Pacific Gas and Electric Company

TW-01 Aquifer Test Report

Topock Compressor Station
Needles, California

June 2022

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Acronyms and Abbreviations

amsl	above mean sea level
AOC	Area of Concern
bgs	below ground surface
btoc	below top of casing
C/RAWP	Construction/Remedial Action Work Plan
Cr6	hexavalent chromium
CS	carbon sample
CSM	conceptual site model
DTSC	Department of Toxic Substances Control
FD	field duplicate
ft/day	feet per day
ft^2/day	square feet per day
gpm	gallon per minute
gpm/ft	gallon per minute per foot
HDPE	high-density polyethylene pipe
IM-3	Interim Measure 3
K_h	horizontal hydraulic conductivity
K_v	vertical hydraulic conductivity
OUL	Ozark Underground Laboratories
PG&E	Pacific Gas & Electric
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RWT	Rhodamine WT
SWMU	Solid Waste Management Unit
TCS	Topock Compressor Station
TDS	total dissolved solids
TWG	Technical Work Group
µg/L	microgram per liter
µS/cm	microSiemen per centimeter
USGS	United States Geological Survey

1 Introduction

1.1 Background

Pacific Gas and Electric Company (PG&E) is implementing the final groundwater remedy (the Project) to address chromium in groundwater near the PG&E Topock Compressor Station (TCS) located in eastern San Bernardino County 15 miles southeast of the City of Needles, California (the site; **Figure 1**).

Construction of the Project began in October 2018 following the plans and procedures documented in the Construction/Remedial Action Work Plan (C/RAWP; CH2M Hill 2015a). Per the C/RAWP, construction includes the installation of remedial wells and monitoring wells and testing of select wells to provide additional hydraulic data to update the conceptual site model (CSM), groundwater model, and the design (C/RAWP Section 3.2.1.5).

Data collected during well installation and testing have been reported in the monthly progress reports per the C/RAWP. Interpretation of the data has been discussed during a series of meetings with the Technical Work Group (TWG) on 7/16, 7/21, 8/13, 8/27, 9/9, and 9/23/2020. PG&E concluded that an aquifer test at well TW-01 near Areas of Concern 5, 6, 15, and 19 (**Figure 1**) would provide valuable information on impacted aquifer and for possible design improvements for the Phase II remedy. In order to fully evaluate this proposal, the Department of Toxic Substances Control (DTSC) directed PG&E to prepare a TW-01 Aquifer Test Work Plan. The work plan was submitted to DTSC and the Department of the Interior, on behalf of itself and the Bureau of Land Management (BLM), the U.S. Fish and Wildlife Service, and the Bureau of Reclamation (DOI) in December 2020. Following comments from stakeholders, a revised Work Plan was submitted in February 2021. DOI (DOI 2021) and DTSC (DTSC 2021) approved the revised Work Plan on April 8, 2021, in respective letters.

1.2 Conceptual Site Model Summary

An overview of the site CSM, including site geology, hydrogeology, and hexavalent chromium (Cr6]) distribution in groundwater, is provided in this section. However, this CSM is specific to the area affected by the aquifer test, not representative of the site. For additional information about site geology and hydrogeology, refer to the Basis of Design Report/Final (100%) Design Submittal for the Final Groundwater Remedy (CH2MHill 2015b) and the Resource Conservation and Recovery Act (RCRA) Facility Investigation/Remedial Investigation Report (CH2MHill 2009).

1.2.1 Geology

The site is situated in the Basin and Range geomorphic province in the Mohave Valley and lies upon a north-sloping piedmont terrace along the northern margin of the Chemehuevi Mountains. Across most of the site, Miocene Conglomerate and pre-Tertiary metamorphic and igneous bedrock are overlain by younger, unconsolidated sedimentary deposits referred to as the Alluvial Aquifer (CH2MHill 2009, 2015b). The Alluvial Aquifer consists of alluvial sands, gravels, and fines shed from the local mountain chains surrounding the valley and fluvial material deposited by the Colorado River (CH2MHill 2015b).

Figure 2 shows the alignment of three cross-sections (F-F', H-H' and I-I'), and **Figures 3** through **5** show cross-sectional views of the geology oriented north-to-south (F-F' – **Figure 3**), northwest-to-southeast (H-H' – **Figure 4**) through the TCS, and northeast-to-southwest (I-I' – **Figure 5**) from the TCS towards the Colorado River Floodplain. As shown in the cross-sections, the contact between bedrock and the overlying Alluvial Aquifer is deeper to the north (approximately 246 feet above mean sea level [amsl] at monitoring well MW-83), and thus the vertical thickness of the unconsolidated alluvial sediments (Alluvial Aquifer) increases to the north. The bedrock/Alluvial Aquifer contact intersects the water table between monitoring wells MW-68 and MW-70.

1.2.2 Hydrogeology

The site is located at the southern end of the Mohave Valley groundwater basin. On a regional scale, groundwater in the northern and central areas of the valley is recharged primarily by the Colorado River. However, in the southern end of the valley (in which the site is located), groundwater is recharged primarily from mountain runoff. Under natural conditions, groundwater beneath the site flows from the west/southwest to the east/northeast across the site (CH2M Hill 2015b).

Groundwater flow occurs primarily in the Alluvial Aquifer. The alluvial sediments are generally silty sand with little to some gravel or gravelly sand with little to some silt. The underlying Miocene Conglomerate and pre-Tertiary metamorphic and igneous bedrock typically exhibit lower permeability than the Alluvial Aquifer. Groundwater in the bedrock occurs in irregularly distributed, highly localized, and discontinuous water-bearing zones that is characteristic of fractured crystalline rocks (CH2M Hill 2014). Gradients are upward between bedrock and the overlying Alluvial Aquifer (CH2M Hill 2015b).

The water table elevation in the Alluvial Aquifer is relatively flat. However, due to the variable topography, the depth to groundwater ranges from as shallow as 5 feet below ground surface (bgs) in the floodplain of the Colorado River to approximately 170 feet bgs in the upland alluvial terrace areas. The saturated thickness of the Alluvial Aquifer thins to the south, pinching out along the outcrop of the Miocene Conglomerate bedrock. In the western and northern portions of the site, where the depth to bedrock increases, the saturated Alluvial Aquifer is more than 300 feet thick (CH2M Hill 2015b).

1.2.3 Cr6 Distribution and Trends

The Cr6 plume is defined as the part of the aquifer where Cr6 concentrations exceed natural background levels. The calculated statistical upper tolerance limit of natural background levels for Cr6 in alluvial groundwater is 32 micrograms per liter (µg/L; CH2M Hill 2009, 2015b). A plan view of the Cr6 at the site is depicted on **Figure 2**. The majority of the Cr6 plume is located in the Alluvial Aquifer, with the highest Cr6 concentrations detected beneath the TCS at PT-9D (9,300 to 17,400 µg/L), screened approximately 350 to 370 feet amsl on the north end of the station, and MW-68-180 (1,400 to 61,000 µg/L), screened approximately 442 to 457 feet amsl on the western side of the station near the bedrock interface. Cr6 concentrations above 10,000 µg/L were also historically observed downgradient at National Trails Highway at the MW-20 well cluster in the 2004 to 2012 timeframe, with a maximum of 13,300 µg/L at MW-20-130 in March 2008, and at MW-50-100, with a maximum of 10,900 µg/L in March 2008. A small portion of the plume extends into the bedrock near the East Ravine; however, the bedrock beneath the central portion of the TCS does not contain Cr6 at MW-66-BR-270 and MW-68BR-280 (CH2M Hill 2014, 2015a, 2015b).

The existing chromium contamination in groundwater has previously been largely attributable to historical wastewater discharge from TCS operations to Bat Cave Wash (designated as Solid Waste Management Unit [SWMU] 1/Area of Concern [AOC] 1 [CH2M Hill 2015b]). More recent examination of the groundwater monitoring data, particularly the elevated concentrations at monitoring well MW-68-180, has suggested the potential for an additional source of elevated Cr6 in groundwater at the TCS. Known sources of Cr6 in shallow soil (less than 10 feet bgs) in the vicinity of monitoring well MW-68-180 include historical releases from the former water treatment chemical mixing area (AOC 19) and auxiliary jacket water cooling pumps (AOC 15).

1.2.4 Total Dissolved Solids

Total dissolved solids (TDS) distribution in groundwater is an additional component of the CSM for the site. The following is an excerpt from the Final RCRA Facility Investigation/Remedial Investigation Report. Volume 2 (CH2M Hill, 2009) that summarizes TDS at the site; "A historical source of high TDS water was from the Topock Compressor Station blowdown water discharge to Bat Cave Wash. Though sparsely documented, the TDS of this water is assumed to be very high during early years of operation, with progressively lower values over time. By the late 1960s the TDS reached values observed in non-plume wells (CH2M Hill, 2009). As described in the RFI Volume 2 report, an apparent higher TDS in the plume well data set is related to the proximity of their screened intervals to the bedrock surface. This higher TDS is likely associated with older water in the bedrock and deeper alluvium in this part of the basin. Wells screened closer to the bedrock surface tend to have higher TDS, regardless of whether the well is associated with the plume or not." (CH2M Hill 2015b).

On the compressor station, in the area of interest, specific conductance in the shallow intervals is several times lower than in the deeper alluvial intervals. For example, specific conductance from 2014 to 2019 ranged from 3,500 to 5,395 microSiemens per centimeter (µS/cm) at MW-68-180 and from 15,799 to 19,640 µS/cm at the deeper well MW-68-240.

1.3 Test Objectives

The goal of the well TW-01 aquifer testing was to further characterize the aquifer properties to support the additional characterization of groundwater flow and solute transport pathways in the vicinity of the TCS. TW-01 was selected for the proposed testing because this well has a suitable construction and capacity to induce a hydraulic influence from pumping that can be measured at the distances of available monitoring wells at the TCS. The specific objectives of the testing were to accomplish the following:

- Determine effective aquifer properties (hydraulic conductivity, transmissivity, specific yield, mobile/immobile porosity, anisotropy, and storativity) in the TCS area and provide information to update the groundwater fate and transport model for this area.
- Evaluate the influence of aquifer boundaries with a primary focus on the bedrock interface to the south of well TW-01.
- Evaluate the hydraulic influence of extraction and effect on Cr6 concentrations in groundwater. Specifically, this objective was evaluated using dye tracer, drawdown, and Cr6 concentration data collected during the pumping test at TW-01 to estimate the capture zone from well TW-01 itself, to estimate the capture zones of other potential pumping locations in the source area, and to evaluate the time scales for pore flushing to achieve concentration reductions.

- Evaluate aquifer equilibrium during periods without episodic recharge under pumping conditions at TW-01.
- Assess the potential of impacts to hydraulic gradients from a large storm event. The sampling frequency of transducers in wells MW-9, MW-10S, MW-10D, MW-11S, MW-11D, MW-38S, MW-38D, MW-84 (four screens) and MW-85 (control well located outside wash – three screens) near Bat Cave Wash were programmed at the start of the test to measure water levels at 5-minute intervals. This instrument data collection frequency will continue at least three months past the occurrence of a large precipitation event (i.e., greater than 0.35 inch in a 24-hour period), even if it occurs after the end point of the TW-01 aquifer test. This will provide increased data resolution so that more detailed evaluations of the effects of flood conditions in the wash can be performed. These data will be analyzed, and the findings will be presented to the agencies and TWG during a forthcoming meeting. The instrument data collection frequency will not be changed in the above-listed wells until the agencies provide concurrence that the goals of the infiltration study have been met.
- Evaluate and inform an update of the CSM for the potential historical source of Cr6 on the compressor station through collection and analysis of water levels and other parameters via dataloggers and additional Cr6 and other constituents by groundwater sampling. An additional objective is to further refine our understanding of the flow paths in the compressor station area. Because the data collection to complete this objective will extend beyond the timeframe of the TW-01 pumping test, the results of this objective will be reported under separate cover.

The ultimate goal of the aquifer testing was to provide information necessary for updating the existing groundwater model and for planning possible design improvements for the Phase II remedy for the site. An overview of the aquifer testing is provided in the following sections of this report.

2 Aquifer Test Methodology

2.1 Overview

Well TW-01 was an existing test well installed in November 2003 to characterize the hydrogeology and aquifer capacity of the saturated Alluvial Aquifer beneath the TCS. Before the start of testing, TW-01 was redeveloped to re-establish communication with the aquifer and improve the pumping capacity from the well.

The aquifer testing included a two-phase constant rate test and a tracer study. The first phase of the constant rate test lasted approximately 1 week and included a high frequency of data collection. The purpose of the first phase of the test was to provide a dataset with a sufficient resolution to estimate the hydraulic properties of the Alluvial Aquifer. The second phase of the test was much longer (approximately 6 months) but involved a lower frequency of data collection. The data collected during the second phase of the test was used to evaluate the potential influence of the boundary conditions in the TCS area (potentially from bedrock, Bat Cave Wash, and/or the Colorado River), to assess the length of time needed for the aquifer to reach equilibrium under a pumping condition, and to allow for sufficient time to pass for the tracer study to be completed. Cr6 samples were collected from TW-01 during both phases of the test to evaluate the effect of pumping on Cr6 concentrations.

The tracer study was conducted concurrent with the constant rate test. Two different dye tracers were injected into monitoring wells MW-38D and MW-67-185 (located near TW-01), and tracer concentrations were periodically measured in TW-01 and nearby monitoring wells to confirm the arrival of each of the dye tracers and estimate the mobile and immobile porosity of the Alluvial Aquifer. Dye tracers were injected at MW-38D and MW-67-185 because they are close enough to well TW-01 to allow for arrival of tracer at TW-01 during the test. The depth intervals selected represent the depths and hydrogeologic intervals of interest. The MW-67-185 interval was selected to represent the shallow hydrogeologic layer in which the Cr6 mass at MW-68-180 is situated. The MW-38D interval was selected to represent the hydrogeologic layer in which the deeper western extent of the plume is contained. Injection of tracer into MW-38D will also aid in the evaluation of the hydraulic influence of TW-01 pumping on this western extent of the plume. Fluorescein dye tracer was injected into MW-38D, and Rhodamine WT (RWT) was injected into MW-67-185.

2.2 Well TW-01 Preparation

TW-01 is a 5-inch-diameter polyvinyl chloride (PVC) extraction well with a single well screen extending from 168 to 268 feet bgs. The well screen extends through the entire Alluvial Aquifer, from the top of bedrock to the approximate water table surface. The boring and construction log for well TW-01 is provided in **Appendix A**.

TW-01 was redeveloped on November 23, 2020 to re-establish aquifer communication and improve its productivity, which may have deteriorated over time since its installation. After redevelopment, a stepped-rate pumping test was conducted to characterize the performance of the well and select a pumping rate that could be sustained during the constant rate test. The stepped-rate test was performed at three different pumping rates with a total test duration of 2 hours. The pumping duration for the first two steps was 30 minutes each, and the duration for the last step was 1 hour. The results from the step test are summarized in **Table 1**.

Table 1. Summary of TW-01 Step Test Results

Step	Time-weighted Average Pumping Rate (gpm)	Maximum Drawdown (cumulative feet)	Specific Capacity (gpm/foot)
1	30.3	1.34	22.7
2	60.7	2.82	21.6
3	91.1	4.61	19.8

Notes:
Step 1 and Step 2 ran for 30 minutes. Step 3 ran for 1 hour.
gpm = gallons per minute
gpm/foot = gallons per minute per foot

The specific capacities measured from the well following redevelopment ranged from 19.8 to 22.7 gpm/ft. The post-redevelopment specific capacities were higher than the 10.8 to 16.4 gpm/foot range of specific capacities measured when the well was originally installed. The increase in specific capacity achieved shows that the well was successfully redeveloped.

Based on the results from the stepped-rate test, it was determined that TW-01 would be able to sustain a flow rate of 90 gpm for the duration of the proposed constant rate aquifer test. A pump was installed in TW-01 that was sized to deliver approximately 90 gpm continuous flow from TW-01 to the on-site Interim Measure 3 (IM-3) treatment system. This pump was used to conduct the TW-01 constant rate aquifer test.

2.3 Tracer Test Preparation

As discussed above, wells MW-38D and MW-67-185 were used for the tracer study during the constant rate test. Well MW-38D is a 2-inch-diameter PVC monitoring well installed to a depth of 190.9 feet bgs and is screened in the Alluvial Aquifer from 163 to 183 feet bgs. Well MW-67-185 is also a 2-inch-diameter PVC monitoring well. MW-67-185 is installed to a depth of 186.7 feet bgs and is screened in the Alluvial Aquifer from 177 to 187 feet bgs. Well construction logs for both monitoring wells are provided in **Appendix A**.

MW-38D was damaged by two separate flooding events in January 2010 and October 2012. After additional investigation and reconnaissance work in April 2013, the well was repaired in May 2013 and has been sampled as part of the Topock groundwater monitoring program since that time. MW-38D was redeveloped during the week of November 23, 2020 to better assess the well condition and casing integrity before the start of the constant rate test. Redevelopment was completed using procedures consistent with the Phase 1 remedy monitoring wells. Following redevelopment, a downhole video log survey was conducted, and an injectivity evaluation was performed to evaluate the specific injectivity for MW-38D for the tracer injections.

During downhole video logging of MW-38D, the field geologist noted a slight bend or bulge in the blank casing above the screen located approximately 79 feet below the top of casing (btoc) and a minor crack in the casing at the top of the screen between the joint of the blank and the PVC screen. These observations did not appear to pose significant problems for the proposed injections. After completion of the redevelopment and camera survey, it was concluded that MW-38D was in good condition and could be used for the tracer study.

2.4 Aquifer Test Equipment and Setup

2.4.1 Constant Rate Test

The existing IM-3 extraction wells are being used for gradient control on the flood plain with a flow rate limited to 135 gpm, which could not be exceeded in combination with the TW-01 pumping test. At the start of the constant rate test, groundwater pumping rates in the existing IM-3 extraction wells were reduced so that the IM-3 system would have the capacity to treat the combined flow from well TW-1 and the IM-3 extraction wells at a total combined flow rate of 135 gpm during the test. The total flow rate from the IM-3 extraction wells was adjusted to approximately 45 gpm, so that the IM-3 treatment capacity would not be exceeded with the combined flow of well TW-1 pumping at 90 gpm for a combined flow rate of 135 gpm during the test.

As discussed above, a new submersible pump capable of achieving the targeted flow rate of 90 gpm was installed in TW-01. Water pumped from TW-01 was conveyed to the final remedy pipelines and MW-20 Bench IM-3 Infrastructure using a temporary pipeline constructed for the test. The temporary pipeline was constructed with 3-inch by 6-inch double-walled high-density polyethylene (HDPE) pipe. Access ports were installed at designed low points along the temporary pipeline to allow inspection of leaks within the containment space of the double-contained line. Air/vacuum relief assemblies were installed at the high point of the pipeline to ensure proper pipeline operations. The assemblies were contained within an above grade concrete vault to collect any potential spillage.

The conveyance pipeline was connected to the existing 6-inch by 10-inch double-walled HDPE pipeline installed as part of the Phase 1 Final Groundwater Remedy construction. The connection was made at pipeline segment C10 near the south end of the jack and bore under National Trails Highway through a previously installed flanged cleanout port. A concrete vault was installed over this port to provide containment during connection, operation, and disassembly of the temporary conveyance pipeline. At the MW-20 Bench, a temporary connection was installed between the remedy piping and the existing IM-3 infrastructure to allow the extracted groundwater to be conveyed to the IM-3 facility for treatment. An inline booster pump was installed between the remedy piping and IM-3 piping to ensure that the transferred groundwater could reach the treatment facility with sufficient flow to maintain the targeted extraction rate during the constant rate test. The three storage tanks located at the MW-20 Bench (IM-3 Brine Tanks) were used as temporary storage and/or as surge tanks during the transfer of water extracted from well TW-01 to IM-3.

Double-walled piping does not enable the use of in-line valving or other mechanical equipment. Therefore, an isolation valve and flow meter were installed at the surface of the well head before transitioning to the double-walled pipe. An additional isolation valve was installed at the connection to pipeline segment C10 at the transition to the existing remedy piping to allow the temporary pipeline to be removed from service at a later date.

The primary source of power for the constant rate test was provided by Needles Electric. A new pole and pole-mounted transformer were installed near the electrical infrastructure that was used for the uplands pilot study. The TW-01 pump was powered and controlled by a variable frequency drive and mounted in an enclosure rated for the outdoor environment.

2.4.2 Tracer Testing

Fluorescein and RWT dyes were injected into monitoring wells MW-38D and MW-67-185 (**Figure 6**). The dyes were procured from Ozark Underground Laboratories (OUL) and were stored and handled according to the manufacturer's recommendations. The dyes were mixed with water in large frac tanks which were filled with water provided from the on-site TCS raw water tanks and delivered using a water truck. The TCS water tanks are filled with water from wells Topock-2 and Topock-3. Both MW-38D and MW-67-185 were fitted with the equipment needed to perform injections including pumps, conveyance hosing, generators, and electric flowmeter/totalizers.

The first batch of fluorescein dye and water for MW-38D was mixed on June 7, 2021, by adding 10.5 pounds of dye to approximately 17,500 gallons of water. Injection of the dye solution into MW-38D began on June 8, 2021. A second batch of dye was mixed on June 10, 2021, when the total volume of the first batch had been injected. Injection continued until June 12, 2021, when the second batch was completed. A total volume of 35,000 gallons of fluorescein dye solution was injected into MW-38D before the start of the constant rate test. Average daily injection flow rates at MW-38D ranged from 14 to 18 gpm during the injection period.

The first batch of RWT and water was mixed on June 8, 2021, by adding 25 pounds of dye to approximately 11,350 gallons of water. Injection of the dye solution into MW-67-185 began on the same day. Per the work plan, the dye solution was intended to be injected at a rate of approximately 10 gpm over 30 hours with an intended injection volume of 18,000 gallons. However, the injection rate had to be lowered to less than 1 gpm to prevent an excessive increase in the water level in the well. The low injection rate limited the total volume that could be injected into the well within a reasonable time frame.

The injection into MW-67-185 proceeded at the lower flow rate until a few days before the start of the constant rate test. A total of 2,350 gallons of dye solution was injected between June 8 and June 12, 2021 at an average daily flow rate between 0.5 and 0.75 gpm. Injection was halted during the first phase of the constant rate test to allow equilibrium conditions to establish during this phase of the test. Injections were resumed on June 23, 2021, to increase the total volume of dye solution injected. . Injection continued through July 19, 2021, at average daily flow rates that ranged from 0.65 to 0.94 gpm. The additional volume injected during the second phase of injection was 8,190 gallons, resulting in a total volume injected of 10,540 gallons. **Table 2** summarizes the injection volumes at each of the wells, the dyes used at each location, and the injection flow rates at each well.

Table 2. Tracer Injection Summary

Injection Locations	Screen Interval (feet bgs)	Dye Tracer Used	Daily Average Injection Flow Rate (gpm)	Dates of Injection (hours)
MW-38D	163.3 – 183.3	Fluorescein	14 to 18	6/7/2021 through 6/12/2021
MW-67-185	177.0 – 187.0	RWT	0.5 to 0.94	6/8/2021 through 6/12/2021 and 6/23/2021 through 7/19/2021

2.5 Monitoring Network and Sampling Program

2.5.1 Water Level and Field Parameter Monitoring

Data loggers were installed in 47 monitoring wells **(Table 3a**)across the site as part of the TW-01 aquifer test data collection (**Figure 6**). Groundwater levels in the wells were monitored manually using electric water level probes and automatically using pressure transducers with datalogging capabilities. Select monitoring wells surrounding well TW-01 were analyzed quantitatively. This subset of 27 wells were those where drawdowns resulting from pumping TW-01 were clearly evident. The remaining wells were more distant, the drawdown trends were not as clear, and the data from these wells were only analyzed qualitatively. MW-75-202, from the northernmost portion of the site that was likely not be influenced by the aquifer test, was chosen to monitor long-term background groundwater level trends. The wells quantitatively analyzed for the TW-01 aquifer testing are summarized in **Table 3b.** Well logs for each of the wells monitored are provided in **Appendix A.**

The transducers were installed in the wells before the start of the constant rate aquifer test and tracer study to allow for the collection of background data. Transducers were installed before January 2021 in all wells listed in **Table 3b** except for MW-09, MW-11, MW-11D, MW-40D, and MW-70BR-287. The transducers in these remaining wells were installed in May 2021. In most of the wells, either Solinst Levelogger 5 LTC transducers (capable of measuring water level, specific conductivity, and temperature data) or Solinst Levelogger 5/Edge transducers (capable of measuring water level and temperature) were installed. In-Situ Aqua TROLL 600s, (capable of measuring water level, temperature, pH, conductivity, dissolved oxygen, and oxidation-reduction potential), were installed in monitoring wells MW-66-165, MW-67-185, MW-68-180, and MW-68-240. Data collection started immediately after deployment. The type of transducer installed in each well is summarized in **Table 3b**.

Manual water levels were collected from all wells in Table 3b using electric water level probes. Frequent manual water level monitoring began on the morning before the start of the test. During the first week of the test, manual water levels were collected multiple times per day, with the greatest frequency being during the first day of the test. After the first phase of the test, the frequency of manual measurements was reduced to a frequency ranging from bi-monthly to every other month until the end of the long-term phase of the test.

2.5.2 River Stage Monitoring

A stilling well (I-3) installed in the Colorado River was also monitored during the test. The stilling well was placed in the west bank of the river at the location shown on **Figure 6**. The stilling well was monitored both manually and using a pressure transducer to evaluate the influence of the Colorado River on the groundwater elevations in the TW-01 test area. Water level measurements from the stilling well were supplemented by measurements from the United States Geological Survey (USGS) gage 09423000 on the Colorado River just below the Davis Dam approximately 20 miles upstream from the site.

2.5.3 Barometric Pressure Monitoring

The atmospheric pressure at the site was monitored using a barometric transducer attached to the wellhead of one of the monitoring wells near well TW-01. Atmospheric pressure was measured to compensate the pressure measurements from the transducers (i.e., removing the influence of the atmospheric pressure on the total pressure measured by the transducer so that only the pressure from the water column overlying the transducer could be determined) and to evaluate whether atmospheric pressure changes influence groundwater elevations in the aquifer.

2.5.4 Tracer Monitoring

Tracer monitoring was performed at extraction well TW-01 and selected monitoring wells during the aquifer testing. The tracer monitoring included the following:

- Background sampling at TW-01 and selected monitoring wells: Groundwater samples were collected before the start of the constant rate test in May and June of 2021. These samples were collected using modified low-flow sampling techniques.
- Batch samples of the tracer solution in the tanks: Representative water samples were collected from each of the mixing tanks during the injection phase of the test.
- Grab groundwater sampling and carbon sampler deployment at TW-01 throughout the tracer study: Sample collection began on August 3, 2021 (approximately 8 weeks after injections began and 7 weeks after extraction began at well TW-01) and continued weekly into December 2021. The grab groundwater samples were collected from a sample tap installed along the groundwater discharge line. Carbon samplers were initially deployed in a sample bucket setup, which was (due to leakage) subsequently changed to an in-line sampling chamber setup as depicted in **Appendix B**. Samplers were deployed for approximately 1 week at a time and then retrieved and submitted for laboratory analysis.
- Monthly sampling events at injection wells MW-38D and MW-67-185 and selected monitoring wells. Groundwater samples were collected approximately monthly throughout the constant rate test at the injection wells including the second week of August, the third week of September, and the third week of October. These samples were collected using modified low-flow sampling techniques.
- Quarterly sampling events two- and four-months following test start: Groundwater samples were collected in the second and fourth month after the start of the test, including the second week of August and the third week of October. These samples were collected using modified low-flow sampling techniques. Samples were not collected in month six after test start, because cessation of the test in conjunction with start-up was originally planned for September when the sampling planning was done.
- Each of the groundwater samples were collected in 5-milliliter plastic vials and kept in total darkness to prevent sample degradation. Carbon samplers were retrieved from the sample bucket setup and placed in Ziplock bags. All samples were refrigerated. All groundwater samples and carbon samplers were shipped to OUL and analyzed for fluorescein and RWT. **Table 4** summarizes all tracer samples collected during the tracer study.

2.5.5 Cr6 Sampling

Grab water quality samples were also collected from well TW-01 before and during the constant rate test and analyzed for Cr6 concentrations. A background water quality sample was collected on June 10, 2021. During the first week of the constant rate test (June 10 through June 21, 2021), water quality samples were collected daily. After the first week of the test, samples were collected approximately every other week until the end of the test. The samples were collected by filling appropriately preserved bottles from a sample tap placed on the discharge line from Well TW-01. The samples were submitted by courier to Asset Laboratories for analysis of Cr6. Water quality samples were collected from TW-01 on the dates identified in **Table 5a**.

Table 5a. TW-01 Cr6 Sample Summary

Test Period	Sample Date
Background	6/10/2021
Constant Rate Test	6/15/2021
Constant Rate Test	6/16/2021
Constant Rate Test	6/17/2021
Constant Rate Test	6/18/2021
Constant Rate Test	6/19/2021
Constant Rate Test	6/20/2021
Constant Rate Test	6/28/2021
Constant Rate Test	7/12/2021
Constant Rate Test	7/26/2021
Constant Rate Test	8/16/2021
Constant Rate Test	9/2/2021
Constant Rate Test	9/9/2021
Constant Rate Test	9/23/2021
Constant Rate Test	10/07/2021

Additional Cr6 monitoring and transducer data collection were conducted for wells that are part of the IM-3 Performance Monitoring Program (see **Table 5b**) to evaluate potential contaminant migration into the IM-3 area due to pumping activities at TW-01 and the reduction of the pumping rate in the IM-3 area.

Table 5b. Cr6 Sample Summary in IM-3 Performance Monitoring Area

Test Period	Cr6 Monitoring	Transducer Data Collection
MW-34-055	Bi-weekly	Monthly
MW-34-080	Bi-weekly	Monthly
MW-34-100	Bi-weekly	Monthly
MW-36-020	Bi-weekly	Monthly
MW-36-040	Bi-weekly	Monthly
MW-36-070	Bi-weekly	Monthly

Test Period	Cr6 Monitoring	Transducer Data Collection
MW-36-090	Bi-weekly	Monthly
MW-36-100	Bi-weekly	Monthly
MW-44-070	Bi-weekly	Monthly
MW-44-115	Bi-weekly	Monthly
MW-44-125	Bi-weekly	Monthly
MW-44-175	Bi-weekly	Monthly

2.5.6 Groundwater Chemistry Sampling near TW-01

The TW-01 Test Plan outlines additional sampling to be conducted during the constant rate test at TW-01 in the vicinity of the pumping well. **Table 6** summarizes the sampling plan.

Concentration trends for Cr6 and other constituents (cations, anions, arsenic, molybdenum, selenium, dissolved oxygen, oxidation reduction potential, and specific conductance) will be evaluated in the context of changing water levels and flow directions. The analysis will be used to evaluate the source area CSM, looking at the potential explanations for fluctuating and elevated concentrations at MW-68-180. In this report, the data will be evaluated, and obvious trends will be discussed. An in-depth analysis of the additional sampling parameters will be provided under a separate cover.

3 Aquifer Test Analysis

3.1 Pump Operation

Pumping for the constant rate test began at well TW-01 on June 15, 2021. Pumping continued for approximately 6 months until it was permanently ceased on December 10, 2021. The daily flow rates measured during the test are presented on **Figure 7.** The instantaneous flow rate provided by the pump was approximately 90 gpm, though there were some short, temporary pump stoppages that resulted from scheduled maintenance or mechanical difficulties with the system such as temporary loss of power or valve failures. The temporary pump stoppages caused the average flow rate for the test to be 85.4 gpm, which was slightly lower than the instantaneous rate of 90 gpm. Most of the pump stoppages occurred after the first phase of the constant rate test. The average flow rate for the first phase of the test was equal to the instantaneous flow rate of 90 gpm. The temporary pump stoppages resulted in some short-term recovery of the groundwater levels in the monitoring wells closest to well TW-01, but overall were not significantly detrimental to the objectives of the test.

3.2 Water Level Monitoring and Processing

Water level hydrographs were prepared summarizing the manual and transducer groundwater level measurements collected during the constant rate test. The hydrographs also include measurements from several weeks before the start of the test, and for select wells, several additional weeks of measurements during the water level recovery period following the cessation of pumping. The hydrographs illustrate the influence of external factors (those not related to pumping) on the measured groundwater levels and were used to correct the measurements (remove water level changes caused by the external factors) so that the water level changes caused by pumping (drawdowns) at well TW-01 could be isolated.

The summary hydrographs prepared for the individual wells are provided in **Appendix C.** Before preparing the hydrographs, the groundwater level data were reviewed and processed to remove non-representative data resulting from measurement inaccuracies and equipment malfunctions and to make any necessary adjustments to the transducer data to show the true groundwater level. The data processing steps are described in the sections below.

3.2.1 Barometric Compensation

Most of the transducers used to measure groundwater levels were unvented (i.e., the instruments do not have a vent tube that allows the barometric pressure on the water column to be cancelled out by the pressure transmitted in the tube from the atmosphere). The unvented transducers are sealed, and therefore measure the pressure exerted by both the water column above the transducer and the pressure of the atmosphere acting on the water surface. The pressure from the atmosphere must be subtracted from the total measured pressure to determine the pressure from the water column alone. See **Table 3** for transducer details.

The measurements of total pressure recorded by the unvented transducers were compensated for atmospheric pressure using the barometric pressure measurements recorded by the barometric transducer via the following equation:

$$P_w = P_T - P_A$$

where; P_w = pressure from the water column above the transducer;

P_T = total pressure measured by the transducer;

P_A = barometric pressure measured by the barometric transducer.

After the transducer reading was compensated for barometric pressure, the groundwater elevation was determined using an offset based on the elevation of the transducer setting and manual groundwater elevation measurements collected from each well. For monitoring wells that had vented transducers installed, the barometric compensation was not necessary.

3.2.2 Adjustments to Manual Measurements

Transducers are subject to measurement inaccuracies, drifts, and non-linearities. Transducer equipment can also be inadvertently repositioned during field data collection such as during the measurement of manual water levels or the downloading of data logs. Where necessary, the transducer measurements were adjusted to correspond to the manual groundwater level measurements recorded for each of the wells. The hydrographs included in **Appendix C** show the groundwater levels after the completion of the data processing.

3.3 External Influences on Groundwater Elevations

The groundwater levels depicted on the hydrographs exhibit fluctuations that were not related to pumping at well TW-01 during the constant rate test. These fluctuations were most clearly observable in the pre-test groundwater level measurements but were also readily observable in the measurements from the constant rate testing period. The groundwater level measurements exhibited both a short-term daily fluctuation and longer-term fluctuation related to changes in the stage of the Colorado River and seasonal influences.

3.3.1 Barometric Influences

Groundwater levels in the monitoring wells near TW-01 area were observed to fluctuate in response to barometric pressure changes. There was a strong inverse correlation between the barometric pressure and the groundwater levels in the monitoring wells. Increases in barometric pressure resulted in decreases in groundwater elevations and vice-versa.

