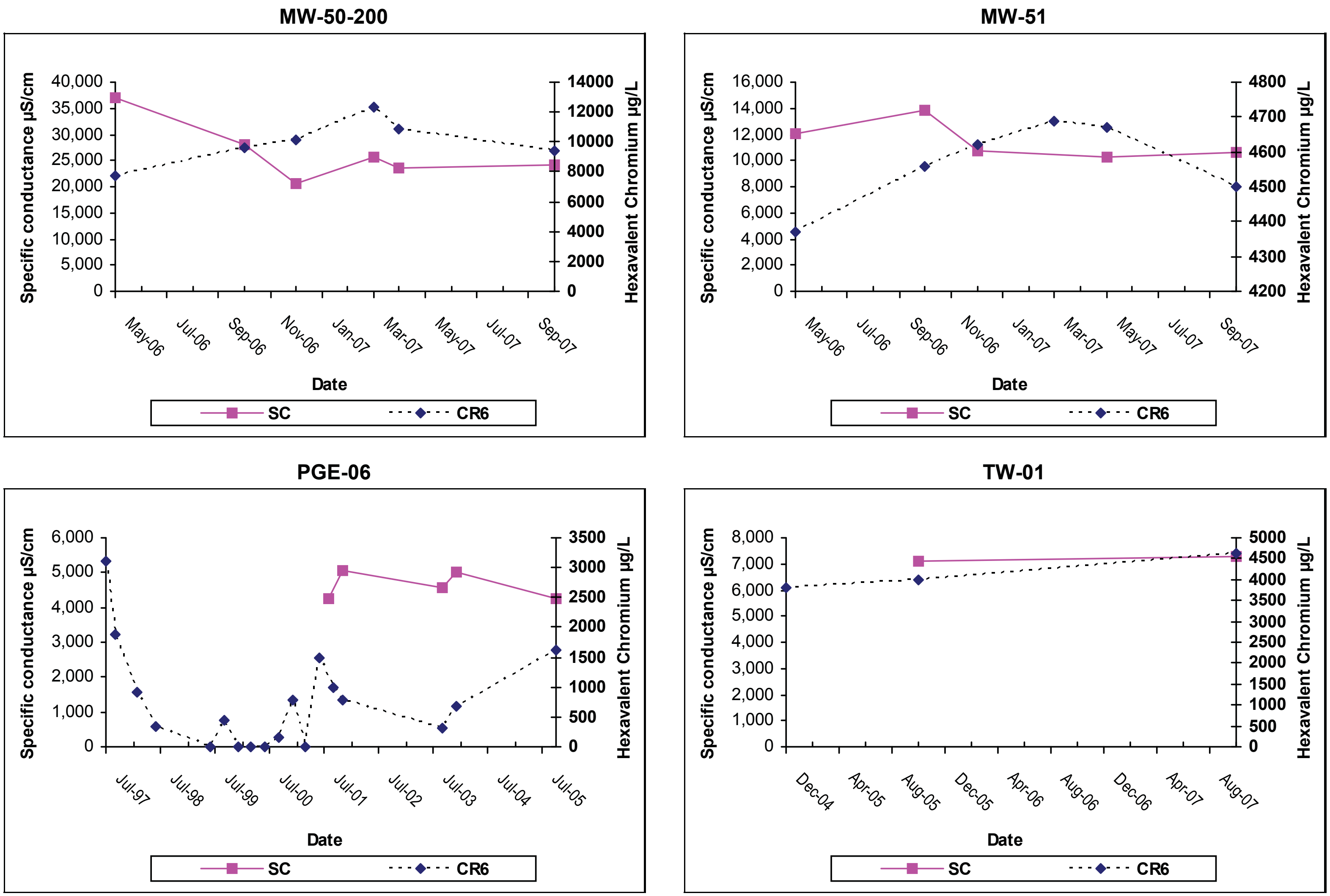
FIGURE G-7
SPECIFIC CONDUCTANCE AND HEXAVALENT CHROMIUM TIME TRENDS IN ALLUVIAL PLUME WELLS

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



Notes:
µS/cm: Microsiemens per centimeter
µg/L: Micrograms per liter

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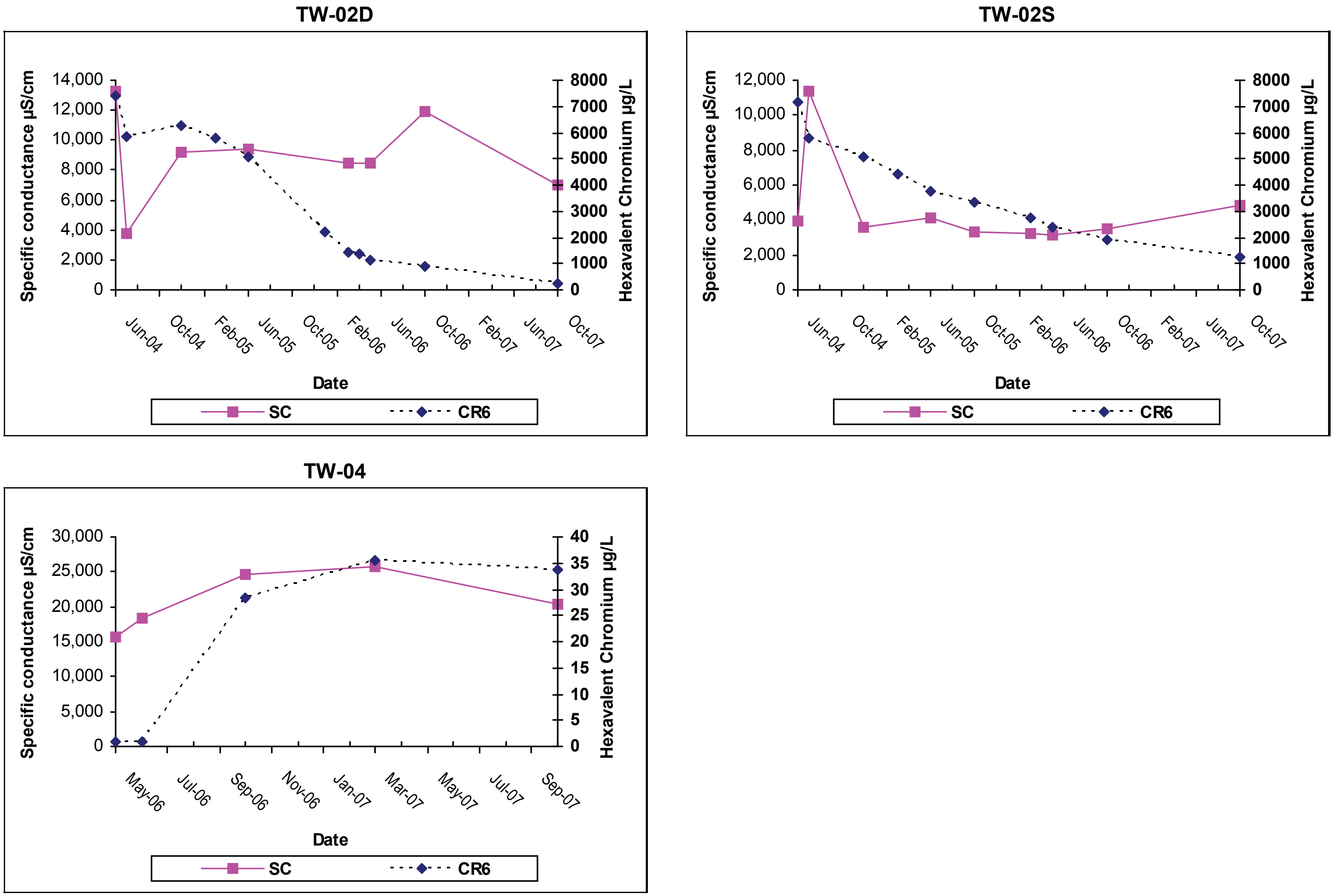
FIGURE G-8
SPECIFIC CONDUCTANCE AND HEXAVALENT CHROMIUM TIME TRENDS IN ALLUVIAL PLUME WELLS

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



Notes:
µS/cm: Microsiemens per centimeter
µg/L: Micrograms per liter

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FIGURE G-9
SPECIFIC CONDUCTANCE AND HEXAVALENT CHROMIUM TIME TRENDS IN ALLUVIAL PLUME WELLS

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2 ADDENDUM)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

Appendix H

Errata for Revised Final RFI/RI Volume 2 Report

Summary of Well Designation Changes

Well	Changed To:
MW-27-20	Fluvial
MW-27-60	Fluvial
MW-27-85	Fluvial
MW-33-90	Alluvial
MW-39-60	Alluvial
PT-1D	Alluvial
PT-2M	Alluvial
PT-2D	Alluvial
PT-3S	Fluvial
PT-4D	Alluvial
PT-5M	Alluvial
PT-5D	Alluvial
PT-6M	Alluvial
PT-6D	Alluvial
PTI-1S	Fluvial
PTI-1M	Alluvial
PTI-1D	Alluvial
Sanders	Alluvial

Impacts of Well Designation Changes

Volume 2 Addendum: 1 Table and 1 Figure changed (included in this report)
Table B-1 – updated per designation corrections above
Figure 2-2 – H-H' cross section, edited alluvial/fluvial contact for MW-39 (similar to Figure 5-7 in Volume 2)

Volume 2 Report: 4 Figures, 2 tables & 1 text page change (included in this appendix)
1) Table 4-2 – updated per designation corrections above
2) Table B-1 – updated per designation corrections above

<u>MW-33-90 changing to Alluvial affects:</u>
- Page 6-26 text - first sentence deleted "MW-33-90", "mid-level and", and redundant "MW-36-100, MW-34-100"

<u>MW-39-60 changing to Alluvial affects:</u>
1) Figure 5-2 - A-A' cross section, edited alluvial/fluvial contact
2) Figure 5-7 - F-F' cross section, edited alluvial/fluvial contact
3) Figure 5-22 - footnote at bottom deleted "MW-39-60", deleted asterisks at MW-39-60
4) Figure 6-13 - A-A' cross section, edited alluvial/fluvial contact
- Page 6-26 text - second sentence deleted "MW-39-60"

Non-reducing conditions are present in several ~~mid-level and~~ deep fluvial wells (~~MW-33-90,~~ e.g. MW-34-100, MW-36-090, MW-36-100, and MW-45-95a~~ e.g., MW-36-100, MW-34-100,~~ as shown on Figures 5-22 and 5-23). Prior to IM-3 extraction, which acted to spread more reducing shallow groundwater deeper and to the west, several other fluvial wells showed non-reducing conditions (MW-30-50, MW-34-80, and MW-39-50~~, and MW-39-60~~). Because these wells are within the plume flowpath, Cr(VI) concentrations are correspondingly elevated. The reason for these non-reducing conditions is believed to be a combination of original depositional environment and age of the deep fluvial deposits. In the early stage of the Colorado River when these sediments were deposited, the young river was actively eroding and flowing at high energy. This early stage of river development is not as conducive to biological habitat development as in later stages, resulting in fluvial deposits that are relatively low in organic carbon. In addition, because these deposits are old compared to the more recent shallow deposits, there has been more time for the original organic carbon to be used up by reaction with naturally-aerobic alluvial groundwater over recent geologic time. The overall result is a carbon-poor, non-reducing environment similar to that observed in the alluvial material. This geochemical condition is not present in all deep fluvial wells. The southern end of the floodplain has more dense vegetation, and may have supported this environment as long as the river has been in this eastward-bending orientation. Fluvial well clusters in this area (MW-43, MW-52, MW-53) display reducing conditions in all depth intervals. In addition, well MW-28-90, a deep fluvial well in the northern floodplain, also shows consistently reducing conditions. Data from these wells demonstrate that there is natural variation in the distribution of reducing material in deep fluvial deposits.