Figure 8 depicts groundwater levels measured in MW-66-230 during the first phase (approximately 6.5 days) of the constant rate test along with the barometric pressure measured by the barometric transducer. The measured barometric pressure exhibited an irregular daily fluctuation but also longer-term (over a period several days to weeks) fluctuations related to passage of weather fronts and differing air masses. The groundwater levels in MW-66-230 exhibited a daily fluctuation that was of similar magnitude but inverse to the barometric fluctuation. There was minimal lag time between the barometric pressure changes and the groundwater level changes. The groundwater levels in the wells analyzed for the TW-01 constant rate test exhibited a response to changes in barometric pressure.

3.3.2 Influence of the Colorado River

Groundwater levels in the monitoring wells at the site have also been observed to fluctuate in response to changes in the stage of the Colorado River. The stage and flow in the Colorado River adjacent to the site is largely controlled by releases from Lake Mohave through the Davis Dam, located approximately 33 miles upstream of the site. Davis Dam further regulates releases from the Hoover Dam and Lake Meade located further upstream. Releases from the Davis Dam are made to meet downstream municipal and agricultural water needs. Releases tend to be greatest from late spring to early summer and least from late fall to early winter. Releases also fluctuate daily, with the greatest flows typically occurring in the late evening and the least typically occurring in the early morning. Releases from the dam are measured by the USGS Gage 09423000 on the Colorado River just below the dam.

Stage measurements for the Colorado River immediately below the dam are depicted on **Figure 9**. Water levels measured in the stilling well at the site are also depicted on **Figure 9**. The figure shows a direct correlation between the releases from the dam and the water levels measured in the stilling well. The daily fluctuation in releases from the dam cause a daily fluctuation in the stage of the Colorado River at the stilling well site. However, the daily change in the stage of the river is of a lower magnitude at the stilling well site and is lagged in time relative to the daily change just below the dam. The time lag results from the time required for water released from the dam to reach the stilling wellsite.

Groundwater levels at the site also exhibit a daily fluctuation that correlates to the fluctuation in the stage of the Colorado River, which indicates a hydraulic connection between the Alluvial Aquifer and the river. In monitoring wells nearer to the river, the magnitude of the daily groundwater level fluctuation tends to be large, and the time lag relative to the river fluctuation tends to be short. Groundwater level fluctuations in monitoring wells further from the river tend to be of lesser magnitude and have a greater lag time.

Figure 10 shows groundwater levels measured in monitoring well MW-66-230, which is located approximately 586 feet away from well TW-01. The stage of the Colorado River measured at the stilling well is also shown on **Figure 10**. Correlations between the daily fluctuations in the groundwater levels and the daily fluctuations in the stage of the river are difficult to perceive because the response of the groundwater levels to changes in barometric pressure is larger and tends to mask the response to changes in the river stage. However, if the response to barometric pressure changes is removed (discussed in Section 3.4.2), the response to the river becomes more apparent.

Figure 10 also shows the groundwater levels measured in MW-66-230 corrected for barometric pressure influences. The corrected groundwater levels exhibit a daily fluctuation that is directly correlated to changes in the stage of the river. Because of the relatively large distance between MW-66-230 and the river, the magnitude of the fluctuation is relatively small and is lagged approximately 370 minutes relative to the fluctuation in the river. The groundwater elevations in the monitoring wells analyzed for the TW-01 constant rate test exhibited a similar response to changes in the stage of the river.

3.3.3 Long-Term Seasonal Trends

Groundwater levels at the TCS also exhibit longer-term seasonal trends that follow an annual cycle. Groundwater levels peak in mid-summer and are at a minimum in mid-winter. The annual cycle correlates most strongly to the annual cycle in the stage of the Colorado River. The stage of the Colorado River typically peaks in May and reaches a minimum in January. The stage changes more rapidly in the spring when flows in the river are increasing and changes more slowly in the fall when flows are decreasing. The groundwater levels at the TCS mirror these trends, though the changes are lagged in time to varying degrees depending on the depth of the well and its distance from the river.

Figure 11 illustrates the seasonal trend in the stage of the river and groundwater levels at the TCS in mid to late 2021. As illustrated by the water levels measured in the stilling well, the stage of the river was at or near its seasonal maximum in early June, just before the start of the constant rate test. After reaching the peak, the stage of the river began to gradually decline and continued to decline through the end of the year.

Groundwater levels measured in well MW-75-202 are also depicted on **Figure 11.** MW-75-202 is located at the northern end of the TCS, furthest from the influence of pumping from well TW-01 during the constant rate test. Of the wells monitored, groundwater level trends in this well are the most representative of “background” conditions during the constant rate test. Groundwater levels in MW-75-202 were near their annual maximum at the beginning of constant rate test and remained nearly stable until the end of June. The groundwater level then began to gradually decline in response to the decline in the stage of the river. Because MW-75-202 is located near the river, the lag time between the seasonal change in groundwater level and the season change in the stage of the river was relatively small.

Groundwater levels measured in well MW-68-180 are also depicted on **Figure 11.** Groundwater level trends in this well illustrate the water level trends observed within the influence of pumping of well TW-01 during the constant rate test. Groundwater levels in MW-68-180 were still slightly increasing at the beginning of the test, likely because the well is a greater distance from the river and the response to the seasonal change in the stage of the river is more lagged. A distinct decline in the groundwater level occurred at the start of the constant rate test in response to pumping at well TW-01. Thereafter, the groundwater elevation continued to decline in response to pumping, though some portion of the decline (particularly after multiple months of pumping) is likely due to the seasonal decline in the stage of the river.

Groundwater levels measured in well MW-40D are also depicted on **Figure 11.** Well MW-40D is located more than 1,000 feet from well TW-01 and illustrates groundwater level trends near to edge of the radius of influence of pumping during the constant rate test. Well MW-40D appears to be influenced by pumping from well TW-01, as there is some decline in the groundwater level at the start of the constant rate test. However, the decline is relatively small, which causes the decline resulting from pumping and the decline resulting from the long-term seasonal decline in the stage of river to be difficult to discern. The MW-40D data illustrate the difficulty in determining the influence from pumping in wells located near the edge of the radius of influence of pumping during the constant rate test.

3.4 Water Level Corrections

The groundwater level measurements were corrected for the external influences not related to pumping during the constant rate test to isolate the groundwater level changes caused by pumping from TW-01 alone. Because there is a range of salinities at the TCS, groundwater elevations were also adjusted to a standard density to allow groundwater levels between wells to be compared. These groundwater level corrections and other corrections to the constant rate test drawdown measurements are described below.

3.4.1 Density Corrections

Groundwater flows from areas of a high energy state to areas with a lower energy state. The energy state of a groundwater system is represented by the groundwater head, which is affected by the groundwater elevation, water density, and fluid pressure. Water density is affected by the salinity of the groundwater and the temperature. For groundwater systems with a uniform density, the measured groundwater elevations are representative of the groundwater head distribution. However, If the water density is variable, groundwater elevations require adjustments to a standard density.

Because there is a range of groundwater salinities at the TCS, groundwater elevations were corrected to a freshwater equivalent head, which is the groundwater elevation that would be present if the groundwater salinity concentrations were that of fresh water. A Standard Operating Procedure (SOP-A22 from the Topock Field Procedures Manual) has been developed for correcting the groundwater elevation measurements at the TCS. SOP-A22 is provided in **Appendix D**.

The groundwater levels at the TCS were converted to an equivalent freshwater head using specific conductance and salinity measurements from the transducers installed in the monitoring wells. Some of the transducers used for the test were capable of measuring both salinity and specific conductance data, while others only measure specific conductance directly. For some wells, water salinity or density was determined from a water sample collected from the well. The various methods used to correct the groundwater elevations based on the type of salinity and density data available for the given well are outlined in SOP-A22. The density correction factors calculated for each well are summarized in **Table 7.**

3.4.2 Barometric Corrections

As discussed above, groundwater elevations are influenced by both changes in barometric pressure and changes in the stage of the Colorado River. Because both the barometric pressure and the stage of the river fluctuate daily, it was difficult to precisely determine the relative contribution of each on the observed fluctuations in groundwater levels. However, the barometric correction was applied first because the response of the groundwater levels to barometric pressure changes was much larger than the response to changes in river stage within the TW-01 area.

Several points of time during the background monitoring period and the first phase of the constant rate test were used to estimate the barometric efficiencies for each well. The barometric efficiency is the ratio of the change of the groundwater elevation to the corresponding change in barometric pressure as defined by the following equation:

$$BE = \frac{\Delta h_w}{\Delta h_p} * 100\%$$

where; *BE* = barometric efficiency;

Δh_w = change in groundwater level;

Δh_p = corresponding change in barometric pressure.

The ratio of the change in the groundwater level to corresponding the change in barometric pressure was calculated for the selected points of time to estimate the best overall efficiency correction factor to apply for the well. The estimated barometric efficiencies were then used to correct the groundwater levels measured in the wells using the following equation:

$$h_w{}' = h_w + BE * \left(h_p - h_{pi}\right)$$

where; h_w' = corrected groundwater level;

h_w = measured groundwater level;

BE = barometric efficiency;

h_p = barometric pressure at time t;

h_{pi} = barometric pressure at the start of the test.

Because of the overlapping response of the groundwater levels to changes in the stage of the Colorado River, there was some uncertainty in the barometric efficiencies estimated for the monitoring wells. Therefore, some iterative adjustments to the calculated barometric efficiencies were made to determine the efficiency value that provided the best correction of the data. The barometric efficiencies used for each well are summarized in **Table 6**. The barometric efficiencies were relatively high, ranging from 85 to 95 percent. The lag times between the barometric change and the corresponding groundwater level changes were not significant.

3.4.3 River Corrections

The groundwater levels were next corrected for the influence of river. The influence of the river on groundwater elevations became more apparent after the barometric correction was completed. The daily cycle in the releases from the Davis Dam produces a daily cycle in the stage of the river at the TCS similar to a tidal fluctuation. Groundwater levels in the monitoring wells exhibit a similar daily cycle that is lagged by several hours relative to the river fluctuation.

The groundwater levels were corrected for the influence of the river by calculating a river efficiency, which is defined as the ratio of the change in the groundwater elevation to the corresponding change in the river stage using the following equation:

$$RE = \frac{\Delta h_w}{\Delta h_r} * 100\%$$

where: *RE* = river efficiency;

Dh_w = change in groundwater level;

Dh_r = corresponding change in river level.

River efficiencies were estimated for each well by calculating the ratio of the change in the groundwater level to the corresponding change in the river level for several selected points in time. Lag times (i.e., delay in time between the river level change and the corresponding groundwater level change) were also estimated for the wells. The estimated efficiencies and lag times were then used to correct the groundwater levels for the influence of the river using the equation below:

$$h_w{}' = h_w - RE * (h_{c+l} - h_{ci})$$

where: $h_w{}'$ = corrected groundwater level;

h_w = measured groundwater level;

RE = barometric efficiency;

l = lag time;

h_p = river level at time t - lag time (l);

hc_i = river level at the start of the test.

The river efficiencies and lag times used for each of the monitoring wells are summarized in **Table 7**. The efficiencies used for the monitoring wells were relatively small, ranging from 2.5 to 3.5 percent. Conversely, the lag times were relatively large, ranging from 270 minutes to 460 minutes. The relatively small efficiencies and large lag times are reflective of the relatively large distance between the test area and the river.

Table 7. Groundwater Level Correction Summary

Well ID	Barometric Efficiency	River Efficiency	Lag Time (min)	Salinity Correction	Temperature Correction (calculated)
TW-1	90%	3.5%	370	0.137[a]	0.207
MW-9	95%	4.0%	450	0.0082 - 0.0090[b]	0.459 - 0.472
MW-10	95%	3.0%	350	0.0169[a]	0.083
MW-10D	95%	3.0%	350	0.0081[a]	0.210
MW-11S	95%	3.5%	300	0.0028[a]	0.0772 - 0.0790
MW-11D	95%	3.5%	325	0.29 - 0.40[b]	0.52 - 0.53
MW-24A	95%	3.5%	270	0.22 - 0.31[b]	0.067 - 0.077
MW-24B	95%	3.0%	400	0.74 - 0.76[b]	0.41 - 0.43
MW-38S	90%	3.5%	300	0.01 - 0.172[b]	0.171
MW-38D	95%	2.5%	370	0.09 - 0.25[b]	0.53 - 0.56
MW-40D	95%	3.5%	350	1.27[a]	0.88 - 0.9

Well ID	Barometric Efficiency	River Efficiency	Lag Time (min)	Salinity Correction	Temperature Correction (calculated)
MW-65-160	95%	3.0%	400	0.2[b]	0.09
MW-65-225	85%	2.5%	350	0.3462[a]	0.33
MW-66-165	95%	3.5%	325	0.03[b]	0.11 - 0.13
MW-66-230	95%	3.5%	400	0.8[a]	0.38
MW-67-185	90%	3.5%	420	0.0018 - 0.105[b]	0.10
MW-67-260	95%	3.0%	400	1.14[a]	0.38 - 0.39
MW-68-180	95%	3.5%	460	0.0038 - 0.014[b]	0.108 - 0.344
MW-68-240	95%	3.0%	400	0.5 - 0.53[b]	0.30 - 0.31

Notes:

Min = Minutes

a - Salinity information provided from laboratory data

b - Salinity information calculated from transducer data per SOP-A22

The river corrections are focused on removing the influence from the short-term daily fluctuations in the river stage. An example of the correction of the drawdowns from the first phase of the constant rate test for the influence of the river is depicted on **Figure 12**. Though applying the short-term correction factors will also provide some compensation for the long-term seasonal decline in the stage of river, external influences that fluctuate in a unique and variable manner (such as the long-term seasonal trend observed in the river) cannot be reliably corrected for. Therefore, the reliability of the river correction becomes more uncertain as the elapsed pumping time during the constant rate test lengthens.

Based on the trends depicted on **Figure 11**, the first phase of the pumping test was completed when groundwater levels at the TCS were relatively stable. Therefore, the long-term seasonal fluctuation in the river does not have a significant influence on the drawdowns observed during this portion of the test. As the elapsed pumping time during the constant rate test increases (particularly beyond the first several weeks of pumping), the long-term seasonal fluctuation in the river becomes more influential. For this reason, the evaluation of the drawdowns from the second phase of the constant rate test was more qualitative in nature.

3.4.4 Other Corrections

During the constant rate test, the decline in groundwater elevations resulting from pumping reduced the saturated thickness of the alluvial aquifer, thereby reducing the transmissivity of the aquifer. The drawdowns measured during the pumping tests were corrected for the reduction of the saturated aquifer thickness using the following equation:

$$s_c = \frac{s_0 - s_0^2}{2b}$$

where: s_c = corrected groundwater level;

s_o = measured groundwater level;

b = original saturated aquifer thickness.

Because the drawdowns observed during the constant rate test were small relative to the total saturated thickness of the Alluvial Aquifer, the corrections for the reduced saturated aquifer thickness were minor.

Well TW-01 is screened through the entire interval from the water table surface to the bottom of the Alluvial Aquifer. However, the monitoring wells have relatively short screens that are at different vertical positions within the Alluvial Aquifer. The drawdowns observed in wells at the same distance from the pumping wells but screened at different vertical positions within the aquifer will be different due to the vertical components of flow within the aquifer.

The drawdowns observed in the monitoring wells were analyzed using the Aqtestolve (Hydrosolve, Inc. 2007) aquifer testing analysis software. The Aqtesolve software has features that allow for the automatic correction of drawdown data for both the reduction of the saturated aquifer thickness and the partially penetrating monitoring well screens. The software documentation can be consulted for additional documentation on the correction methods used by the software.

3.5 Constant Rate Test Analysis

Following correction of the groundwater level data, drawdown plots were prepared to assess the behavior of the Alluvial aquifer, including the hydraulic properties of the aquifer; whether any aquifer boundaries exist; and the radius of influence from pumping. As discussed above, the constant rate test was divided into two phases. The analysis or the first phase of the test is described in Section 3.5.1. The analysis of the second phase of the test was more qualitative in nature and is described in Section 3.5.2.

3.5.1 Short-Term Analysis

Data were collected frequently during the first phase of the test (approximately 1 week) to provide sufficient data resolution to estimate values for the hydraulic properties of the Alluvial Aquifer (hydraulic conductivity, transmissivity, and specific yield). Beyond the first week, aquifer testing continued as the second phase for approximately 6 months to determine the long-term influence of pumping on the aquifer including identifying any aquifer boundaries, estimating the capture zone created by pumping TW-01, evaluating the effect of pumping on Cr6 concentrations in groundwater, and evaluating the time scales for pore flushing to achieve concentration reductions. The analysis of the data from the first phase of the test is summarized below.

Aquifer Response Curves

A semi-logarithmic plot of the corrected drawdown versus time data from the first phase of the constant rate test is depicted on **Figure 13**. In well TW-01, the drawdowns in the well increased rapidly from the onset of pumping until approximately 5 minutes into the test. After the first 5 minutes of pumping, the increase in drawdown became much slower and remained so until approximately 300 minutes into the test. After 300 minutes, the rate of drawdown began to gradually increase again, reaching a relatively stable slope by the end of the first week of the test. The drawdown versus time data exhibited an S-shaped “delayed yield” drawdown curve characteristic of unconfined aquifers. The initial steep portion of the drawdown trend reflects the release of water from elastic aquifer storage, similar to a confined aquifer. The flatter slope from approximately 5 to 300 minutes into the test is a result of gravity drainage of water that accompanies the lowering of the water table. The steeper slope beyond 300 minutes is a result of the dissipation of gravity drainage as the pumping time increased.

The monitoring wells exhibited drawdown trends similar to that for TW-01. However, the initial drawdown trends from the first 5 minutes of the test are less well developed because of the time required for drawdowns to propagate to the distances of the monitoring wells. The transition from the flatter slope to the steeper slope beyond 300 minutes into the test is still observable. There appears to be an additional flattening of the drawdown trend at the very end of the test; however, this apparent trend was determined to be an artifact of the barometric correction (discussed in Section 3.5.2).

Distribution of Drawdown

A corrected drawdown versus distance plot (at approximately 7,200 minutes after test start before apparent flattening of the drawdowns at the end of the first phase of the test) is presented on **Figure 14** to illustrate the extent and distribution of the cone-of-depression produced by pumping during the constant rate test. As shown on **Figure 14**, the drawdowns measured at the monitoring wells fell on a relatively consistent trend. However, there was some asymmetry in the measured drawdowns, as the drawdowns in the monitoring wells to the south of well TW-01 were slightly larger than those in the monitoring wells to the north of TW-01. The larger drawdowns to south of TW-01 are likely a result of the thinning and pinching out of the Alluvial Aquifer in this direction.

Aquifer Coefficient Analysis

Corrected drawdown versus time data from the first phase of the constant rate test were analyzed to estimate values for the hydraulic properties of the Alluvial Aquifer. Standard curve-fitting methods were used to analyze the drawdown trends and estimate the transmissivity, hydraulic conductivity, and storage coefficients for the aquifer. Because a distinct delayed-yield type response characteristic of an unconfined aquifer was observed in the drawdown versus time plots, the Neuman (1972, 1974) solution for a pumping test in an unconfined aquifer was used to analyze the drawdown trends. The corrected drawdown data from the wells were analyzed using the aquifer test analysis software AQTESOLV® (Hydrosolve, Inc. 2007). The AQTESOLV® software provides features for additional automated corrections for the reduction of the saturated thickness of an unconfined aquifer and for partially penetrating pumping and monitoring well screens. Curve-fitting plots of the corrected drawdown versus time data for each of the monitoring well are provided in **Appendix E**.

The transmissivity, storativity, and specific yields estimated from the drawdown versus time data are summarized in **Table 8**. The estimated transmissivities were relatively consistent, ranging from approximately 1,650 to 4,800 square feet per day (ft^2/day). The estimated aquifer storativities ranged from 0.00025 to 0.004, and the estimated specific yields ranged from 0.011 to 0.049. Using the saturated aquifer thicknesses present at each monitoring well as the thickness of the aquifer from which water was provided to the pumping well, the calculated aquifer hydraulic conductivities ranged from 17.8 to 61.7 feet per day (ft/day). A spatial depiction of the of the estimated hydraulic conductivities is provided on **Figure 15**.

The Neuman B-parameter was also estimated from the curve-fits to the rate test drawdown versus time data. The B-parameter is defined by the following equation:

$$B = \frac{r^2 K_v}{b^2 K_h}$$

Where; r = distance from the pumping well to the monitoring well;
b = original saturated aquifer thickness;
K_v = vertical hydraulic conductivity;
K_h = horizontal hydraulic conductivity.

Using the distance from the pumping and the saturated aquifer thickness for each monitoring well, the B-parameter was used to calculate the ratio of the horizontal to vertical hydraulic conductivity of the aquifer (K_h/K_v). The B-parameter and K_h/K_v values are also summarized in **Table 7.**

The Neuman (1972, 1974) solution was also used to evaluate the drawdown versus distance data from the constant rate test. Curve-fitting was performed to the drawdowns measured at 7,200 minutes into the test near the end of the first phase of the constant rate test. The transmissivity, storativity, and specific yield estimated from the drawdown versus distance data were 3,400 ft^2/day, 0.001, and 0.019, respectively, and were in line with the estimates from the drawdown versus time data. Assuming the saturated aquifer thickness at the pumping well (TW-01), the hydraulic conductivity calculated from the drawdown versus time data was 33.9 ft/day.

Geometric mean aquifer coefficients were calculated using both the drawdown versus time and drawdown versus distance estimates. The mean transmissivity, storativity, and specific yield were 3,030 ft^2/day, 0.00075, and 0.022, respectively. The mean hydraulic conductivity was 30.6 ft/day, and the mean horizontal to vertical hydraulic conductivity ratio (K_h/K_v) was 25.2.

Table 8. Aquifer Coefficient Summary

Well	Transmissivity (ft^2/day)	Storativity	Specific Yield	Aquifer Thickness (feet)	Hydraulic Conductivity (ft/day)	B-Parameter	Horizontal to Vertical Conductivity Ratio
MW-10	2,600	0.00043	0.022	49.2	52.8	0.45	96.9
MW-10D	3,000	0.00025	0.024	48.6	61.7	1.10	40.6
MW-11S	2,800	0.0006	0.03	127.5	22.0	0.51	27.6
MW-11D	3,100	0.0018	0.032	127.5	24.3	1	14.1
MW-24A	2,600	0.0019	0.036	107.3	24.2	0.12	56.8
MW-24B	3,700	0.00069	0.027	107.3	34.5	0.58	11.4
MW-38S	4,500	0.0017	0.019	125.5	35.9	0.09	46.0
MW-38D	4,500	0.00076	0.034	126.3	35.6	0.66	5.9
MW-40D	4,800	0.00087	0.017	165.4	29.0	2.6	15.3
MW-65-160	2,300	0.0003	0.011	88.5	26.0	1.1	51.0

Well	Transmissivity (ft^2/day)	Storativity	Specific Yield	Aquifer Thickness (feet)	Hydraulic Conductivity (ft/day)	B-Parameter	Horizontal to Vertical Conductivity Ratio
MW-65-225	2,400	0.0017	0.017	88.7	27.1	3.5	16.0
MW-66-165	3,000	0.0012	0.024	100.8	29.8	0.19	25.0
MW-66-230	3,800	0.00025	0.019	100.4	37.8	0.53	9.0
MW-67-185	3,400	0.004	0.022	102.2	33.3	0.11	45.1
MW-67-260	2,800	0.00028	0.049	101.9	27.5	0.75	6.1
MW-68-180	1,650	0.0003	0.011	92.8	17.8	0.17	181.5
MW-68-240	2,200	0.00068	0.014	92.7	23.7	1.35	22.9
Distance-Drawdown	3,400	0.001	0.019	100.4	33.9	---	20
Geometric Mean	**3,032**	**0.00075**	**0.022**	**99.0**	**30.6**	**0.5**	**25.2**

3.5.2 Long-Term Qualitative Analysis

The groundwater level measurements from the second phase of the test (beyond the first week of pumping) were reviewed to assess long-term drawdown trends from pumping. As discussed above, the assessment was qualitative in nature because longer-term external influences become more influential over long periods of pumping, which results in drawdown trends that become less certain.

Long-Term Groundwater Level Corrections

As discussed in the previous sections, groundwater elevations in the monitoring wells fluctuate in response to both changes in barometric pressure and changes in the stage of the Colorado River. Because both fluctuate daily, it was difficult to isolate the influence from each individually, resulting in some uncertainty in the correction factors. The relatively high barometric efficiencies used for the first phase of the constant rate test provided the best correction of the short-term daily fluctuations in the groundwater levels but tended to introduce artificial trends into the long-term data. Correcting the long-term data using lower barometric efficiencies reduced these artificial trends and provided a better evaluation of the data. Changing the barometric correction factors also altered the river correction factors that provided the best correction of the long-term data (though only by a small degree). The river correction factors applied to the long-term were, therefore, also changed slightly. The barometric and river correction factors used for the long-term data are summarized in **Table 9**. Hydrographs of the corrected long-term groundwater elevations are provided in **Appendix F**.

Table 9. Groundwater Level Correction Summary for Long-Term Qualitative Evaluation

Well	Barometric Efficiency	River Efficiency	River Lag Time (min)
TW-1	25%	4.0%	470
MW-9	25%	5.0%	500
MW-10	25%	3.5%	500
MW-10D	25%	4.0%	450
MW-11D	25%	3.5%	550
MW-12	25%	4.0%	500
MW-24A	25%	4.0%	530
MW-24B	25%	3.5%	550
MW-38S	25%	3.5%	470
MW-38D	25%	4.0%	550
MW-40D	25%	5.0%	550
MW-65-160	25%	4.5%	550
MW-65-225	25%	4.0%	550
MW-66-230	25%	5.0%	530
MW-67-260	25%	4.0%	530
MW-68-180	25%	4.0%	550
MW-68-240	25%	4.0%	500
MW-68BR-280 (bedrock)	10%	1.0%	350
MW-70-105 (bedrock)	30%	2.0%	420
MW-69-195 (bedrock)	30%	2.0%	400
MW-70BR-225 (bedrock)	30%	2.0%	300
MW-70BR-287 (bedrock)	30%	1.5%	370

Long-Term Drawdown Trends

Figure 16 is a summary plot of the long-term drawdown versus time trends. During the second phase of the constant rate test, the corrected drawdown trends continued to follow the slope observed at the end of the first phase of the test and the “delayed yield” type curve characteristic of unconfined aquifers. The flattening of the drawdown trends observed at the end of the first phase of the test (**Figure 13)** are not apparent when the barometric efficiency correction is reduced. The apparent trend appears to have been an artifact of short-term barometric correction.

Figure 17 is an example drawdown versus time plot for one of the monitoring wells (MW-24B) that illustrates the long-term corrected drawdown trends. The drawdown trends exhibit an apparent inflection at approximately 50 days into the constant rate test, which corresponds to the first week of August 2021. The drawdown trend steepens (increasing rate of drawdown) beyond this time. A steepening drawdown trend suggests the presence of a barrier boundary that began to affect the cone of depression produced by pumping at TW-01 during the constant rate test. The most likely cause of a barrier boundary effect would be the pinching out of the Alluvial Aquifer to the bedrock to the south of TW-01.

The long-term drawdown trends are also affected by long-term season changes in the stage of the Colorado River. The stage of the river was also declining throughout much of the second phase of the constant rate test, and the rate of change in the stage of the river was not uniform during this period. There is not a clear correlation between the trends in the river and the inflection in the long-term drawdown trends in the wells, but there was some increase in the rate of decline in the stage of the river before inflection. The apparent inflection in the drawdown trends could also be a result of changes in the rate of decline in the stage of the river; therefore, the presence of a barrier boundary cannot be confirmed with certainty solely from the long-term drawdown versus time trends.

Distribution of Drawdown

A corrected drawdown versus distance plot was prepared to illustrate the extent and distribution of the cone of depression produced by pumping near the second phase of the constant rate test (**Figure 18**). The corrected drawdowns depicted are from the end of the constant rate test 177 days after the start of the test. Similar to the trends observed at the end of the first phase of the test (**Figure 14)**, there was some asymmetry in the drawdowns measured in the monitoring wells. Drawdowns measured in monitoring wells to the south of TW-01 were slightly larger than drawdowns measured in the wells to the north of TW-01. The apparent radius of influence (calculated by projecting the trends on the drawdown versus distance plot in Figure 18 to the zero drawdown distance) was 10,000 feet in the northward direction and 30,000 feet in the southward direction, which would encompass the entire TCS. However, the radius of influence estimated from this plot is likely overstated because of the long-term decline in the stage of the river that had occurred by this time relative to the start of the test and potentially the influence of a barrier boundary to the south. The actual radius of influence is difficult to determine due to these factors.

Recovery Period

The constant rate pumping test was ended on December 9, 2021. The recovery of water levels following the cessation of pumping was monitored in select wells for a period of approximately 1 month as depicted in the hydrographs in **Appendix C** and **Appendix F**. The duration of recovery monitoring was short relative to the duration of the constant rate pumping test; therefore, the recovery of the water levels was likely incomplete. Overall, the recovery data exhibited trends similar to those of the drawdown data such as unconfined aquifer response and water levels affected by fluctuations in barometric pressure and the river.

Assessment of Bedrock Wells

The long-term groundwater level trends from the bedrock wells monitored during the testing were evaluated to further assess whether there is hydraulic communication between the bedrock to the south of well TW-01 and the

Alluvial Aquifer. The long-term groundwater level data from wells MW-68BR-280, MW-69-195, MW-70-105, MW-70BR-225, and MW-70BR-287, which are located to the south of well TW-01, are depicted in the hydrograph on **Figure 19**. The long-term data from each of the bedrock wells show that groundwater levels in each of the bedrock wells began to decline at the start of the constant rate test and continued to decline as the test progressed. The decline in the water levels at the start of the test indicates that the groundwater levels in the bedrock to the south of TW-01 was being influenced by pumping.

Bedrock well MW-66BR-270 was an exception. Groundwater levels in this well were increasing at the start of the test and continued to increase at a gradually slowing rate as the test progressed (**Figure 20**). The lack of influence from the constant rate test and the apparent recovery trend (possibly from a previous episode of pumping) suggest that the transmissivity of bedrock formation screened by this well is very low, and that this well is hydraulically poorly connected to the bedrock aquifer.

Figure 21 is a plot of the long-term drawdown versus time data for the bedrock monitoring wells (excluding MW-66BR-270) overlain on the long-term drawdown versus time data from the alluvial wells to further assess whether there is hydraulic communication between the Alluvial Aquifer and bedrock to the south of well TW-01. The plot shows that the drawdown trends in the bedrock wells are relatively similar to those in the alluvial wells, except that the development of the drawdowns in the bedrock wells is somewhat delayed. The similarity between the drawdown trends suggests hydraulic communication between the Alluvial Aquifer and bedrock. **Figure 22** is a plot of the apparent drawdown versus distance measurements from the bedrock wells overlain on the same measurements from the alluvial wells at the end of the second phase of the constant rate test. This plot shows that apparent drawdowns measured in the bedrock wells were in line with drawdowns in the Alluvial Aquifer at similar distances. These data further suggest hydraulic communication between the Alluvial Aquifer and the bedrock to the south of well TW-01.

3.5.3 Tracer Study Results

Tracer concentrations were periodically measured in TW-01 and nearby monitoring wells to monitor the movement of the dye tracers and estimate the mobile porosity of the Alluvial Aquifer. Samples were collected during background monitoring and the constant rate test as described in Section 2.5.4. Dye tracer analysis was conducted on groundwater samples collected using low-flow sampling protocol and on matrix from carbon samplers. A complete summary of the tracer sampling results is provided in **Tables 10a and 10b,** the laboratory reports are attached in **Appendix G**.

Background Sampling

Background samples collected from some of the monitoring wells exhibited low-concentration detections of RWT and fluorescein. RWT was only detected in one well sampled (MW-24A) at a concentration of 21.7 µg/L. Fluorescein was detected in nine of 26 wells sampled, with concentrations that ranged from 0.02 ppb at well MW-24A to 299 ppb at well PT7M. The detections were observed at monitoring wells more than 300 feet from extraction well TW-01 in an area in which a previous tracer study was conducted in 2008 as part of the Upland Reactive Zone In-Situ Pilot Test (Arcadis 2009 and Arcadis 2014). Given the relatively large distance between the extraction well and the monitoring wells that exhibited detections (greater than 300 feet) relative to the distance between extraction wells and the wells used to inject dye tracer (approximately 230 to 250 feet), as well as the low background concentrations relative to the targeted injection concentrations (a difference of two to three orders of magnitude), there was little concern that these background concentrations would negatively impact the results of this tracer study.

Batch Sampling

After mixing the tracer solutions in the tanks, representative water samples were collected from the tanks for analysis. Two batch samples were collected from the tank with the fluorescein dye solution for injection into well MW-38D, and one batch sample was collected from the tank with the RWT dye solution for injection into well MW-67-185. Based on the sample results, the tanks with the fluorescein dye were mixed to concentrations of 83,000 ppb and 84,900 ppb, and the tank with the RWT solution was mixed to a concentration of 292,000 ppb.

Injection Wells

Both injection wells MW-38D and MW-67-185 were monitored monthly to evaluate washout during the tracer study. By the October sampling event, dye concentrations at the injection wells showed evidence of injection solution washout. Fluorescein concentrations in well MW-38D decreased more than 95 percent compared to the injection concentration, and the RWT concentration in well MW-67-185 decreased by more than 40 percent compared to the injection concentration. The low RWT result for the sample collected from MW-67-185 in September appears to be an anomaly. The follow-up sample collected in October confirmed the August results.

Extraction Well TW-01

Extraction well TW-01 was sampled weekly by collecting grab groundwater samples from the effluent (**Table 10a**) and retrieving the carbon samplers deployed during the previous sampling event (**Table 10b**). Select samples were analyzed for dye concentrations based on field observations and the elapsed time since the injections were completed. The fluorescein and RWT dyes in groundwater samples were first detected in the grab groundwater samples collected from the TW-01 extracted water on October 20 and November 2, 2021, respectively (**Table 10a**). Both fluorescein and RWT were first detected in the carbon samplers on October 20, 2021, approximately 135 and 134 days after the start of injections, respectively (**Table 10b**). The carbon samplers measure the mass of dye per mass of carbon over the deployment period. The results from the carbon samplers indicated that both the fluorescein and RWT dyes were present in the effluent before the first detection in the water samples (**Tables 10a** and **10b**). **Figures 23 and 24** show both the water and carbon sampler detections for both fluorescein and RWT at TW-01 in elapsed time since the start of injections.

The tracer test data was used to verify the mobile porosity of 12% used in the groundwater flow model developed for the site. The 12% mobile porosity was originally calculated during the Uplands Pilot Tests (**Arcadis 2014**). For the simulation of the TW-01 tracer test, rings of particles were initialized around the well screens for MW-38D and MW-67-185, to represent the Fluorescein and Rhodamine tracers respectively, and the resultant path lines and travel times were computed using the particle tracking software MODPATH (Pollock, 1989). TW-01 was simulated at a constant extraction rate of 90 gpm for the full duration of the TW-01 tracer test. Simulated alluvial aquifer hydraulic conductivities in the groundwater flow model in the area of the TW-01 tracer test varied between 35.6 ft/d and 61 ft/d consistent with the calculated hydraulic conductivities presented in **Table 8**. Using a 12% mobile porosity, the simulated travel time from MW-38D to TW-01 (249 ft) and from MW-67-185 to TW-01 (228 ft) was between 120 and 130 days, which is consistent with the observed tracer data arrival at TW-01.

Monitoring Wells

Select monitoring wells were sampled for tracer concentrations monthly and/or quarterly throughout the tracer study (**Table 10a**). The concentrations detected in the monitoring wells during the constant rate test were similar to those detected during the background monitoring period. Some variation in concentrations were observed over time, likely due to changes in the hydraulic influence from long-term pumping at well TW-01. For example, the greatest variation was observed at wells PT-7M and PT-7D, in which concentrations varied by approximately one order of magnitude. Results for PT-7M indicate a fluorescein concentration of 299 ppb in May and 48.6 ppb in October. Fluorescein in PT-7D was observed at 16.2 ppb in May, increased to 114 ppb in August and dropped to 92.2 ppb in October. Both PT-7M or PT-7D are located outside the test area and the detected concentrations are likely related to variability of residual tracer from a previous tracer injection completed in 2009. In addition, given the large distance between these monitoring wells and extraction well TW-01, the concentration levels detected in PT-7M or PT-7D are unlikely to affect the current tracer injections.

3.5.4 Cr6 Concentrations in the Floodplain

A review of the Cr6 data collected from the IM-3 well clusters located in the floodplain near TW-03D and TW-02D, MW-34, MW-36, MW-44, and MW-46 before and during the constant rate aquifer test stable Cr6 conditions for the duration of the aquifer test to evaluate changes in Cr6 concentrations as the pumping rates from the existing IM-3 extraction wells decreased. The analytical results show that the Cr6 concentrations in most of the wells are stable, remaining below the background concentration of 32 μg/L, or non-detect. The only exception was MW-36-100; where the Cr6 concentrations increased to more than twice baseline at 36 μg/L on November 1, 2021. The Cr6 concentration subsequently dropped to 8 ug/L in the second November sample and the sample collected in December. **Table 11** summarizes the results, the laboratory reports are attached in **Appendix G**.

3.5.5 Groundwater Chemistry Sampling Results

Table 12 summarizes the analytical results of the groundwater samples collected from wells near TW-01 during the constant rate test, the laboratory reports are attached in **Appendix G.** While most of the constituents sampled for during the duration of the constant rate test did not change over time, Cr6, arsenic, manganese, nitrate and selenium were the exception and are discussed below.

Trends in the vicinity of the TW-01 extraction include:

- TW-01 Cr6 concentrations monitored in well TW-01 before and during the constant rate test are depicted on **Figure 25**. Cr6 concentrations in TW-01 have ranged from 1,200 to 1,500 µg/L since the well was redeveloped in November 2020. Concentrations measured before and at the beginning of the constant rate test ranged from 1,400 to 1,500 µg/L. After the first 3 months of the test, concentrations ranged from 1,200 to 1,300 µg/L. Cr6 concentrations in well TW-01 have remained relatively stable overall; however, a slight decreasing trend was observed during the constant rate test that could potentially be a result of the increasing size of the cone of depression associated with extended pumping at TW-01.
- MW-68 cluster: MW-68-180 Cr6 concentrations in the June and July samples were 62,000 and 65,000 μg/L, comparable to the elevated concentrations of 61,000 and 63,000 μg/L detected in December 2020 and February 2021 prior to the test. Starting in July 2021, Cr6 concentrations decreased to a minimum of 26,000 μg/L in December 2021, which is comparable to the concentration of 25,000 μg/L detected in February 2020. Nitrate, selenium, and molybdenum concentrations were comparable to historical ranges. Cr6 concentrations and other analytes did not vary significantly at MW-68-240 or MW-68BR-280.

- MW-67 cluster: MW-67-185 concentrations were affected by tracer injections, with Cr6 concentrations decreasing from 2,000 μg/L, to non-detect, nitrate/nitrite decreasing from 95 to 0.12 μg/L and selenium decreasing from 430 to 54 μg/L, manganese increasing from non-detect to 1,600 μg/L and molybdenum increasing from 5.6 to 80 μg/L following the injection, reflecting injected tracer solution. At MW-67-225, Cr6 concentrations decreased from 3,400 μg/L to 2,800 μg/L and selenium decreased from 89 to 50 μg/L, while molybdenum and nitrate varied.
- MW-66 cluster: MW-66-165 Cr6 concentrations decreased 520 to 350 μg/L, comparable to typical fluctuations between 400 and 550 μg/L measured from 2019 to 2020. MW-66-230 Cr6 concentrations decreased from 6,200 to 5,200 μg/L, below the range of 6000 to 6,700 μg/L detected in 2019 and 2020. Concentrations of nitrate, molybdenum, and selenium varied modestly at MW-66-165 and MW-67-185 during the test.
- In Bat Cave Wash, the concentration of Cr6 decreased from 130 to 67 μg/L at MW-10 and from 400 to 88 μg/L at MW-10D and from 11 to 5.6 μg/L at MW-38S, while concentrations increased from 23 to 50 μg/L at MW-38D where tracer solution was injected.

3.5.6 Flood Event Monitoring

A subset of wells near Bat Cave Wash was equipped with transducers programmed to collect data at 5-minute intervals. The objective was to collect high resolution groundwater elevation data in case of a large precipitation event, allowing to evaluate the effect of flood conditions in the Wash. Between the start of the TW-01 pump test on July 15, 2021 and the end of the test on December 9, 2021, no large precipitation event (i.e., greater than 0.35 inch in a 24-hour period) had occurred.

A rain event with precipitation of 1.25 inches over a period of 3 hours was reported on March 28, 2022. The data that was collected by the transducers will be assessed and provided in a presentation.

3.6 Comparisons to TW-03 Aquifer Test Results

Aquifer testing was also performed on the Alluvial Aquifer to north of TW-01 in June of 2020. A 3-day constant rate test was performed on well TW-03, located approximately 1,600 feet north of TW-01. The procedure for the TW-03 constant rate test was similar to that for the TW-01 test, except for the much shorter duration (i.e., 72 hr duration for the TW-03D test vs. more than 6-month duration for the TW-01 test). The composition of the geologic deposits/Alluvial Aquifer at well TW-03 is similar to that at TW-01. In both areas, the aquifer consists predominantly of well-graded alluvial sands with gravel and silt. However, the aquifer is thicker at the well TW-03 location, and TW-03 is located closer to Colorado River and further from the pinching out of the Alluvial Aquifer into the bedrock to the south. A presentation summarizing the TW-03 aquifer testing and results is provided in **Appendix H**. A comparison of the results from the two aquifer tests is provided below to assess the potential differences in the hydraulic properties of the Alluvial Aquifer across the site.

3.6.1 Comparison of Correction Factors

The groundwater levels measured during the TW-03 aquifer testing were processed and corrected similar to the groundwater levels from TW-01 aquifer testing. The corrections applied to the groundwater levels indicate the local behavior of the aquifer. These corrections are summarized in **Table 13**.

In general, the river efficiencies observed during the well TW-03 testing were much higher than those observed during the TW-01 testing and were dependent on the distance between the monitoring well being observed and the Colorado River. Efficiencies observed during the TW-03 testing ranged from a high of 45 to 55 percent in the monitoring wells closest to the river to 3 to 10 percent in the monitoring wells furthest from the river. This compares to efficiencies that ranged from 1 to 5 percent in the monitoring wells observed during the TW-01 aquifer testing.

The time lag between the change in the stage of the Colorado River and the corresponding change in groundwater levels was also shorter for the monitoring observed during the TW-03 testing, which were as short as 25 to 40 minutes for the monitoring wells nearest to the river and typically from 100 to 200 minutes for the monitoring wells furthest from the river. The time lags observed during the TW-01 testing ranged from 350 to 500 minutes.

In the monitoring wells observed during the TW-03 testing, the influence of the river on groundwater levels was greater than the barometric influence. The changes in groundwater levels caused by the changes in the stage of the river were large enough to mask the changes caused by barometric pressure changes, and a barometric correction could not be performed for most of the wells monitored. For the TW-01 testing, the influence from barometric pressure changes were greater than influence from the river.

The differences in the corrections applied to the groundwater level measurements from the two tests reflect the diminishing response of the aquifer to the Colorado River as the distance from the river increases. Monitoring wells close to the river exhibited a relatively large river efficiency and short lag time. For wells further from the river, the river efficiencies decrease and the lag times increase, thereby allowing the underlying barometric effect to be observable.

Table 13. Groundwater Level Correction Summary for the TW-03 Aquifer Testing

Well	Approximate Distance from River (ft)	Distance from Pumping Well (ft)	River Efficiency (percent)	Lag Time (min)
TW-03D	540	0	0.18	60
MW-20-70	560	143	0.06	180
MW-20-100	560	143	0.12	100
MW-20-130	560	140	0.18	80
MW-31-060	530	249	0.09	200
MW-31-135	530	207	0.19	60
MW-36-90	220	428	0.48	40
MW-36-100	220	429	0.48	40
MW-39-040	390	272	0.48	40
MW-39-060	390	278	0.44	40

Well	Approximate Distance from River (ft)	Distance from Pumping Well (ft)	River Efficiency (percent)	Lag Time (min)
MW-39-070	390	272	0.33	40
MW-39-080	390	278	0.34	45
MW-39-100	390	286	0.35	40
MW-44-125	140	417	0.53	25
MW-77-046	390	315	0.17	70
MW-77-102	390	315	0.34	30
MW-77-158	390	315	0.34	30
MW-77-187	390	315	0.35	30
MW-78-072	670	300	0.03	350
MW-78-142	670	300	0.09	150
MW-81-043	420	232	0.15	120
MW-81-098	420	232	0.28	30
PT-5S	300	263	0.54	30
PT-5M	300	263	0.45	30
PT-5D	300	263	0.40	35
IRZ-21	570	70	0.10	150
IRZ-23	570	97	0.10	150
IRZ-25	660	214	0.08	150

3.6.2 Comparison of Estimated Aquifer Coefficients

As observed during the TW-01 test, the corrected drawdown versus time data from the well TW-03 constant rate test exhibited an S-shaped “delayed yield” type drawdown curve characteristic of unconfined aquifers. The transmissivities, storativities, and specific yields estimated from the TW-03 constant rate test are summarized in **Table 14**. The geometric mean transmissivity estimated from the TW-03 test was 4,610 ft^2/day. This was slightly higher than the geometric mean transmissivity of 3,032 ft^2/day from the TW-01 testing. The geometric mean hydraulic conductivity estimated from the TW-03 test was 42.1 ft/day. This was slightly higher than the geometric mean hydraulic conductivity of 33.9 ft/day estimated from the TW-01 testing, but these values are practically the same. The difference between the mean transmissivities estimated from tests were greater than the difference between the mean hydraulic conductivities because the saturated aquifer thickness at the TW-03 location is greater.

The storage coefficients (storativity and specific yield) estimated from the TW-03 test were in the same range as those estimated from the TW-01 test. The geometric mean storativity estimated from the TW-03 test was 0.00039 compared to 0.00075 from the TW-01 test. The geometric mean specific yield estimated from the TW-03 test was 0.041 compared to 0.022 from the TW-01 test. The ratio of the horizontal to vertical hydraulic conductivity estimated from the TW-03 test (geometric mean of 29.1:1) was also within the range of the ratio estimated from the TW-01 test (geometric mean of 25.2).

Curve matching plots from the TW-03 constant rate test are provided in **Appendix I**. There was some flattening of the corrected drawdown tends at the very end of the TW-03 constant rate test, which suggested the potential presence of a recharge boundary. While this could have been due to recharge from the river, it may have also been an artifact of background fluctuations in water levels and/or a result of uncertainty in the data corrections. A longer period of testing would have been necessary to conclusively determine the presence of a recharge boundary from the river.

The similarity of the estimated aquifer coefficients estimated from the two tests reflects the relative uniformity of the hydraulic properties of the Alluvial Aquifer at the TCS. Though the descriptions of the grain size of the Alluvial Aquifer recorded on boring logs at the site appear to vary substantially, the results from the aquifer tests suggest that overall hydraulic properties of the aquifer are relatively similar across the site. The primary differences between the two tests were the difference in the saturated aquifer thickness between the two locations and the relative influence of the river and the pinching out of the Alluvial Aquifer into the bedrock to the south.

4 Summary and Conclusions

Aquifer testing was completed at well TW-01 for the purposes of updating the groundwater model and to provide data for possible design optimizations and improvements for the Phase II remedy at the TCS. The aquifer testing included a two-phase constant rate pumping test, tracer testing, and Cr6 sampling at well TW-01. The constant rate test ran from June 15 through December 10, 2021, for a total duration of approximately 6 months. The first phase of the test featured rapid data collection and lasted approximately 1 week. The primary purpose of the first phase of the test was to provide sufficient data resolution to analyze the hydraulic properties of the Alluvial Aquifer (hydraulic conductivity, transmissivity, specific yield). The second phase of the test (the remaining portion of the 6-month testing period) included less frequent data collection with the primary goal of qualitatively evaluating long-term drawdown trends, evaluating for the influence from aquifer boundaries, allowing enough time for the tracers in the aquifer to reach well TW-01, and observing the influence of long-term pumping on Cr6 concentrations in TW-01.

Groundwater levels were measured from TW-01 and many nearby monitoring wells during the testing. Fluctuations were observed in the groundwater levels that were not related to pumping from TW-01 during the constant rate test. To isolate the drawdowns caused by pumping at TW-01, groundwater level measurements were corrected to remove fluctuations caused by external influences not related to pumping, which included barometric pressure changes and changes in the stage of the Colorado River.

Because there is a range of groundwater salinities at the TCS, groundwater levels were also adjusted to a freshwater equivalent head. Further corrections were made to account for the reduction of the saturated thickness of the aquifer during pumping and monitoring well screens that partially penetrate the Alluvial Aquifer.

The corrected drawdowns measured during the first phase of the constant rate test exhibited an S-shaped “delayed yield” drawdown curve characteristic of unconfined aquifers. Standard curve-fitting methods were used to analyze the drawdown versus time and the drawdown versus distance trends to estimate the transmissivity, hydraulic conductivity, and storage coefficients of the aquifer. The aquifer properties estimated for the Alluvial Aquifer are summarized below:

Transmissivity: Range: 1,650 – 4,800 ft^2/day, Geometric Mean: 3,032 ft^2/day;

Hydraulic Conductivity: Range: 17.8 – 61.7 ft/day, Geometric Mean: 33.9 ft/day;

Storativity: 0.000025 – 0.004, Geometric Mean: 0.00075;

Specific Yield: 0.011 – 0.049, Geometric Mean: 0.022;

K_h/K_v: 5.9 – 181.5, Geometric Mean: 25.2.

There was some asymmetry in the cone of depression produced by pumping, in that drawdowns measured in the monitoring wells to the south of TW-01 were slightly larger than those measured in the monitoring wells to the north of TW-01. The Alluvial Aquifer becomes thinner and eventually pinches out to the south of TW-01, and the greater drawdowns observed to the south of TW-01 are likely a result of this thinning.

The aquifer coefficients estimated from the TW-01 constant rate test were similar to those estimated from the TW-03 test. The similarity of the estimated aquifer coefficients from the two tests reflects the relative uniformity of the bulk hydraulic properties of the Alluvial Aquifer at the TCS at the scale of the tests conducted. The primary differences between the two tests were a result of the differing saturated aquifer thickness at the two locations, the differing influences from the river, and the pinching out of the Alluvial Aquifer to the south.

The groundwater level measurements from the second phase of the test (beyond the first week of data collection) were reviewed to assess long-term drawdown trends from pumping and determine whether any aquifer boundaries influenced the cone of depression produced by pumping. The assessment was qualitative in nature because longer-term external influences become more influential over long periods of pumping, which results in the drawdown trends becoming less certain.

During the second phase of the constant rate test, the corrected drawdown versus time trends continued to follow the slope observed at the end of the first phase of the test. However, the drawdown trends exhibited an apparent inflection at approximately 50 days into the constant rate test, which suggested the possible influence of a barrier boundary, potentially from the pinching out of the Alluvial Aquifer into bedrock to the south of TW-01. However, the long-term drawdown trends were also affected by a long-term seasonal decline in the stage of the Colorado River, which may also have caused the apparent inflection. The presence of a barrier boundary could not be confirmed with certainty from the long-term drawdown versus time trends alone.

Similar to the trends observed at the end of the first phase of the constant rate test, there was some asymmetry in drawdowns produced by pumping, in that drawdowns measured in the monitoring wells to the south of TW-01 were slightly larger than those measure in the monitoring wells to the north of TW-01. The apparent radius of influence was 10,000 feet in the northward direction and 30,000 feet in the southward direction; however, the radius of influence is likely overstated due to the long-term seasonal decline in the stage of the river and potentially the influence of a barrier boundary to the south.

Several bedrock wells to the south of Well TW-01 monitored during the aquifer testing exhibited a response to pumping from TW-01. The drawdowns measured in the bedrock wells were in line with those measured in the Alluvial Aquifer at similar distances. This suggests hydraulic communication between the Alluvial Aquifer and at least portions of the bedrock to the south of well TW-01.

A tracer study was completed during the TW-01 constant rate test. Fluorescein and RWT dyes were injected into monitoring wells MW-38D and MW-67-185. Fluorescein and RWT dyes were first detected at minor concentrations (<0.1 ppb) in the water samples collected from TW-01 on October 20 and November 2, 2021, respectively. Carbon samplers deployed in TW-01 also indicated that both the fluorescein and RWT dyes were present in the wells on October 20, 2021, approximately 135 days after the start of injections. The groundwater flow model developed for the site was used to estimate the mobile porosity of the aquifer based on the observed tracer concentrations from the carbon samplers at TW-01. Based on the model evaluation, the mobile porosity of the aquifer was estimated to be approximately 12 percent.

Cr6 concentrations in TW-01 have ranged from 1,200 to 1,500 µg/L since the well was redeveloped in November 2020. Concentrations measure before and at the beginning of the constant rate test ranged from 1,400 to 1,500 µg/L. After the first 3 months of the test, concentrations ranged from 1,200 to 1,300 µg/L. Cr6 concentrations in well TW-01 have remained relatively stable overall; however, a slight decreasing trend was observed during the constant rate test that may be a result of the increasing size of the cone of depression associated with extended pumping at TW-01.

Concentration of Cr6 in the IM-3 Performance Monitoring area were stable or non-detect despite a reduction of the pumping rate during the TW-01 constant rate test. The data are inconclusive as to whether or not there was contaminant migration to the IM-3 Performance Monitoring area due to the pumping activities of the constant rate test. Groundwater chemistry data collected from the monitoring well network during the constant rate test indicates little influence from the pump test to most of the wells. Anomalies in Cr6 trends were observed in MW-38D, MW-67-185, and MW-68-180, significant changes of manganese and nitrate in MW-67-185 indicate reducing conditions at this well.

The data and results of the TW-01 and TW-03D aquifer tests were used to further calibrate and refine the groundwater flow model developed for the site. The updated groundwater flow model will be used to plan possible design improvements for the Phase II remedy for the TCS.

5 References

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Tables

Table 3a
TW-01 Aquifer Test Program Summary
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Site Area	Aquifer	Well Casing Diameter (inches)	Well Depth (ft bgs)	Well Screen Interval (ft bgs)	Transducer Type
MW-09	Bat Cave Wash	Alluvial	4 in PVC	89.4	77 - 87	Levelogger 5 LTC
MW-10	Bat Cave Wash	Alluvial	4 in PVC	96.9	74 - 94	Levelogger 5 LTC
MW-11	Bat Cave Wash	Alluvial	4 in PVC	86.1	62.5 - 82.5	Levelogger Edge
MW-12	East of Station	Alluvial	4 in PVC	50.4	27.5 - 47.5	Levelogger 5 LTC
MW-24A	MW-24 Bench	Alluvial	4 in PVC	127.5	104 - 124	Levelogger 5 LTC
MW-24B	MW-24 Bench	Alluvial	4 in PVC	214.8	193 - 213	Levelogger 5 LTC
MW-26	Route 66	Alluvial	2 in PVC	70.1	51.5 - 71.5	Levelogger Edge
MW-38D	Bat Cave Wash	Alluvial	2 in PVC	190.9	163 - 183	Levelogger 5 LTC
MW-38S	Bat Cave Wash	Alluvial	2 in PVC	98.1	75 - 95	Levelogger 5 LTC
MW-40D*	I-40 Median	Alluvial	2 in PVC	266.0	240 - 260	Levelogger 5
MW-40S*	I-40 Median	Alluvial	2 in PVC	134.0	115 - 135	Levelogger 5
MW-51	Route 66	Alluvial	4 in PVC	113.3	97 - 112	Levelogger Edge
MW-59-100	East Ravine	Alluvial	2 in Sch 40 PVC	101.0	86 - 101	Levelogger 5 LTC
MW-65-160	Topock Compressor Station	Alluvial	2 in PVC	160.1	150 - 160	Levelogger 5 LTC
MW-65-225	Topock Compressor Station	Alluvial	2 in PVC	225.1	215 - 225	Levelogger 5 LTC
MW-66-165	Topock Compressor Station	Alluvial	2 in PVC	162.1	142 - 162	Aqua TROLL 600
MW-66-230	Topock Compressor Station	Alluvial	2 in PVC	228.1	218 - 228	Levelogger 5 LTC
MW-66BR-270	Topock Compressor Station	Bedrock	5 in	270.6	248 - 271	Levelogger 5 LTC
MW-67-185	Topock Compressor Station	Alluvial	2 in	186.7	177 - 187	Aqua TROLL 600
MW-67-225	Topock Compressor Station	Alluvial	2 in PVC	225.0	210 - 225	Levelogger 5 LTC
MW-67-260	Topock Compressor Station	Alluvial	2 in PVC	260.0	250 - 260	Levelogger 5 LTC
MW-68-180	Topock Compressor Station	Alluvial	2 in PVC	180.1	165 - 180	Aqua TROLL 600
MW-68-240	Topock Compressor Station	Alluvial	2 in PVC	240.1	220 - 240	Aqua TROLL 600
MW-68BR-280	Topock Compressor Station	Bedrock	5 in	278.2	257 - 279	Aqua TROLL 600
MW-69-195	Topock Compressor Station	Bedrock	2 in	195.5	176 - 196	Levelogger 5 LTC
MW-70-105	East Ravine	Bedrock	2 in PVC	107.8	85 - 105	Levelogger 5 LTC
MW-70BR-225	East Ravine	Bedrock	5 in PVC/ 3.8 in open	229.0	130.0 - 229.0	Levelogger 5 LTC
MW-10D	Bat Cave Wash	Alluvial	2 in PVC	125.5	108.1 - 123.1	Levelogger 5 LTC
MW-11D	Bat Cave Wash	Alluvial	2 in PVC	132.4	110 - 130	Levelogger 5 LTC
MW-70BR-287	East Ravine	Bedrock	5 in PVC/ 3.8 in open	288.9	258.0 - 288.9	Levelogger 5 LTC

Table 3a
TW-01 Aquifer Test Program Summary
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Site Area	Aquifer	Well Casing Diameter (inches)	Well Depth (ft bgs)	Well Screen Interval (ft bgs)	Transducer Type
MW-75-033	Floodplain	Alluvial	2 in PVC	35.4	18 - 33	Levelogger 5
MW-75-117	Floodplain	Alluvial	2 in PVC	119.3	97 - 117	Levelogger 5
MW-75-202	Floodplain	Alluvial	2 in PVC	204	183 202	Levelogger 5
MW-75-267	Floodplain	Alluvial	2 in PVC	269.3	247 - 267	Levelogger 5
MW-75-337	Floodplain	Alluvial	2 in PVC	357	317 - 337	Levelogger 5
MW-84-057	Bat Cave Wash	Alluvial	2 in PVC	59.4	42 - 57	Levelogger 5
MW-84-095	Bat Cave Wash	Alluvial	2 in PVC	97.4	75 - 95	Levelogger 5
MW-84-132	Bat Cave Wash	Alluvial	2 in PVC	134.4	112 - 132	Levelogger 5
MW-84-193	Bat Cave Wash	Alluvial	2 in PVC	195.5	173 - 193	Levelogger 5
MW-85-129	Upland	Alluvial	2 in PVC	131.3	114 - 129	Levelogger 5
MW-85-217	Upland	Alluvial	2 in PVC	219	197 - 217	Levelogger 5
MW-85-237	Upland	Alluvial	2 in PVC	239	227 - 237	Levelogger 5
MW-88-107	Bat Cave Wash	Alluvial	2 in PVC	109.3	87 - 111	Levelogger 5 LTC
MW-95-113	Bat Cave Wash	Alluvial	2 in PVC	115.3	93 - 113	Levelogger 5 LTC
MW-95-157	Bat Cave Wash	Alluvial	2 in PVC	159.3	137 - 157	Levelogger 5 LTC
MW-98-055 (MW-K)	East of Station	Alluvial	2 in PVC	57.3	40-55	Levelogger 5 LTC
MW-98-077 (MW-K)	East of Station	Alluvial	2 in PVC	79.3	67-77	Levelogger 5 LTC
Totals					**47**	**27**

* = The MW-40 cluster will be monitored using pressure transducers only and is not included in Monitoring Well Area 1 or 2.
Manual data will be collected periodically during the TW-01 aquifer test.
Levelogger 5 Parameters = Water Level and Temperature
Levelogger 5 LTC Parameters = Water level, Temperature, and Conductivity
Aqua TROLL 600 Parameters = Water Level, pH, Conductivity, Dissolved Oxygen, and Oxidation-Reduction Potential

ft = feet
bgs = below ground surface
ID = identification
IM = interim measure
LTC = Level, Temperature, and Conductivity
PVC = polyvinyl chloride (pipe)

Table 3b
Monitoring Network Qualitatively Analysed for the TW-01 Aquifer Testing
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Well	Aquifer	Casing Material and Diameter (inches)	Well Depth (feet bgs)	Screen or Open-Hole Interval (ft bgs)	Distance from TW-01 (feet)	Transducer Type
TW-01	Alluvial	5-inch PVC	271.0	169 - 269	---	Levelogger 5 LTC
MW-9	Alluvial	4-inch PVC	89.4	77 - 87	622.22	Levelogger 5 LTC
MW-10	Alluvial	4-inch PVC	96.9	74 – 94	324.81	Levelogger 5 LTC
MW-10D	Alluvial	2-inch PVC	125.5	108 - 123	324.81	Levelogger 5 LTC
MW-11S	Alluvial	4-inch PVC	86.1	62.5 - 82.5	478.41	Levelogger 5 LTC
MW-11D	Alluvial	2-inch PVC	132.4	110 - 130	478.41	Levelogger 5 LTC
MW-12	Alluvial	4-inch PVC	50.4	27.5 - 47.5	814.23	Levelogger 5 LTC
MW-24A	Alluvial	2-inch PVC	127.5	104 – 124	127.5	Levelogger 5 LTC
MW-24B	Alluvial	2-inch PVC	214.8	193 - 213	214.8	Levelogger 5 LTC
MW-38S	Alluvial	2-inch PVC	98.1	75 - 95	255.3	Levelogger 5 LTC
MW-38D	Alluvial	2-inch PVC	190.9	163 - 183	249.25	Levelogger 5 LTC
MW-40D	Alluvial	2-inch PVC	266.0	240 - 260	1042.36	Levelogger 5
MW-65-160	Alluvial	2-inch PVC	160.1	150 - 160	663.1	Levelogger 5 LTC
MW-65-225	Alluvial	2-inch PVC	225.1	215 - 225	663.1	Levelogger 5 LTC
MW-66-165	Alluvial	2-inch PVC	162.1	142 - 162	219.73	Aqua TROLL 600, Vented

Table 3b
Monitoring Network Qualitatively Analysed for the TW-01 Aquifer Testing
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Well	Aquifer	Casing Material and Diameter (inches)	Well Depth (feet bgs)	Screen or Open-Hole Interval (ft bgs)	Distance from TW-01 (feet)	Transducer Type
MW-66-230	Alluvial	2-inch PVC	228.1	218 - 228	219.73	Levelogger 5 LTC
MW-66BR-270	Bedrock	5-inch Steel	270.6	248 - 271	222.95	Levelogger 5 LTC
MW-67-185	Alluvial	2-inch PVC	186.7	177 - 187	227.61	Aqua TROLL 600, Vented
MW-67-225	Alluvial	2-inch PVC	225.0	210 - 225	217.74	Levelogger 5 LTC
MW-67-260	Alluvial	2-inch PVC	260.0	250 - 260	217.74	Levelogger 5 LTC
MW-68-180	Alluvial	2-inch PVC	180.1	165 - 180	515.46	Aqua TROLL 600, Vented
MW-68-240	Alluvial	2-inch PVC	240.1	220 - 240	515.46	Aqua TROLL 600, Vented
MW-68BR-280	Bedrock	5-inch Steel	278.2	257 - 279	506.75	Aqua TROLL 600, Vented
MW-69-195	Bedrock	2-inch PVC	195.5	176 - 196	854.74	Levelogger 5 LTC
MW-70-105	Bedrock	2-inch PVC	107.8	85 - 105	895.33	Levelogger 5 LTC
MW-70BR-225	Bedrock	5-inch PVC	229.3	120 - 227	954.41	Levelogger 5 LTC
MW-70BR-287	Bedrock	5-inch PVC	288.9	258 - 289	948.16	Levelogger 5 LTC
MW-75-202	Alluvial	2-inch PVC	201.7	182 - 202	2,563.14	Levelogger 5 LTC

Table 4
Tracer Sample Summary
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Sample Locations	Sample ID	Sample Date	Sample Matrix
MW-10	MW-10-0521	5/5/2021	Water
MW-10	MW-10-M3W13-0921	9/22/2021	Water
MW-10D	MW-10D-0521	5/5/2021	Water
MW-10D	MW-10D-M3W13-0921	9/22/2021	Water
MW-24A	MW-24A-0521	5/5/2021	Water
MW-24A	MW-24A-M2W7-0821	8/11/2021	Water
MW-24A	MW-24A-M4W17-1021	10/21/2021	Water
MW-24B	MW-24B-0521	5/5/2021	Water
MW-24B	MW-24B-M2W7-0821	8/11/2021	Water
MW-24B	MW-24B-M4W17-1021	10/21/2021	Water
MW-38D	MW-38D-0521	5/5/2021	Water
MW-38D	MW-38D-M2W7-0821	8/11/2021	Water
MW-38D	MW-38D-M3W13-0921	9/22/2021	Water
MW-38D	MW-38D-M4W17-1021	10/21/2021	Water
MW-38D-BATCH1	MW-38D-BATCH1	6/8/2021	Water
MW-38D-BATCH2	MW-38D-BATCH2	6/11/2021	Water
MW-38S	MW-38S-0521	5/5/2021	Water
MW-38S	MW-38S-M2W7-0821	8/11/2021	Water
MW-38S	MW-38S-M3W13-0921	9/22/2021	Water
MW-38S	MW-38S-M4W17-1021	10/21/2021	Water

Table 4
Tracer Sample Summary
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Sample Locations	Sample ID	Sample Date	Sample Matrix
MW-66-165	MW-66-165-0521	5/5/2021	Water
MW-66-165	MW-66-165-M3W13-0921	9/24/2021	Water
MW-66-230	MW-66-230-0521	5/5/2021	Water
MW-66-230	MW-66-230-M3W13-0921	9/24/2021	Water
MW-66BR-270	MW-66BR-270-0521	5/5/2021	Water
MW-66BR-270	MW-66BR-270-M4W15-1021	10/8/2021	Water
MW-67-185	MW-67-185-0521	5/4/2021	Water
MW-67-185	MW-918-Q221-FD	5/4/2021	Water
MW-67-185	MW-67-185-RE-0521	5/19/2021	Water
MW-67-185	MW-67-185-M2W7-0821	8/17/2021	Water
MW-67-185	MW-67-185-M3W13-0921	9/23/2021	Water
MW-67-185	MW-67-185-M4W17-1021	10/21/2021	Water
MW-67-185-BATCH1	MW-67-185-BATCH1	6/9/2021	Water
MW-67-225	MW-67-225-0521	5/4/2021	Water
MW-67-225	MW-67-225-M2W7-0821	8/17/2021	Water
MW-67-225	MW-67-225-M3W13-0921	9/24/2021	Water
MW-67-225	MW-67-225-M4W17-1021	10/21/2021	Water
MW-67-260	MW-67-260-0521	5/4/2021	Water
MW-67-260	MW-67-260-M3W13-0921	9/24/2021	Water
MW-68-180	MW-68-180-0521	5/4/2021	Water

Table 4
Tracer Sample Summary
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Sample Locations	Sample ID	Sample Date	Sample Matrix
MW-68-180	MW-68-180-RE-0521	5/19/2021	Water
MW-68-180	MW-68-180-M3W13-0921	9/23/2021	Water
MW-68-240	MW-68-240-0521	5/4/2021	Water
MW-68-240	MW-68-240-M3W13-0921	9/23/2021	Water
MW-68BR-280	MW-68BR-280-0521	5/4/2021	Water
MW-68BR-280	MW-68BR-280-M3W13-0921	9/23/2021	Water
PT7D	PT7D-0521	5/4/2021	Water
PT7D	PT7D-M2W7-0821	8/11/2021	Water
PT7D	PT7D-M4W17-1021	10/19/2021	Water
PT7M	PT7M-0521	5/4/2021	Water
PT7M	PT7M-M2W7-0821	8/11/2021	Water
PT7M	PT7M-M4W17-1021	10/19/2021	Water
PT7S	PT7S-0521	5/4/2021	Water
PT7S	PT7S-M2W7-0821	8/11/2021	Water
PT7S	PT7S-M4W17-1021	10/19/2021	Water
PT8D	PT8D-0521	5/4/2021	Water
PT8D	PT8D-M2W7-0821	8/16/2021	Water
PT8D	MW-915-M2W7-Q321-FD	8/16/2021	Water
PT8D	PT8D-M4W17-1021	10/19/2021	Water
PT8M	PT8M-0521	5/4/2021	Water