TDS concentrations in plume well samples are highly variable. The same tendency toward higher TDS at depth observed in non-plume wells (Section 5.3.1.4) is observed in plume wells. Although historical records of the composition of cooling tower blowdown water are sparse, it appears that cooling water was kept in circulation much longer in the early 1950s than in later decades. This would result in a larger degree of evaporation before the water was discharged, resulting in higher TDS. General chemistry analyses of two "tower recirculating water" samples from 1952 were used to calculate TDS, resulting in values of 22,000 and 29,000 mg/L made up of naturally present, but concentrated salts. The circulation cycles were reduced over the course of operations and, in 1969, the blowdown water TDS was 8,900 mg/L. By 1986, blowdown TDS had been further reduced to 6,610 mg/L. At first review, it was observed that the TDS of alluvial plume wells tends to be greater than that of non-plume alluvial wells. However, upon more detailed analysis, it is apparent the explanation for the apparent higher TDS in plume well data set relates to the proximity of their screened intervals to the bedrock surface. As shown in Figure 5-20, most plume wells are screened close to the bedrock surface. Wells screened closer to the bedrock surface tend to have higher TDS, regardless of whether the well is associated with the plume or not. The alluvial material at the base of the aquifer represents the oldest in the depositional sequence, which would be expected to have been segregated from the hydrologic cycle the longest and has accumulated the most dissolved solids. Many of the plume wells were constructed with screens closer to bedrock and may therefore biased toward higher TDS compared to non-plume wells. A two-tailed student t-test was run between plume wells and non-plume wells, and the range of screen heights above bedrock for non-plume wells was significantly different (i.e. higher) than that of plume wells at the

TABLE 4-2

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Location ID	Investigation Program & Well Type [1]	Status [2]	Date Installed	Ground Elevation (feet MSL)	Screen Interval (feet bgs)	Monitoring [3] Zone	Additional Characterization [4]		
							Geophys	Gr-Size	Hyd Test
Groundwater Monitoring Wells									
MW-1	New Ponds - Monitoring	Active	Aug-86	660	201 - 211	SA - alluvial			
MW-3	New Ponds - Monitoring	Active	Aug-86	649	193 - 203	SA - alluvial			
MW-4	New Ponds - Monitoring	Active	Aug-86	624	165 - 175	SA - alluvial			
MW-5	New Ponds - Monitoring	Active	Jun-89	635	176 - 185	SA - alluvial			
MW-6	New Ponds - Monitoring	Active	Jun-89	642	185 - 194	SA - alluvial			
MW-7	New Ponds - Monitoring	Active	Jun-89	630	173 - 183	SA - alluvial			
MW-8	New Ponds - Monitoring	Active	Jun-89	627	169 - 178	SA - alluvial			
MW-9	RFI - Monitoring	Active	Jul-97	534	77 - 87	SA - alluvial		X	
MW-10	RFI - Monitoring	Active	Jun-97	529	74 - 94	SA - alluvial		X	
MW-11	RFI - Monitoring	Active	Jun-97	521	63 - 83	SA - alluvial		X	
MW-12	RFI - Monitoring	Active	Jul-97	483	28 - 48	SA - alluvial			
MW-13	RFI - Monitoring	Active	Jul-97	487	29 - 49	SA - alluvial			
MW-14	RFI - Monitoring	Active	Jul-97	570	111 - 131	SA - alluvial			
MW-15	RFI - Monitoring	Active	Jul-97	640	181 - 201	SA - alluvial		X	
MW-16	RFI - Monitoring	Active	Apr-98	655	198 - 218	SA - alluvial			
MW-17	RFI - Monitoring	Active	May-98	588	130 - 150	SA - alluvial		X	
MW-18	RFI - Monitoring	Active	Apr-98	544	85 - 105	SA - alluvial			
MW-19	RFI - Monitoring	Active	Mar-98	499	46 - 66	SA - alluvial			
MW-20-70	RFI - Monitoring	Active	Mar-98	499	50 - 70	SA - alluvial			
MW-20-100	RFI - Monitoring	Active	Apr-99	499	90 - 100	MA - alluvial			X
MW-20-130	RFI - Monitoring	Active	Apr-99	499	121 - 131	DA - alluvial	X		X
MW-21	RFI - Monitoring	Active	May-98	506	39 - 59	SA - alluvial			
MW-22	RFI - Monitoring	Active	Apr-98	458	6 - 11	SA - fluvial		X	
MW-23	RFI - Monitoring	Active	Apr-98	505	60 - 80	BR-Tmc	X		
MW-24A	RFI - Monitoring	Active	May-98	565	104 - 124	SA - alluvial	X		
MW-24B	RFI - Monitoring	Active	May-98	563	193 - 213	DA - alluvial	X		
MW-24BR	RFI - Monitoring	Active	Apr-98	563	378 - 437	BR-pTbr	X		X
MW-25	RFI - Monitoring	Active	Apr-99	541	85 - 105	SA - alluvial			
MW-26	RFI - Monitoring	Active	Apr-99	503	52 - 72	SA - alluvial			X
MW-27-20	RFI - Monitoring	Active	Apr-99	459	7 - 17	SA - fluvial			X
MW-27-60	IM - Monitoring	Active	Feb-05	458	47 - 57	MA - fluvial			
MW-27-85	IM - Monitoring	Active	Feb-05	458	78 - 88	DA - fluvial	X		
MW-28-25	RFI - Monitoring	Active	Apr-99	465	13 - 23	SA - fluvial			X
MW-28-90	IM - Monitoring	Active	Apr-04	465	70 - 90	DA - fluvial	X	X	
MW-29	RFI - Monitoring	Active	Apr-99	483	30 - 40	SA - fluvial			
MW-30-30	RFI - Monitoring	Active	Apr-99	466	12 - 32	SA - fluvial			X
MW-30-50	RFI - Monitoring	Active	Mar-03	466	40 - 50	MA - fluvial			
MW-31-60	RFI - Monitoring	Active	Apr-99	495	42 - 62	SA - alluvial			
MW-31-135	IM - Monitoring	Active	Mar-04	495	113 - 133	DA - alluvial	X	X	
MW-32-20	RFI - Monitoring	Active	Mar-03	459	10 - 20	SA - fluvial			
MW-32-35	RFI - Monitoring	Active	Mar-03	459	28 - 35	SA - fluvial			
MW-33-40	RFI - Monitoring	Active	Mar-03	485	29 - 39	SA - fluvial			

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							Geophys	Gr-Size	Hyd Test
Groundwater Monitoring Wells									
MW-33-90	RFI - Monitoring	Active	Mar-03	485	69 - 89	MA - alluvial			
MW-33-150	IM - Monitoring	Active	Feb-05	485	132 - 152	DA - alluvial			
MW-33-210	IM - Monitoring	Active	Feb-05	485	190 - 210	DA - alluvial	X		
MW-34-55	RFI - Monitoring	Active	Jun-03	459	45 - 55	MA - fluvial			
MW-34-80	RFI - Monitoring	Active	Jun-03	459	73 - 83	DA - fluvial	X	X	
MW-34-100	IM - Monitoring	Active	Jan-05	459	90 - 100	DA - fluvial	X		
MW-35-60	IM - Monitoring	Active	Mar-04	481	41 - 61	SA - alluvial			
MW-35-135	IM - Monitoring	Active	Mar-04	481	116 - 136	DA - alluvial	X	X	
MW-36-20	IM - Monitoring	Active	May-04	467	10 - 20	SA - fluvial			
MW-36-40	IM - Monitoring	Active	May-04	467	30 - 40	SA - fluvial			
MW-36-50	IM - Monitoring	Active	May-04	467	46 - 51	MA - fluvial			
MW-36-70	IM - Monitoring	Active	May-04	467	60 - 70	MA - fluvial			
MW-36-90	IM - Monitoring	Active	May-04	467	80 - 90	DA - fluvial			
MW-36-100	IM - Monitoring	Active	May-04	467	88 - 98	DA - fluvial	X	X	
MW-37S	IM - Monitoring	Active	Apr-04	484	64 - 84	MA - alluvial			
MW-37D	IM - Monitoring	Active	Apr-04	484	180 - 200	DA - alluvial	X	X	
MW-38S	IM - Monitoring	Active	Apr-04	523	75 - 95	SA - alluvial			
MW-38D	IM - Monitoring	Active	Apr-04	523	163 - 183	DA - alluvial	X	X	
MW-39-40	IM - Monitoring	Active	Apr-04	465	30 - 40	SA - fluvial			
MW-39-50	IM - Monitoring	Active	Apr-04	465	47 - 52	MA - fluvial			
MW-39-60	IM - Monitoring	Active	Apr-04	465	49 - 59	MA - alluvial			
MW-39-70	IM - Monitoring	Active	Apr-04	465	60 - 70	MA - alluvial			
MW-39-80	IM - Monitoring	Active	Apr-04	465	70 - 80	DA - alluvial			
MW-39-100	IM - Monitoring	Active	Apr-04	465	80 - 100	DA - alluvial	X	X	
MW-40S	IM - Monitoring	Active	May-04	566	115 - 135	SA - alluvial			
MW-40D	IM - Monitoring	Active	May-04	567	240 - 260	DA - alluvial	X	X	
MW-41S	IM - Monitoring	Active	Nov-04	477	40 - 60	SA - alluvial			
MW-41M	IM - Monitoring	Active	Nov-04	477	170 - 190	DA - alluvial			
MW-41D	IM - Monitoring	Active	Nov-04	477	271 - 291	DA - alluvial	X		X
MW-42-30	IM - Monitoring	Active	Feb-05	461	10 - 30	SA - fluvial			
MW-42-55	IM - Monitoring	Active	Feb-05	461	43 - 53	MA - fluvial			
MW-42-65	IM - Monitoring	Active	Feb-05	461	56 - 66	MA - fluvial	X		
MW-43-25	IM - Monitoring	Active	Feb-05	463	15 - 25	SA - fluvial			
MW-43-75	IM - Monitoring	Active	Feb-05	463	65 - 75	DA - fluvial			
MW-43-90	IM - Monitoring	Active	Feb-05	460	80 - 90	DA - fluvial	X		
MW-44-70	IM - Monitoring	Active	Mar-06	471	61 - 71	MA - fluvial			
MW-44-115	IM - Monitoring	Active	Mar-06	470	103 - 113	DA - alluvial			
MW-44-125	IM - Monitoring	Active	Mar-06	471	116 - 125	DA - alluvial	X		
MW-45-095a	IM - Monitoring	Active	Feb-06	467	83 - 93	DA - fluvial			
MW-46-175	IM - Monitoring	Active	Feb-06	481	165 - 175	DA - alluvial			
MW-46-205	IM - Monitoring	Active	Feb-06	481	197 - 207	DA - alluvial	X		
MW-47-55	IM - Monitoring	Active	Mar-06	483	45 - 55	SA - alluvial			

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							Geophys	Gr-Size	Hyd Test
Groundwater Monitoring Wells									
MW-47-115	IM - Monitoring	Active	Mar-06	483	105 - 115	DA - alluvial			
MW-48	IM - Monitoring	Active	May-06	484	124 - 134	BR-Tmc			X
MW-49-135	IM - Monitoring	Active	Mar-06	483	125 - 135	DA - alluvial			
MW-49-275	IM - Monitoring	Active	Mar-06	483	255 - 275	DA - alluvial			
MW-49-365	IM - Monitoring	Active	Mar-06	483	345 - 365	DA - alluvial	X		
MW-50-095	IM - Monitoring	Active	Apr-06	495	85 - 95	MA - alluvial			
MW-50-200	IM - Monitoring	Active	Apr-06	495	190 - 200	DA - alluvial	X		
MW-51	IM - Monitoring	Active	Apr-06	502	97 - 112	MA - alluvial			
MW-52S	IM - Monitoring	Active	Mar-07	460	47 - 49	MA - fluvial			
MW-52M	IM - Monitoring	Active	Mar-07	460	66 - 68	DA - fluvial			
MW-52D	IM - Monitoring	Active	Mar-07	460	85 - 87	DA - fluvial			
MW-53S	IM - Monitoring	Inactive	Mar-07	460	29 - 30	SA - fluvial			
MW-53M	IM - Monitoring	Active	Mar-07	460	99 - 100	DA - fluvial			
MW-53D	IM - Monitoring	Active	Mar-07	460	124 - 125	DA - fluvial			
MWP-1	Old Ponds - Monitoring	decomm	Jul-85	675	75 - 115	SA - alluvial			
MWP-2	Old Ponds - Monitoring	decomm	Jul-85	675	200 - 260	SA - alluvial			
MWP-2RD	Old Ponds - Monitoring	decomm	Jul-85	674	265 - 275	BR-pTbr			
MWP-3	Old Ponds - Monitoring	decomm	Jul-85	661	108 - 208	SA - alluvial			
MWP-7	Old Ponds - Monitoring	decomm	Oct-85	675	70 - 110	SA - alluvial			
MWP-8	Old Ponds - Monitoring	Standby	Oct-85	677	181 - 211	SA - alluvial			
MWP-9	Old Ponds - Monitoring	decomm	Oct-85	680	179 - 219	SA - alluvial			
MWP-10	Old Ponds - Monitoring	Standby	Jan-86	675	194 - 234	SA - alluvial			
MWP-12	Old Ponds - Monitoring	Standby	Jan-86	662	96 - 136	SA - alluvial			
MWP-14	Old Ponds - Monitoring	decomm	Jun-92	674	206 - 216	SA - alluvial			
MWP-15	Old Ponds - Monitoring	decomm	Jun-92	676	198 - 208	SA - alluvial			
MWP-16	Old Ponds - Monitoring	decomm	Jun-92	690	210 - 220	SA - alluvial			
OW-1S	CMP - Monitoring	Active	Nov-04	548	84 - 114	SA - alluvial			
OW-1M	CMP - Monitoring	Active	Sep-04	548	165 - 185	MA - alluvial			
OW-1D	CMP - Monitoring	Active	Sep-04	548	257 - 277	DA - alluvial		X	
OW-2S	CMP - Monitoring	Active	Dec-04	546	71 - 101	SA - alluvial			
OW-2M	CMP - Monitoring	Active	Dec-04	546	190 - 210	MA - alluvial			
OW-2D	CMP - Monitoring	Active	Dec-04	547	310 - 330	DA - alluvial		X	
OW-3S	IM - Monitoring	Active	Oct-04	556	86 - 116	SA - alluvial			
OW-3M	IM - Monitoring	Active	Oct-04	556	180 - 200	MA - alluvial			
OW-3D	IM - Monitoring	Active	Oct-04	556	242 - 262	DA - alluvial	X	X	X
OW-5S	CMP - Monitoring	Active	Nov-04	549	70 - 110	SA - alluvial			
OW-5M	CMP - Monitoring	Active	Nov-04	549	210 - 250	DA - alluvial			
OW-5D	CMP - Monitoring	Active	Nov-04	550	300 - 320	DA - alluvial		X	
P-2	New Ponds - Monitoring	Inactive	Aug-86	536	239 - 249	DA - alluvial			
PGE-7BR	IM - Monitoring	Active	Oct-07	563	249 - 300	BR-pTbr	X		X
CW-1M	CMP - Monitoring	Active	Jan-05	563	140 - 190	MA - alluvial			
CW-1D	CMP - Monitoring	Active	Jan-05	564	250 - 300	DA - alluvial	X		