Table 4
Tracer Sample Summary
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Sample Locations	Sample ID	Sample Date	Sample Matrix
PT8M	PT8M-M2W7-0821	8/16/2021	Water
PT8M	PT8M-M4W17-1021	10/19/2021	Water
PT8S	PT8S-0521	5/4/2021	Water
PT8S	PT8S-M2W7-0821	8/16/2021	Water
PT8S	PT8S-M4W17-1021	10/19/2021	Water
PT9D	PT9D-0521	5/5/2021	Water
PT9D	PT9D-M2W7-0821	8/16/2021	Water
PT9D	PT9D-M4W17-1021	10/19/2021	Water
PT9M	PT9M-0521	5/5/2021	Water
PT9M	PT9M-M2W7-0821	8/16/2021	Water
PT9M	PT9M-M4W17-1021	10/19/2021	Water
PT9S	PT9S-0521	5/5/2021	Water
PT9S	PT9S-M2W7-0821	8/16/2021	Water
PT9S	PT9S-M4W17-1021	10/19/2021	Water
TW-01	TW-01-0421	6/10/2021	Water
TW-01	MW-917-Q221-FD	6/10/2021	Water
TW-01	TW-01-M2W6-0821	8/3/2021	Water
TW-01	TW-01-M2W6-0821-CS	8/9/2021	Carbon Sampler
TW-01	TW-01-M2W7-0821	8/16/2021	Water
TW-01	TW-01-M2W7-0821-CS	8/16/2021	Carbon Sampler

Table 4
Tracer Sample Summary
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Sample Locations	Sample ID	Sample Date	Sample Matrix
TW-01	MW-918-M2W7-Q321-FD	8/16/2021	Water
TW-01	TW-01-M2W10-0821	9/1/2021	Water
TW-01	TW-01-M2W10-0821-CS	9/1/2021	Carbon Sampler
TW-01	TW-01-M3W12-0921	9/15/2021	Water
TW-01	TW-01-M3W12-0921-CS	9/15/2021	Carbon Sampler
TW-01	TW-01-M3W13-0921	9/23/2021	Water
TW-01	TW-01-M3W13-0921-CS	9/23/2021	Carbon Sampler
TW-01	MW-931-Q321-FD	9/23/2021	Water
TW-01	TW-01-M3W14-0921-CS	9/30/2021	Carbon Sampler
TW-01	TW-01-M4W15-1021	10/7/2021	Water
TW-01	TW-01-M4W15-1021-CS	10/7/2021	Carbon Sampler
TW-01	MW-901-Q421-FD	10/7/2021	Water
TW-01	TW-01-M4W17-1021	10/20/2021	Water
TW-01	TW-01-M4W17-1021-CS	10/20/2021	Carbon Sampler
TW-01	MW-902-Q421-FD	10/20/2021	Water
TW-01	TW-01-M5W19-1121	11/2/2021	Water
TW-01	TW-01-M5W19-1121-CS	11/2/2021	Carbon Sampler
TW-01	MW-905-Q421-FD	11/2/2021	Water
TW-01	TW-01-M5W20-1121	11/11/2021	Water
TW-01	TW-01-M5W20-1121-CS	11/11/2021	Carbon Sampler

Table 4
Tracer Sample Summary
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Sample Locations	Sample ID	Sample Date	Sample Matrix
TW-01	TW-01-M5W21-1121	11/15/2021	Water
TW-01	TW-01-M5W21-1121-CS	11/15/2021	Carbon Sampler
TW-01	TW-01-M5W22-1121	11/22/2021	Water
TW-01	TW-01-M5W22-1121-CS	11/22/2021	Carbon Sampler
TW-01	TW-01-M6W23-1221	12/2/2021	Water
TW-01	TW-01-M6W23-1221-CS	12/2/2021	Carbon Sampler
TW-01	TW-01-M6W24-1221	12/8/2021	Water
TW-01	TW-01-M6W24-1221-CS	12/8/2021	Carbon Sampler

Notes:
CS - carbon sampler
FD - field duplicate

Table 6
Constant Rate Test Sampling Plan
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Sample Event	Frequency	Purpose	Sample Method	Analysis	Sample Locations
Baseline sampling – groundwater	Once	Evaluate baseline conditions before starting the constant-rate aquifer test and tracer study. Determine if any residual tracer remains from the 2009 pilot test. Monitor Cr6 concentrations before test start.	Modified low-flow (sampled within one to two day time period)	• Cr6 • Cr (T) for dissolved metals • Fluorescent tracers • Cations (calcium, magnesium, potassium and sodium) and the anions (chloride, sulfate, and nitrate) • Additional metals (arsenic, selenium, and molybdenum) • Specific Conductivity • TDS • Caprolactam	MW-10 MW-66-165/230/270 MW-67-185/225/260 MW-38S/D TW-01* MW-24A/B PT7S/M/D PT8S/M/D PT9S/M/D MW-68-180/240/BR-280 MW-10D
TW-01 Cr6 concentration monitoring	Every 24 hours during 7-day constant rate test; biweekly during extended constant-rate test	Monitor Cr6 concentrations.	Grab	• Cr6 • Cr (T) for dissolved metals • Specific Conductivity • TDS	TW-01

Table 6
Constant Rate Test Sampling Plan
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Sample Event	Frequency	Purpose	Sample Method	Analysis	Sample Locations
IM-3 Water Quality Evaluation for Water Treatment	Monthly	Assess water quality for suitability of treatment by IM-3 system	Grab	• Cr6 • Cr (T) for dissolved metals • Cations (calcium, magnesium, potassium, and sodium) and the anions (chloride, sulfate, and nitrate) • Additional metals (arsenic, selenium, and molybdenum) • pH • Specific Conductance • Oil and Grease • Total dissolved solids (TDS) • Total suspended solids (TSS) • Total organic carbon (TOC) • Title 22 metals • Ammonia • Fluoride • Nitrate/nitrite • Sulfate	TW-01

Table 6
Constant Rate Test Sampling Plan
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Sample Event	Frequency	Purpose	Sample Method	Analysis	Sample Locations
Tracer monitoring – extracted water	Weekly (possibly twice per week once breakthrough is observed or suspected)	Monitor for tracer breakthrough.	Grab	• Fluorescent tracers • Cations (calcium, magnesium, potassium, and sodium) and the anions (chloride and sulfate and nitrate) • Additional metals (arsenic, selenium, and molybdenum)	TW-01
	Weekly	Monitor for tracer breakthrough between groundwater samples. Ensure that breakthrough is not missed between sample events.	Carbon sampler	• Fluorescent tracers	TW-01
Additional tracer sampling	Approximately months 2, 4, and 6	Evaluate if residual tracer concentrations (if any remain) are changing over time due to long-term pumping at TW-01.	Modified low-flow (sampled within one to two day time period)	• Fluorescent tracers	MW-24A/B PT7S/M/D PT8S/M/D PT9S/M/D MW-38D/S MW-67-185/225

Table 6
Constant Rate Test Sampling Plan
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Sample Event	Frequency	Purpose	Sample Method	Analysis	Sample Locations
Solute transport monitoring-groundwater	Approximately months 3 and 6	Evaluate influence of pumping on Cr6 concentrations	Modified low-flow (sampled within one to two day time period)	• Cr6 • Cr (T) for dissolved metals • Cations (calcium, magnesium, potassium, and sodium) and the anions (chloride, sulfate, and nitrate) • Additional metals (arsenic, selenium, molybdenum) • Fluorescent tracers • Specific Conductivity • TDS	MW-10 MW-66-165/230/270 MW-67-185/225/260 MW-38S/D MW-68-180/240/BR-280 MW-10D
	Monthly	Evaluate concentration trends at MW-68-180 in conjunction with datalogger collection	Modified low-flow	• Cr6	MW-68-180

Cr(T) = total chromium

* In addition to Cr(T), Cr6, and tracers, to evaluate water quality for treatment at IM-3, TW-01 was sampled and analyzed for pH, specific conductance, oil and grease, TDS, TSS, TOC, Title 22 metals, ammonia, fluoride, nitrate/nitrite, and sulfate. Analytical data collected from TW-01 on November 4, 2020, is attached in Table 2 of the Work Plan.

Table 10a
Summary of Tracer Analytical Results in Groundwater
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Sample Location	Sample ID	Sample Date	Fluorescein ppb	Rhodamine-WT ppb
Baseline Samples				
MW-10	MW-10-0521	5/5/2021	ND (0.002)	ND (0.015)
MW-10D	MW-10D-0521	5/5/2021	ND (0.002)	ND (0.015)
MW-24A	MW-24A-0521	5/5/2021	0.020	21.7
MW-24B	MW-24B-0521	5/5/2021	ND (0.002)	ND (0.015)
MW-38D	MW-38D-0521	5/5/2021	ND (0.002)	ND (0.015)
MW-38S	MW-38S-0521	5/5/2021	ND (0.002)	ND (0.015)
MW-66-165	MW-66-165-0521	5/5/2021	ND (0.002)	ND (0.015)
MW-66-230	MW-66-230-0521	5/5/2021	ND (0.002)	ND (0.015)
MW-66BR-270	MW-66BR-270-0521	5/5/2021	ND (0.002)	ND (0.015)
MW-67-185	MW-67-185-0521	5/4/2021	0.060	ND (0.015)
MW-67-185	MW-918-Q221 FD	5/4/2021	0.060	ND (0.015)
MW-67-185	MW-67-185-RE-0521	5/19/2021	ND (0.002)	ND (0.015)
MW-67-225	MW-67-225-0521	5/4/2021	ND (0.002)	ND (0.015)
MW-67-260	MW-67-260-0521	5/4/2021	ND (0.002)	ND (0.015)
MW-68-180	MW-68-180-0521	5/4/2021	1.1	ND (0.015)

Table 10a
Summary of Tracer Analytical Results in Groundwater
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Sample Location	Sample ID	Sample Date	Fluorescein ppb	Rhodamine-WT ppb
MW-68-180	MW-68-180-RE-0521	5/19/2021	ND (0.002)	ND (0.015)
MW-68-240	MW-68-240-0521	5/4/2021	ND (0.002)	ND (0.015)
MW-68BR-280	MW-68BR-280-0521	5/4/2021	ND (0.002)	ND (0.015)
PT-7D	PT7D-0521	5/4/2021	16.2	ND (0.015)
PT-7M	PT7M-0521	5/4/2021	299	ND (0.015)
PT-7S	PT7S-0521	5/4/2021	0.03	ND (0.015)
PT-8D	PT8D-0521	5/4/2021	ND (0.002)	ND (0.015)
PT-8M	PT8M-0521	5/4/2021	0.85	ND (0.015)
PT-8S	PT8S-0521	5/4/2021	ND (0.002)	ND (0.015)
PT-9D	PT9D-0521	5/5/2021	ND (0.002)	ND (0.015)
PT-9M	PT9M-0521	5/5/2021	55.1	ND (0.015)
PT-9S	PT9S-0521	5/5/2021	0.25	ND (0.015)
TW-01	TW-01-0421	6/10/2021	ND (0.002)	ND (0.015)
TW-01	MW-917-Q221 FD	6/10/2021	ND (0.002)	ND (0.015)
Batch Samples				
MW-38D-BATCH1	MW-38D-BATCH1	6/8/2021	83000	ND (0.015)

Table 10a
Summary of Tracer Analytical Results in Groundwater
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Sample Location	Sample ID	Sample Date	Fluorescein ppb	Rhodamine-WT ppb
MW-38D-BATCH2	MW-38D-BATCH2	6/11/2021	84900	ND (0.015)
MW-67-185-BATCH1	MW-67-185-BATCH1	6/9/2021	ND (0.002)	292000
Injection Well Samples				
MW-38D	MW-38D-M2W7-0821	8/11/2021	16,900	ND (0.015)
MW-38D	MW-38D-M3W13-0921	9/22/2021	3,160	ND (0.015)
MW-38D	MW-38D-M4W17-1021	10/21/2021	1,090	ND (0.015)
MW-67-185	MW-67-185-M2W7-0821	8/17/2021	ND (0.002)	239000
MW-67-185	MW-67-185-M3W13-0921	9/23/2021	2.19	173000
MW-67-185	MW-67-185-M4W17-1021	10/21/2021	ND (0.002)	173000
Extraction Well TW-01 Samples				
TW-01	TW-01-M2W6-0821	8/3/2021	ND (0.002)	ND (0.015)
TW-01	TW-01-M2W7-0821	8/16/2021	ND (0.002)	ND (0.015)
TW-01	MW-918-M2W7-Q321 FD	8/16/2021	ND (0.002)	ND (0.015)
TW-01	TW-01-M2W10-0821	9/1/2021	ND (0.002)	ND (0.015)
TW-01	TW-01-M3W12-0921	9/15/2021	ND (0.002)	ND (0.015)
TW-01	TW-01-M3W13-0921	9/23/2021	ND (0.002)	ND (0.015)

Table 10a
Summary of Tracer Analytical Results in Groundwater
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Sample Location	Sample ID	Sample Date	Fluorescein ppb	Rhodamine-WT ppb
TW-01	MW-931-Q321 FD	9/23/2021	ND (0.002)	ND (0.015)
TW-01	TW-01-M4W15-1021	10/7/2021	ND (0.002)	ND (0.015)
TW-01	MW-901-Q421 ED	10/7/2021	ND (0.002)	ND (0.015)
TW-01	TW-01-M4W17-1021	10/20/2021	0.020	ND (0.015)
TW-01	MW-902-Q421 FD	10/20/2021	0.020	ND (0.015)
TW-01	TW-01-M5W19-1121	11/2/2021	0.04	0.06
TW-01	MW-905-Q421 FD	11/2/2021	0.050	0.080
TW-01	TW-01-M5W20-1121	11/11/2021	0.04	0.150
TW-01	TW-01-M5W21-1121	11/15/2021	0.060	0.230
TW-01	TW-01-M5W22-1121	11/22/2021	5.36	32.5
TW-01	TW-01-M6W23-1221	12/2/2021	0.08	0.590
TW-01	TW-01-M6W24-1221	12/8/2021	0.09	0.76
Monitoring Well Samples				
MW-10	MW-10-M3W13-0921	9/22/2021	ND (0.002)	ND (0.015)
MW-10D	MW-10D-M3W13-0921	9/22/2021	ND (0.002)	ND (0.015)
MW-24A	MW-24A-M2W7-0821	8/11/2021	6.8	49.5

Table 10a
Summary of Tracer Analytical Results in Groundwater
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Sample Location	Sample ID	Sample Date	Fluorescein ppb	Rhodamine-WT ppb
MW-24A	MW-24A-M4W17-1021	10/21/2021	0.12	86.8
MW-24B	MW-24B-M2W7-0821	8/11/2021	0	ND (0.015)
MW-24B	MW-24B-M4W17-1021	10/21/2021	ND (0.002)	0.96
MW-38S	MW-38S-M2W7-0821	8/11/2021	ND (0.002)	ND (0.015)
MW-38S	MW-38S-M3W13-0921	9/22/2021	ND (0.002)	ND (0.015)
MW-38S	MW-38S-M4W17-1021	10/21/2021	ND (0.002)	2.0
MW-66-165	MW-66-165-M3W13-0921	9/24/2021	ND (0.002)	ND (0.015)
MW-66-230	MW-66-230-M3W13-0921	9/24/2021	ND (0.002)	ND (0.015)
MW-66BR-270	MW-66BR-270-M4W15-1021	10/8/2021	ND (0.002)	ND (0.015)
MW-67-225	MW-67-225-M2W7-0821	8/17/2021	ND (0.002)	ND (0.015)
MW-67-225	MW-67-225-M3W13-0921	9/24/2021	2.21	0.02
MW-67-225	MW-67-225-M4W17-1021	10/21/2021	ND (0.002)	ND (0.015)
MW-67-260	MW-67-260-M3W13-0921	9/24/2021	5.57	0.02
MW-68-180	MW-68-180-M3W13-0921	9/23/2021	0.285	ND (0.015)
MW-68-240	MW-68-240-M3W13-0921	9/23/2021	ND (0.002)	ND (0.015)
MW-68BR-280	MW-68BR-280-M3W13-0921	9/23/2021	ND (0.002)	ND (0.015)

Table 10a
Summary of Tracer Analytical Results in Groundwater
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Sample Location	Sample ID	Sample Date	Fluorescein ppb	Rhodamine-WT ppb
PT7D	PT7D-M2W7-0821	8/11/2021	114	ND (0.015)
PT7D	PT7D-M4W17-1021	10/19/2021	92.2	ND (0.015)
PT7M	PT7M-M2W7-0821	8/11/2021	91.5	ND (0.015)
PT7M	PT7M-M4W17-1021	10/19/2021	48.6	ND (0.015)
PT7S	PT7S-M2W7-0821	8/11/2021	0.38	ND (0.015)
PT7S	PT7S-M4W17-1021	10/19/2021	0.16	ND (0.015)
PT8D	PT8D-M2W7-0821	8/16/2021	0.37	ND (0.015)
PT8D	MW-915-M2W7-Q321 FD	8/16/2021	0.37	ND (0.015)
PT8D	PT8D-M4W17-1021	10/19/2021	2.29	ND (0.015)
PT8M	PT8M-M2W7-0821	8/16/2021	25.1	ND (0.015)
PT8M	PT8M-M4W17-1021	10/19/2021	7.1	ND (0.015)
PT8S	PT8S-M2W7-0821	8/16/2021	0.05	ND (0.015)
PT8S	PT8S-M4W17-1021	10/19/2021	ND (0.002)	ND (0.015)
PT9D	PT9D-M2W7-0821	8/16/2021	0.08	ND (0.015)
PT9D	PT9D-M4W17-1021	10/19/2021	ND (0.002)	ND (0.015)
PT9M	PT9M-M2W7-0821	8/16/2021	84.1	ND (0.015)

Table 10a
Summary of Tracer Analytical Results in Groundwater
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Sample Location	Sample ID	Sample Date	Fluorescein ppb	Rhodamine-WT ppb
PT9M	PT9M-M4W17-1021	10/19/2021	47.1	ND (0.015)
PT9S	PT9S-M2W7-0821	8/16/2021	ND (0.002)	ND (0.015)
PT9S	PT9S-M4W17-1021	10/19/2021	ND (0.002)	ND (0.015)

Notes:
FD = Field Duplicate
ND = not detected at listed reporting limit
ppb = parts per billion

Table 10b
Summary of Tracer Analytical Results in Carbon Samplers
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Type of Sample	Deployment Date	Retrieval Date	Deployment Period (days)	Fluorescein (ppb)	Rhodamine-WT (ppb)
TW-01	M1W1	Carbon Sampler	6/10/2021	06/28/2021	18	NA	NA
TW-01	M1W2	Carbon Sampler	6/28/2021	07/10/2021	12	NA	NA
TW-01	M1W3	Carbon Sampler	7/10/2021	07/12/2021	2	NA	NA
TW-01	M1W4	Carbon Sampler	7/12/2021	07/20/2021	8	NA	NA
TW-01	M1W5	Carbon Sampler	7/20/2021	07/26/2021	6	NA	NA
TW-01	TW-01-M2W6-0821-CS	Carbon Sampler	07/26/2021	08/03/2021	8	ND (0.002)	ND (0.015)
TW-01	TW-01-M2W7-0821-CS	Carbon Sampler	08/09/2021	08/16/2021	13	ND (0.002)	ND (0.015)
TW-01	M2W9	Carbon Sampler	08/16/2021	08/25/2021	9	NA	NA
TW-01	TW-01-M2W10-0821-CS	Carbon Sampler	08/25/2021	09/01/2021	7	ND (0.002)	ND (0.015)
TW-01	M2W11	Carbon Sampler	09/01/2021	09/09/2021	8	NA	NA
TW-01	TW-01-M3W12-0921-CS	Carbon Sampler	9/9/2021	09/15/2021	6	ND (0.002)	ND (0.015)
TW-01	TW-01-M3W13-0921-CS	Carbon Sampler	09/15/2021	09/23/2021	8	ND (0.002)	ND (0.015)
TW-01	TW-01-M3W14-0921-CS	Carbon Sampler	09/23/2021	09/30/2021	7	ND (0.002)	ND (0.015)

Table 10b
Summary of Tracer Analytical Results in Carbon Samplers
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Type of Sample	Deployment Date	Retrieval Date	Deployment Period (days)	Fluorescein (ppb)	Rhodamine-WT (ppb)
TW-01	TW-01-M4W15-1021-CS	Carbon Sampler	09/30/2021	10/07/2021	7	ND (0.002)	ND (0.015)
TW-01	TW-01-M4W17-1021-CS	Carbon Sampler	10/7/2021	10/20/2021	13	3.48	19.80
TW-01	TW-01-M5W19-1121-CS	Carbon Sampler	10/20/2021	11/02/2021	13	16.50	75.40
TW-01	TW-01-M5W20-1121-CS	Carbon Sampler	11/02/2021	11/11/2021	9	1.99	6.31
TW-01	TW-01-M5W21-1121-CS	Carbon Sampler	11/11/2021	11/15/2021	4	8.93	51.60
TW-01	TW-01-M5W22-1121-CS	Carbon Sampler	11/15/2021	11/22/2021	7	0.08	0.51
TW-01	TW-01-M6W23-1221-CS	Carbon Sampler	11/22/2021	12/02/2021	10	9.10	103.00
TW-01	TW-01-M6W24-1221-CS	Carbon Sampler	12/02/2021	12/08/2021	6	4.46	66.50

Notes:
NA = Not Analyzed
ND = not detected at listed reporting limit
ppb = parts per billion

Table 11
Summary of Cr6 Results in IM-3 Performance Monitoring Area
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Result Status	Hexavalent Chromium (µg/L)
MW-34-055	MW-34-055-M1W1-0621	6/30/2021	Final	ND (0.2)
MW-34-055	MW-34-055-M1W3-0621	07/12/2021	Final	ND (0.2)
MW-34-055	MW-34-055-M1W5-0721	07/26/2021	Final	ND (0.2)
MW-34-055	MW-34-055-M2W7-0821	08/10/2021	Final	ND (0.2)
MW-34-055	MW-34-055-M2W9-0821	08/26/2021	Final	ND (0.2)
MW-34-055	MW-34-055-M3W11-0921	09/08/2021	Final	ND (0.2)
MW-34-055	MW-34-055-M3W13-0921	09/22/2021	Final	ND (0.2)
MW-34-055	MW-34-055-M4W15-1021	10/06/2021	Final	ND (0.2)
MW-34-055	MW-34-055-M4W17-1021	10/20/2021	Final	ND (0.2)
MW-34-055	MW-34-055-M5W19-1121	11/02/2021	Final	ND (0.2)
MW-34-055	MW-34-055-M5W21-1121	11/19/2021	Final	ND (0.2)
MW-34-055	MW-34-055-Q421	12/01/2021	Final	ND (0.2)
MW-34-080	MW-34-080-Q221	04/28/2021	Final	ND (0.2)
MW-34-080	MW-34-080-M1W1-0621	06/30/2021	Final	ND (0.2)
MW-34-080	MW-927-Q221 - FD	06/30/2021	Final	ND (0.2)
MW-34-080	MW-34-080-M1W3-0621	07/12/2021	Final	ND (0.2)
MW-34-080	MW-34-080-M1W5-0721	07/26/2021	Final	ND (0.2)
MW-34-080	MW-34-080-M2W7-0821	08/10/2021	Final	ND (0.2)
MW-34-080	MW-34-080-M2W9-0821	08/26/2021	Final	ND (0.2)

Table 11
Summary of Cr6 Results in IM-3 Performance Monitoring Area
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Result Status	Hexavalent Chromium (µg/L)
MW-34-080	MW-34-080-M3W11-0921	09/08/2021	Final	ND (0.2)
MW-34-080	MW-34-080-M3W13-0921	09/22/2021	Final	ND (0.2)
MW-34-080	MW-34-080-M4W15-1021	10/06/2021	Final	ND (0.2)
MW-34-080	MW-34-080-M4W17-1021	10/20/2021	Final	ND (0.2)
MW-34-080	MW-34-080-M5W19-1121	11/02/2021	Final	ND (0.2)
MW-34-080	MW-34-080-M5W21-1121	11/19/2021	Final	ND (0.2)
MW-34-080	MW-34-080-Q421	12/01/2021	Final	ND (0.2)
MW-34-100	MW-34-100-Q221	04/28/2021	Final	ND (0.2)
MW-34-100	MW-34-100-M1W1-0621	06/30/2021	Final	ND (0.2)
MW-34-100	MW-34-100-M1W3-0621	07/12/2021	Final	ND (0.2)
MW-34-100	MW-34-100-M1W5-0721	07/26/2021	Final	ND (0.2)
MW-34-100	MW-34-100-M2W7-0821	08/10/2021	Final	ND (0.2)
MW-34-100	MW-34-100-M2W9-0821	08/26/2021	Final	ND (0.2)
MW-34-100	MW-34-100-Q321	08/26/2021	Final	ND (1.0)
MW-34-100	MW-34-100-M3W11-0921	09/08/2021	Final	ND (0.2)
MW-34-100	MW-34-100-M3W13-0921	09/22/2021	Final	ND (0.2)
MW-34-100	MW-34-100-M4W15-1021	10/06/2021	Final	ND (0.2)
MW-34-100	MW-34-100-M4W17-1021	10/20/2021	Final	ND (0.2)
MW-34-100	MW-903-Q421 - FD	10/20/2021	Final	ND (1.0)

Table 11
Summary of Cr6 Results in IM-3 Performance Monitoring Area
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Result Status	Hexavalent Chromium (µg/L)
MW-34-100	MW-34-100-M5W19-1121	11/02/2021	Final	ND (1.0)
MW-34-100	MW-34-100-M5W21-1121	11/19/2021	Final	ND (1.0)
MW-34-100	MW-34-100-Q421	12/01/2021	Final	ND (1.0)
MW-34-100	MW-930-Q421 - FD	12/01/2021	Final	ND (1.0)
MW-36-020	MW-36-020-M1W1-0621	06/29/2021	Final	ND (0.2)
MW-36-020	MW-36-020-M1W3-0621	07/13/2021	Final	ND (0.2)
MW-36-020	MW-36-020-M1W5-0721	07/27/2021	Final	ND (0.2)
MW-36-020	MW-36-020-M2W7-0821	08/09/2021	Final	ND (0.2)
MW-36-020	MW-36-020-M2W9-0821	08/25/2021	Final	ND (0.2)
MW-36-020	MW-36-020-M3W11-0921	09/07/2021	Final	ND (0.2)
MW-36-020	MW-36-020-M3W13-0921	09/21/2021	Final	ND (0.2)
MW-36-020	MW-36-020-M4W15-1021	10/06/2021	Final	ND (0.2)
MW-36-020	MW-36-020-M4W17-1021	10/18/2021	Final	ND (0.2)
MW-36-020	MW-36-020-M5W19-1121	11/01/2021	Final	ND (0.2)
MW-36-020	MW-36-020-M5W21-1121	11/18/2021	Final	ND (0.2)
MW-36-020	MW-36-020-Q421	12/03/2021	Final	ND (0.2)
MW-36-040	MW-36-040-M1W1-0621	06/29/2021	Final	ND (0.2)
MW-36-040	MW-36-040-M1W3-0621	07/13/2021	Final	ND (0.2)
MW-36-040	MW-36-040-M1W5-0721	07/27/2021	Final	ND (0.2)

Table 11
Summary of Cr6 Results in IM-3 Performance Monitoring Area
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Result Status	Hexavalent Chromium (µg/L)
MW-36-040	MW-36-040-M2W7-0821	08/09/2021	Final	ND (0.2)
MW-36-040	MW-36-040-M2W9-0821	08/25/2021	Final	ND (0.2)
MW-36-040	MW-36-040-M3W11-0921	09/07/2021	Final	ND (0.2)
MW-36-040	MW-36-040-M3W13-0921	09/21/2021	Final	ND (0.2)
MW-36-040	MW-36-040-M4W15-1021	10/06/2021	Final	ND (0.2)
MW-36-040	MW-36-040-M4W17-1021	10/18/2021	Final	ND (0.2)
MW-36-040	MW-36-040-M5W19-1121	11/01/2021	Final	ND (0.2)
MW-36-040	MW-36-040-M5W21-1121	11/18/2021	Final	ND (0.2)
MW-36-040	MW-906-Q421 - FD	11/18/2021	Final	ND (0.2)
MW-36-040	MW-36-040-Q421	12/03/2021	Final	ND (0.2)
MW-36-040	MW-931-Q421 - FD	12/03/2021	Final	ND (0.2)
MW-36-050	MW-36-050-M1W1-0621	06/29/2021	Final	ND (0.2)
MW-36-050	MW-36-050-M1W3-0621	07/13/2021	Final	ND (0.2)
MW-36-050	MW-36-050-M1W5-0721	07/27/2021	Final	ND (0.2)
MW-36-050	MW-36-050-M2W7-0821	08/09/2021	Final	ND (0.2)
MW-36-050	MW-36-050-M2W9-0821	08/25/2021	Final	ND (0.2)
MW-36-050	MW-929-Q321 - FD	08/25/2021	Final	ND (0.2)
MW-36-050	MW-36-050-M3W11-0921	09/07/2021	Final	ND (0.2)
MW-36-050	MW-36-050-M3W13-0921	09/21/2021	Final	ND (0.2)

Table 11
Summary of Cr6 Results in IM-3 Performance Monitoring Area
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Result Status	Hexavalent Chromium (µg/L)
MW-36-050	MW-36-050-M4W15-1021	10/06/2021	Final	ND (0.2)
MW-36-050	MW-36-050-M4W17-1021	10/18/2021	Final	ND (0.2)
MW-36-050	MW-36-050-M5W19-1121	11/01/2021	Final	ND (0.2)
MW-36-050	MW-36-050-M5W21-1121	11/18/2021	Final	ND (0.2)
MW-36-050	MW-36-050-Q421	12/03/2021	Final	ND (0.2)
MW-36-070	MW-36-070-M1W1-0621	06/29/2021	Final	ND (0.2)
MW-36-070	MW-36-070-M1W3-0621	07/13/2021	Final	ND (0.2)
MW-36-070	MW-36-070-M1W5-0721	07/27/2021	Final	ND (0.2)
MW-36-070	MW-36-070-M2W7-0821	08/09/2021	Final	ND (0.2)
MW-36-070	MW-36-070-M2W9-0821	08/25/2021	Final	ND (0.2)
MW-36-070	MW-36-070-M3W11-0921	09/07/2021	Final	ND (0.2)
MW-36-070	MW-36-070-M3W13-0921	09/21/2021	Final	ND (0.2)
MW-36-070	MW-36-070-M4W15-1021	10/06/2021	Final	ND (0.2)
MW-36-070	MW-36-070-M4W17-1021	10/18/2021	Final	ND (0.2)
MW-36-070	MW-36-070-M5W19-1121	11/01/2021	Final	ND (0.2)
MW-36-070	MW-36-070-M5W21-1121	11/18/2021	Final	ND (0.2)
MW-36-070	MW-36-070-Q421	12/03/2021	Final	ND (0.2)
MW-36-090	MW-36-090-Q221	04/28/2021	Final	ND (0.2)
MW-36-090	MW-36-090-M1W1-0621	06/29/2021	Final	ND (0.2)

Table 11
Summary of Cr6 Results in IM-3 Performance Monitoring Area
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Result Status	Hexavalent Chromium (µg/L)
MW-36-090	MW-36-090-M1W3-0621	07/13/2021	Final	ND (0.2)
MW-36-090	MW-36-090-M1W5-0721	07/27/2021	Final	ND (0.2)
MW-36-090	MW-36-090-M2W7-0821	08/09/2021	Final	ND (0.2)
MW-36-090	MW-36-090-M2W9-0821	08/25/2021	Final	ND (0.2)
MW-36-090	MW-36-090-M3W11-0921	09/07/2021	Final	ND (0.2)
MW-36-090	MW-36-090-M3W13-0921	09/21/2021	Final	ND (0.2)
MW-36-090	MW-36-090-M4W15-1021	10/06/2021	Final	ND (0.2)
MW-36-090	MW-36-090-M4W17-1021	10/18/2021	Final	ND (0.2)
MW-36-090	MW-36-090-M5W19-1121	11/01/2021	Final	ND (0.2)
MW-36-090	MW-36-090-M5W21-1121	11/18/2021	Final	ND (0.2)
MW-36-090	MW-36-090-Q421	12/03/2021	Final	ND (0.2)
MW-36-100	MW-36-100-Q221	04/28/2021	Final	5.5
MW-36-100	MW-36-100-M1W1-0621	06/29/2021	Final	ND (0.2)
MW-36-100	MW-36-100-M1W3-0621	07/13/2021	Final	ND (0.2)
MW-36-100	MW-36-100-M1W5-0721	07/27/2021	Final	ND (0.2)
MW-36-100	MW-36-100-M2W7-0821	08/09/2021	Final	ND (0.2)
MW-36-100	MW-36-100-M2W9-0821	08/25/2021	Final	8.7
MW-36-100	MW-36-100-M3W11-0921	09/07/2021	Final	ND (0.2)
MW-36-100	MW-36-100-M3W13-0921	09/21/2021	Final	ND (0.2)

Table 11
Summary of Cr6 Results in IM-3 Performance Monitoring Area
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Result Status	Hexavalent Chromium (µg/L)
MW-36-100	MW-36-100-M4W15-1021	10/06/2021	Final	ND (0.2)
MW-36-100	MW-36-100-M4W17-1021	10/18/2021	Final	ND (0.2)
MW-36-100	MW-36-100-M5W19-1121	11/01/2021	Final	36
MW-36-100	MW-36-100-M5W21-1121	11/18/2021	Final	8.0
MW-36-100	MW-36-100-Q421	12/03/2021	Final	8.0
MW-44-070	MW-44-070-Q221	04/28/2021	Final	ND (0.2)
MW-44-070	MW-44-070-M1W1-0621	06/29/2021	Final	ND (0.2)
MW-44-070	MW-44-070-M1W3-0621	07/12/2021	Final	ND (0.2)
MW-44-070	MW-44-070-M1W5-0721	07/27/2021	Final	ND (0.2)
MW-44-070	MW-44-070-M2W7-0821	08/10/2021	Final	ND (0.2)
MW-44-070	MW-917-M2W7-Q321 - FD	08/10/2021	Final	ND (0.2)
MW-44-070	MW-44-070-M2W9-0821	08/26/2021	Final	ND (0.2)
MW-44-070	MW-44-070-M3W11-0921	09/08/2021	Final	ND (0.2)
MW-44-070	MW-44-070-M3W13-0921	09/23/2021	Final	ND (0.2)
MW-44-070	MW-44-070-M4W15-1021	10/06/2021	Final	ND (0.2)
MW-44-070	MW-44-070-M4W17-1021	10/20/2021	Final	ND (0.2)
MW-44-070	MW-44-070-M5W19-1121	11/02/2021	Final	ND (0.2)
MW-44-070	MW-44-070-M5W21-1121	11/19/2021	Final	ND (0.2)
MW-44-070	MW-44-070-Q421	12/08/2021	Final	ND (0.2)

Table 11
Summary of Cr6 Results in IM-3 Performance Monitoring Area
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Result Status	Hexavalent Chromium (µg/L)
MW-44-115	MW-44-115-Q221	04/28/2021	Final	2.3
MW-44-115	MW-44-115-M1W1-0621	06/29/2021	Final	ND (1.0)
MW-44-115	MW-44-115-M1W3-0621	07/12/2021	Final	2.5
MW-44-115	MW-44-115-M1W5-0721	07/27/2021	Final	2.1
MW-44-115	MW-914-Q321 - FD	07/27/2021	Final	2.1
MW-44-115	MW-44-115-M2W7-0821	08/10/2021	Final	0.99
MW-44-115	MW-44-115-M2W9-0821	08/26/2021	Final	ND (1.0)
MW-44-115	MW-44-115-Q321	08/26/2021	Final	ND (1.0)
MW-44-115	MW-44-115-M3W11-0921	09/08/2021	Final	1.4
MW-44-115	MW-44-115-M3W13-0921	09/23/2021	Final	1.0
MW-44-115	MW-932-Q321 - FD	09/23/2021	Final	1.0
MW-44-115	MW-44-115-M4W15-1021	10/06/2021	Final	0.9
MW-44-115	MW-44-115-M4W17-1021	10/20/2021	Final	1.4
MW-44-115	MW-44-115-M5W19-1121	11/02/2021	Final	1.2
MW-44-115	MW-44-115-M5W21-1121	11/19/2021	Final	1.1
MW-44-115	MW-44-115-Q421	12/08/2021	Final	1.8
MW-44-125	MW-44-125-Q221	04/28/2021	Final	ND (0.2)
MW-44-125	MW-44-125-M1W1-0621	06/29/2021	Final	ND (0.2)
MW-44-125	MW-44-125-M1W3-0621	07/12/2021	Final	ND (0.2)

Table 11
Summary of Cr6 Results in IM-3 Performance Monitoring Area
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Result Status	Hexavalent Chromium (µg/L)
MW-44-125	MW-44-125-M1W5-0721	07/27/2021	Final	ND (0.2)
MW-44-125	MW-44-125-M2W7-0821	08/10/2021	Final	ND (0.2)
MW-44-125	MW-44-125-M2W9-0821	08/26/2021	Final	ND (0.2)
MW-44-125	MW-44-125-M3W11-0921	09/08/2021	Final	ND (0.2)
MW-44-125	MW-44-125-M3W13-0921	09/23/2021	Final	ND (0.2)
MW-44-125	MW-44-125-M4W15-1021	10/06/2021	Final	ND (0.2)
MW-44-125	MW-44-125-M4W17-1021	10/20/2021	Final	ND (0.2)
MW-44-125	MW-44-125-M5W19-1121	11/02/2021	Final	ND (1.0)
MW-44-125	MW-44-125-M5W21-1121	11/19/2021	Final	ND (0.2)
MW-44-125	MW-44-125-Q421	12/08/2021	Final	ND (1.0)
MW-46-175	MW-46-175-Q221	04/29/2021	Final	6.6
MW-46-175	MW-46-175-M1W1-0621	06/30/2021	Final	6.5
MW-46-175	MW-46-175-M1W3-0621	07/12/2021	Final	5.7
MW-46-175	MW-46-175-M1W5-0721	07/26/2021	Final	4.8
MW-46-175	MW-46-175-M2W7-0821	08/10/2021	Final	5.3
MW-46-175	MW-46-175-M2W9-0821	08/26/2021	Final	5.2
MW-46-175	MW-46-175-Q321	08/26/2021	Final	5.3
MW-46-175	MW-46-175-M3W11-0921	09/09/2021	Final	5.4
MW-46-175	MW-46-175-M3W13-0921	09/23/2021	Final	4.3

Table 11
Summary of Cr6 Results in IM-3 Performance Monitoring Area
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Result Status	Hexavalent Chromium (µg/L)
MW-46-175	MW-46-175-M4W15-1021	10/06/2021	Final	6.1
MW-46-175	MW-46-175-M4W17-1021	10/20/2021	Final	3.6
MW-46-175	MW-904-Q421 - FD	10/20/2021	Final	3.6
MW-46-175	MW-46-175-M5W19-1121	11/02/2021	Final	5.2
MW-46-175	MW-46-175-M5W21-1121	11/19/2021	Final	4.2
MW-46-175	MW-46-175-Q421	12/08/2021	Final	2.1

Table 12
TW-01 Groundwater Chemistry Sampling Results
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Sample Type	Aluminum, dissolved (µg/L)	Ammonia as nitrogen (mg/L)	Antimony, dissolved (µg/L)	Arsenic, dissolved (µg/L)	Barium, dissolved (µg/L)	Beryllium, dissolved (µg/L)	Boron, dissolved (mg/L)	Cadmium, dissolved (µg/L)	Calcium, dissolved (mg/L)	Caprolactam (µg/L)	Chloride (mg/L)	Chromium, Hexavalent (µg/L)	Chromium, total dissolved (µg/L)	Cobalt, dissolved (µg/L)
MW-10	MW-10-0521	05/05/2021	N	--	--	--	1.5	--	--	--	--	160	ND (10)	670	130	130 J	--
MW-10	MW-10-M3W13-0921	09/22/2021	N	--	--	--	1.6 J	--	--	--	--	150 J	--	710	120	140 J	--
MW-10	MW-10-Q421	12/08/2021	N	--	--	--	0.93	--	--	--	--	--	--	--	69	71	--
MW-10	MW-916-Q421	12/08/2021	FD	--	--	--	0.92	--	--	--	--	--	--	--	67	72	--
MW-10D	MW-10D-0521	05/05/2021	N	--	--	--	ND (0.1)	--	--	--	--	200	ND (10)	990	400	370 J	--
MW-10D	MW-10D-Q221	05/19/2021	N	ND (50)	ND (0.2)	ND (0.5)	ND (0.1)	45	ND (0.5 J)	1.1	ND (0.5)	160	--	980	400	390	ND (0.5)
MW-10D	MW-10D-0821	08/24/2021	N	ND (50)	ND (0.2)	ND (0.5)	ND (0.1)	43	ND (0.5)	1.1	ND (0.5)	130	--	920	240	270	ND (0.5)
MW-10D	MW-10D-M3W13-0921	09/22/2021	N	--	--	--	ND (0.1 J)	--	--	--	--	120 J	--	840	94	120 J	--
MW-10D	MW-10D-Q421	12/08/2021	N	--	--	--	ND (0.1)	--	--	--	--	--	--	--	88	89	--
MW-24A	MW-24A-0521	05/05/2021	N	--	--	--	ND (0.1)	--	--	--	--	11	ND (10)	300	ND (0.2)	ND (1.0 J)	--
MW-24A	MW-24A-M2W7-0821	08/11/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-24A	MW-24A-Q421	12/09/2021	N	--	--	--	ND (0.1)	--	--	--	--	--	--	--	ND (0.2)	1.9	--
MW-24B	MW-24B-0521	05/05/2021	N	--	--	--	ND (0.1)	--	--	--	--	97	ND (10)	6,700	48	45 J	--
MW-24B	MW-24B-M2W7-0821	08/11/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-24B	MW-24B-Q421	12/09/2021	N	--	--	--	ND (0.1)	--	--	--	--	--	--	--	ND (1.0)	1.3	--
MW-24B	MW-919-Q421	12/09/2021	FD	--	--	--	ND (0.1)	--	--	--	--	--	--	--	ND (1.0)	1.1	--
MW-38D	MW-38D-0521	05/05/2021	N	--	--	--	ND (0.1)	--	--	--	--	96	ND (10)	7,500	23	22 J	--
MW-38D	MW-38D-M3W13-0921	09/22/2021	N	--	--	--	ND (0.1 J)	--	--	--	--	550 J	--	7,000	30	36 J	--
MW-38D	MW-38D-Q421	12/08/2021	N	--	--	--	ND (0.1)	--	--	--	--	--	--	--	50	47	--
MW-38S	MW-38S-0521	05/05/2021	N	--	--	--	5.5	--	--	--	--	34	ND (10)	350	11	11 J	--
MW-38S	MW-38S-Q321	08/27/2021	N	--	--	--	6.5 J	--	--	--	--	--	--	--	15	17	--
MW-38S	MW-38S-M3W13-0921	09/22/2021	N	--	--	--	9.0 J	--	--	--	--	18 J	--	140	5.6	5.3 J	--
MW-38S	MW-38S-Q421	12/08/2021	N	--	--	--	7.2	--	--	--	--	--	--	--	15	17	--
MW-66-165	MW-66-165-0521	05/05/2021	N	--	--	--	ND (0.1)	--	--	--	--	240	ND (10)	940	520	500 J	--
MW-66-165	MW-66-165-M3W13-0921	09/24/2021	N	--	--	--	ND (0.1 J)	--	--	--	--	230 J	--	820	360	410	--
MW-66-165	MW-66-165-Q421	12/07/2021	N	--	--	--	0.49	--	--	--	--	--	--	--	350	350	--
MW-66-230	MW-66-230-0521	05/05/2021	N	--	--	--	ND (0.1)	--	--	--	--	96	ND (10)	6,600	6,000	6,200 J	--
MW-66-230	MW-66-230-M3W13-0921	09/24/2021	N	--	--	--	3.4 J	--	--	--	--	570 J	--	7,000	4,800	5,400	--
MW-66-230	MW-66-230-Q421	12/07/2021	N	--	--	--	8.9	--	--	--	--	--	--	--	5,000	5,200	--
MW-66BR-270	MW-66BR-270-Q221	04/28/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-66BR-270	MW-66BR-270-0521	05/05/2021	N	--	--	--	ND (0.1)	--	--	--	--	370	ND (10)	6,200	ND (1.0)	ND (1.0 J)	--
MW-66BR-270	MW-66BR-270-M3W13-0921	10/08/2021	N	--	--	--	0.11	--	--	--	--	280	--	5,600	ND (1.0)	ND (1.0)	--
MW-66BR-270	MW-66BR-270-Q421	12/16/2021	N	--	--	--	ND (0.1)	--	--	--	--	--	--	--	ND (1.0)	1.9	--
MW-67-185	MW-67-185-0521	05/04/2021	N	--	--	--	ND (0.1)	--	--	--	--	820	ND (10)	2,300	2,000	2,000	--
MW-67-185	MW-918-Q221	05/04/2021	FD	--	--	--	ND (0.1)	--	--	--	--	720	ND (10)	2,300	2,000	1,900	--
MW-67-185	MW-67-185-RE-0521	05/19/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-67-185	MW-67-185-M3W13-0921	09/23/2021	N	--	--	--	2.2 J	--	--	--	--	190 J	--	910	ND (100)	ND (5.0 J)	--
MW-67-185	MW-67-185-Q421	12/07/2021	N	--	--	--	ND (0.1)	--	--	--	--	--	--	--	ND (100)	ND (1.0)	--
MW-67-225	MW-67-225-0521	05/04/2021	N	--	--	--	0.81	--	--	--	--	150	ND (10)	1,500	3,400	3,400	--
MW-67-225	MW-67-225-M3W13-0921	09/24/2021	N	--	--	--	ND (0.1 J)	--	--	--	--	140 J	--	1,300	2,100	2,400	--
MW-67-225	MW-67-225-Q421	12/07/2021	N	--	--	--	ND (0.1)	--	--	--	--	--	--	--	2,800	3,000	--
MW-68-180	MW-68-180-0521	05/04/2021	N	--	--	--	2	--	--	--	--	420	ND (10)	740	37,000	37,000	--
MW-68-180	MW-68-180-RE-0521	05/19/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-68-180	MW-68-180-M1-0621	06/28/2021	N	--	--	--	--	--	--	--	--	--	--	--	62,000	--	--
MW-68-180	MW-68-180-M1W5-0721	07/27/2021	N	--	--	--	--	--	--	--	--	--	--	--	65,000	--	--
MW-68-180	MW-68-180-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-68-180	MW-68-180-M2-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	47,000	--	--

Table 12
TW-01 Groundwater Chemistry Sampling Results
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Sample Type	Aluminum, dissolved (µg/L)	Ammonia as nitrogen (mg/L)	Antimony, dissolved (µg/L)	Arsenic, dissolved (µg/L)	Barium, dissolved (µg/L)	Beryllium, dissolved (µg/L)	Boron, dissolved (mg/L)	Cadmium, dissolved (µg/L)	Calcium, dissolved (mg/L)	Caprolactam (µg/L)	Chloride (mg/L)	Chromium, Hexavalent (µg/L)	Chromium, total dissolved (µg/L)	Cobalt, dissolved (µg/L)
MW-68-180	MW-68-180-M3W11-0921	09/09/2021	N	--	--	--	--	--	--	--	--	--	--	--	48,000	--	--
MW-68-180	MW-68-180-Q321	09/09/2021	N	--	--	--	1	--	--	--	--	--	--	--	49,000	60,000	--
MW-68-180	MW-68-180-M3W13-0921	09/23/2021	N	--	--	--	1.0 J	--	--	--	--	680 J	--	1,100	46,000	56,000 J	--
MW-68-180	MW-68-180-M4W15-1021	10/07/2021	N	--	--	--	--	--	--	--	--	--	--	--	49,000	--	--
MW-68-180	MW-68-180-M5W19-1121	11/02/2021	N	--	--	--	--	--	--	--	--	--	--	--	34,000	--	--
MW-68-180	MW-68-180-Q421	12/07/2021	N	--	--	--	1.9	--	--	--	--	--	--	--	26,000	28,000	--
MW-68-240	MW-68-240-0521	05/04/2021	N	--	--	--	ND (0.1)	--	--	--	--	590	ND (10 J)	5,400	2,000	2,000	--
MW-68-240	MW-68-240-M3W13-0921	09/23/2021	N	--	--	--	ND (0.1 J)	--	--	--	--	660 J	--	5,400	1,800	2,000 J	--
MW-68-240	MW-68-240-Q421	12/07/2021	N	--	--	--	ND (0.1)	--	--	--	--	--	--	--	1,900	2,000	--
MW-68-240	MW-925-Q421	12/07/2021	FD	--	--	--	ND (0.1)	--	--	--	--	--	--	--	1,900	1,900	--
MW-68BR-280	MW-68BR-280-0521	05/04/2021	N	--	--	--	ND (0.1)	--	--	--	--	410	ND (10)	7,300	ND (1.0)	1.3	--
MW-68BR-280	MW-68BR-280-M3W13-0921	09/23/2021	N	--	--	--	ND (0.1 J)	--	--	--	--	340 J	--	7,200	ND (1.0)	ND (1.0 J)	--
MW-68BR-280	MW-68BR-280-Q421	12/02/2021	N	--	--	--	ND (0.1)	--	--	--	--	--	--	--	ND (1.0)	ND (1.0)	--
PT7D	PT7D-0521	05/04/2021	N	--	--	--	ND (0.1)	--	--	--	--	520	ND (10)	7,100	ND (1.0)	ND (1.0)	--
PT7D	PT7D-M2W7-0821	08/11/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PT7M	PT7M-0521	05/04/2021	N	--	--	--	ND (0.1)	--	--	--	--	250	ND (10)	2,600	ND (1.0)	1	--
PT7M	PT7M-M2W7-0821	08/11/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PT7S	PT7S-0521	05/04/2021	N	--	--	--	0.34	--	--	--	--	180	ND (10)	1,300	420	410	--
PT7S	PT7S-M2W7-0821	08/11/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PT8D	PT8D-0521	05/04/2021	N	--	--	--	ND (0.1)	--	--	--	--	660	ND (10)	7,200	240	230	--
PT8D	PT8D-M2W7-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PT8D	PT8D-Q421	12/10/2021	N	--	--	--	ND (0.1)	--	--	--	--	--	--	--	200	200	--
PT8M	PT8M-0521	05/04/2021	N	--	--	--	3.3	--	--	--	--	600	ND (10)	3,000	ND (0.2)	9.3	--
PT8M	PT8M-M2W7-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PT8S	PT8S-0521	05/04/2021	N	--	--	--	34	--	--	--	--	69	ND (10)	860	ND (0.2)	ND (1.0)	--
PT8S	PT8S-M2W7-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PT9D	PT9D-0521	05/05/2021	N	--	--	--	ND (0.1)	--	--	--	--	100	ND (10)	6,700	4,900	5,100 J	--
PT9D	PT9D-M2W7-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PT9D	PT9D-Q421	12/10/2021	N	--	--	--	ND (0.1)	--	--	--	--	--	--	--	7,000	6,100	--
PT9M	PT9M-0521	05/05/2021	N	--	--	--	ND (0.1)	--	--	--	--	160	ND (10)	3,600	570	580 J	--
PT9M	PT9M-M2W7-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PT9M	PT9M-Q421	12/10/2021	N	--	--	--	ND (0.1)	--	--	--	--	--	--	--	64	87	--
PT9S	PT9S-0521	05/05/2021	N	--	--	--	0.77	--	--	--	--	160	ND (10)	860	28	29 J	--
PT9S	PT9S-M2W7-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PT9S	PT9S-Q421	12/10/2021	N	--	--	--	ND (0.1)	--	--	--	--	--	--	--	34	35	--
TW-01	TW-01-0421	06/10/2021	N	ND (50)	ND (0.2)	ND (0.5)	ND (0.1)	30	ND (0.5 J)	1.3 J	ND (0.5)	200	ND (10 J)	1,600	1,400	1,500	ND (0.5)
TW-01	MW-917-Q221	06/10/2021	FD	ND (50)	ND (0.2)	ND (0.5)	ND (0.1)	29	ND (0.5 J)	1.6 J	ND (0.5)	210	ND (10 J)	1,500	1,400	1,500	ND (0.5)
TW-01	TW-01-061521	06/15/2021	N	--	--	--	--	--	--	--	--	--	--	--	1,400	1,500	--
TW-01	TW-01-061621-0035	06/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-061621	06/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	1,400	1,500	--
TW-01	TW-01-061721-0025	06/17/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-061721	06/17/2021	N	--	--	--	--	--	--	--	--	--	--	--	1,400	1,500	--
TW-01	TW-01-061821-0130	06/18/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-061821	06/18/2021	N	--	--	--	--	--	--	--	--	--	--	--	1,400	1,500	--
TW-01	TW-01-061921-0125	06/19/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-061921	06/19/2021	N	--	--	--	--	--	--	--	--	--	--	--	1,500	1,500	--
TW-01	TW-01-062021-0130	06/20/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 12
TW-01 Groundwater Chemistry Sampling Results
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Sample Type	Aluminum, dissolved (µg/L)	Ammonia as nitrogen (mg/L)	Antimony, dissolved (µg/L)	Arsenic, dissolved (µg/L)	Barium, dissolved (µg/L)	Beryllium, dissolved (µg/L)	Boron, dissolved (mg/L)	Cadmium, dissolved (µg/L)	Calcium, dissolved (mg/L)	Caprolactam (µg/L)	Chloride (mg/L)	Chromium, Hexavalent (µg/L)	Chromium, total dissolved (µg/L)	Cobalt, dissolved (µg/L)
TW-01	TW-01-062021	06/20/2021	N	--	--	--	--	--	--	--	--	--	--	--	1,500	1,500	--
TW-01	TW-01-062121-0130	06/21/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-062121	06/21/2021	N	--	--	--	--	--	--	--	--	--	--	--	1,400	1,500	--
TW-01	TW-01-M1W1-0621	06/28/2021	N	ND (50)	ND (0.2)	ND (0.5)	ND (0.1)	32	ND (0.5 J)	1.2	ND (0.5)	200	--	1,500	1,500	1,600	ND (0.5)
TW-01	TW-01-M1W2-0621	07/08/2021	N	--	--	--	ND (0.1)	--	--	--	--	210	--	1,600	--	--	--
TW-01	TW-01-M1W3-0621	07/12/2021	N	--	--	--	ND (0.1)	--	--	--	--	210	--	1,600	1,500	1,700	--
TW-01	MW-928-Q221	07/12/2021	FD	--	--	--	ND (0.1)	--	--	--	--	210	--	1,600	1,500	1,700	--
TW-01	TW-01-M1W4-0621	07/20/2021	N	--	--	--	ND (0.1)	--	--	--	--	230	--	1,600	--	--	--
TW-01	TW-01-M1W5-0721	07/26/2021	N	--	--	--	ND (0.1)	--	--	--	--	230	--	1,600	1,400	1,500	--
TW-01	TW-01-M2W6-0821	08/03/2021	N	--	--	--	ND (0.1)	--	--	--	--	240	--	1,600	--	--	--
TW-01	TW-01-M2W7-0821	08/16/2021	N	ND (50)	ND (0.2)	ND (0.5)	ND (0.1)	35	ND (0.5 J)	1.3	ND (0.5)	230	--	1,700	1,400	1,400	ND (0.5)
TW-01	MW-918-M2W7-Q321	08/16/2021	FD	ND (50)	ND (0.2)	ND (0.5)	ND (0.1)	34	ND (0.5 J)	1.3	ND (0.5)	220	--	1,700	1,400	1,500	ND (0.5)
TW-01	TW-01-M2W9-0821	08/25/2021	N	--	--	--	ND (0.1 J)	--	--	--	--	250	--	1,700	--	--	--
TW-01	TW-01-M2W10-0821	09/01/2021	N	--	--	--	ND (0.1)	--	--	--	--	240	--	1,700	--	1,500 J	--
TW-01	TW-01-M2W10-090221	09/02/2021	N	--	--	--	--	--	--	--	--	--	--	--	1,200	--	--
TW-01	TW-01-M3W11-0921	09/09/2021	N	ND (50)	ND (0.2)	ND (0.5)	ND (0.1)	42	ND (0.5)	1.2	ND (0.5)	240	--	1,700	1,200	1,300	ND (0.5)
TW-01	MW-930-Q321	09/09/2021	FD	ND (50)	ND (0.2)	ND (0.5)	ND (0.1)	42	ND (0.5)	1.2	ND (0.5)	230	--	1,700	1,300	1,500	ND (0.5)
TW-01	TW-01-M3W12-0921	09/15/2021	N	--	--	--	ND (0.1)	--	--	--	--	240	--	1,700	--	--	--
TW-01	TW-01-M3W13-0921	09/23/2021	N	--	--	--	ND (0.1 J)	--	--	--	--	280 J	--	1,700	1,200	1,400 J	--
TW-01	MW-931-Q321	09/23/2021	FD	--	--	--	ND (0.1 J)	--	--	--	--	270 J	--	1,700	1,200	1,400 J	--
TW-01	TW-01-M3W14-0921	09/30/2021	N	--	--	--	ND (0.1 J)	--	--	--	--	310 J	--	1,700	--	--	--
TW-01	TW-01-M4W15-1021	10/07/2021	N	ND (50)	ND (0.2)	ND (0.5)	0.79	37	ND (0.5)	1.4	ND (0.5)	260	--	1,800	1,300	1,300	ND (0.5)
TW-01	MW-901-Q421	10/07/2021	FD	ND (50)	ND (0.2)	ND (0.5)	0.72	36	ND (0.5)	1.5	ND (0.5)	250	--	1,800	1,300	1,300	ND (0.5)
TW-01	TW-01-M4W17-1021	10/20/2021	N	--	--	--	0.92	--	--	--	--	270	--	1,800	1,300	1,400	--
TW-01	MW-902-Q421	10/20/2021	FD	--	--	--	1	--	--	--	--	290	--	1,800	1,300	1,400	--
TW-01	TW-01-M5W19-1121	11/02/2021	N	ND (50)	ND (0.2)	ND (0.5)	1.1	38	ND (0.5)	1.4	ND (0.5)	280	--	1,800	1,300	1,300	ND (0.5)
TW-01	MW-905-Q421	11/02/2021	FD	ND (50)	ND (0.2)	ND (0.5)	1	41	ND (0.5)	1.4	ND (0.5)	260	--	1,700	1,300	1,300	ND (0.5)
TW-01	TW-01-M5W20-1121	11/11/2021	N	--	--	--	--	--	--	--	--	--	--	--	1,300	--	--
TW-01	TW-01-M5W21-1121	11/15/2021	N	--	--	--	1.7	--	--	--	--	240	--	1,800	1,300	1,300	--
TW-01	TW-01-M5W22-1121	11/22/2021	N	--	--	--	--	--	--	--	--	--	--	--	1,200	--	--
TW-01	TW-01-M6W23-1221	12/02/2021	N	--	--	--	--	--	--	--	--	--	--	--	1,200	--	--
TW-01	TW-01-M6W24-1221	12/08/2021	N	--	--	--	--	--	--	--	--	--	--	--	1,200	--	--
TW-01	TW-01-Q421	12/08/2021	N	--	--	--	0.76	--	--	--	--	--	--	--	1,200	1,300	--

Table 12
TW-01 Groundwater Chemistry Sampling Results
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Sample Type	Copper, dissolved (µg/L)	Fluoride (mg/L)	Iron, dissolved (µg/L)	Lead, dissolved (µg/L)	Magnesium, dissolved (mg/L)	Manganese, dissolved (µg/L)	Mercury, dissolved (µg/L)	Molybdenum, dissolved (µg/L)	Nickel, dissolved (µg/L)	Nitrate/ Nitrite as Nitrogen (mg/L)	Oil and Grease (mg/L)	pH (SU)	Potassium, dissolved (mg/L)	Selenium, dissolved (µg/L)
MW-10	MW-10-0521	05/05/2021	N	--	--	--	--	--	0.57	--	17	--	8.8	--	--	13 J	6.3
MW-10	MW-10-M3W13-0921	09/22/2021	N	--	--	--	--	23 J	ND (0.5)	--	17 J	--	11	--	--	11	7.3
MW-10	MW-10-Q421	12/08/2021	N	--	--	--	--	--	1.3	--	15	--	11	--	--	--	6.1
MW-10	MW-916-Q421	12/08/2021	FD	--	--	--	--	--	1.1	--	15	--	11	--	--	--	6.2
MW-10D	MW-10D-0521	05/05/2021	N	--	--	--	--	--	ND (0.5)	--	1.6	--	12	--	--	16 J	6.9
MW-10D	MW-10D-Q221	05/19/2021	N	ND (1.0)	1.1	ND (20)	ND (1.0)	32 J	ND (0.5)	ND (0.2)	1.4	ND (1.0 J)	12	--	--	16 J	7.3
MW-10D	MW-10D-0821	08/24/2021	N	ND (1.0 J)	1.2	ND (20 J)	ND (1.0)	28	ND (0.5 J)	ND (0.2)	1.4	ND (1.0 J)	11	--	--	18 J	6.6
MW-10D	MW-10D-M3W13-0921	09/22/2021	N	--	--	--	--	22 J	ND (0.5)	--	1.4 J	--	9.5	--	--	12	6.6
MW-10D	MW-10D-Q421	12/08/2021	N	--	--	--	--	--	ND (0.5)	--	1.8	--	9.5	--	--	--	5.3
MW-24A	MW-24A-0521	05/05/2021	N	--	--	--	--	--	15	--	96	--	ND (0.05)	--	--	3.6 J	ND (0.5)
MW-24A	MW-24A-M2W7-0821	08/11/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-24A	MW-24A-Q421	12/09/2021	N	--	--	--	--	--	430	--	110	--	ND (0.1)	--	--	--	ND (0.5)
MW-24B	MW-24B-0521	05/05/2021	N	--	--	--	--	--	110	--	59	--	0.48	--	--	51 J	1.4
MW-24B	MW-24B-M2W7-0821	08/11/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-24B	MW-24B-Q421	12/09/2021	N	--	--	--	--	--	87	--	63	--	ND (0.1)	--	--	--	ND (0.5)
MW-24B	MW-919-Q421	12/09/2021	FD	--	--	--	--	--	87	--	64	--	ND (0.1)	--	--	--	ND (0.5)
MW-38D	MW-38D-0521	05/05/2021	N	--	--	--	--	--	20	--	87	--	0.075	--	--	50 J	ND (0.5)
MW-38D	MW-38D-M3W13-0921	09/22/2021	N	--	--	--	--	11 J	5.4	--	38 J	--	0.36	--	--	47	ND (0.5)
MW-38D	MW-38D-Q421	12/08/2021	N	--	--	--	--	--	5.3	--	58	--	1.5	--	--	--	0.83
MW-38S	MW-38S-0521	05/05/2021	N	--	--	--	--	--	53	--	15	--	5.9	--	--	6.4 J	4
MW-38S	MW-38S-Q321	08/27/2021	N	--	--	--	--	--	22	--	12	--	6.1	--	--	--	4.4
MW-38S	MW-38S-M3W13-0921	09/22/2021	N	--	--	--	--	3.3 J	14	--	16 J	--	6.1	--	--	3.7	2.2
MW-38S	MW-38S-Q421	12/08/2021	N	--	--	--	--	--	3.4	--	8.2	--	7	--	--	--	3.9
MW-66-165	MW-66-165-0521	05/05/2021	N	--	--	--	--	--	2.2	--	5.8	--	24	--	--	20 J	24
MW-66-165	MW-66-165-M3W13-0921	09/24/2021	N	--	--	--	--	37 J	4.8	--	6.7	--	19	--	--	13	17
MW-66-165	MW-66-165-Q421	12/07/2021	N	--	--	--	--	--	ND (0.5)	--	5.4	--	19	--	--	--	11
MW-66-230	MW-66-230-0521	05/05/2021	N	--	--	--	--	--	12	--	74	--	11	--	--	57 J	7.6
MW-66-230	MW-66-230-M3W13-0921	09/24/2021	N	--	--	--	--	5.3 J	14	--	76	--	8.8	--	--	56	7.1
MW-66-230	MW-66-230-Q421	12/07/2021	N	--	--	--	--	--	8.1	--	67	--	10	--	--	--	6.9
MW-66BR-270	MW-66BR-270-Q221	04/28/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-66BR-270	MW-66BR-270-0521	05/05/2021	N	--	--	--	--	--	1,000	--	1.9	--	ND (0.05)	--	--	52 J	ND (0.5)
MW-66BR-270	MW-66BR-270-M3W13-0921	10/08/2021	N	--	--	--	--	18	40	--	12	--	ND (0.1)	--	--	38	ND (0.5)
MW-66BR-270	MW-66BR-270-Q421	12/16/2021	N	--	--	--	--	--	820	--	--	--	--	--	--	--	--
MW-67-185	MW-67-185-0521	05/04/2021	N	--	--	--	--	--	ND (0.5)	--	5.6	--	100	--	--	20	430
MW-67-185	MW-918-Q221	05/04/2021	FD	--	--	--	--	--	ND (0.5)	--	5.6	--	95	--	--	20	430
MW-67-185	MW-67-185-RE-0521	05/19/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-67-185	MW-67-185-M3W13-0921	09/23/2021	N	--	--	--	--	29	1,600	--	89 J	--	0.12	--	--	18	54
MW-67-185	MW-67-185-Q421	12/07/2021	N	--	--	--	--	--	2,000	--	47	--	8.5	--	--	--	26
MW-67-225	MW-67-225-0521	05/04/2021	N	--	--	--	--	--	5.3	--	54	--	26	--	--	17	89
MW-67-225	MW-67-225-M3W13-0921	09/24/2021	N	--	--	--	--	6.3 J	32	--	72	--	32	--	--	16	72
MW-67-225	MW-67-225-Q421	12/07/2021	N	--	--	--	--	--	1.2	--	42	--	15	--	--	--	50
MW-68-180	MW-68-180-0521	05/04/2021	N	--	--	--	--	--	ND (0.5)	--	46	--	15	--	--	13	14
MW-68-180	MW-68-180-RE-0521	05/19/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-68-180	MW-68-180-M1-0621	06/28/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-68-180	MW-68-180-M1W5-0721	07/27/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-68-180	MW-68-180-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-68-180	MW-68-180-M2-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 12
TW-01 Groundwater Chemistry Sampling Results
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Sample Type	Copper, dissolved (µg/L)	Fluoride (mg/L)	Iron, dissolved (µg/L)	Lead, dissolved (µg/L)	Magnesium, dissolved (mg/L)	Manganese, dissolved (µg/L)	Mercury, dissolved (µg/L)	Molybdenum, dissolved (µg/L)	Nickel, dissolved (µg/L)	Nitrate/ Nitrite as Nitrogen (mg/L)	Oil and Grease (mg/L)	pH (SU)	Potassium, dissolved (mg/L)	Selenium, dissolved (µg/L)
MW-68-180	MW-68-180-M3W11-0921	09/09/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-68-180	MW-68-180-Q321	09/09/2021	N	--	--	--	--	--	1.4	--	55	--	34	--	--	--	25
MW-68-180	MW-68-180-M3W13-0921	09/23/2021	N	--	--	--	--	65	ND (0.5)	--	58 J	--	34	--	--	18	25
MW-68-180	MW-68-180-M4W15-1021	10/07/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-68-180	MW-68-180-M5W19-1121	11/02/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-68-180	MW-68-180-Q421	12/07/2021	N	--	--	--	--	--	ND (0.5)	--	50	--	27	--	--	--	15
MW-68-240	MW-68-240-0521	05/04/2021	N	--	--	--	--	--	23	--	24	--	4.2	--	--	38	4.1
MW-68-240	MW-68-240-M3W13-0921	09/23/2021	N	--	--	--	--	19	18	--	28 J	--	4.8	--	--	43	4.4
MW-68-240	MW-68-240-Q421	12/07/2021	N	--	--	--	--	--	12	--	25	--	5.1	--	--	--	3.9
MW-68-240	MW-925-Q421	12/07/2021	FD	--	--	--	--	--	12	--	24	--	5.1	--	--	--	3.4
MW-68BR-280	MW-68BR-280-0521	05/04/2021	N	--	--	--	--	--	55	--	24	--	ND (0.05)	--	--	44	ND (0.5)
MW-68BR-280	MW-68BR-280-M3W13-0921	09/23/2021	N	--	--	--	--	2.7	68	--	27 J	--	ND (0.1)	--	--	47	ND (0.5)
MW-68BR-280	MW-68BR-280-Q421	12/02/2021	N	--	--	--	--	--	60	--	--	--	--	--	--	--	--
PT7D	PT7D-0521	05/04/2021	N	--	--	--	--	--	7,400	--	43	--	ND (0.05)	--	--	34	ND (0.5)
PT7D	PT7D-M2W7-0821	08/11/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PT7M	PT7M-0521	05/04/2021	N	--	--	--	--	--	1,900	--	5.5	--	0.065	--	--	16	ND (0.5)
PT7M	PT7M-M2W7-0821	08/11/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PT7S	PT7S-0521	05/04/2021	N	--	--	--	--	--	12	--	7.1	--	4.8	--	--	13	4.5
PT7S	PT7S-M2W7-0821	08/11/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PT8D	PT8D-0521	05/04/2021	N	--	--	--	--	--	230	--	62	--	0.76	--	--	47	0.76
PT8D	PT8D-M2W7-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PT8D	PT8D-Q421	12/10/2021	N	--	--	--	--	--	270	--	--	--	--	--	--	--	--
PT8M	PT8M-0521	05/04/2021	N	--	--	--	--	--	6,100	--	9.2	--	0.48	--	--	21	ND (0.5)
PT8M	PT8M-M2W7-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PT8S	PT8S-0521	05/04/2021	N	--	--	--	--	--	650	--	41	--	1.1	--	--	7.6	2
PT8S	PT8S-M2W7-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PT9D	PT9D-0521	05/05/2021	N	--	--	--	--	--	2.3	--	88	--	3.5	--	--	44 J	3.3
PT9D	PT9D-M2W7-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PT9D	PT9D-Q421	12/10/2021	N	--	--	--	--	--	3.5	--	90	--	6.4	--	--	--	4.6
PT9M	PT9M-0521	05/05/2021	N	--	--	--	--	--	30	--	5.1	--	2.4	--	--	38 J	2.6
PT9M	PT9M-M2W7-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PT9M	PT9M-Q421	12/10/2021	N	--	--	--	--	--	110	--	7.2	--	7.2	--	--	--	5.7
PT9S	PT9S-0521	05/05/2021	N	--	--	--	--	--	970	--	18	--	2.6	--	--	9.5 J	1.8
PT9S	PT9S-M2W7-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PT9S	PT9S-Q421	12/10/2021	N	--	--	--	--	--	320	--	8.6	--	5	--	--	--	6
TW-01	TW-01-0421	06/10/2021	N	ND (1.0)	2.6	ND (20)	ND (1.0)	17	ND (0.5)	ND (0.2 J)	25	ND (5.0 J)	14	ND (4.1)	7.3	18 J	10
TW-01	MW-917-Q221	06/10/2021	FD	ND (1.0)	2.6	ND (20)	ND (1.0)	19	ND (0.5)	ND (0.2 J)	24	ND (5.0 J)	15	ND (4.0)	7.3	19 J	10
TW-01	TW-01-061521	06/15/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-061621-0035	06/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-061621	06/16/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-061721-0025	06/17/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-061721	06/17/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-061821-0130	06/18/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-061821	06/18/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-061921-0125	06/19/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-061921	06/19/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-062021-0130	06/20/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 12
TW-01 Groundwater Chemistry Sampling Results
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Sample Type	Copper, dissolved (µg/L)	Fluoride (mg/L)	Iron, dissolved (µg/L)	Lead, dissolved (µg/L)	Magnesium, dissolved (mg/L)	Manganese, dissolved (µg/L)	Mercury, dissolved (µg/L)	Molybdenum, dissolved (µg/L)	Nickel, dissolved (µg/L)	Nitrate/ Nitrite as Nitrogen (mg/L)	Oil and Grease (mg/L)	pH (SU)	Potassium, dissolved (mg/L)	Selenium, dissolved (µg/L)
TW-01	TW-01-062021	06/20/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-062121-0130	06/21/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-062121	06/21/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-M1W1-0621	06/28/2021	N	ND (1.0)	3.5	23 J	ND (1.0)	20 J	ND (0.5)	ND (0.2)	34 J	ND (5.0 J)	14	ND (4.0)	7.3	17	10
TW-01	TW-01-M1W2-0621	07/08/2021	N	--	--	--	--	24	ND (0.5)	--	35	--	14	--	--	19 J	11
TW-01	TW-01-M1W3-0621	07/12/2021	N	--	--	--	--	22 J	--	--	35	--	14	--	--	20 J	10
TW-01	MW-928-Q221	07/12/2021	FD	--	--	--	--	24 J	--	--	35	--	15	--	--	20 J	9.8
TW-01	TW-01-M1W4-0621	07/20/2021	N	--	--	--	--	22	ND (0.5)	--	30	--	13	--	--	17 J	11
TW-01	TW-01-M1W5-0721	07/26/2021	N	--	--	--	--	22	--	--	30	--	14	--	--	17 J	10
TW-01	TW-01-M2W6-0821	08/03/2021	N	--	--	--	--	25	ND (0.5)	--	30	--	13	--	--	18	12
TW-01	TW-01-M2W7-0821	08/16/2021	N	ND (1.0)	3.4	ND (20)	ND (1.0)	24 J	ND (0.5)	ND (0.2 J)	30	ND (5.0 J)	12	ND (4.0 J)	7.3	17	12
TW-01	MW-918-M2W7-Q321	08/16/2021	FD	ND (1.0)	3.2	ND (20)	ND (1.0)	24 J	ND (0.5)	ND (0.2 J)	29	ND (1.0 J)	13	ND (4.0 J)	7.3	24	12
TW-01	TW-01-M2W9-0821	08/25/2021	N	--	--	--	--	23	ND (0.5)	--	31	--	12	--	--	18	12
TW-01	TW-01-M2W10-0821	09/01/2021	N	--	3.5	--	--	23	ND (0.5)	--	22	--	12	--	--	18	9.2
TW-01	TW-01-M2W10-090221	09/02/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-M3W11-0921	09/09/2021	N	ND (1.0)	3.5	ND (20 J)	ND (1.0)	23 J	ND (0.5)	ND (0.2)	39	ND (1.0)	12	ND (4.0)	7.4	18	14
TW-01	MW-930-Q321	09/09/2021	FD	ND (1.0)	3.4	ND (20 J)	ND (1.0)	23 J	ND (0.5)	ND (0.2)	38	ND (1.0)	11	ND (4.0)	7.4	17	14
TW-01	TW-01-M3W12-0921	09/15/2021	N	--	--	--	--	23 J	ND (0.5)	--	37	--	12	--	--	20 J	14
TW-01	TW-01-M3W13-0921	09/23/2021	N	--	--	--	--	25	ND (0.5)	--	38 J	--	11	--	--	19	12
TW-01	MW-931-Q321	09/23/2021	FD	--	--	--	--	24	ND (0.5)	--	39 J	--	11	--	--	18	13
TW-01	TW-01-M3W14-0921	09/30/2021	N	--	--	--	--	30	ND (0.5)	--	40	--	15	--	--	20	14
TW-01	TW-01-M4W15-1021	10/07/2021	N	ND (1.0)	3.9	ND (20)	ND (1.0)	25	ND (0.5)	ND (0.2)	34	ND (5.0)	11	ND (4.0)	7.4	22	12
TW-01	MW-901-Q421	10/07/2021	FD	ND (1.0)	4.2	ND (20)	ND (1.0)	26	ND (0.5)	ND (0.2)	34	ND (1.0)	12	ND (4.0)	7.4	21	12
TW-01	TW-01-M4W17-1021	10/20/2021	N	--	--	--	--	26	ND (0.5)	--	33	--	11	--	--	19	13
TW-01	MW-902-Q421	10/20/2021	FD	--	--	--	--	27	ND (0.5)	--	34	--	11	--	--	20	14
TW-01	TW-01-M5W19-1121	11/02/2021	N	ND (1.0)	3.8	ND (20)	ND (1.0)	26	ND (0.5)	ND (0.2)	32	ND (5.0)	11	ND (4.1)	7.4	18	13
TW-01	MW-905-Q421	11/02/2021	FD	ND (1.0)	4.1	ND (20)	ND (1.0)	25	ND (0.5)	ND (0.2)	31	ND (1.0)	11	ND (4.1)	7.4	18	14
TW-01	TW-01-M5W20-1121	11/11/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-M5W21-1121	11/15/2021	N	--	--	--	--	24	--	--	32	--	11	--	--	18	13
TW-01	TW-01-M5W22-1121	11/22/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-M6W23-1221	12/02/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-M6W24-1221	12/08/2021	N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-Q421	12/08/2021	N	--	--	--	--	--	ND (0.5)	--	31	--	11	--	--	--	13