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							Geophys	Gr-Size	Hyd Test
Groundwater Monitoring Wells									
CW-2M	CMP - Monitoring	Active	Feb-05	547	152 - 202	MA - alluvial			
CW-2D	CMP - Monitoring	Active	Jan-05	547	285 - 335	DA - alluvial	X		
CW-3M	CMP - Monitoring	Active	Feb-05	532	172 - 222	MA - alluvial			
CW-3D	CMP - Monitoring	Active	Jan-05	532	270 - 320	DA - alluvial	X		
CW-4M	CMP - Monitoring	Active	Jan-05	516	120 - 170	MA - alluvial			
CW-4D	CMP - Monitoring	Active	Jan-05	516	233 - 283	DA - alluvial	X		
P-1	Old Ponds - Monitoring	decomm	Feb-86	694	171 - 211	SA - alluvial			
Extraction, Test & Injection Wells									
IW-2	IM - Injection	Active	Dec-04	547	170 - 330	MA-DA - alluvial	X		X
IW-3	IM - Injection	Active	Dec-04	551	160 - 320	MA-DA - alluvial	X		X
PE-1	IM - Extraction	Active	Mar-05	458	79 - 89	DA - fluvial			X
PGE-8	TCS - Injection	Inactive	Jun-69	595	405 - 554	BR-pTbr	X		X
PGE-PT-1	New Ponds - Test	Inactive	Nov-86	625	220 - 260	MA-DA - alluvial			
TW-1	IM - Test	Active	Nov-03	621	169 - 269	SA-MA-DA - alluvial	X		X
TW-2S	IM - Extraction	Standby	Apr-04	497	43 - 93	SA-MA - alluvial	X		
TW-2D	IM - Extraction	Standby	Apr-04	497	113 - 148	DA - alluvial	X	X	
TW-3D	IM - Extraction	Active	Oct-05	497	111 - 156	DA - alluvial			X
TW-4	IM - Test	Active	Mar-06	483	210 - 250	DA - alluvial	X		X
TW-5	IM - Test	Active	Apr-06	495	110 - 150	DA - alluvial			X
In-Situ Pilot Test Wells									
PT-1S	ISPT - Monitoring	Active	Jan-06	472	35 - 45	SA - fluvial			
PT-1M	ISPT - Monitoring	Active	Jan-06	472	60 - 70	MA - fluvial			
PT-1D	ISPT - Monitoring	Active	Jan-06	472	95 - 105	DA - alluvial			
PT-2S	ISPT - Monitoring	Active	Feb-06	471	35 - 45	SA - fluvial			
PT-2M	ISPT - Monitoring	Active	Feb-06	471	60 - 70	MA - alluvial			
PT-2D	ISPT - Monitoring	Active	Feb-06	471	95 - 105	DA - alluvial			
PT-3S	ISPT - Monitoring	Active	Feb-06	472	35 - 45	SA - fluvial			
PT-3M	ISPT - Monitoring	Active	Feb-06	472	60 - 70	MA - alluvial			
PT-3D	ISPT - Monitoring	Active	Feb-06	472	95 - 105	DA - alluvial			
PT-4S	ISPT - Monitoring	Active	Feb-06	472	35 - 45	SA - fluvial			
PT-4M	ISPT - Monitoring	Active	Feb-06	472	60 - 70	MA - fluvial			
PT-4D	ISPT - Monitoring	Active	Feb-06	472	95 - 105	DA - alluvial			
PT-5S	ISPT - Monitoring	Active	Feb-06	471	35 - 45	SA - fluvial			
PT-5M	ISPT - Monitoring	Active	Feb-06	471	60 - 70	MA - alluvial			
PT-5D	ISPT - Monitoring	Active	Feb-06	471	95 - 105	DA - alluvial			
PT-6S	ISPT - Monitoring	Active	Jan-06	474	35 - 45	SA - fluvial			
PT-6M	ISPT - Monitoring	Active	Jan-06	474	60 - 70	MA - alluvial			
PT-6D	ISPT - Monitoring	Active	Jan-06	474	95 - 105	DA - alluvial			
PT-7S	ISPT - Monitoring	Active	May-07	561	130 - 155	SA - alluvial			
PT-7M	ISPT - Monitoring	Active	May-07	561	165 - 185	MA - alluvial			
PT-7D	ISPT - Monitoring	Active	May-07	560	177 - 217	DA - alluvial			
PT-8S	ISPT - Monitoring	Active	May-07	562	147 - 152	SA - alluvial			

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Location ID	Investigation Program & Well Type [1]	Status [2]	Date Installed	Ground Elevation (feet MSL)	Screen Interval (feet bgs)	Monitoring Zone [3]	Additional Characterization [4]		
							Geophys	Gr-Size	Hyd Test
In-Situ Pilot Test Wells									
PT-8M	ISPT - Monitoring	Active	May-07	562	162 - 183	MA - alluvial			
PT-8D	ISPT - Monitoring	Active	May-07	562	190 - 210	DA - alluvial			
PT-9S	ISPT - Monitoring	Active	Jun-07	562	128 - 148	SA - alluvial			
PT-9M	ISPT - Monitoring	Active	Jun-07	560	163 - 183	MA - alluvial			
PT-9D	ISPT - Monitoring	Active	Jun-07	560	190 - 210	DA - alluvial			
PTI-1S	ISPT - Injection	Active	Jan-06	473	35 - 45	SA - fluvial			
PTI-1M	ISPT - Injection	Active	Jan-06	473	60 - 70	MA - alluvial			
PTI-1D	ISPT - Injection	Active	Jan-06	473	95 - 105	DA - alluvial			
PTR-1	ISPT - recirculation	Active	May-07	558	125 - 220	MA-DA - alluvial			
PTR-2	ISPT - recirculation	Active	Jun-07	565	118 - 218	MA-DA - alluvial			
Water Supply Wells									
PGE-1	TCS - original supply	decomm	Sep-51	555	99 - 177	MA - alluvial			
PGE-2	TCS - original supply	decomm	Jul-51	552	98 - 152	MA - alluvial			
PGE-6	TCS - replacement supply	decomm	Jun-64	562	110 - 180	SA-MA - alluvial			
PGE-7	TCS - replacement supply	Inactive	Sep-64	563	195 - 330	DA-BR-pTbr	X		
PGE-9N	TCS - replacement supply	Inactive	Apr-97	460	25 - 95	MA-DA - fluvial			
PGE-9S	TCS - replacement supply	Inactive	Apr-97	459	30 - 100	MA-DA - fluvial			
Park Moabi-1	SBC original supply	decomm	Mar-61	470	28 - 180	---			
Park Moabi-3	SBC supply	Active	Aug-86	517	80 - 200	MA - alluvial			
Park Moabi-4	SBC supply	Standby	Oct-06	485	93 - 140	MA - alluvial	X		
Selected Wells in Arizona									
Sanders	private supply	Active	Jun-05	464	48 - 68	SA - alluvial			
Smith	private supply	decomm	Feb-98	505	48 - 68	SA			
TMW-6	TM - Monitoring	decomm	Jan-91	469	12 - 32	SA - fluvial			
TMW-8	TM - Monitoring	decomm	Jan-91	465	5 - 25	SA - fluvial			
TMW-9	TM - Monitoring	decomm	Jan-91	461	6 - 31	SA - fluvial			
TMW-10	TM - Monitoring	decomm	Jan-91	470	10 - 30	SA - fluvial			
TMW-11	TM - Monitoring	decomm	Jan-91	468	10 - 30	SA - fluvial			
Topock-1	ATSF original supply	decomm	---	505	---	SA - fluvial			
Topock-2	City of Needles supply	Active	Sep-80	509	100 - 140	SA - alluvial			
Topock-3	City of Needles supply	Active	May-74	511	85 - 130	SA - alluvial			
Exploratory & Test Borings									
B-25	RFI - Boring	Closed	Apr-98	672	---	---			
CB-1	Caltrans - Boring I-40	Closed	Mar-62	471	---	---			
CB-2	Caltrans - Boring I-40	Closed	Mar-62	499	---	---			
CB-3	Caltrans - Boring I-40	Closed	Mar-62	504	---	---			
CB-4	Caltrans - Boring I-40	Closed	Mar-62	504	---	---			
CB-5	Caltrans - Boring I-40	Closed	Mar-62	460	---	---			
CB-6	Caltrans - Boring I-40	Closed	Mar-62	460	---	---			
CB-7	Caltrans - Boring I-40	Closed	Mar-62	459	---	---			
CB-8	Caltrans - Boring I-40	Closed	Mar-62	460	---	---			
CB-9	Caltrans - Boring I-40	Closed	Mar-62	461	---	---			

TABLE 4-2

Drilling and Well Construction Summary for RFI/RI Characterization

RCRA Facility Investigation/Remedial Investigation Report (Volume 2)

PG&E Topock Compressor Station, Needles, California

Location ID	Investigation Program & Well Type [1]	Status [2]	Date Installed	Ground Elevation (feet MSL)	Screen Interval (feet bgs)	Monitoring Zone [3]	Additional Characterization [4]		
							Geophys	Gr-Size	Hyd Test
Exploratory & Test Borings									
CB-10	Caltrans - Boring I-40	Closed	Mar-62	459	---	---			
CB-11	Caltrans - Boring I-40	Closed	Mar-62	459	---	---			
CB-12	Caltrans - Boring I-40	Closed	May-62	458	---	---			
CB-13	Caltrans - Boring I-40	Closed	Mar-62	458	---	---			
CB-14	Caltrans - Boring I-40	Closed	Mar-62	458	---	---			
IW-1	IM - Boring	Closed	Nov-04	545	---	---	X		
PE-1A	IM - Boring	Closed	Feb-05	461	---	---			
PE-1B	IM - Boring	Closed	Feb-05	459	---	---			
PM-B1	SBC Park Maobi - Boring	Closed	Mar-86	475	---	---			
PM-B2	SBC Park Maobi - Boring	Closed	Mar-86	495	---	---			
XMW-9	RFI - Boring	Closed	Jun-97	536	---	---			

Notes:

Boring and well constuction logs included in Appendex B

[1] Investigation Programs:

CMP	Compliance Monitoring Program, for IM No. 3 injection well field
IM	Interim Measures, includes IM No. 3 investigations and well installation
ISPT	In-situ Pilot Test, includes Floodplain and Upland test areas
New Ponds	TCS evaporation ponds, current operated site with active monitoring WDR
Old Ponds	TCS former, closed evaporation pond site
RFI	RCRA Facility Investigation / Remedial Investigation
SBC	San Bernardino County, Park Moabi water supply
TCS	PGE's Topock Compressor Station, operations facilities
TM	Topock Marina underground storage tank (UST) investigation

[2] Location status (as of October 2007):

Active	Well used in current PGE monitoring, testing, or compliance project
Standby	Existing well (servicable condition) not used in current monitoring
Inactive	Existing well (closed condition)
Decomm	Destroyed, permanently abandoned well
Closed	Exploratory or test boring, closed and sealed after logging
Unknown	Well status unknown

[3] Monitoring zone:

SA	Shallow zone of the Alluvial Aquifer completed in alluvial fan deposits (alluvial) or Colorado River deposits (fluvial)
MA	Mid-depth zone of the Alluvial Aquifer completed in alluvial fan deposits (alluvial) or Colorado River deposits (fluvial)
DA	Deep zone of the Alluvial Aquifer completed in alluvial fan deposits (alluvial) or Colorado River deposits (fluvial)
BR-Tmc	Bedrock well; completed in Miocene Conglomerate
BR-pTbr	Bedrock well; completed in pre-Tertiary metamorphic and igneous bedrock.

[4] Additional Characterization:

Geophy	Wireline geophysical log (Appendix C this report)
Gr-Size	Sediment grain-size analysis (Appendix B4 this report)
Hyd Test	Hydraulic test preformed (constant discharge or single-well recovery/slug test; Appendix H)

Additional Abbreviations:

ATSF	Atchison, Topeka and Santa Fe Railway
MSL	Feet above mean sea level; ground elevations rounded to whole foot for presentation.
bgs	Feet below ground surface; well screen depths rounded to whole foot for presentation.
---	data not available or not applicable

TABLE B-1

Drilling and Well Construction Summary for RFI/RI Characterization

RCRA Facility Investigation/Remedial Investigation Report (Volume 2)

PG&E Topock Compressor Station, Needles, California

					Elevation [5]			Top of Screen [6]		Base of Screen [6]								
Location ID[1]	Boring ID	Investigation Program[2] & Well Type	Status[3]	Monitoring[4] Zone	Ground (ft MSL)	Measure Point (ft MSL)	Boring Total Depth (ft bgs)	Depth (ft bgs)	Elevation (ft MSL)	Depth (ft bgs)	Elevation (ft MSL)	Well Depth[7] (ft bgs)	Approx Depth[8] to Water (ft TOC)	Screen Length (ft)	Well Casing	Sump Length	Date Installed	Drilling Method
Groundwater Monitoring Wells																		
MW-1	P-1	New Ponds - Monitoring	Active	SA - alluvial	660	662	212	201	461	211	451	211	205	10	4" PVC	---	Aug-86	Air Percuss
MW-3	P-3	New Ponds - Monitoring	Active	SA - alluvial	649	651	207	193	458	203	448	204	195	10	4" PVC	---	Aug-86	Air Percuss
MW-4	P-4	New Ponds - Monitoring	Active	SA - alluvial	624	626	180	165	461	175	451	175	169	10	4" PVC	---	Aug-86	Air Percuss
MW-5	MW-5	New Ponds - Monitoring	Active	SA - alluvial	635	636	188	176	460	185	451	185	179	9	4" PVC	---	Jun-89	Air Rotary
MW-6	MW-6	New Ponds - Monitoring	Active	SA - alluvial	642	643	194	185	458	194	449	194	186	9	4" PVC	---	Jun-89	Air Rotary
MW-7	MW-7	New Ponds - Monitoring	Active	SA - alluvial	630	632	188	173	459	183	449	183	176	10	4" PVC	---	Jun-89	Air Rotary
MW-8	MW-8	New Ponds - Monitoring	Active	SA - alluvial	627	628	179	169	459	178	450	178	171	9	4" PVC	---	Jun-89	Air Rotary
MW-9	MW-9	RFI - Monitoring	Active	SA - alluvial	534	537	89	77	460	87	450	87	80	10	4" PVC	---	Jul-97	Rotosonic
MW-10	MW-10	RFI - Monitoring	Active	SA - alluvial	529	531	99	74	457	94	437	95	75	20	4" PVC	---	Jun-97	Rotosonic
MW-11	MW-11	RFI - Monitoring	Active	SA - alluvial	521	523	87	63	460	83	440	84	4	20	4" PVC	---	Jun-97	Rotosonic
MW-12	MW-12	RFI - Monitoring	Active	SA - alluvial	483	484	50	28	457	48	437	49	28	20	4" PVC	---	Jul-97	Rotosonic
MW-13	MW-13	RFI - Monitoring	Active	SA - alluvial	487	489	50	29	460	49	440	50	33	20	4" PVC	---	Jul-97	Rotosonic
MW-14	MW-14	RFI - Monitoring	Active	SA - alluvial	570	571	135	111	460	131	440	131	114	20	4" PVC	---	Jul-97	Rotosonic
MW-15	MW-15	RFI - Monitoring	Active	SA - alluvial	640	642	204	181	461	201	441	202	185	20	4" PVC	---	Jul-97	Rotosonic
MW-16	MW-16	RFI - Monitoring	Active	SA - alluvial	655	657	218	198	459	218	439	218	200	20	4" PVC	---	Apr-98	Air Rotary
MW-17	MW-17	RFI - Monitoring	Active	SA - alluvial	588	590	151	130	460	150	440	150	132	20	4" PVC	---	May-98	Rotosonic
MW-18	MW-18	RFI - Monitoring	Active	SA - alluvial	544	545	110	85	460	105	440	105	89	20	4" PVC	---	Apr-98	Air Rotary
MW-19	MW-19	RFI - Monitoring	Active	SA - alluvial	499	500	66	46	454	66	434	66	50	20	4" PVC	---	Mar-98	Air Rotary
MW-20-70	MW-20-70	RFI - Monitoring	Active	SA - alluvial	499	500	70	50	450	70	430	70	46	20	4" PVC	---	Mar-98	Air Rotary
MW-20-100	MW-20-100	RFI - Monitoring	Active	MA - alluvial	499	501	100	90	411	100	401	100	47	10	4" PVC	---	Apr-99	Rotosonic
MW-20-130	MW-20-130	RFI - Monitoring	Active	DA - alluvial	499	501	132	121	380	131	370	131	47	10	4" PVC	---	Apr-99	Rotosonic
MW-21	MW-21	RFI - Monitoring	Active	SA - alluvial	506	506	62	39	467	59	447	59	32	20	4" PVC	---	May-98	Rotosonic
MW-22	MW-22	RFI - Monitoring	Active	SA - fluvial	458	461	12	6	455	11	450	11	6	5	2" PVC	---	Apr-98	Hand Auger
MW-23	MW-23	RFI - Monitoring	Active	BR-Tmc	505	507	80	60	447	80	427	80	52	20	4" PVC	---	Apr-98	Air Rotary
MW-24A	MW-24A	RFI - Monitoring	Active	SA - alluvial	565	567	125	104	463	124	443	125	111	20	4" PVC	---	May-98	Rotosonic
MW-24B	MW-24B	RFI - Monitoring	Active	DA - alluvial	563	565	218	193	372	213	352	213	110	20	4" PVC	---	May-98	Rotosonic
MW-24BR	MW-24BR	RFI - Monitoring	Active	BR-pTbr	563	564	442	378	186	437	127	437	108	59	4" PVC	---	Apr-98	Air Rotary
MW-25	MW-25	RFI - Monitoring	Active	SA - alluvial	541	543	107	85	458	105	438	105	87	20	4" PVC	---	Apr-99	Rotosonic
MW-26	MW-26	RFI - Monitoring	Active	SA - alluvial	503	502	74	52	451	72	431	72	47	20	2" PVC	---	Apr-99	Rotosonic
MW-27-20	MW-27	RFI - Monitoring	Active	SA - fluvial	459	461	17	7	454	17	444	17	5	10	2" PVC	---	Apr-99	Hollow Stem Auger
MW-27-60	MW-27-060	IM - Monitoring	Active	MA - fluvial	458	461	60	47	414	57	404	58	9	10	2" PVC	---	Feb-05	Rotosonic
MW-27-85	MW-27	IM - Monitoring	Active	DA - fluvial	458	461	107	78	383	88	373	98	6	10	2" PVC	10' sump	Feb-05	Rotosonic
MW-28-25	MW-28	RFI - Monitoring	Active	SA - fluvial	465	467	23	13	454	23	444	23	12	10	2" PVC	---	Apr-99	Hollow Stem Auger
MW-28-90	MW-28	IM - Monitoring	Active	DA - fluvial	465	468	148	70	398	90	378	95	13	20	2" PVC	5' sump	Apr-04	Rotosonic
MW-29	---	RFI - Monitoring	Active	SA - fluvial	483	485	40	30	456	40	446	40	30	10	2" PVC	---	Apr-99	Hollow Stem Auger
MW-30-30	MW-30-30	RFI - Monitoring	Active	SA - fluvial	466	468	32	12	456	32	436	32	14	20	2" PVC	---	Apr-99	Hollow Stem Auger
MW-30-50	MW-30-50	RFI - Monitoring	Active	MA - fluvial	466	469	63	40	429	50	419	50	14	10	4" PVC	---	Mar-03	Rotosonic
MW-31-60	MW-31	RFI - Monitoring	Active	SA - alluvial	495	497	65	42	455	62	435	62	42	20	4" PVC	---	Apr-99	Rotosonic
MW-31-135	MW-31	IM - Monitoring	Active	DA - alluvial	495	498	168	113	385	133	365	133	44	20	2" PVC	---	Mar-04	Rotosonic
MW-32-20	MW-32-20	RFI - Monitoring	Active	SA - fluvial	459	462	20	10	452	20	442	20	6	10	2" PVC	---	Mar-03	Rotosonic
MW-32-35	MW-32-35	RFI - Monitoring	Active	SA - fluvial	459	462	37	28	434	35	427	35	7	8	4" PVC	---	Mar-03	Rotosonic

TABLE B-1

Drilling and Well Construction Summary for RFI/RI Characterization

RCRA Facility Investigation/Remedial Investigation Report (Volume 2)

PG&E Topock Compressor Station, Needles, California

					Elevation[5]			Top of Screen[6]		Base of Screen[6]								
Location ID[1]	Boring ID	Investigation Program[2] & Well Type	Status[3]	Monitoring[4] Zone	Ground (ft MSL)	Measure Point (ft MSL)	Boring Total Depth (ft bgs)	Depth (ft bgs)	Elevation (ft MSL)	Depth (ft bgs)	Elevation (ft MSL)	Well Depth[7] (ft bgs)	Approx Depth[8] to Water (ft TOC)	Screen Length (ft)	Well Casing	Sump Length	Date Installed	Drilling Method
Groundwater Monitoring Wells																		
MW-33-40	MW-33-40	RFI - Monitoring	Active	SA - fluvial	485	487	40	29	458	39	448	39	32	10	4" PVC	---	Mar-03	Rotosonic
MW-33-90	MW-33-90	RFI - Monitoring	Active	MA - alluvial	485	488	130	69	419	89	399	89	32	20	4" PVC	---	Mar-03	Rotosonic
MW-33-150	MW-33	IM - Monitoring	Active	DA - alluvial	485	488	158	132	356	152	336	152	33	20	2" PVC	---	Feb-05	Rotosonic
MW-33-210	MW-33	IM - Monitoring	Active	DA - alluvial	485	487	237	190	297	210	277	220	33	20	2" PVC	10' sump	Feb-05	Rotosonic
MW-34-55	MW-34-55	RFI - Monitoring	Active	MA - fluvial	459	461	57	45	416	55	406	55	6	10	4" PVC	---	Jun-03	Rotosonic
MW-34-80	MW-34-80	RFI - Monitoring	Active	DA - fluvial	459	461	93	73	388	83	378	83	5	10	4" PVC	---	Jun-03	Rotosonic
MW-34-100	MW-34	IM - Monitoring	Active	DA - fluvial	459	461	116	90	371	100	361	115	6	10	2" PVC	15' sump	Jan-05	Rotosonic
MW-35-60	MW-35	IM - Monitoring	Active	SA - alluvial	481	484	61	41	443	61	423	61	29	20	2" PVC	---	Mar-04	Rotosonic
MW-35-135	MW-35	IM - Monitoring	Active	DA - alluvial	481	484	168	116	368	136	348	156	29	20	2" PVC	20' sump	Mar-04	Rotosonic
MW-36-20	MW-36	IM - Monitoring	Active	SA - fluvial	467	469	20	10	459	20	449	20	16	10	1" PVC	---	May-04	Rotosonic
MW-36-40	MW-36	IM - Monitoring	Active	SA - fluvial	467	470	40	30	440	40	430	40	16	10	1" PVC	---	May-04	Rotosonic
MW-36-50	MW-36	IM - Monitoring	Active	MA - fluvial	467	470	108	46	424	51	419	51	15	5	1" PVC	---	May-04	Rotosonic
MW-36-70	MW-36	IM - Monitoring	Active	MA - fluvial	467	469	70	60	409	70	399	70	15	10	1" PVC	---	May-04	Rotosonic
MW-36-90	MW-36	IM - Monitoring	Active	DA - fluvial	467	470	90	80	390	90	380	90	16	10	1" PVC	---	May-04	Rotosonic
MW-36-100	MW-36	IM - Monitoring	Active	DA - fluvial	467	470	108	88	382	98	372	108	15	10	2" PVC	10' sump	May-04	Rotosonic
MW-37S	MW-37	IM - Monitoring	Active	MA - alluvial	484	486	85	64	422	84	402	84	31	20	2" PVC	---	Apr-04	Rotosonic
MW-37D	MW-37	IM - Monitoring	Active	DA - alluvial	484	486	228	180	306	200	286	225	31	20	2" PVC	25' sump	Apr-04	Rotosonic
MW-38S	MW-38S	IM - Monitoring	Active	SA - alluvial	523	526	130	75	451	95	431	95	70	20	2" PVC	---	Apr-04	Rotosonic
MW-38D	MW-38	IM - Monitoring	Active	DA - alluvial	523	525	195	163	362	183	342	188	70	20	2" PVC	5' sump	Apr-04	Rotosonic
MW-39-40	MW-39	IM - Monitoring	Active	SA - fluvial	465	468	70	30	438	40	428	42	14	10	1" PVC	2' sump	Apr-04	Rotosonic
MW-39-50	MW-39	IM - Monitoring	Active	MA - fluvial	465	468	80	47	421	52	416	54	13	5	1" PVC	2' sump	Apr-04	Rotosonic
MW-39-60	MW-39	IM - Monitoring	Active	MA - alluvial	465	468	118	49	419	59	409	64	13	10	1" PVC	5' sump	Apr-04	Rotosonic
MW-39-70	MW-39	IM - Monitoring	Active	MA - alluvial	465	468	70	60	408	70	398	72	14	10	1" PVC	2' sump	Apr-04	Rotosonic
MW-39-80	MW-39	IM - Monitoring	Active	DA - alluvial	465	468	80	70	398	80	388	80	14	10	1" PVC	---	Apr-04	Rotosonic
MW-39-100	MW-39	IM - Monitoring	Active	DA - alluvial	465	468	118	80	388	100	368	115	14	20	2" PVC	15' sump	Apr-04	Rotosonic
MW-40S	MW-40	IM - Monitoring	Active	SA - alluvial	566	566	135	115	451	135	431	135	110	20	2" PVC	---	May-04	Rotosonic
MW-40D	MW-40	IM - Monitoring	Active	DA - alluvial	567	566	268	240	326	260	306	265	111	20	2" PVC	5' sump	May-04	Rotosonic
MW-41S	MW-41	IM - Monitoring	Active	SA - alluvial	477	480	60	40	440	60	420	60	24	20	2" PVC	---	Nov-04	Rotosonic
MW-41M	MW-41	IM - Monitoring	Active	DA - alluvial	477	480	190	170	310	190	290	190	24	20	2" PVC	---	Nov-04	Rotosonic
MW-41D	MW-41	IM - Monitoring	Active	DA - alluvial	477	479	320	271	208	291	188	311	24	20	2" PVC	20' sump	Nov-04	Rotosonic
MW-42-30	MW-42	IM - Monitoring	Active	SA - fluvial	461	464	30	10	454	30	434	30	12	20	2" PVC	---	Feb-05	Rotosonic
MW-42-55	MW-42	IM - Monitoring	Active	MA - fluvial	461	464	53	43	421	53	411	53	9	10	2" PVC	---	Feb-05	Rotosonic
MW-42-65	MW-42	IM - Monitoring	Active	MA - fluvial	461	463	81	56	407	66	397	81	9	10	2" PVC	15' sump	Feb-05	Rotosonic
MW-43-25	MW-43	IM - Monitoring	Active	SA - fluvial	463	463	25	15	448	25	438	25	8	10	2" PVC	---	Feb-05	Rotosonic
MW-43-75	MW-43	IM - Monitoring	Active	DA - fluvial	463	463	75	65	398	75	388	75	8	10	2" PVC	---	Feb-05	Rotosonic
MW-43-90	MW-43	IM - Monitoring	Active	DA - fluvial	460	463	97	80	383	90	373	90	7	10	2" PVC	---	Feb-05	Rotosonic
MW-44-70	MW-44	IM - Monitoring	Active	MA - fluvial	471	472	134	61	411	71	401	71	16	10	2" PVC	---	Mar-06	Rotosonic
MW-44-115	MW-44	IM - Monitoring	Active	DA - alluvial	470	472	117	103	369	113	359	113	18	10	2" PVC	---	Mar-06	Rotosonic
MW-44-125	MW-44	IM - Monitoring	Active	DA - alluvial	471	472	134	116	356	125	347	134	18	9	2" PVC	10' sump	Mar-06	Rotosonic
MW-45-095a	MW-45	IM - Monitoring	Active	DA - fluvial	467	470	97	83	387	93	377	94	15	10	2" PVC	---	Feb-06	Rotosonic
MW-45-095b	MW-45	IM - Monitoring	Active	DA - fluvial	467	470	97	83	387	93	377	94	18	10	1" PVC	---	Feb-06	Rotosonic