Table 12
TW-01 Groundwater Chemistry Sampling Results
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Sample Type	Silver, dissolved (µg/L)	Sodium, dissolved (mg/L)	Specific conductance (µS/cm)	Sulfate (mg/L)	Thallium, dissolved (µg/L)	Total dissolved solids (mg/L)	Total organic carbon (mg/L)	Total Suspended Solids (TSS) (mg/L)	Vanadium, dissolved (µg/L)	Zinc, dissolved (µg/L)
MW-10	MW-10-0521	05/05/2021	N	--	420	2,800	270	--	1,700	--	--	--	--
MW-10	MW-10-M3W13-0921	09/22/2021	N	--	500	3,000	280	--	1,800	--	--	--	--
MW-10	MW-10-Q421	12/08/2021	N	--	--	--	--	--	--	--	--	--	--
MW-10	MW-916-Q421	12/08/2021	FD	--	--	--	--	--	--	--	--	--	--
MW-10D	MW-10D-0521	05/05/2021	N	--	630	3,800	370	--	2,300	--	--	--	--
MW-10D	MW-10D-Q221	05/19/2021	N	ND (0.5)	590	--	380	ND (0.5)	2,300	ND (1.0)	--	12	ND (10)
MW-10D	MW-10D-0821	08/24/2021	N	ND (0.5)	630	--	370	ND (0.5)	2,200	ND (1.0)	--	14	ND (10)
MW-10D	MW-10D-M3W13-0921	09/22/2021	N	--	520	3,400	270	--	1,900	--	--	--	--
MW-10D	MW-10D-Q421	12/08/2021	N	--	--	--	--	--	--	--	--	--	--
MW-24A	MW-24A-0521	05/05/2021	N	--	400	1,700	180	--	990	--	--	--	--
MW-24A	MW-24A-M2W7-0821	08/11/2021	N	--	--	--	--	--	--	--	--	--	--
MW-24A	MW-24A-Q421	12/09/2021	N	--	--	--	--	--	--	--	--	--	--
MW-24B	MW-24B-0521	05/05/2021	N	--	5,600	19,000	760	--	13,000	--	--	--	--
MW-24B	MW-24B-M2W7-0821	08/11/2021	N	--	--	--	--	--	--	--	--	--	--
MW-24B	MW-24B-Q421	12/09/2021	N	--	--	--	--	--	--	--	--	--	--
MW-24B	MW-919-Q421	12/09/2021	FD	--	--	--	--	--	--	--	--	--	--
MW-38D	MW-38D-0521	05/05/2021	N	--	5,700	21,000	720	--	12,000 J	--	--	--	--
MW-38D	MW-38D-M3W13-0921	09/22/2021	N	--	5,300	21,000	700	--	13,000	--	--	--	--
MW-38D	MW-38D-Q421	12/08/2021	N	--	--	--	--	--	--	--	--	--	--
MW-38S	MW-38S-0521	05/05/2021	N	--	320	1,700	150	--	920	--	--	--	--
MW-38S	MW-38S-Q321	08/27/2021	N	--	--	1,600	--	--	--	--	--	--	--
MW-38S	MW-38S-M3W13-0921	09/22/2021	N	--	190	1,000	81	--	580	--	--	--	--
MW-38S	MW-38S-Q421	12/08/2021	N	--	--	--	--	--	--	--	--	--	--
MW-66-165	MW-66-165-0521	05/05/2021	N	--	530	3,900	450	--	2,300	--	--	--	--
MW-66-165	MW-66-165-M3W13-0921	09/24/2021	N	--	490	3,000	360	--	2,100	--	--	--	--
MW-66-165	MW-66-165-Q421	12/07/2021	N	--	--	--	--	--	--	--	--	--	--
MW-66-230	MW-66-230-0521	05/05/2021	N	--	5,300	19,000	1,000	--	12,000	--	--	--	--
MW-66-230	MW-66-230-M3W13-0921	09/24/2021	N	--	5,200	19,000	990	--	13,000	--	--	--	--
MW-66-230	MW-66-230-Q421	12/07/2021	N	--	--	--	--	--	--	--	--	--	--
MW-66BR-270	MW-66BR-270-Q221	04/28/2021	N	--	--	--	--	--	--	--	--	--	--
MW-66BR-270	MW-66BR-270-0521	05/05/2021	N	--	4,700	17,000	290	--	10,000	--	--	--	--
MW-66BR-270	MW-66BR-270-M3W13-0921	10/08/2021	N	--	3,600	15,000	250	--	9,200	--	--	--	--
MW-66BR-270	MW-66BR-270-Q421	12/16/2021	N	--	--	--	--	--	--	--	--	--	--
MW-67-185	MW-67-185-0521	05/04/2021	N	--	920 J	7,700	590	--	5,300	--	--	--	--
MW-67-185	MW-918-Q221	05/04/2021	FD	--	940 J	7,700	580	--	6,100	--	--	--	--
MW-67-185	MW-67-185-RE-0521	05/19/2021	N	--	--	--	--	--	--	--	--	--	--
MW-67-185	MW-67-185-M3W13-0921	09/23/2021	N	--	330	3,800	360	--	2,100	--	--	--	--
MW-67-185	MW-67-185-Q421	12/07/2021	N	--	--	--	--	--	--	--	--	--	--
MW-67-225	MW-67-225-0521	05/04/2021	N	--	1,600 J	6,700	1,100	--	4,700	--	--	--	--
MW-67-225	MW-67-225-M3W13-0921	09/24/2021	N	--	1,400	5,400	990	--	4,000	--	--	--	--
MW-67-225	MW-67-225-Q421	12/07/2021	N	--	--	--	--	--	--	--	--	--	--
MW-68-180	MW-68-180-0521	05/04/2021	N	--	550 J	4,100	1,100	--	3,000	--	--	--	--
MW-68-180	MW-68-180-RE-0521	05/19/2021	N	--	--	--	--	--	--	--	--	--	--
MW-68-180	MW-68-180-M1-0621	06/28/2021	N	--	--	--	--	--	--	--	--	--	--
MW-68-180	MW-68-180-M1W5-0721	07/27/2021	N	--	--	--	--	--	--	--	--	--	--
MW-68-180	MW-68-180-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--
MW-68-180	MW-68-180-M2-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--

Table 12
TW-01 Groundwater Chemistry Sampling Results
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PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Sample Type	Silver, dissolved (µg/L)	Sodium, dissolved (mg/L)	Specific conductance (µS/cm)	Sulfate (mg/L)	Thallium, dissolved (µg/L)	Total dissolved solids (mg/L)	Total organic carbon (mg/L)	Total Suspended Solids (TSS) (mg/L)	Vanadium, dissolved (µg/L)	Zinc, dissolved (µg/L)
MW-68-180	MW-68-180-M3W11-0921	09/09/2021	N	--	--	--	--	--	--	--	--	--	--
MW-68-180	MW-68-180-Q321	09/09/2021	N	--	--	5,600	--	--	--	--	--	--	--
MW-68-180	MW-68-180-M3W13-0921	09/23/2021	N	--	680	5,700	1,400	--	4,300	--	--	--	--
MW-68-180	MW-68-180-M4W15-1021	10/07/2021	N	--	--	--	--	--	--	--	--	--	--
MW-68-180	MW-68-180-M5W19-1121	11/02/2021	N	--	--	--	--	--	--	--	--	--	--
MW-68-180	MW-68-180-Q421	12/07/2021	N	--	--	--	--	--	--	--	--	--	--
MW-68-240	MW-68-240-0521	05/04/2021	N	--	4,200 J	16,000	880	--	11,000	--	--	--	--
MW-68-240	MW-68-240-M3W13-0921	09/23/2021	N	--	4,300	17,000	890	--	11,000	--	--	--	--
MW-68-240	MW-68-240-Q421	12/07/2021	N	--	--	--	--	--	--	--	--	--	--
MW-68-240	MW-925-Q421	12/07/2021	FD	--	--	--	--	--	--	--	--	--	--
MW-68BR-280	MW-68BR-280-0521	05/04/2021	N	--	5,400 J	20,000	690	--	13,000	--	--	--	--
MW-68BR-280	MW-68BR-280-M3W13-0921	09/23/2021	N	--	5,900	22,000	670	--	13,000	--	--	--	--
MW-68BR-280	MW-68BR-280-Q421	12/02/2021	N	--	--	--	--	--	--	--	--	--	--
PT7D	PT7D-0521	05/04/2021	N	--	5,400 J	20,000	700	--	13,000	--	--	--	--
PT7D	PT7D-M2W7-0821	08/11/2021	N	--	--	--	--	--	--	--	--	--	--
PT7M	PT7M-0521	05/04/2021	N	--	1,700 J	8,500	3	--	5,600	--	--	--	--
PT7M	PT7M-M2W7-0821	08/11/2021	N	--	--	--	--	--	--	--	--	--	--
PT7S	PT7S-0521	05/04/2021	N	--	900 J	4,700	360	--	2,900	--	--	--	--
PT7S	PT7S-M2W7-0821	08/11/2021	N	--	--	--	--	--	--	--	--	--	--
PT8D	PT8D-0521	05/04/2021	N	--	5,500 J	20,000	780	--	12,000 J	--	--	--	--
PT8D	PT8D-M2W7-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--
PT8D	PT8D-Q421	12/10/2021	N	--	--	--	--	--	--	--	--	--	--
PT8M	PT8M-0521	05/04/2021	N	--	3,100 J	9,200	720	--	6,300	--	--	--	--
PT8M	PT8M-M2W7-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--
PT8S	PT8S-0521	05/04/2021	N	--	660 J	3,300	250	--	1,900	--	--	--	--
PT8S	PT8S-M2W7-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--
PT9D	PT9D-0521	05/05/2021	N	--	5,200	19,000	960	--	13,000	--	--	--	--
PT9D	PT9D-M2W7-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--
PT9D	PT9D-Q421	12/10/2021	N	--	--	--	--	--	--	--	--	--	--
PT9M	PT9M-0521	05/05/2021	N	--	2,500	11,000	690	--	8,700	--	--	--	--
PT9M	PT9M-M2W7-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--
PT9M	PT9M-Q421	12/10/2021	N	--	--	--	--	--	--	--	--	--	--
PT9S	PT9S-0521	05/05/2021	N	--	550	3,200	270	--	1,900	--	--	--	--
PT9S	PT9S-M2W7-0821	08/16/2021	N	--	--	--	--	--	--	--	--	--	--
PT9S	PT9S-Q421	12/10/2021	N	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-0421	06/10/2021	N	ND (0.5)	1,100	5,600	550	ND (0.5)	3,600	ND (1.0)	ND (5.0)	9.3	ND (10)
TW-01	MW-917-Q221	06/10/2021	FD	ND (0.5)	1,200	5,600	540	ND (0.5)	3,600	ND (1.0)	ND (5.0)	9.3	ND (10)
TW-01	TW-01-061521	06/15/2021	N	--	--	5,700	--	--	3,600	--	--	--	--
TW-01	TW-01-061621-0035	06/16/2021	N	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-061621	06/16/2021	N	--	--	5,700	--	--	3,500	--	--	--	--
TW-01	TW-01-061721-0025	06/17/2021	N	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-061721	06/17/2021	N	--	--	5,700	--	--	3,600	--	--	--	--
TW-01	TW-01-061821-0130	06/18/2021	N	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-061821	06/18/2021	N	--	--	5,700	--	--	3,600	--	--	--	--
TW-01	TW-01-061921-0125	06/19/2021	N	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-061921	06/19/2021	N	--	--	5,400	--	--	3,600	--	--	--	--
TW-01	TW-01-062021-0130	06/20/2021	N	--	--	--	--	--	--	--	--	--	--

Table 12
TW-01 Groundwater Chemistry Sampling Results
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Location ID	Sample ID	Sample Date	Sample Type	Silver, dissolved (µg/L)	Sodium, dissolved (mg/L)	Specific conductance (µS/cm)	Sulfate (mg/L)	Thallium, dissolved (µg/L)	Total dissolved solids (mg/L)	Total organic carbon (mg/L)	Total Suspended Solids (TSS) (mg/L)	Vanadium, dissolved (µg/L)	Zinc, dissolved (µg/L)
TW-01	TW-01-062021	06/20/2021	N	--	--	5,400	--	--	3,600	--	--	--	--
TW-01	TW-01-062121-0130	06/21/2021	N	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-062121	06/21/2021	N	--	--	5,200	--	--	3,300	--	--	--	--
TW-01	TW-01-M1W1-0621	06/28/2021	N	ND (0.5)	1,100	5,700	530	ND (0.5)	3,600	ND (10)	ND (5.0)	11	ND (10)
TW-01	TW-01-M1W2-0621	07/08/2021	N	--	1,000	--	530	--	--	--	--	--	--
TW-01	TW-01-M1W3-0621	07/12/2021	N	--	1,000	5,500	520	--	3,800	--	--	--	--
TW-01	MW-928-Q221	07/12/2021	FD	--	1,100	5,400	520	--	3,700	--	--	--	--
TW-01	TW-01-M1W4-0621	07/20/2021	N	--	1,200	--	510	--	--	--	--	--	--
TW-01	TW-01-M1W5-0721	07/26/2021	N	--	1,200	5,200	510	--	3,900	--	--	--	--
TW-01	TW-01-M2W6-0821	08/03/2021	N	--	1,100	--	520	--	--	--	--	--	--
TW-01	TW-01-M2W7-0821	08/16/2021	N	ND (0.5)	1,100	6,700	530	ND (0.5)	4,000	ND (5.0)	ND (5.0)	10	ND (10)
TW-01	MW-918-M2W7-Q321	08/16/2021	FD	ND (0.5)	1,300	6,600	530	ND (0.5)	3,900	ND (1.0)	ND (5.0)	10	ND (10)
TW-01	TW-01-M2W9-0821	08/25/2021	N	--	1,100	--	510	--	--	--	--	--	--
TW-01	TW-01-M2W10-0821	09/01/2021	N	--	1,200	6,200	510	--	4,000	--	--	--	--
TW-01	TW-01-M2W10-090221	09/02/2021	N	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-M3W11-0921	09/09/2021	N	ND (0.5)	700 J	6,400	510	ND (0.5)	4,000	ND (1.0)	ND (5.0)	14	ND (10)
TW-01	MW-930-Q321	09/09/2021	FD	ND (0.5)	1,300 J	6,400	500	ND (0.5)	4,100	ND (1.0)	ND (5.0)	14	ND (10)
TW-01	TW-01-M3W12-0921	09/15/2021	N	--	1,200 J	--	520	--	--	--	--	--	--
TW-01	TW-01-M3W13-0921	09/23/2021	N	--	1,200	6,500	520	--	4,100	--	--	--	--
TW-01	MW-931-Q321	09/23/2021	FD	--	1,200	6,500	510	--	3,900	--	--	--	--
TW-01	TW-01-M3W14-0921	09/30/2021	N	--	1,300	--	540	--	--	--	--	--	--
TW-01	TW-01-M4W15-1021	10/07/2021	N	ND (0.5)	1,200	6,200	520	ND (0.5)	3,800	ND (1.0)	ND (5.0)	12	ND (10)
TW-01	MW-901-Q421	10/07/2021	FD	ND (0.5)	1,200	6,400	510	ND (0.5)	4,000	ND (1.0)	ND (5.0)	12	ND (10)
TW-01	TW-01-M4W17-1021	10/20/2021	N	--	1,200	5,800	510	--	3,900	--	--	--	--
TW-01	MW-902-Q421	10/20/2021	FD	--	1,300	5,800	520	--	3,900	--	--	--	--
TW-01	TW-01-M5W19-1121	11/02/2021	N	ND (0.5)	1,300	6,300	510	ND (0.5)	3,900	ND (1.0)	ND (5.0)	13	ND (10)
TW-01	MW-905-Q421	11/02/2021	FD	ND (0.5)	1,600	6,300	510	ND (0.5)	4,000	ND (1.0)	ND (5.0)	13	ND (10)
TW-01	TW-01-M5W20-1121	11/11/2021	N	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-M5W21-1121	11/15/2021	N	--	1,200	6,500	500	--	3,800	--	--	--	--
TW-01	TW-01-M5W22-1121	11/22/2021	N	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-M6W23-1221	12/02/2021	N	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-M6W24-1221	12/08/2021	N	--	--	--	--	--	--	--	--	--	--
TW-01	TW-01-Q421	12/08/2021	N	--	--	--	--	--	--	--	--	--	--

Notes:
-- = not applicable.
µg/L = micrograms per liter.
µS/cm = microSiemens per centimeter.
FD = field duplicate.
ID = identification.
J = concentration or reporting limit (RL) estimated by laboratory or data validation.
mg/L = milligrams per liter.
ND = not detected at listed reporting limit.
SU = standard units.

Table 14
Aquifer Coefficient Summary for the TW-03 Aquifer Testing
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Well	Method1	Transmissivity (ft^2/day)	Storativity	Specific Yield	Hydraulic Conductivity (ft/day)	Horizontal to Vertical Conductivity Ratio
MW-20-70	Neuman	9,100	0.00016	0.0012	83.2	17.1
MW-20-70	Tartakovsky-Neuman	3,100	0.00025	0.013	28.3	28.6
MW-20-100	Neuman	3,300	0.00022	0.03	30.2	57.0
MW-20-100	Tartakovsky-Neuman	3,200	0.00017	0.04	29.3	33.3
MW-20-130	Neuman	3,300	0.0006	0.053	30.2	21.3
MW-20-130	Tartakovsky-Neuman	3,500	0.00043	0.054	32.0	22.2
MW-31-60	Neuman	4,600	0.00092	0.04	42.0	64.8
MW-31-60	Tartakovsky-Neuman	6,000	0.00092	0.038	54.8	76.9
MW-31-135	Neuman	4,300	0.00037	0.068	39.3	17.0
MW-31-135	Tartakovsky-Neuman	4,500	0.0003	0.055	41.1	15.9
MW-36-90	Neuman	2,500	0.00015	0.087	22.9	20.7
MW-36-90	Tartakovsky-Neuman	3,200	0.00014	0.095	29.3	25.0
MW-36-100	Neuman	2,400	0.00017	0.09	21.9	18.5
MW-36-100	Tartakovsky-Neuman	3,000	0.00015	0.1	27.4	21.7
MW-39-40	Neuman	3,900	0.00031	0.084	35.6	46.1

Table 14
Aquifer Coefficient Summary for the TW-03 Aquifer Testing
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Well	Method1	Transmissivity (ft^2/day)	Storativity	Specific Yield	Hydraulic Conductivity (ft/day)	Horizontal to Vertical Conductivity Ratio
MW-39-40	Tartakovsky-Neuman	4,500	0.00025	0.12	41.1	50.8
MW-39-60	Neuman	5,100	0.00021	0.042	46.6	92.2
MW-39-60	Tartakovsky-Neuman	5,100	0.00024	0.04	46.6	52.6
MW-39-70	Neuman	3,800	0.00011	0.039	34.7	77.3
MW-39-70	Tartakovsky-Neuman	3,700	0.0001	0.1	33.8	62.5
MW-39-80	Neuman	4,000	0.00015	0.035	36.6	49.7
MW-39-80	Tartakovsky-Neuman	4,200	0.00013	0.041	38.4	50.0
MW-39-100	Neuman	5,800	0.00023	0.02	53.0	73.5
MW-39-100	Tartakovsky-Neuman	5,800	0.00018	0.016	53.0	62.5
MW-44-125	Neuman	3,900	0.00067	0.09	35.6	17.3
MW-44-125	Tartakovsky-Neuman	4,700	0.00071	0.1	43.0	20.0
MW-77-046	Neuman	4,500	0.001	0.077	41.1	27.6
MW-77-046	Tartakovsky-Neuman	5,900	0.0013	0.084	53.9	23.3
MW-77-102	Neuman	4,600	0.0005	0.065	42.0	18.4
MW-77-102	Tartakovsky-Neuman	4,800	0.0004	0.055	43.9	17.2

Table 14
Aquifer Coefficient Summary for the TW-03 Aquifer Testing
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Well	Method1	Transmissivity (ft^2/day)	Storativity	Specific Yield	Hydraulic Conductivity (ft/day)	Horizontal to Vertical Conductivity Ratio
MW-77-158	Neuman	5,300	0.00068	0.06	48.4	18.8
MW-77-158	Tartakovsky-Neuman	5,300	0.00054	0.057	48.4	16.9
MW-77-187	Neuman	6,900	0.0013	0.08	63.1	15.4
MW-77-187	Tartakovsky-Neuman	7,500	0.0013	0.049	68.6	15.4
MW-78-072	Neuman	4,200	0.00061	0.016	38.4	75.2
MW-78-072	Tartakovsky-Neuman	4,300	0.00076	0.032	39.3	20.0
MW-78-142	Neuman	8,200	0.00063	0.13	75.0	57.8
MW-78-142	Tartakovsky-Neuman	5,000	0.00032	0.012	45.7	17.9
MW-81-43	Neuman	3,500	0.0009	0.06	32.0	27.5
MW-81-43	Tartakovsky-Neuman	4,800	0.0009	0.06	43.9	25.0
MW-81-98	Neuman	4,500	0.00035	0.045	41.1	19.6
MW-81-98	Tartakovsky-Neuman	4,500	0.00028	0.042	41.1	17.2
PT-5M	Neuman	3,100	0.00030	0.092	28.3	21.4
PT-5M	Tartakovsky-Neuman	3,500	0.00026	0.11	32.0	23.8
PT-5D	Neuman	4,200	0.00032	0.055	38.4	26.3

Table 14
Aquifer Coefficient Summary for the TW-03 Aquifer Testing
TW-01 Aquifer Test Report
PG&E Topock Compressor Station, Needles, California

Well	Method1	Transmissivity (ft^2/day)	Storativity	Specific Yield	Hydraulic Conductivity (ft/day)	Horizontal to Vertical Conductivity Ratio
PT-5D	Tartakovsky-Neuman	4,200	0.00026	0.082	38.4	23.8
IRZ-21	Neuman	9,300	0.0055	0.028	85.0	12.4
IRZ-21	Tartakovsky-Neuman	9,700	0.0062	0.0065	88.7	12.0
IRZ-23	Neuman	6,800	0.00021	0.01	62.2	42.5
IRZ-23	Tartakovsky-Neuman	6,200	0.00019	0.011	56.7	43.5
IRZ-25	Neuman	6,800	0.00039	0.013	62.2	42.5
IRZ-25	Tartakovsky-Neuman	6,300	0.00036	0.011	57.6	25.0
Distance-Drawdown	Jacob	3,200	-----	0.035	29.3	-----
Geometric Mean		***4,610***	***0.00039***	***0.041***	***42.1***	***29.1***

Figures

LEGEND

- Groundwater Monitoring Well
- Groundwater Well Completed in Bedrock
- Remediation Well
- Test Well
- Property Line

- AOC 5
- AOC 6
- AOC 15
- AOC 19

Notes:
1. AOC = Area of Concern
2. NTH = National Trails Highway

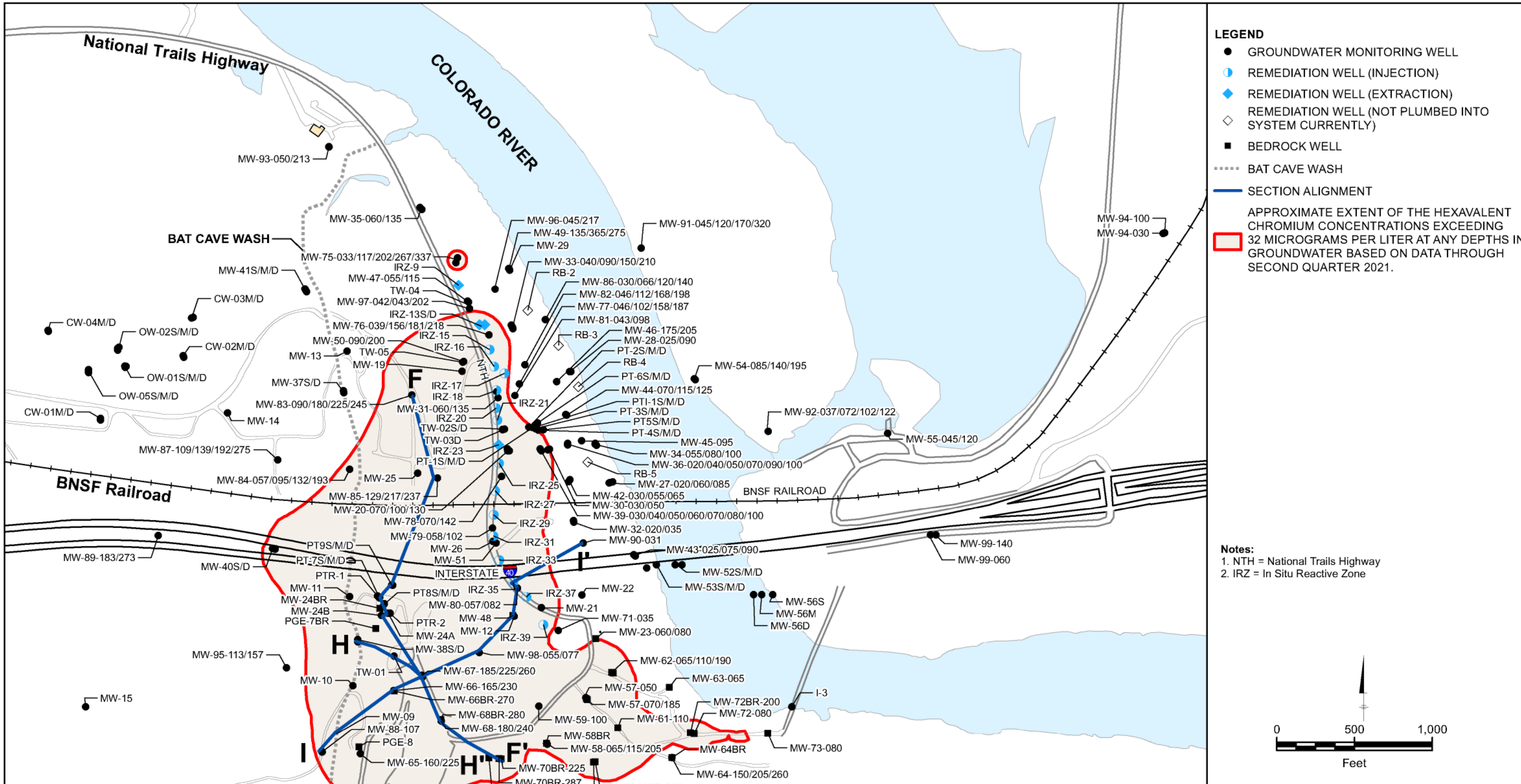
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

AREA OF CONCERN 5, 6, 15, AND 19 LOCATION MAP

ARCADIS

FIGURE
1

T:_ENV\PGE_TOPOCK\GEC\MXD\GMP\TOPOCK_TW-01_PUMP_TEST_REPORT_FIGURES\FINAL\FIGURE1_AOC.MXD 6/15/2022 4:28:16 PM

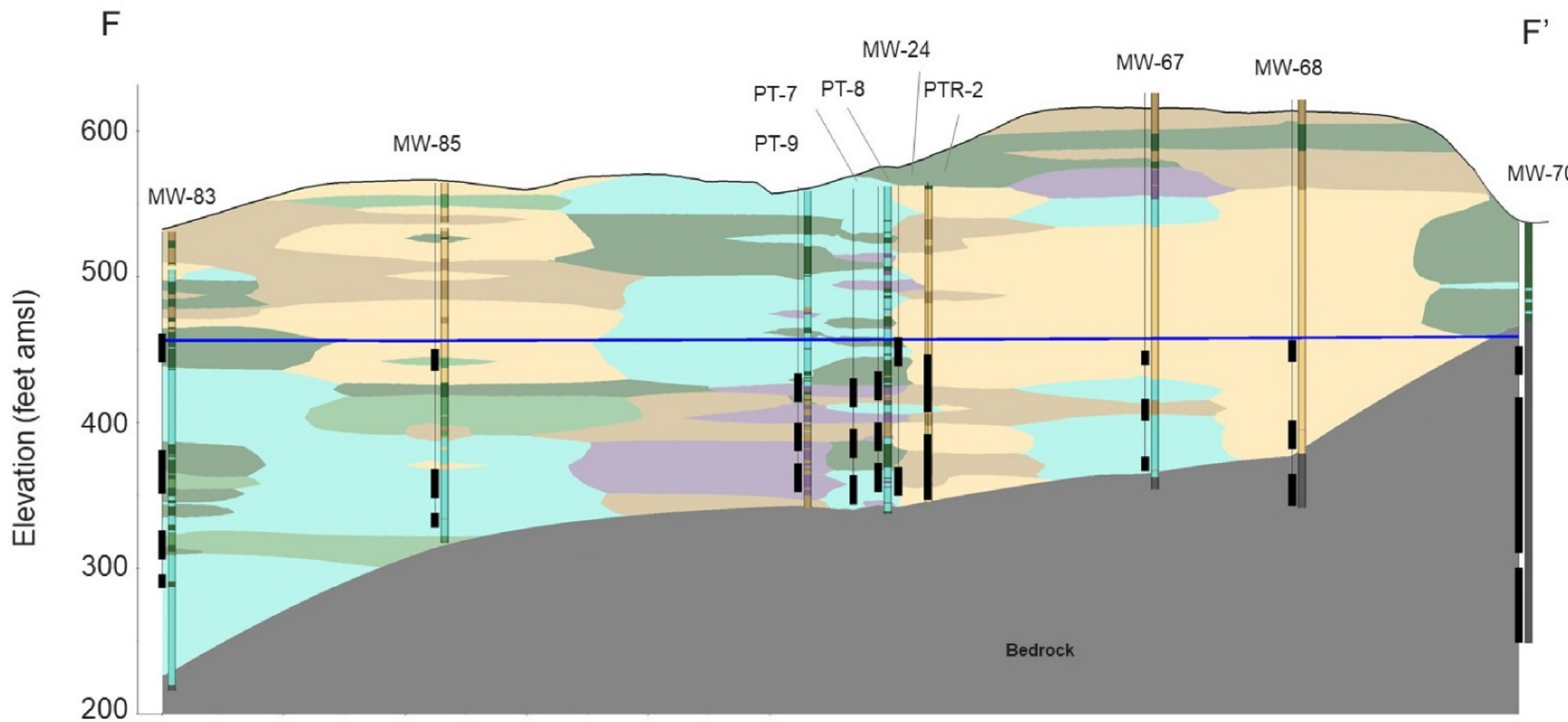


PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CROSS-SECTION ALIGNMENTS

ARCADIS

FIGURE
2



LEGEND

USCS Soil Types

- GP-GW (Gravel)
- SP-SW (Sand)
- GM (Silty Gravel)
- SM (Silty Sand)
- ML-MH (Silt)
- CL-CH (Clay)
- Bedrock

- Well screen

Notes

Vertical exaggeration 3:1.