TABLE B-1
Drilling and Well Construction Summary for RFI/RI Characterization
RCRA Facility Investigation/Remedial Investigation Report (Volume 2)
PG&E Topock Compressor Station, Needles, California

Location ID[1]	Boring ID	Investigation Program[2] & Well Type	Status[3]	Monitoring Zone[4]	Elevation[5] Ground (ft MSL)	Elevation[5] Measure Point (ft MSL)	Boring Total Depth (ft bgs)	Top of Screen[6] Depth (ft bgs)	Top of Screen[6] Elevation (ft MSL)	Base of Screen[6] Depth (ft bgs)	Base of Screen[6] Elevation (ft MSL)	Well Depth[7] (ft bgs)	Approx Depth[8] to Water (ft TOC)	Screen Length (ft)	Well Casing	Sump Length	Date Installed	Drilling Method
Groundwater Monitoring Wells																		
MW-46-175	MW-46	IM - Monitoring	Active	DA - alluvial	481	482	217	165	317	175	307	217	27	10	2" PVC	---	Feb-06	Rotosonic
MW-46-205	MW-46	IM - Monitoring	Active	DA - alluvial	481	482	217	197	286	207	276	217	28	10	2" PVC	---	Feb-06	Rotosonic
MW-47-55	MW-47	IM - Monitoring	Active	SA - alluvial	483	484	117	45	439	55	429	100	28	10	2" PVC	---	Mar-06	Rotosonic
MW-47-115	MW-47	IM - Monitoring	Active	DA - alluvial	483	484	117	105	379	115	369	117	29	10	2" PVC	---	Mar-06	Rotosonic
MW-48	MW-48	IM - Monitoring	Active	BR-Tmc	484	486	155	124	362	134	352	138	32	10	2" PVC	---	May-06	Rotosonic
MW-49-135	MW-49	IM - Monitoring	Active	DA - alluvial	483	484	135	125	359	135	349	135	28	10	1.5" PVC	---	Mar-06	Rotosonic
MW-49-275	MW-49	IM - Monitoring	Active	DA - alluvial	483	484	275	255	229	275	209	275	30	20	2" PVC	---	Mar-06	Rotosonic
MW-49-365	MW-49	IM - Monitoring	Active	DA - alluvial	483	484	384	345	139	365	119	370	31	20	2" PVC	---	Mar-06	Rotosonic
MW-50-095	MW-50	IM - Monitoring	Active	MA - alluvial	495	496	249	85	411	95	401	---	41	10	2" PVC	---	Apr-06	Rotosonic
MW-50-200	MW-50	IM - Monitoring	Active	DA - alluvial	495	496	248	190	306	200	296	---	42	10	2" PVC	---	Apr-06	Rotosonic
MW-51	MW-51	IM - Monitoring	Active	MA - alluvial	502	502	114	97	405	112	390	---	47	15	4" PVC	---	Apr-06	Rotosonic
MW-52S	MW-52	IM - Monitoring	Active	MA - fluvial	460	462	---	47	415	49	413	49	10	2	0.75" MLABS	---	Mar-07	Rotosonic
MW-52M	MW-52	IM - Monitoring	Active	DA - fluvial	460	462	---	66	396	68	394	68	11	2	0.75" MLABS	---	Mar-07	Rotosonic
MW-52D	MW-52	IM - Monitoring	Active	DA - fluvial	460	462	102	85	377	87	375	87	11	2	0.75" MLABS	---	Mar-07	Rotosonic
MW-53S	MW-53	IM - Monitoring	Inactive	SA - fluvial	460	461	---	29	433	30	431	30	---	2	0.75" MLABS	---	Mar-07	Rotosonic
MW-53M	MW-53	IM - Monitoring	Active	DA - fluvial	460	461	---	99	363	100	361	100	14	2	0.75" MLABS	---	Mar-07	Rotosonic
MW-53D	MW-53	IM - Monitoring	Active	DA - fluvial	460	461	133	124	338	125	336	125	14	2	0.75" MLABS	---	Mar-07	Rotosonic
MWP-1	---	Old Ponds - Monitoring	decomm	SA - alluvial	675	---	127	75	---	115	---	125	---	40	3"	---	Jul-85	---
MWP-2	---	Old Ponds - Monitoring	decomm	SA - alluvial	675	---	---	200	---	260	---	270	---	60	3"	---	Jul-85	---
MWP-2RD	---	Old Ponds - Monitoring	decomm	BR-pTbr	674	---	279	265	---	275	---	275	---	10	5"	---	Jul-85	---
MWP-3	---	Old Ponds - Monitoring	decomm	SA - alluvial	661	---	222	108	---	208	---	218	---	100	3"	10' sump	Jul-85	---
MWP-7	---	Old Ponds - Monitoring	decomm	SA - alluvial	675	---	110	70	---	110	---	110	---	40	3"	---	Oct-85	---
MWP-8	---	Old Ponds - Monitoring	Standby	SA - alluvial	677	677	211	181	496	211	466	211	190	30	3" PVC	---	Oct-85	---
MWP-9	---	Old Ponds - Monitoring	decomm	SA - alluvial	680	---	220	179	---	219	---	220	---	40	3" PVC	---	Oct-85	Air Percuss
MWP-10	---	Old Ponds - Monitoring	Standby	SA - alluvial	675	676	235	194	482	234	442	235	209	40	3" PVC	---	Jan-86	---
MWP-12	---	Old Ponds - Monitoring	Standby	SA - alluvial	662	663	217	96	567	136	527	217	108	40	3" PVC	81' sump	Jan-86	---
MWP-14	---	Old Ponds - Monitoring	decomm	SA - alluvial	674	---	221	206	---	216	---	216	---	10	5" PVC	---	Jun-92	Air Rotary
MWP-15	---	Old Ponds - Monitoring	decomm	SA - alluvial	676	---	290	198	---	208	---	208	---	10	5" PVC	---	Jun-92	Air Rotary
MWP-16	---	Old Ponds - Monitoring	decomm	SA - alluvial	690	---	261	210	---	220	---	222	---	10	5" PVC	---	Jun-92	Air Rotary
OW-1S	OW-1	CMP - Monitoring	Active	SA - alluvial	548	550	115	84	467	114	437	114	95	30	2" PVC	---	Nov-04	Rotosonic
OW-1M	OW-1	CMP - Monitoring	Active	MA - alluvial	548	550	291	165	385	185	365	186	95	20	2" PVC	---	Sep-04	Rotosonic
OW-1D	OW-1	CMP - Monitoring	Active	DA - alluvial	548	550	291	257	293	277	273	277	94	20	2" PVC	---	Sep-04	Rotosonic
OW-2S	OW-2	CMP - Monitoring	Active	SA - alluvial	546	549	104	71	478	101	448	101	94	30	2" PVC	---	Dec-04	Rotosonic
OW-2M	OW-2	CMP - Monitoring	Active	MA - alluvial	546	549	210	190	359	210	339	210	93	20	2" PVC	---	Dec-04	Rotosonic
OW-2D	OW-2	CMP - Monitoring	Active	DA - alluvial	547	549	347	310	239	330	219	340	93	20	2" PVC	10' sump	Dec-04	Rotosonic
OW-3S	OW-3	IM - Monitoring	Active	SA - alluvial	556	559	118	86	473	116	443	116	102	30	2" PVC	---	Oct-04	Rotosonic
OW-3M	OW-3	IM - Monitoring	Active	MA - alluvial	556	559	202	180	379	200	359	200	103	20	2" PVC	---	Oct-04	Rotosonic
OW-3D	OW-3	IM - Monitoring	Active	DA - alluvial	556	559	275	242	317	262	297	273	103	20	2" PVC	10' sump	Oct-04	Rotosonic
OW-5S	OW-5	CMP - Monitoring	Active	SA - alluvial	549	552	112	70	482	110	442	110	97	40	2" PVC	---	Nov-04	Rotosonic
OW-5M	OW-5	CMP - Monitoring	Active	DA - alluvial	549	552	252	210	342	250	302	250	96	40	2" PVC	---	Nov-04	Rotosonic
OW-5D	OW-5	CMP - Monitoring	Active	DA - alluvial	550	552	350	300	252	320	232	350	96	20	2" PVC	30' sump	Nov-04	Rotosonic

TABLE B-1
Drilling and Well Construction Summary for RFI/RI Characterization
RCRA Facility Investigation/Remedial Investigation Report (Volume 2)
PG&E Topock Compressor Station, Needles, California

					Elevation [5]			Top of Screen [6]		Base of Screen [6]								
Location ID [1]	**Boring ID**	**Investigation Program [2] & Well Type**	**Status [3]**	**Monitoring [4] Zone**	**Ground** (ft MSL)	**Measure Point** (ft MSL)	**Boring Total Depth** (ft bgs)	**Depth** (ft bgs)	**Elevation** (ft MSL)	**Depth** (ft bgs)	**Elevation** (ft MSL)	**Well Depth [7]** (ft bgs)	**Approx Depth [8] to Water** (ft TOC)	**Screen Length** (ft)	**Well Casing**	**Sump Length**	**Date Installed**	**Drilling Method**
Groundwater Monitoring Wells																		
P-2	---	New Ponds - Monitoring	Inactive	DA - alluvial	536	538	249	239	299	249	289	249	170	10	4" PVC	---	Aug-86	---
PGE-7BR	---	IM - Monitoring	Active	BR-pTbr	563	---	292	249	---	300	---	292	110	51	7"	---	Oct-07	---
CW-1M	CW-1	CMP - Monitoring	Active	MA - alluvial	563	566	191	140	426	190	376	190	109	50	2" PVC	---	Jan-05	Rotosonic
CW-1D	CW-1	CMP - Monitoring	Active	DA - alluvial	564	567	360	250	317	300	267	320	110	50	2" PVC	20' sump	Jan-05	Rotosonic
CW-2M	CW-2	CMP - Monitoring	Active	MA - alluvial	547	549	203	152	397	202	347	206	93	50	2" PVC	---	Feb-05	Rotosonic
CW-2D	CW-2	CMP - Monitoring	Active	DA - alluvial	547	550	385	285	265	335	215	355	93	50	2" PVC	20' sump	Jan-05	Rotosonic
CW-3M	CW-3	CMP - Monitoring	Active	MA - alluvial	532	534	223	172	362	222	312	222	78	50	2" PVC	---	Feb-05	Rotosonic
CW-3D	CW-3	CMP - Monitoring	Active	DA - alluvial	532	534	360	270	264	320	214	340	77	50	2" PVC	20' sump	Jan-05	Rotosonic
CW-4M	CW-4	CMP - Monitoring	Active	MA - alluvial	516	519	170	120	399	170	349	170	62	50	2" PVC	---	Jan-05	Rotosonic
CW-4D	CW-4	CMP - Monitoring	Active	DA - alluvial	516	519	337	233	286	283	236	303	62	50	2" PVC	20' sump	Jan-05	Rotosonic
P-1	---	Old Ponds - Monitoring	decomm	SA - alluvial	694	---	217	171	---	211	---	217	---	40	3" PVC	6' sump	Feb-86	Air Percuss
Extraction, Test & Injection Wells																		
IW-2	IW-2	IM - Injection	Active	MA-DA - alluvial	547	550	412	170	380	330	220	340	96	160	6" Steel	10' sump	Dec-04	Mud Rotary
IW-3	IW-3	IM - Injection	Active	MA-DA - alluvial	551	554	411	160	394	320	234	330	100	160	6" Steel	10' sump	Dec-04	Mud Rotary
PE-1	PE-01	IM - Extraction	Active	DA - fluvial	458	458	97	79	379	89	369	99	16	10	6" Steel	10' sump	Mar-05	Rotosonic
PGE-8	---	TCS - Injection	Inactive	BR-pTbr	595	596	562	405	191	554	42	562	139	149	6.75" Steel	---	Jun-69	---
PGE-PT-1	---	New Ponds - Test	Inactive	MA-DA - alluvial	625	623	280	220	403	260	363	280	168	40	4" Steel	20' sump	Nov-86	Rotosonic
TW-1	TW-1	IM - Test	Active	SA-MA-DA - alluvial	621	621	312	169	452	269	352	269	164	100	5" PVC	---	Nov-03	Mud Rotary
TW-2S	TW-2	IM - Extraction	Standby	SA-MA - alluvial	497	499	98	43	457	93	407	98	34	50	6" PVC	5' sump	Apr-04	Mud Rotary
TW-2D	TW-2	IM - Extraction	Standby	DA - alluvial	497	493	180	113	380	148	345	153	69	35	6" PVC	5' sump	Apr-04	Mud Rotary
TW-3D	TW-3D	IM - Extraction	Active	DA - alluvial	497	498	158	111	387	156	342	156	46	45	8" PVC	---	Oct-05	Rotosonic
TW-4	MW-47	IM - Test	Active	DA - alluvial	483	484	288	210	274	250	234	---	30	40	4" PVC	4' sump	Mar-06	Rotosonic
TW-5	MW-50	IM - Test	Active	DA - alluvial	495	496	150	110	386	150	346	---	41	40	4" PVC	---	Apr-06	Rotosonic
Pilot Study Wells																		
PT-1S	PT-1	ISPT - Monitoring	Active	SA - fluvial	472	475	---	35	440	45	430	45	---	10	2" PVC	---	Jan-06	Rotosonic
PT-1M	PT-1	ISPT - Monitoring	Active	MA - fluvial	472	474	---	60	414	70	404	70	---	10	2" PVC	---	Jan-06	Rotosonic
PT-1D	PT-1	ISPT - Monitoring	Active	DA - alluvial	472	474	125	95	379	105	369	105	---	10	2" PVC	---	Jan-06	Rotosonic
PT-2S	PT-2	ISPT - Monitoring	Active	SA - fluvial	471	473	---	35	438	45	428	45	---	10	2" PVC	---	Feb-06	Rotosonic
PT-2M	PT-2	ISPT - Monitoring	Active	MA - alluvial	471	473	---	60	413	70	403	70	---	10	2" PVC	---	Feb-06	Rotosonic
PT-2D	PT-2	ISPT - Monitoring	Active	DA - alluvial	471	473	127	95	378	105	368	105	---	10	2" PVC	---	Feb-06	Rotosonic
PT-3S	PT-3	ISPT - Monitoring	Active	SA - fluvial	472	473	---	35	438	45	428	45	---	10	2" PVC	---	Feb-06	Rotosonic
PT-3M	PT-3	ISPT - Monitoring	Active	MA - alluvial	472	473	---	60	413	70	403	70	---	10	2" PVC	---	Feb-06	Rotosonic
PT-3D	PT-3	ISPT - Monitoring	Active	DA - alluvial	472	473	129	95	378	105	368	105	---	10	2" PVC	---	Feb-06	Rotosonic
PT-4S	PT-4	ISPT - Monitoring	Active	SA - fluvial	472	474	---	35	439	45	429	45	---	10	2" PVC	---	Feb-06	Rotosonic
PT-4M	PT-4	ISPT - Monitoring	Active	MA - fluvial	472	474	---	60	414	70	404	70	---	10	2" PVC	---	Feb-06	Rotosonic
PT-4D	PT-4	ISPT - Monitoring	Active	DA - alluvial	472	474	127	95	379	105	369	105	---	10	2" PVC	---	Feb-06	Rotosonic
PT-5S	PT-5	ISPT - Monitoring	Active	SA - fluvial	471	473	---	35	438	45	428	45	---	10	2" PVC	---	Feb-06	Rotosonic
PT-5M	PT-5	ISPT - Monitoring	Active	MA - alluvial	471	473	---	60	413	70	403	70	---	10	2" PVC	---	Feb-06	Rotosonic
PT-5D	PT-5	ISPT - Monitoring	Active	DA - alluvial	471	474	127	95	379	105	369	105	---	10	2" PVC	---	Feb-06	Rotosonic
PT-6S	PT-6	ISPT - Monitoring	Active	SA - fluvial	474	476	---	35	441	45	431	45	---	10	2" PVC	---	Jan-06	Rotosonic

TABLE B-1
Drilling and Well Construction Summary for RFI/RI Characterization
RCRA Facility Investigation/Remedial Investigation Report (Volume 2)
PG&E Topock Compressor Station, Needles, California

					Elevation [5]		Boring Total	Top of Screen [6]		Base of Screen [6]								
Location ID [1]	Boring ID	Investigation Program [2] & Well Type	Status [3]	Monitoring [4] Zone	Ground (ft MSL)	Measure Point (ft MSL)	Depth (ft bgs)	Depth (ft bgs)	Elevation (ft MSL)	Depth (ft bgs)	Elevation (ft MSL)	Well Depth [7] (ft bgs)	Approx Depth [8] to Water (ft TOC)	Screen Length (ft)	Well Casing	Sump Length	Date Installed	Drilling Method
Pilot Study Wells																		
PT-6M	PT-6	ISPT - Monitoring	Active	MA - alluvial	474	476	---	60	416	70	406	70	---	10	2" PVC	---	Jan-06	Rotosonic
PT-6D	PT-6	ISPT - Monitoring	Active	DA - alluvial	474	476	137	95	381	105	371	105	---	10	2" PVC	---	Jan-06	Rotosonic
PT-7S	PT-7S/D	ISPT - Monitoring	Active	SA - alluvial	561	561	---	130	431	155	406	155	---	25	2" PVC	---	May-07	Rotosonic
PT-7M	PT-7M	ISPT - Monitoring	Active	MA - alluvial	561	561	188	165	396	185	376	185	---	20	2" PVC	---	May-07	Rotosonic
PT-7D	PT-7D	ISPT - Monitoring	Active	DA - alluvial	560	560	230	177	383	217	343	220	---	40	2" PVC	---	May-07	Rotosonic
PT-8S	PT-8S/D	ISPT - Monitoring	Active	SA - alluvial	562	562	---	147	415	152	410	152	---	5	2" PVC	---	May-07	Rotosonic
PT-8M	PT-8M	ISPT - Monitoring	Active	MA - alluvial	562	562	---	162	400	183	379	182	---	21	2" PVC	---	May-07	Rotosonic
PT-8D	PT-8S/D	ISPT - Monitoring	Active	DA - alluvial	562	562	---	190	372	210	352	213	---	20	2" PVC	---	May-07	Rotosonic
PT-9S	PT-9S/D	ISPT - Monitoring	Active	SA - alluvial	562	559	---	128	431	148	411	153	---	20	2" PVC	---	Jun-07	Rotosonic
PT-9M	PT-9M	ISPT - Monitoring	Active	MA - alluvial	560	559	---	163	396	183	376	182	---	20	2" PVC	---	Jun-07	Rotosonic
PT-9D	PT-9S/D	ISPT - Monitoring	Active	DA - alluvial	560	559	225	190	369	210	349	213	---	20	2" PVC	---	Jun-07	Rotosonic
PTI-1S	PTI-1S	ISPT - Injection	Active	SA - fluvial	473	475	47	35	440	45	430	45	---	10	4" PVC	---	Jan-06	Rotosonic
PTI-1M	PTI-1M	ISPT - Injection	Active	MA - alluvial	473	475	77	60	415	70	405	70	---	10	4" PVC	---	Jan-06	Rotosonic
PTI-1D	PTI-1D	ISPT - Injection	Active	DA - alluvial	473	475	137	95	380	105	370	105	---	10	4" PVC	---	Jan-06	Rotosonic
PTR-1	PTR-1	ISPT - recirculation	Active	MA-DA - alluvial	558	---	225	125	---	220	---	220	---	95	6" LCS	---	May-07	Rotosonic
PTR-2	PTR-2	ISPT - recirculation	Active	MA-DA - alluvial	565	---	223	118	---	218	---	218	---	100	6" LCS	---	Jun-07	Rotosonic
Water Supply Wells																		
PGE-1	PGE-1	TCS - original supply	decomm	MA - alluvial	555	---	176	99	---	177	---	177	---	78	14"	---	Sep-51	---
PGE-2	PGE-2	TCS - original supply	decomm	MA - alluvial	552	---	152	98	---	152	---	152	---	54	14"	---	Jul-51	---
PGE-6	PGE-6	TCS - replacement supply	decomm	SA-MA - alluvial	562	563	180	110	453	180	383	180	107	70	14" Steel	---	Jun-64	---
PGE-7	PGE-7	TCS - replacement supply	Inactive	DA-BR-pTbr	563	564	330	195	369	330	234	330	107	135	14" Steel	---	Sep-64	---
PGE-9N	PGE-9N	TCS - replacement supply	Inactive	MA-DA - fluvial	460	462	95	25	437	95	367	95	---	70	12" Steel	---	Apr-97	---
PGE-9S	PGE-9S	TCS - replacement supply	Inactive	MA-DA - fluvial	459	462	100	30	432	100	362	100	---	70	12" Steel	---	Apr-97	---
Park Moabi-1	PM-01	SBC original supply	decomm	---	470	---	190	28	---	180	---	190	---	152	10" Steel	---	Mar-61	Cable Tool
Park Moabi-3	Well No.3	SBC supply	Active	MA - alluvial	517	519	250	80	439	200	319	210	61	120	8" Steel	10' sump	Aug-86	---
Park Moabi-4	---	SBC supply	Standby	MA - alluvial	485	---	145	93	---	140	---	145	---	47	---	---	Oct-06	Mud Rotary
Selected Wells in Arizona																		
Sanders	Sanders	private supply	Active	SA - alluvial	464	464	230	48	416	68	396	230	---	20	3"	---	Jun-05	---
Smith	Smith	private supply	decomm	SA	505	---	80	48	---	68	---	80	---	20	5" PVC	12' sump	Feb-98	---
TMW-6	TMW-6	TM - Monitoring	decomm	SA - fluvial	469	468	35	12	456	32	436	32	---	20	4" PVC	4' sump	Jan-91	Direct Mud Rotary
TMW-8	TMW-8	TM - Monitoring	decomm	SA - fluvial	465	464	31	5	459	25	439	25	---	20	4" PVC	4' sump	Jan-91	Direct Mud Rotary
TMW-9	TMW-9	TM - Monitoring	decomm	SA - fluvial	461	460	31	6	454	31	429	31	---	25	4" PVC	4' sump	Jan-91	Direct Mud Rotary
TMW-10	TMW-10	TM - Monitoring	decomm	SA - fluvial	470	470	35	10	460	30	440	30	---	20	4" PVC	4' sump	Jan-91	Direct Mud Rotary
TMW-11	TMW-11	TM - Monitoring	decomm	SA - fluvial	468	468	35	10	458	30	438	30	---	20	4" PVC	4' sump	Jan-91	Direct Mud Rotary
Topock-1	Topock-1	ATSF original supply	decomm	SA - fluvial	505*	---	50	---	---	---	---	50	---	---	16"	---	---	---
Topock-2	Topock-2	City of Needles supply	Active	SA - alluvial	509	509	150	100	409	140	369	140	53	40	12" Steel	---	Sep-80	---
Topock-3	Topock-3	City of Needles supply	Active	SA - alluvial	511	511	250	85	426	130	381	150	51	45	12" Steel	20' sump	May-74	---
Exploratory & Test Borings																		
B-25	B-25	RFI - Boring	Closed	---	672	---	210	---	---	---	---	---	---	---	---	---	Apr-98	Air Rotary
CB-1	CB-1	Caltrans - Boring I-40	Closed	---	471	---	54	---	---	---	---	---	---	---	---	---	Mar-62	---