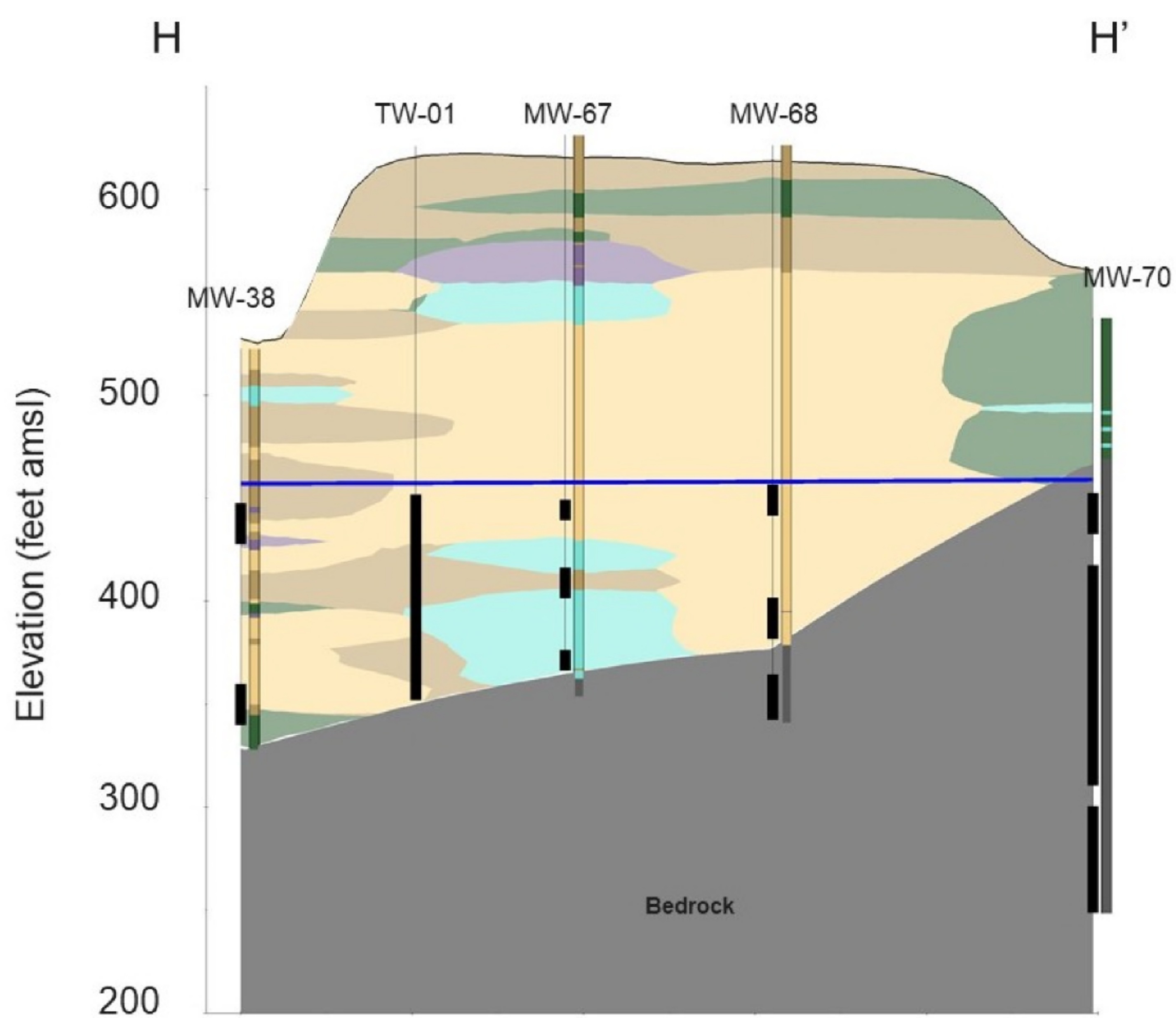
amsl = above mean sea level
USCS = Unified Soil Classification System

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

GEOLOGICAL CROSS-SECTION F-F'

ARCADIS

FIGURE
3



LEGEND

USCS Soil Types

- GP-GW (Gravel)
- SP-SW (Sand)
- GM (Silty Gravel)
- SM (Silty Sand)
- ML-MH (Silt)
- CL-CH (Clay)
- Bedrock

- Well screen

Notes

Vertical exaggeration 3:1.

amsl = above mean sea level
USCS = Unified Soil Classification System

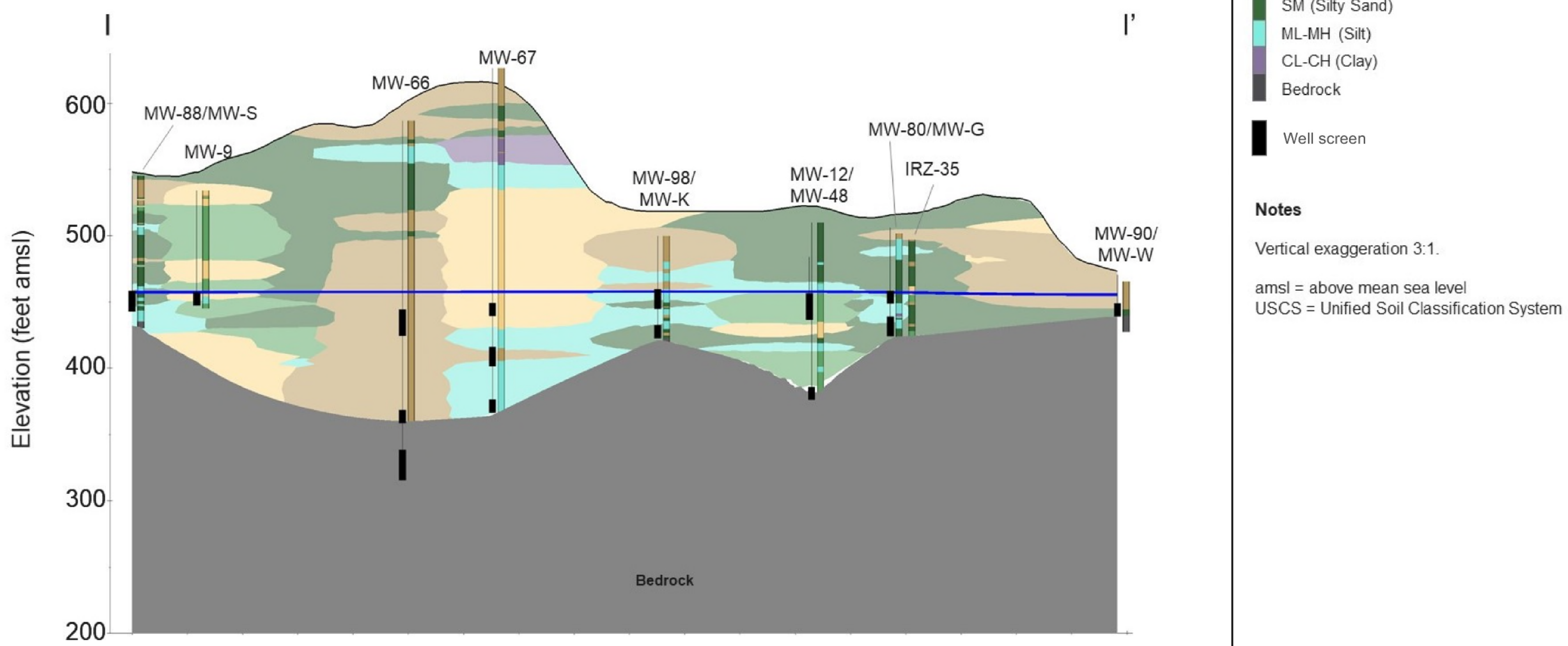
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

GEOLOGICAL CROSS-SECTION H-H'

ARCADIS

FIGURE
4

T:_ENV\PGE_TOPOCK\GEC\MXD\GMP\TOPOCK_TW-01_PUMP_TEST_REPORT_FIGURES\FINAL\FIGURE4_GEOLOGICAL_CROSS-SECTION_H-H.MXD PSI01045 2/28/2022 1:41:03 PM

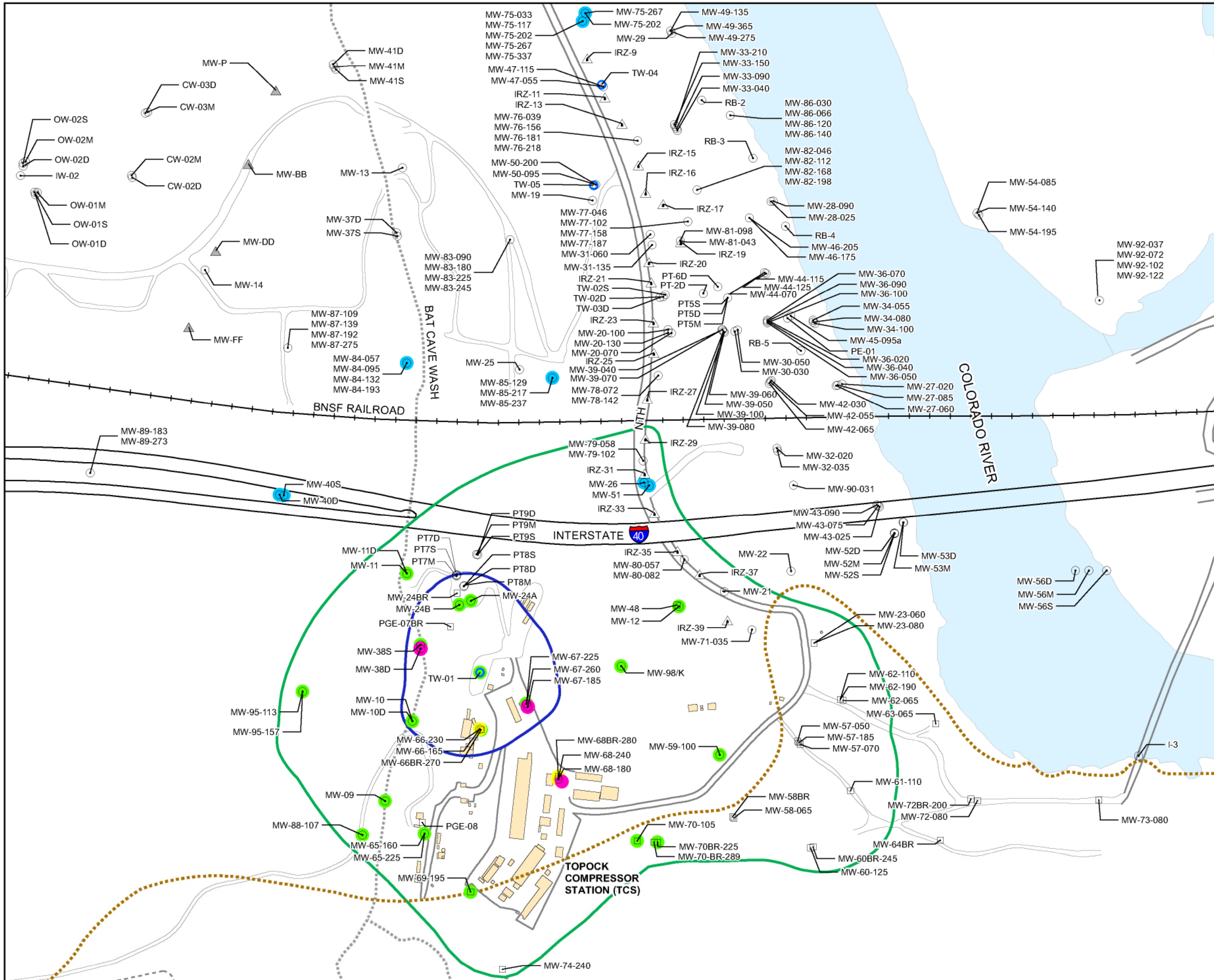


PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

GEOLOGICAL CROSS-SECTION I-I'

ARCADIS

FIGURE
5



LEGEND

- Groundwater Monitoring Well
- Groundwater Well Completed in Bedrock
- Remediation Well
- Test Well
- Wells with an AquaTROLL 600
- Wells with an Levelogger 5 LTC
- Location of Datalogger and Receive Tracer
- Wells with a Levelogger 5
- Monitoring Well Area 1
- Monitoring Well Area 2
- Bat Cave Wash
- Approximate bedrock contact at 455 feet above mean sea level.

MW-68-180: datalogger and tracer injection planned to follow TW-01 pump test

0 250 500

Feet

Notes:
1. NTH = National Trail Highway
2. LTC = Level, Temperature, Conductivity

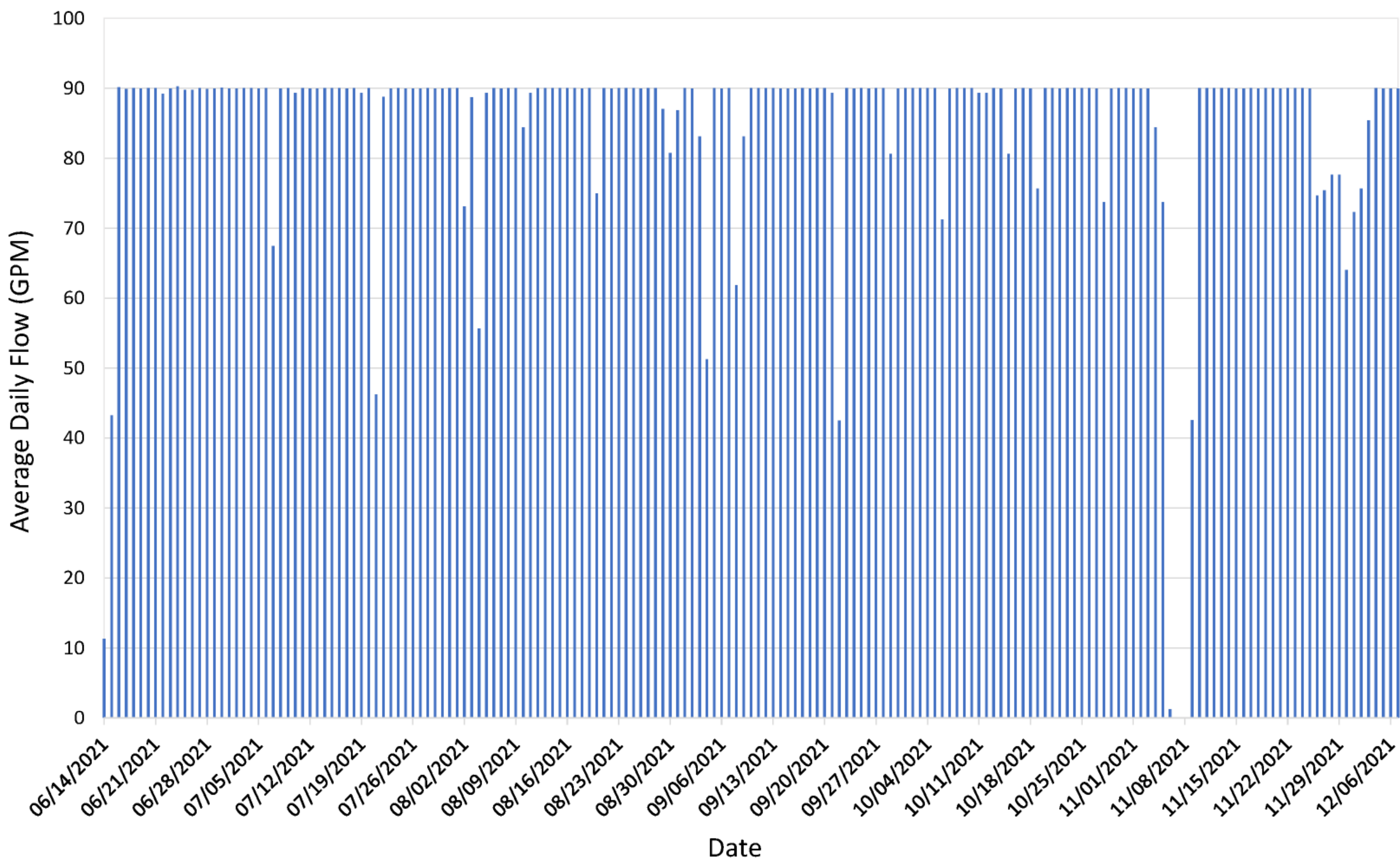
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

DATALOGGER AND TRACER INJECTION LOCATION MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURE 6

T:_ENV\PGE_TOPOCK\GEC\MXD\GMP\TOPOCK_TW-01_PUMP_TEST_REPORT_FIGURES\FINAL\FIGURE6_DATALOGGER AND TRACER INJECTION LOCATION MAP.MXD 3/24/2022 3:40:31 PM



NOTES:

1. Average flow rate of the constant rate test : 85.4 GPM

2. The TW-01 pump was shut-off during the pump test at various dates due to scheduled maintenance or equipment issues.

3. Typically, the pump was brought back on-line within several hours.

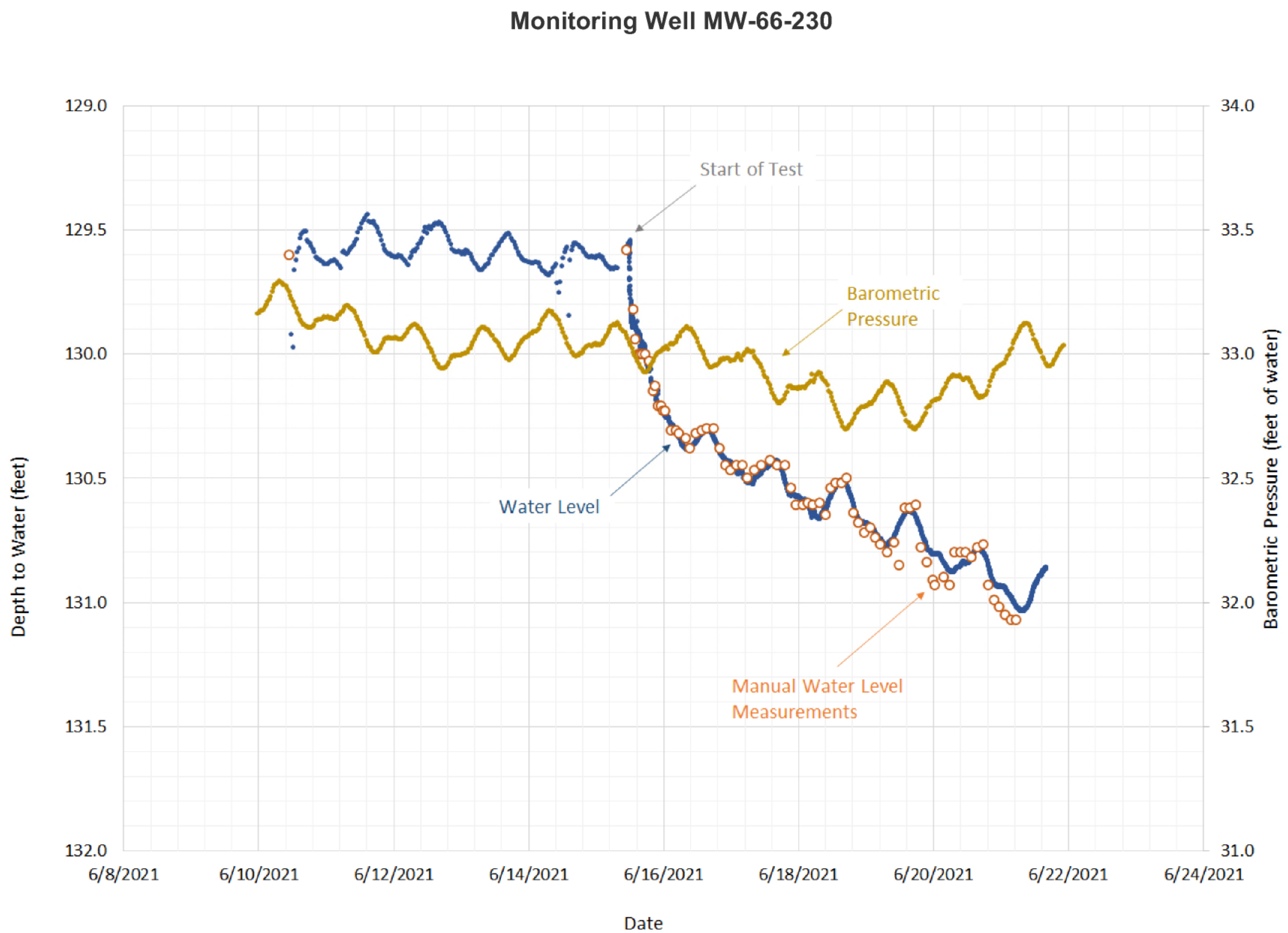
4. GPM - Gallons per Minute

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

SUMMARY OF CONSTANT RATE TEST FLOW MEASUREMENTS

ARCADIS

FIGURE
7



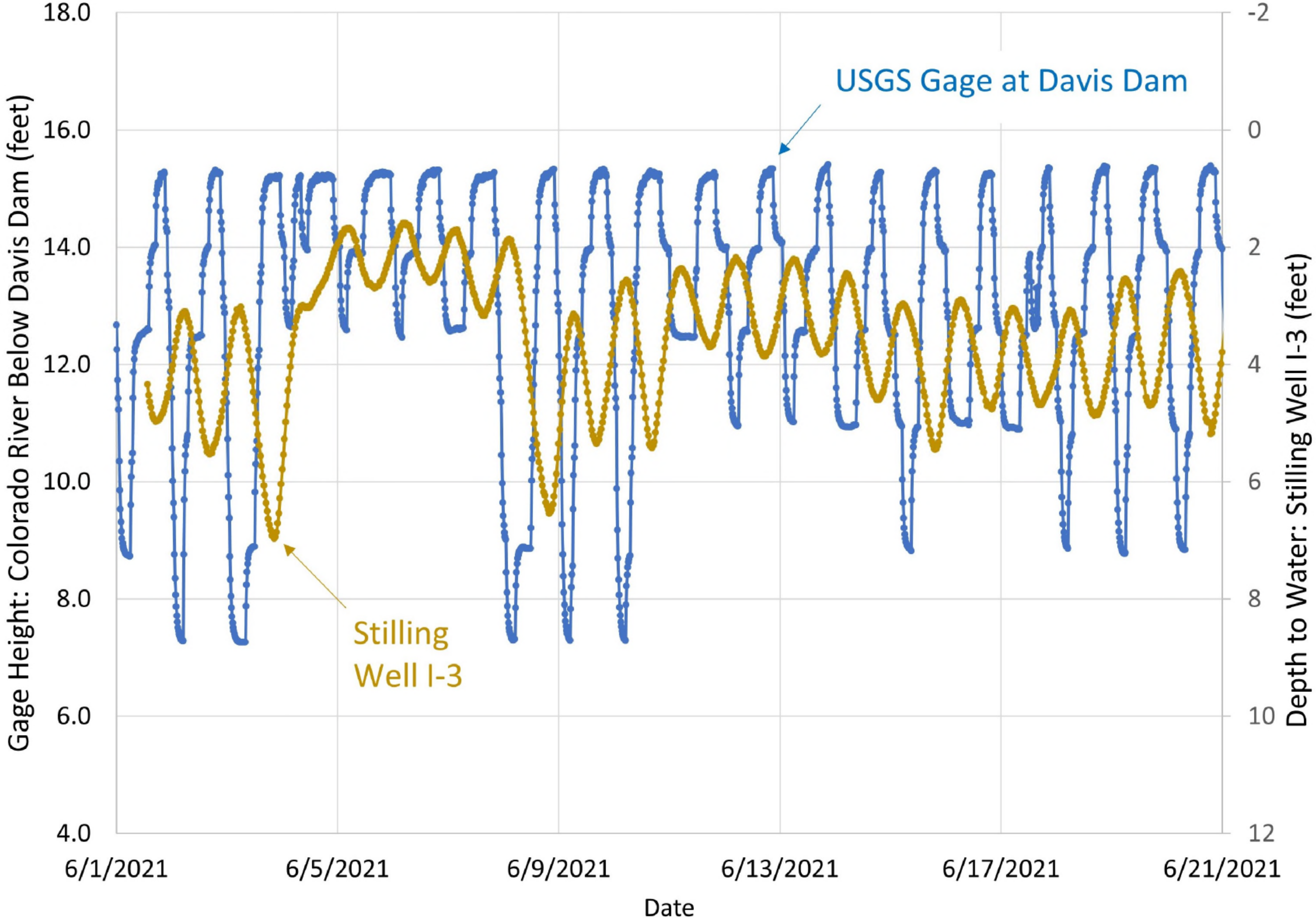
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

EXAMPLE OF CORRELATION BETWEEN GROUNDWATER LEVELS AND BAROMETRIC PRESSURE

ARCADIS

FIGURE
8

T:_ENV\PGE_TOPOCK\GEC\MXD\GMP\TOPOCK_TW-01_PUMP_TEST_REPORT_FIGURES\FINAL\FIGURE8_EXAMPLE OF CORRELATION BETWEEN GROUNDWATER LEVELS AND BAROMETRIC PRESSURE.MXD PSI01045 3/4/2022 1:51:08 PM



LEGEND

Stilling Well I-3

USGS Gage at Davis Dam

Note

USCS = United States Geological Survey

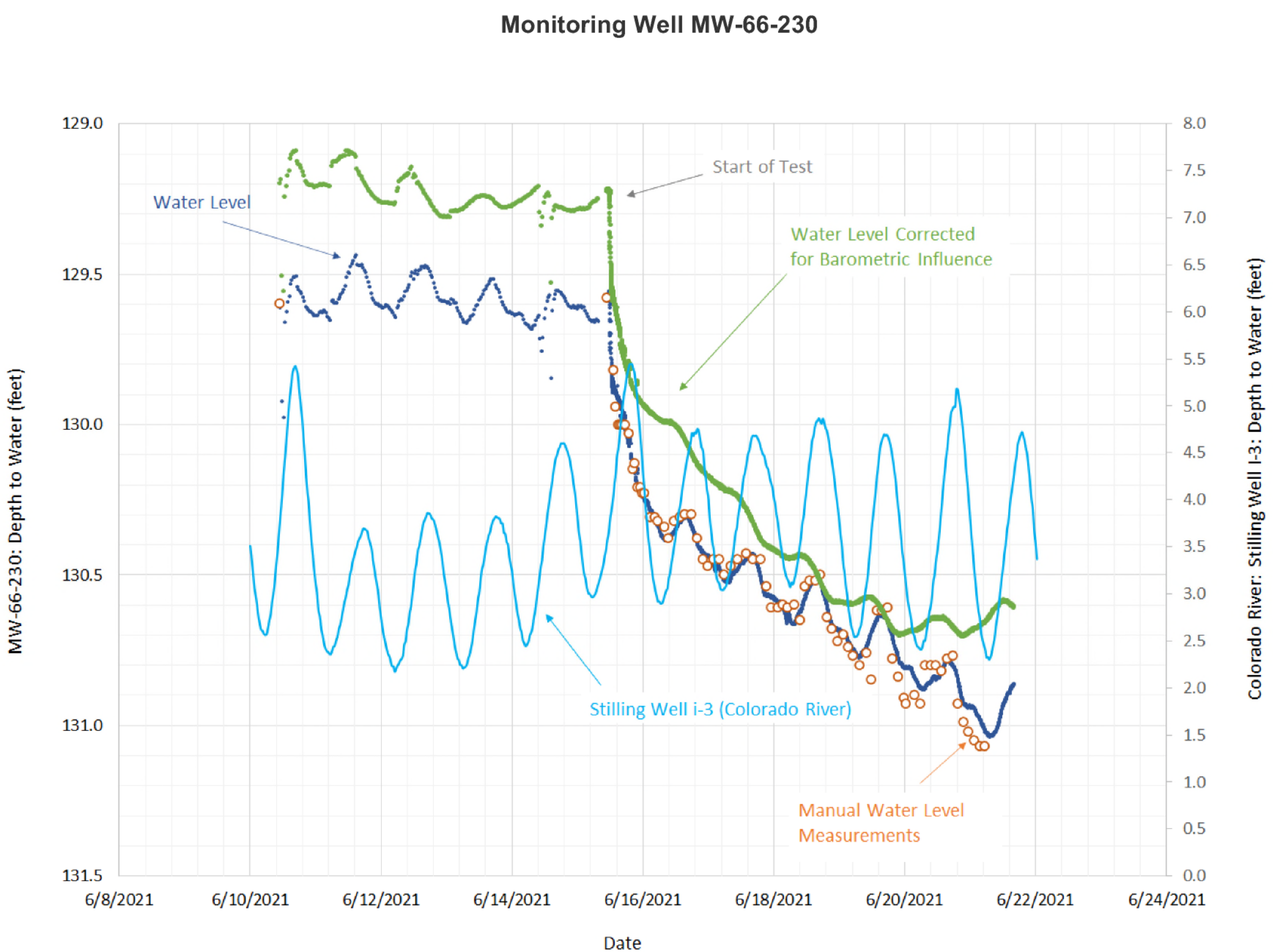
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

STAGE OF THE COLORADO RIVER AT DAVIS DAM AND STILLING WELL I-3

ARCADIS

FIGURE
9

T:_ENV\PGE_TOPOCK\GEC\MXD\GMP\TOPOCK_TW-01_PUMP_TEST_REPORT_FIGURES\FINAL\FIGURE9_STAGE OF THE COLORADO RIVER AT DAVIS DAM AND STILLING WELL I-3.MXD PSI01045 3/24/2022 6:15:12 PM