TABLE B-1
Drilling and Well Construction Summary for RFI/RI Characterization
RCRA Facility Investigation/Remedial Investigation Report (Volume 2)
PG&E Topock Compressor Station, Needles, California

Location ID[1]	Boring ID	Investigation Program[2] & Well Type	Status[3]	Monitoring Zone[4]	Elevation[5] Ground (ft MSL)	Elevation[5] Measure Point (ft MSL)	Boring Total Depth (ft bgs)	Top of Screen[6] Depth (ft bgs)	Top of Screen[6] Elevation (ft MSL)	Base of Screen[6] Depth (ft bgs)	Base of Screen[6] Elevation (ft MSL)	Well Depth[7] (ft bgs)	Approx Depth to Water[8] (ft TOC)	Screen Length (ft)	Well Casing	Sump Length	Date Installed	Drilling Method
Exploratory & Test Borings																		
CB-2	CB-2	Caltrans - Boring I-40	Closed	---	499	---	34	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-3	CB-3	Caltrans - Boring I-40	Closed	---	504	---	37	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-4	CB-4	Caltrans - Boring I-40	Closed	---	504	---	37	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-5	CB-5	Caltrans - Boring I-40	Closed	---	460	---	50	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-6	CB-6	Caltrans - Boring I-40	Closed	---	460	---	20	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-7	CB-7	Caltrans - Boring I-40	Closed	---	459	---	102	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-8	CB-8	Caltrans - Boring I-40	Closed	---	460	---	40	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-9	CB-9	Caltrans - Boring I-40	Closed	---	461	---	105	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-10	CB-10	Caltrans - Boring I-40	Closed	---	459	---	117	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-11	CB-11	Caltrans - Boring I-40	Closed	---	459	---	57	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-12	CB-12	Caltrans - Boring I-40	Closed	---	458	---	125	---	---	---	---	---	---	---	---	---	May-62	---
CB-13	CB-13	Caltrans - Boring I-40	Closed	---	458	---	81	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-14	CB-14	Caltrans - Boring I-40	Closed	---	458	---	110	---	---	---	---	---	---	---	---	---	Mar-62	---
IW-1	IW-1	IM - Boring	Closed	---	545	---	411	---	---	---	---	---	---	---	---	---	Nov-04	Mud Rotary
PE-1A	PE-01	IM - Boring	Closed	---	461	---	90	---	---	---	---	---	---	---	---	---	Feb-05	---
PE-1B	PE-01	IM - Boring	Closed	---	459	---	87	---	---	---	---	---	---	---	---	---	Feb-05	---
PM-B1	---	SBC Park Maobi - Boring	Closed	---	475*	---	250	---	---	---	---	---	---	---	---	5' sump	Mar-86	Mud Rotary
PM-B2	---	SBC Park Maobi - Boring	Closed	---	495*	---	80	---	---	---	---	---	---	---	---	---	Mar-86	Mud Rotary
XMW-9	XMW-9	RFI - Boring	Closed	---	536	538	78	---	538	---	538	---	---	---	---	---	Jun-97	Rotosonic

Notes:

[1] The location IDs listed are the assigned, abbreviated "posting Ids" for wells and borings used on maps, tables, logs and other displays in the RFI/RI report. The project sampling database utilizes additional formated location Ids)see Table B-2)

[2] Investigation Programs:

CMP	Compliance Monitoring Program, for IM No. 3 injection well field
IM	Interim Measures, includes IM No. 3 investigations and well installation
ISPT	In-situ Pilot Test, includes Floodplain and Upland test areas
New Ponds	TCS evaporation ponds, current operated site with active monitoring WDR
Old Ponds	TCS former, closed evaporation pond site
RFI	RCRA Facility Investigation / Remedial Investigation
SBC	San Bernardino County, Park Moabi water supply
TCS	PGE's Topock Compressor Station, operations facilities
TM	Topock Marina underground storage tank (UST) investigation

[3] Location status (as of October 2007):

Active	Well used in current PGE monitoring, testing, or compliance project
Standby	Existing well (servicable condition) not used in current monitoring
Inactive	Existing well (closed condition)
Decomm	Destroyed, permanently abandoned well
Closed	Exploratory or test boring, closed and sealed after logging
Unknown	Well status unknown

[4] Monitoring zone:

SA	Shallow zone of the Alluvial Aquifer completed in alluvial fan deposits (alluvial) or Colorado River deposits (fluvial)
MA	Mid-depth zone of the Alluvial Aquifer completed in alluvial fan deposits (alluvial) or Colorado River deposits (fluvial)
DA	Deep zone of the Alluvial Aquifer completed in alluvial fan deposits (alluvial) or Colorado River deposits (fluvial)
BR-Tmc	Bedrock well; completed in Miocene Conglomerate
BR-pTbr	Bedrock well; completed in pre-Tertiary metamorphic and igneous bedrock.

[5] Elevations noted with asterisk * are estimated from togpgraphic map.

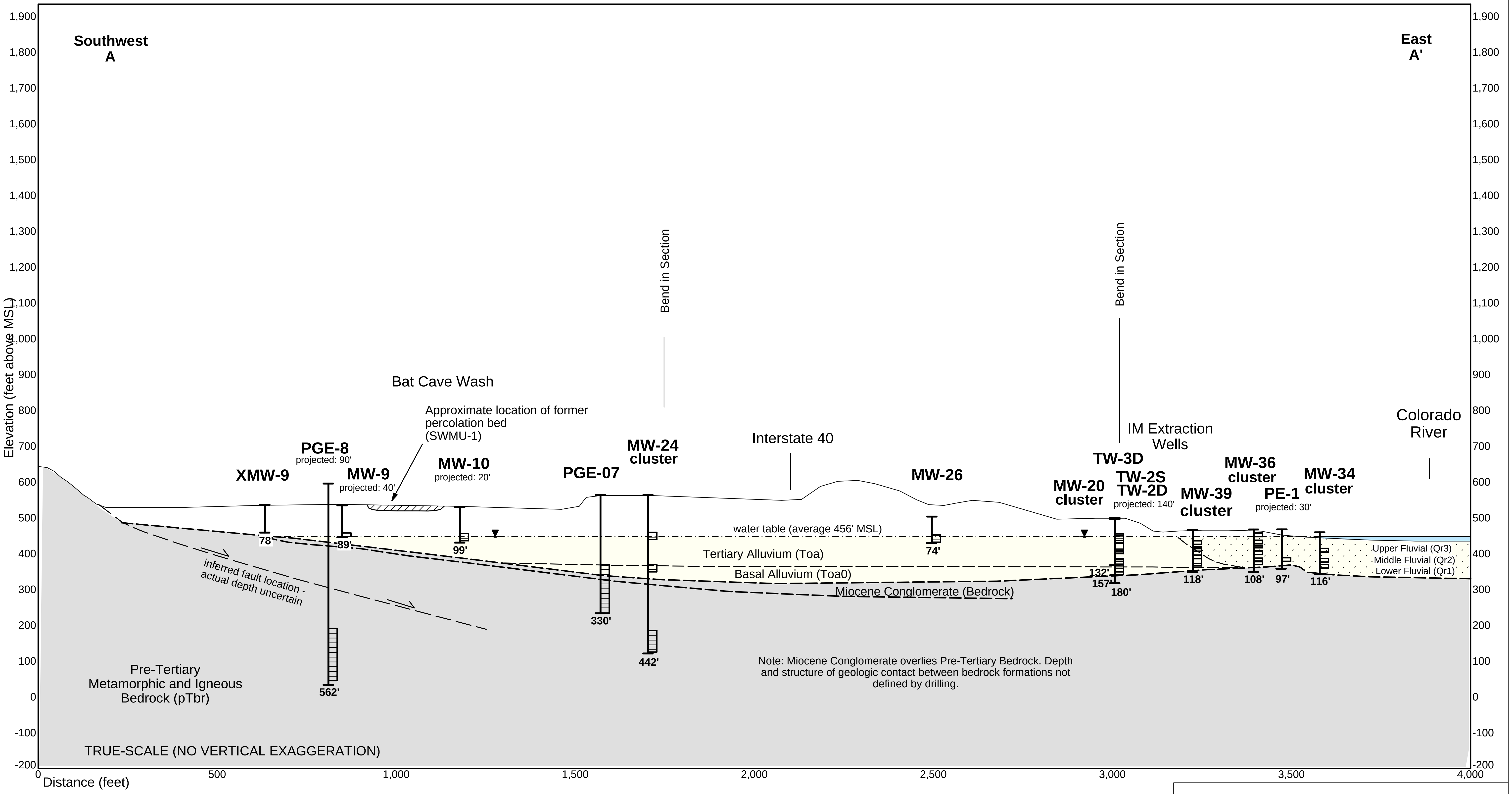
[6] Screen depths rounded-ff to whole foot for presentation.

[7] Well depths indicate the location of the bottom of the well casing in feet below the ground surface.

[8] Depth of water in feet welow top of well casing (TOC). Water depths rounded-off to whole foot for presentation.

Additional Abbreviations:

ATSF	Atchison, Topeka and Santa Fe Railway
MSL	Feet above mean sea level
bgs	Feet below ground surface
PVC	Ployvinyl chloride
---	data not available or not applicable



Notes:
Refer to Figure 5-1 for location of cross-section.
Refer to Table 3-1 for hydrostratigraphic unit descriptions.
MSL = mean sea level

water level ▼
well screen
boring depth (feet) 103

☐ Alluvial Aquifer

▨ Fluvial Deposits (within Alluvial Aquifer)

■ Bedrock

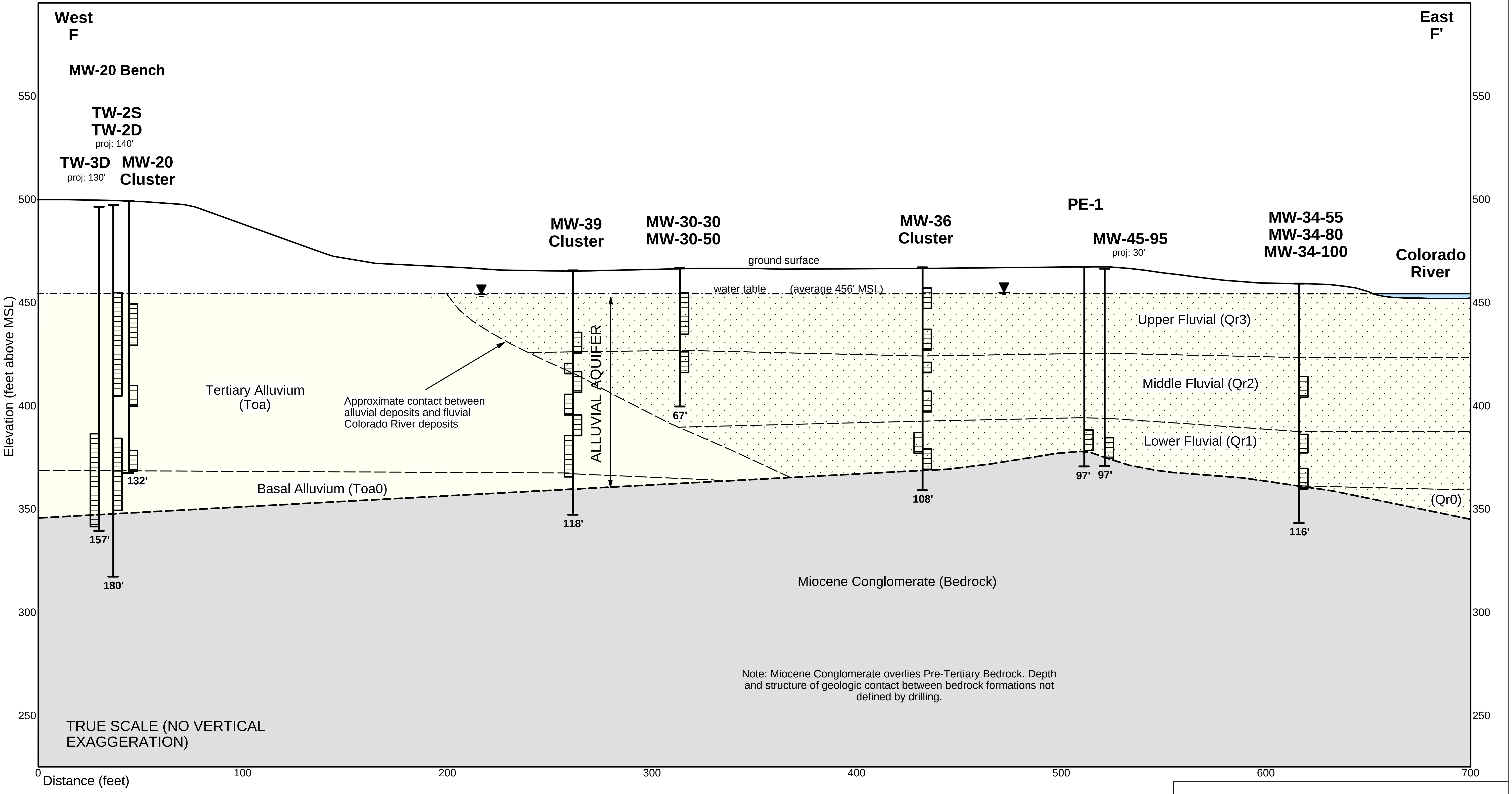
4/28/09

FIGURE 5-2
SITE HYDROGEOLOGIC SECTION A-A'
BAT CAVE WASH TO FLOODPLAIN

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

\\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GINT\INPUT\GINT_WORK_FILE_TYPES\GDW\X-SECTIONS\RFI_2007\12-2008_FINALREVISIONS\FIGURE5-2_XSECA.GDW;



Notes:
Refer to Figure 5-1 for location of cross-section.
Refer to Table 3-1 for hydrostratigraphic
unit descriptions.
MSL = mean sea level

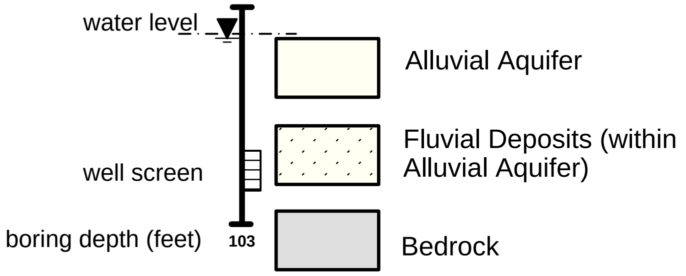


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FIGURE 5-7
FLOODPLAIN HYDROGEOLOGIC CROSS SECTION F-F' IM EXTRACTION AREA

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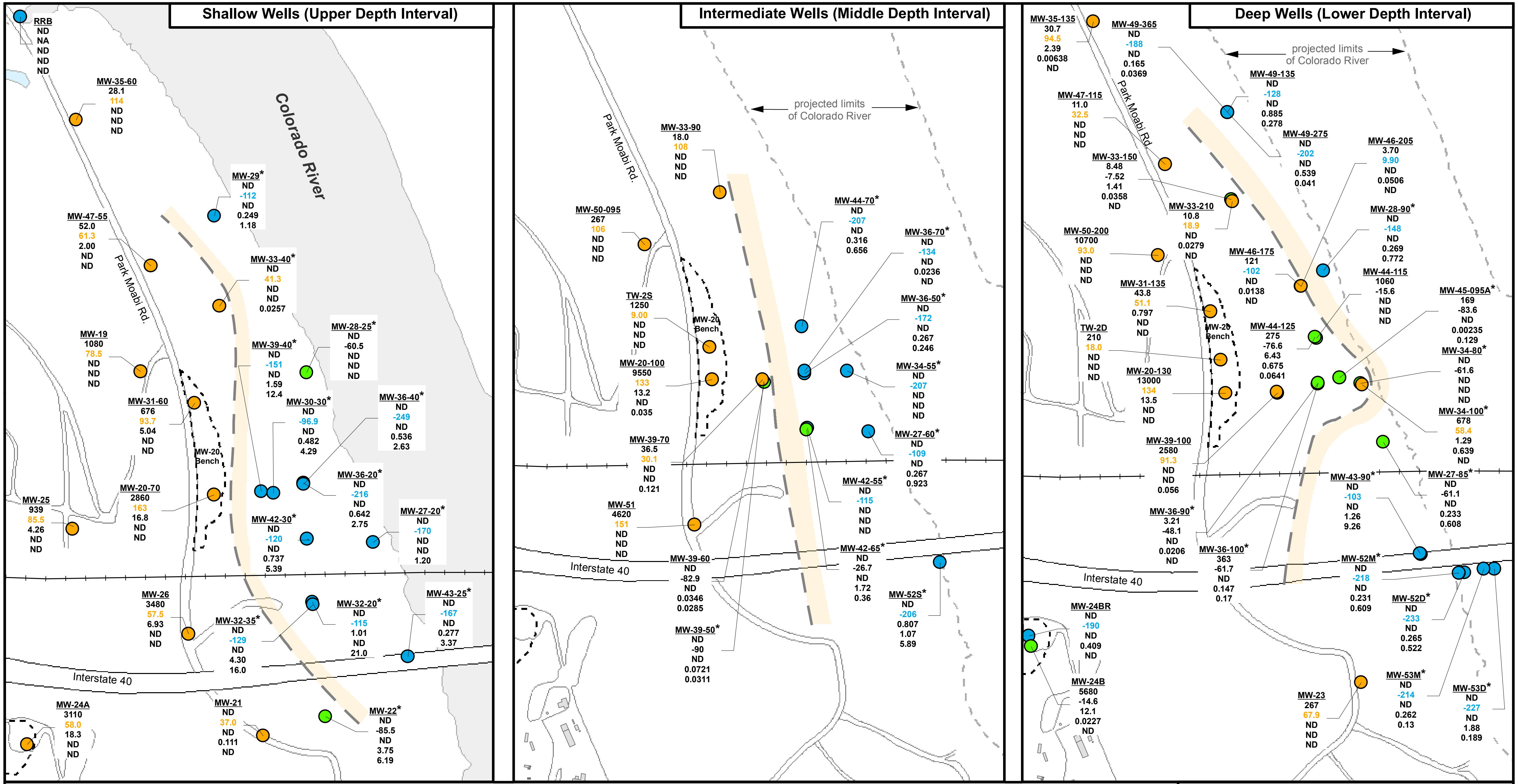
\\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GINT\INPUT\GINT_WORK_FILE_TYPES\GDW\X-SECTIONS\RFI_2007\12-2008_FINALREVISIONS\FIGURE5-7_XSECF.GDW;



LEGEND

- ● Groundwater ORP < -90 mV
- ● Groundwater ORP -90 mV to 1 mV
- ● Groundwater ORP > 1 mV
- Approximate limit of reducing groundwater (ORP less than -90mV)

Average Groundwater Results From Nov. 2006 - Oct. 2007 Sampling

MW-26	Well ID
3,480	Hexavalent chromium, micrograms per liter (µg/L)
57.5	Oxidation reduction potential (ORP), millivolts (mV)
6.93	Nitrate as Nitrogen, milligrams per liter (mg/L)
0.25	Manganese, miligrams per liter (mg/L)
0.25	Iron, miligrams per liter (mg/L)

ORP values less than -90mV highlighted blue.
Positive ORP values highlighted green.

Notes:
ND = not detected
INC = not sampled during sample period
* wells screened in fluvial deposits

Two floodplain wells completed in fluvial deposits (MW-39-50 and MW-30-50) had detected Cr(VI) prior to the 2006-2007 sampling data posted. Well MW-30-50 was last sampled in Oct. 2006.

N

0 400 800 Feet

1 inch = 400 feet

FIGURE 5-22
DISTRIBUTION OF Cr(VI) AND GEOCHEMICAL INDICATOR PARAMETERS IN FLOODPLAIN

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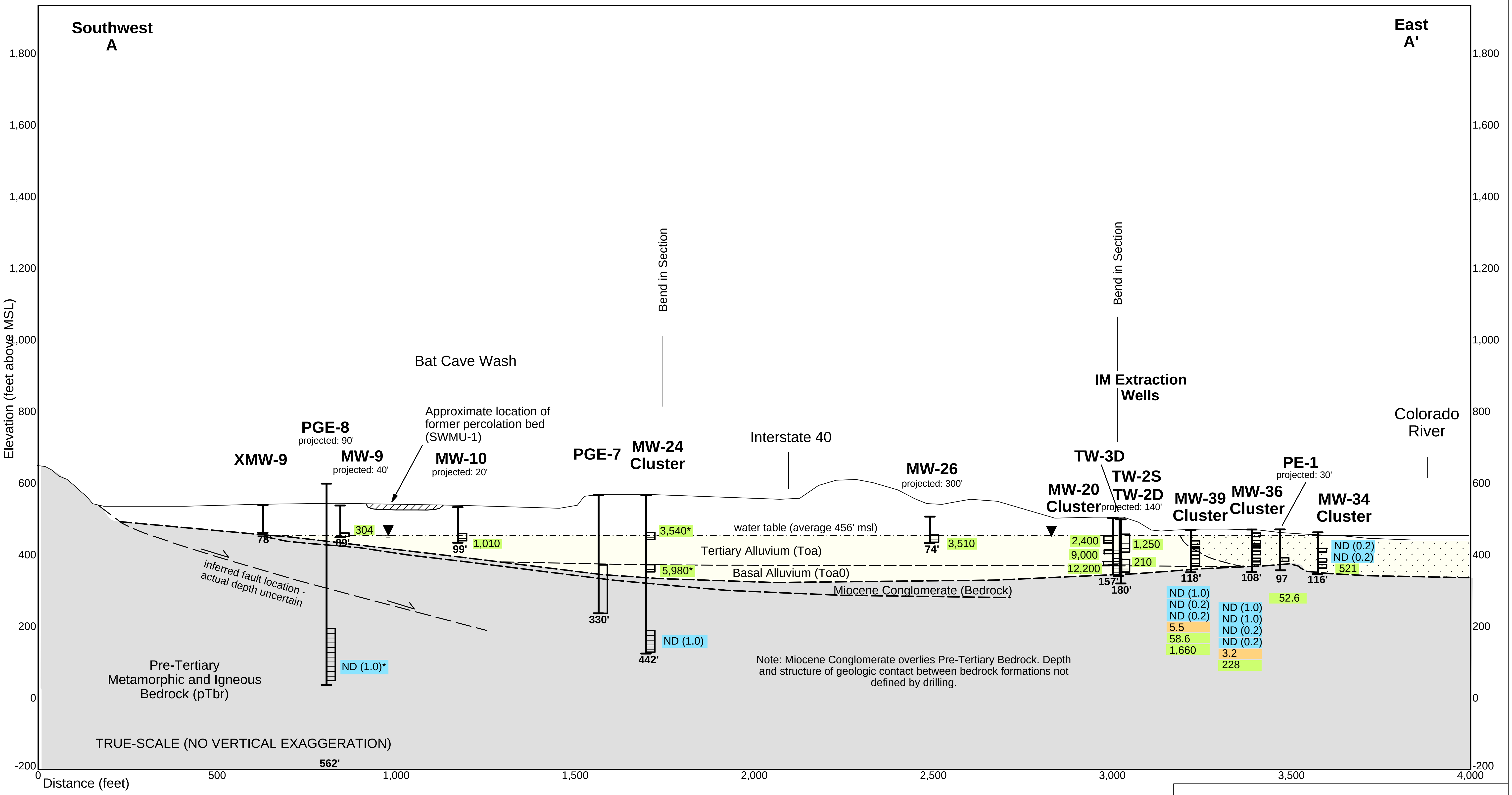
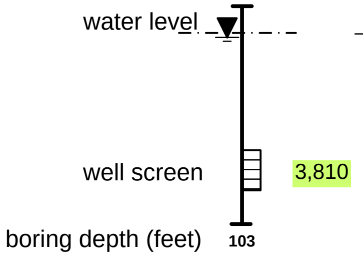
BAO \\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2007\RFI\RFIGEOCHEMINFLOODPLAIN_20090205.MXD FIG5-22_RFIGEOCHEMINFLOODPLAIN_20090205 4/27/2009 15:39:27



Notes:
* Indicates data from March or August, 2007.
Refer to Figure 5-1 for location of cross-section.



Hexavalent Chromium [Cr(VI)] Results, October 2007

Concentrations in micrograms per liter (μg/L)

ND (1)	Not detected at listed reporting limit
28	Less than 32 μg/L
3,810	Greater than 32 μg/L

FIGURE 6-13
Cr(VI) RESULTS, OCTOBER 2007
HYDROGEOLOGIC CROSS SECTION A-A'
BAT CAVE WASH TO FLOODPLAIN

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