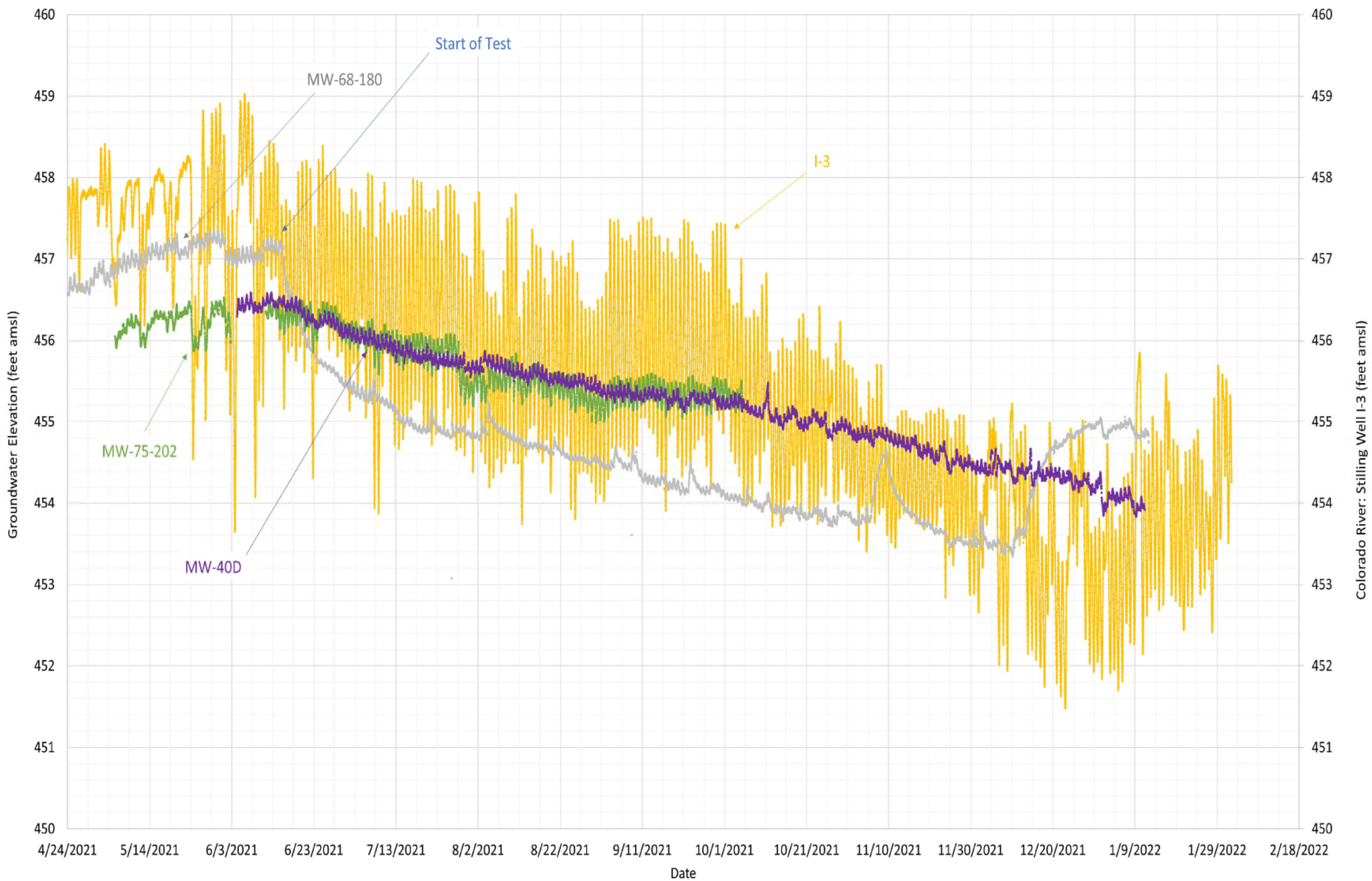


PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

EXAMPLE OF CORRELATION BETWEEN GROUNDWATER LEVELS AND STAGE OF THE COLORADO RIVER

ARCADIS

FIGURE
10



LEGEND

MW-68-180

MW-40D

MW-75-202

I-3

NOTE:

amsl – Above mean sea level

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

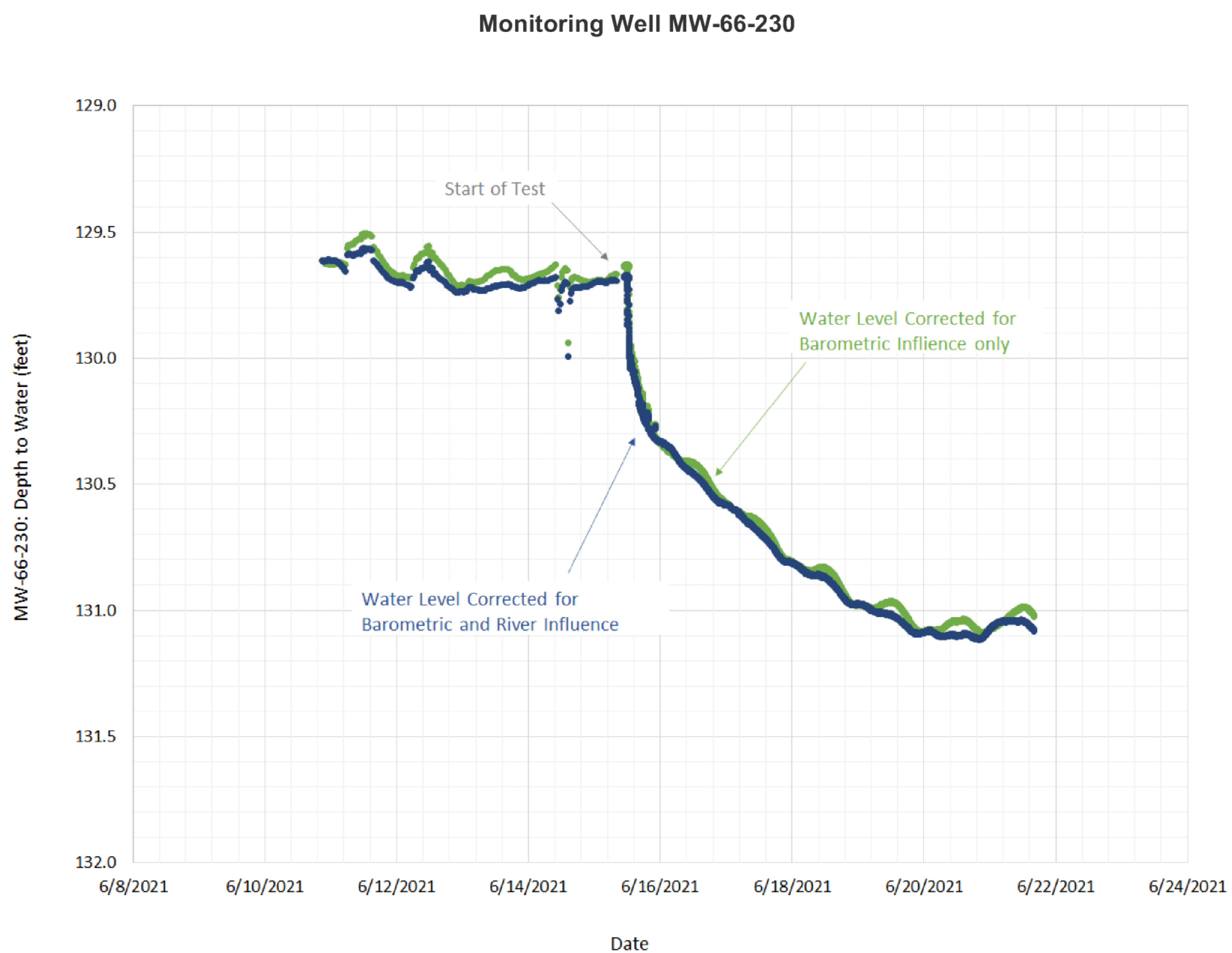
LONG-TERM GROUNDWATER LEVELS VERSUS STAGE OF THE COLORADO RIVER

ARCADIS

FIGURE

11

T:_ENV\PGE_TOPOCK\GEC\MXD\GMP\TOPOCK_TW-01_PUMP_TEST_REPORT_FIGURES\FINAL\FIGURE11_LONGTERM GROUNDWATER LEVELS VERSUS STAGE OF THE COLORADO RIVER.MXD PSI01045 3/4/2022 5:26:56 PM



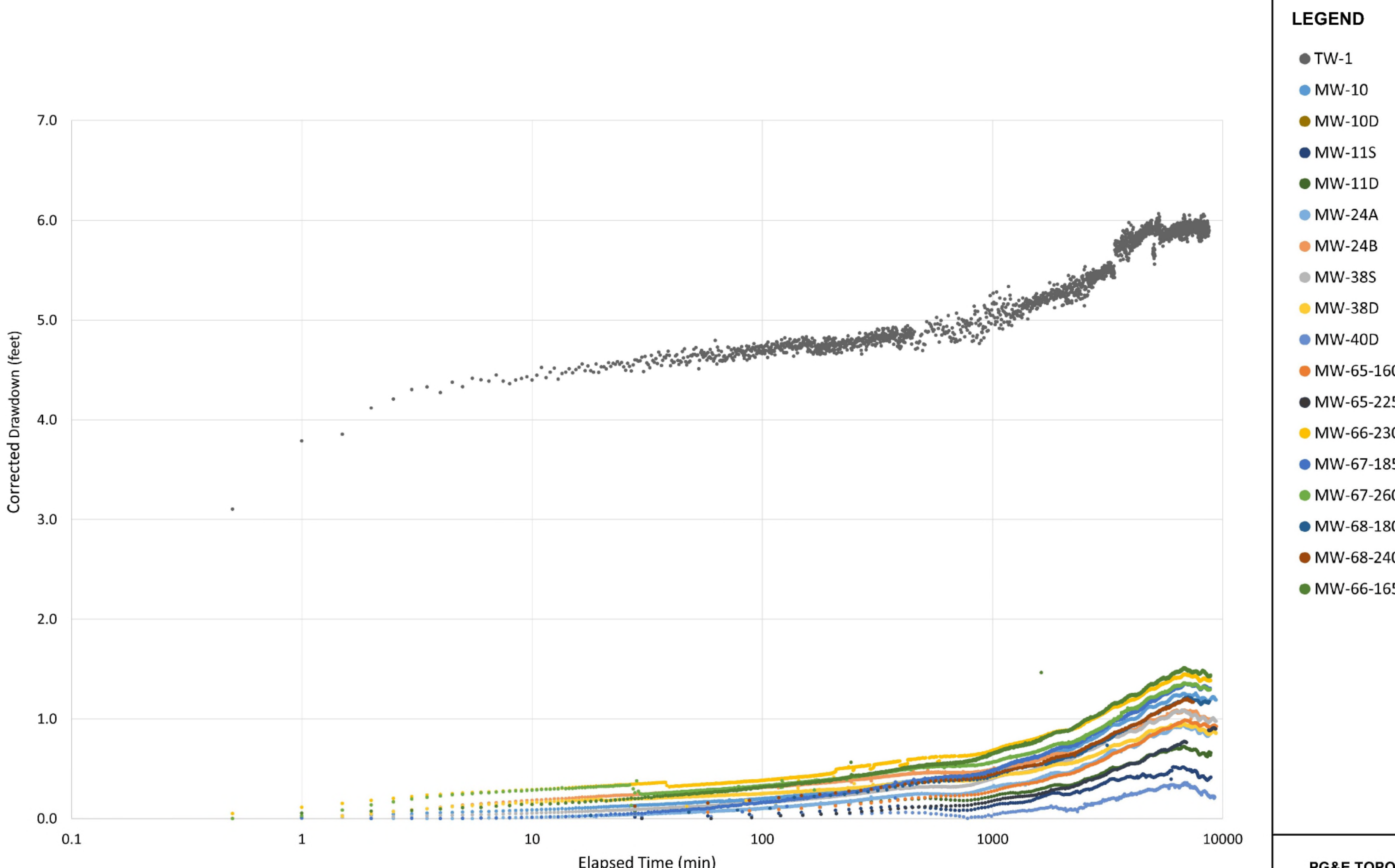
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

EXAMPLE OF CORRECTION FOR BAROMETRIC AND RIVER INFLUENCE

ARCADIS

FIGURE 12

T:_ENV\PGE_TOPOCK\GEC\MXD\GMP\TOPOCK_TW-01_PUMP_TEST_REPORT_FIGURES\FINAL\FIGURE12_EXAMPLE OF CORRECTION FOR BAROMETRIC AND RIVER INFLUENCE.MXD PSI01045 3/4/2022 2:17:43 PM

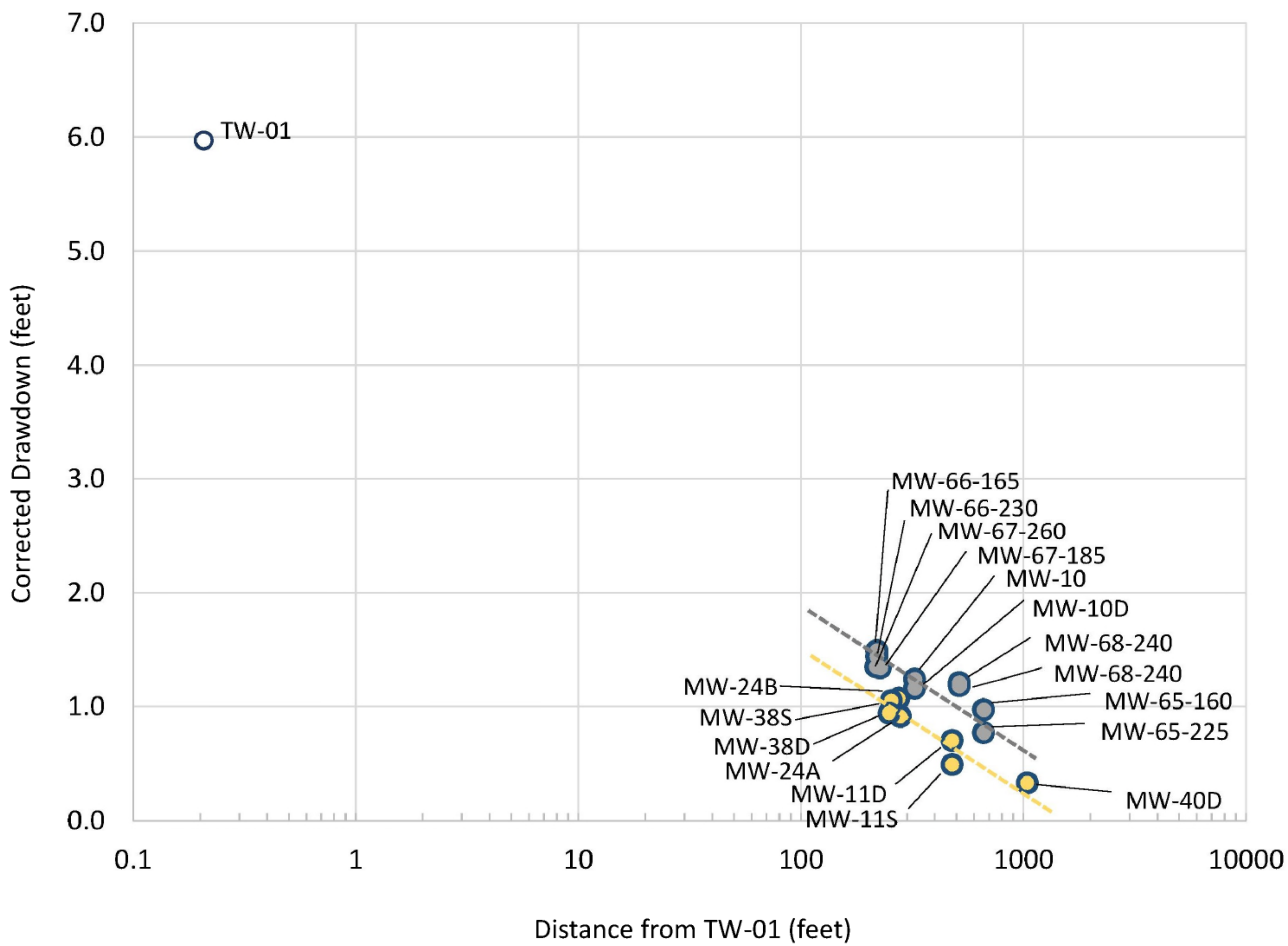


PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

SUMMARY OF CORRECTED DRAWDOWNS VS TIME - END OF PHASE I OF TEST

ARCADIS

FIGURE
13



LEGEND

Corrected Drawdown for wells south of TW-01

Corrected Drawdown for wells north of TW-01

Corrected Drawdown for wells south of TW-01

Corrected Drawdown for wells north of TW-01

NOTE:

Corrected Drawdowns at 7200 minutes into the test

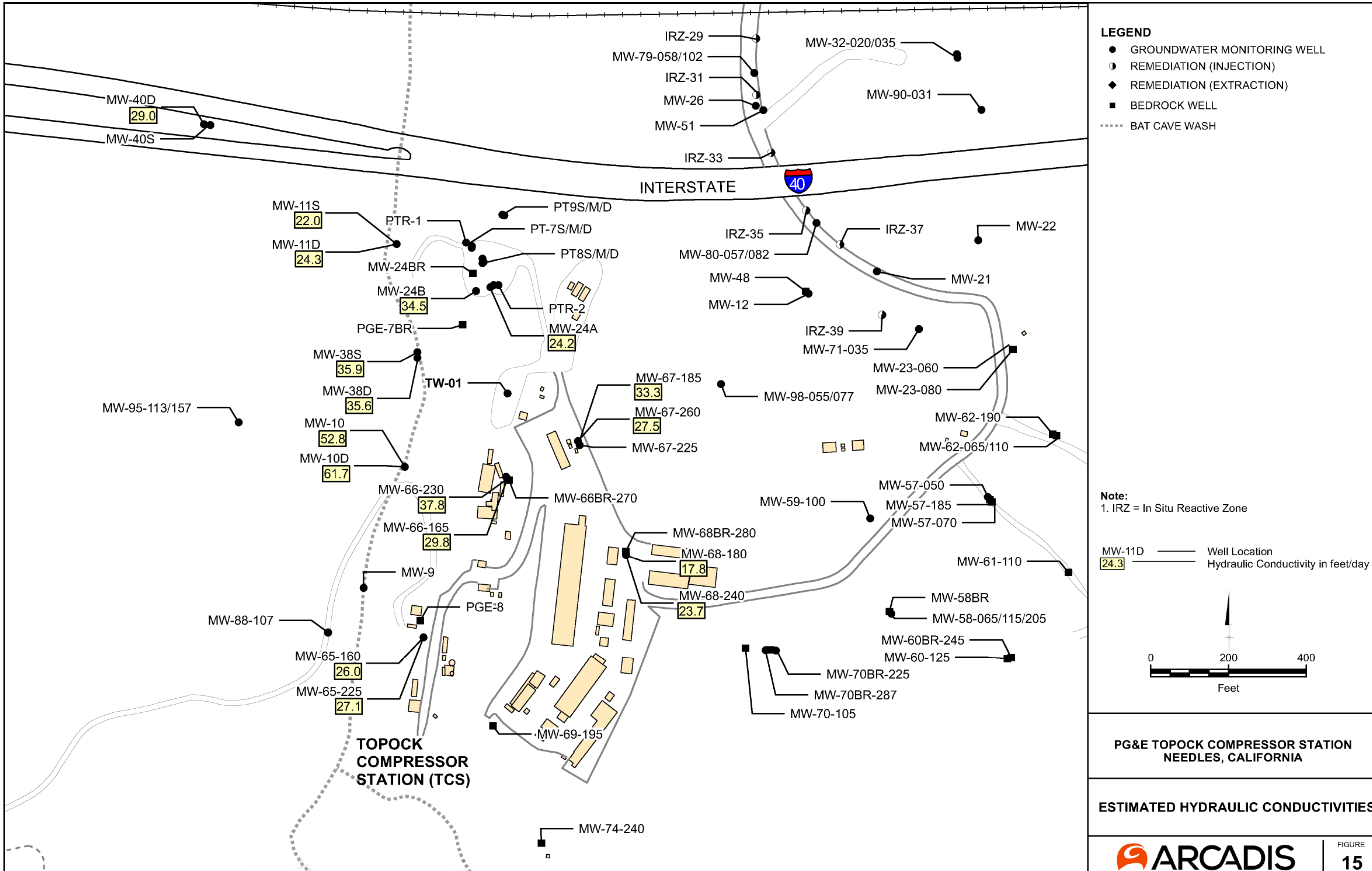
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

SUMMARY OF DRAWDOWNS VS DISTANCE - END OF PHASE I OF TEST

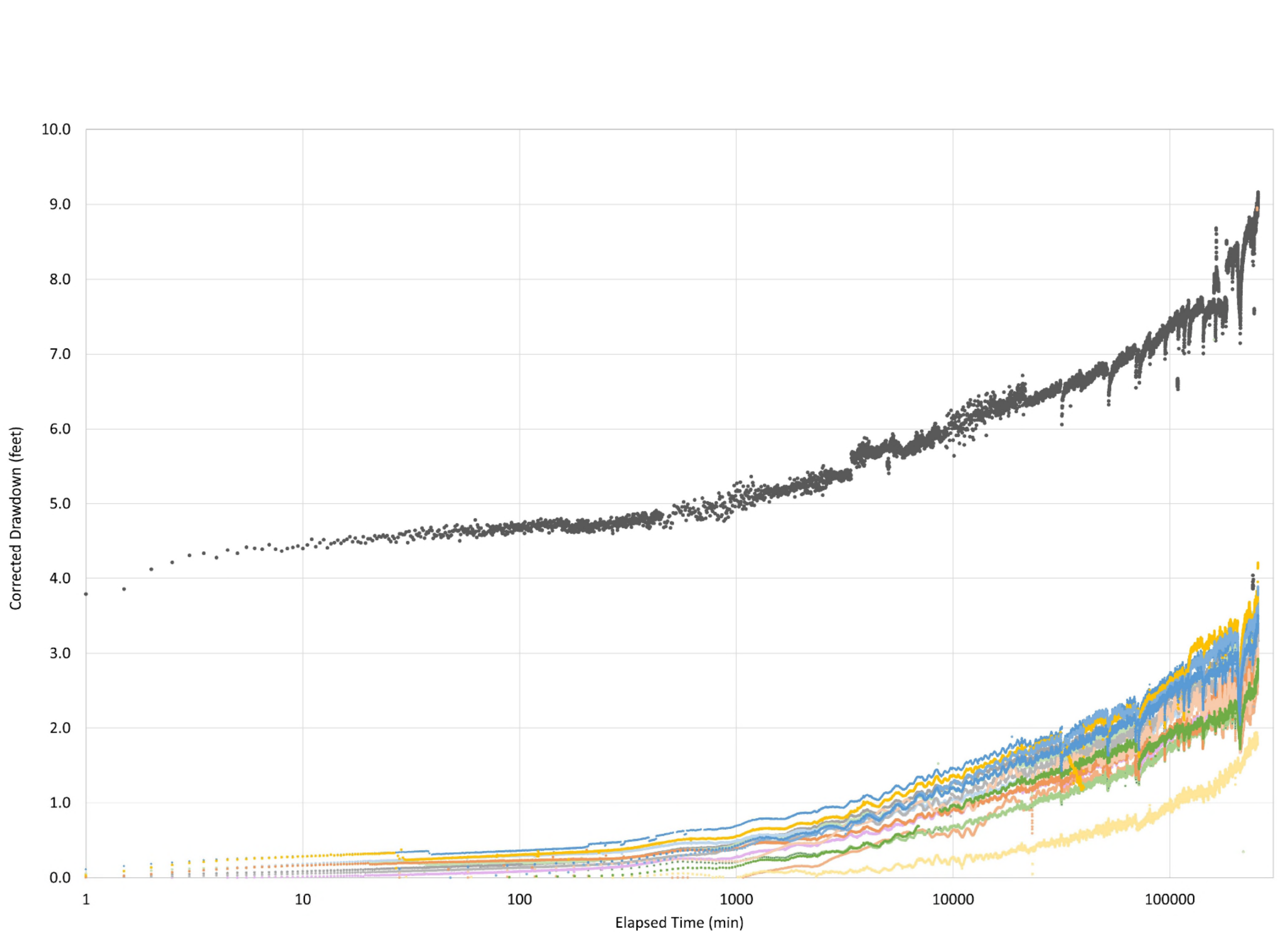
ARCADIS

FIGURE
14

T:_ENV\PGE_TOPOCK\GEC\MXD\GMP\TOPOCK_TW-01_PUMP_TEST_REPORT_FIGURES\FINAL\FIGURE14_SUMMARY OF CORRECTED SHORT-TERM DISTANCE-DRAWDOWNS.MXD PSI01045 03/04/2022 4:24:07 PM



T:_ENV\PGE_TOPOCK\GEC\MXD\GMP\TOPOCK_TW-01_PUMP_TEST_REPORT_FIGURES\FINAL\FIGURE15_ESTIMATED HYDRAULIC CONDUCTIVITIES.MXD 3/4/2022 2:30:30 PM

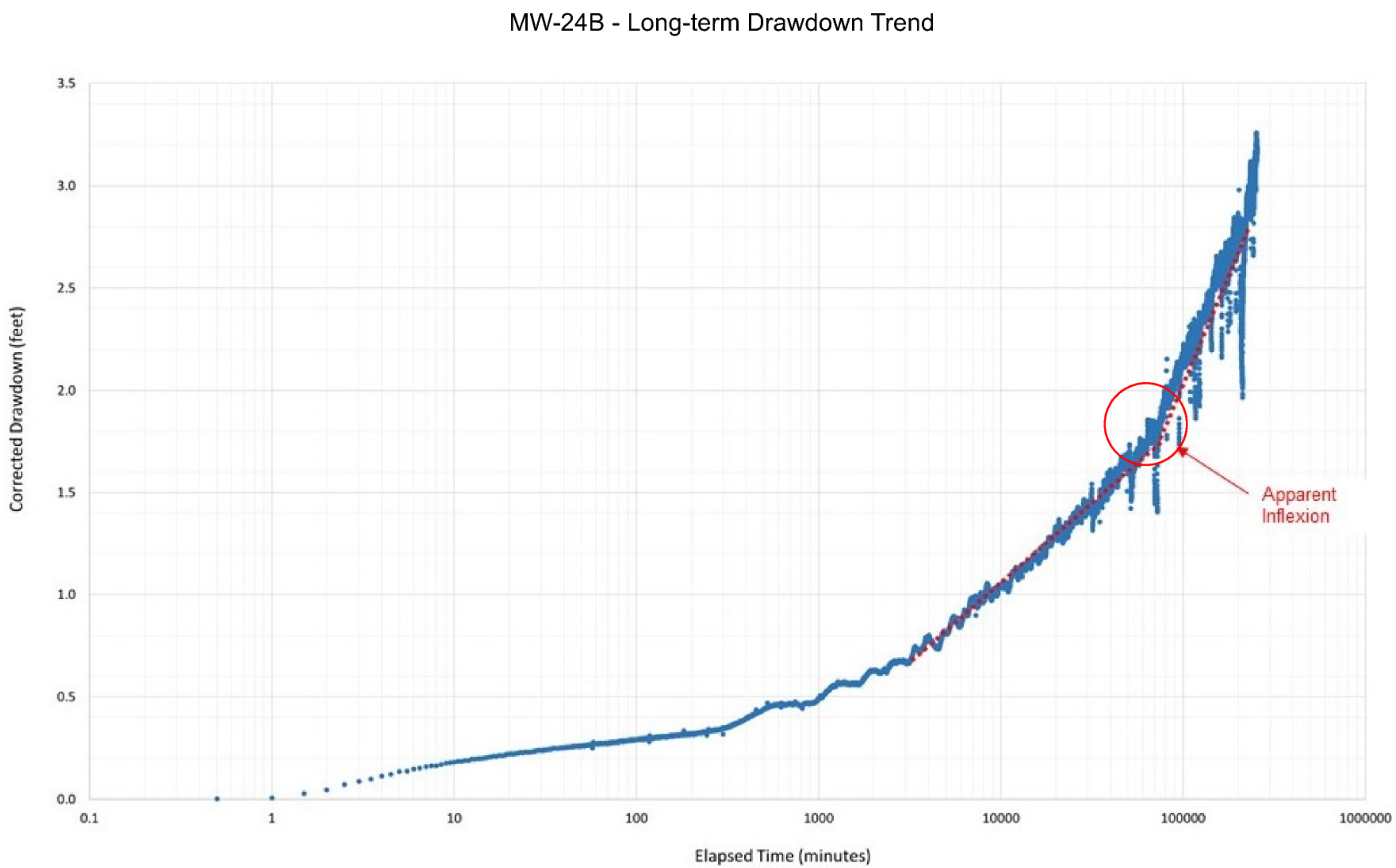


PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CORRECTED DRAWDOWN VS TIME SUMMARY: END OF PHASE II OF TEST

ARCADIS

FIGURE 16



LEGEND

Approximate trend line

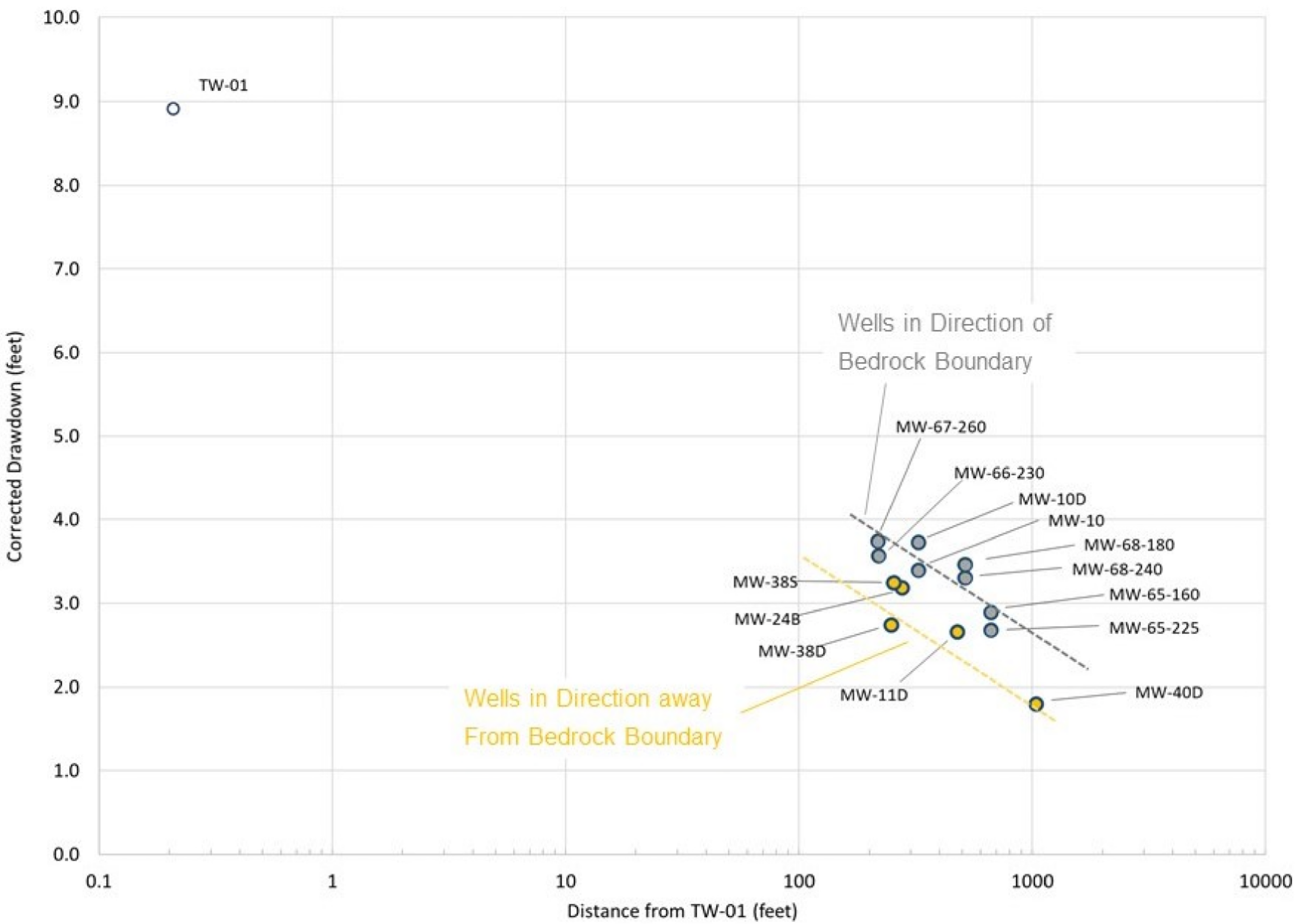
Corrected drawdown

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

EXAMPLE OF LONG-TERM DRAWDOWN TREND

ARCADIS

FIGURE
17



LEGEND

- Corrected Drawdown for wells south of TW-01
- Corrected Drawdown for wells north of TW-01
- Corrected Drawdown for wells south of TW-01
- Corrected Drawdown for wells north of TW-01

NOTES:

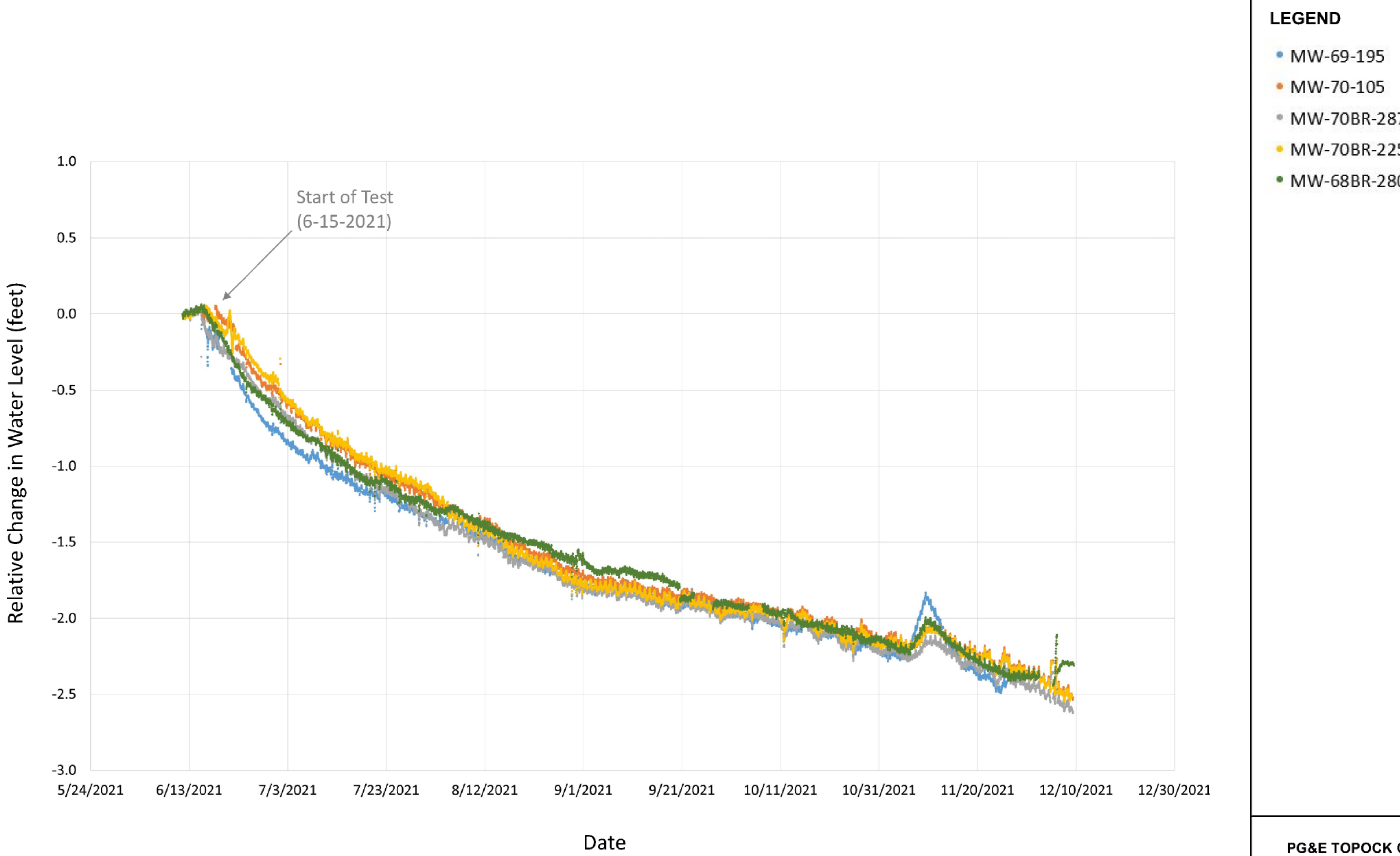
1. Corrected drawdowns 177 days into test
2. Drawdowns in bedrock wells on the same order as drawdowns in the alluvial wells in the direction of the bedrock at similar distances.
3. Indicates some hydraulic connection between alluvium and bedrock.

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CORRECTED DRAWDOWN VS DISTANCE SUMMARY: END OF PHASE II OF TEST

ARCADIS

FIGURE
18

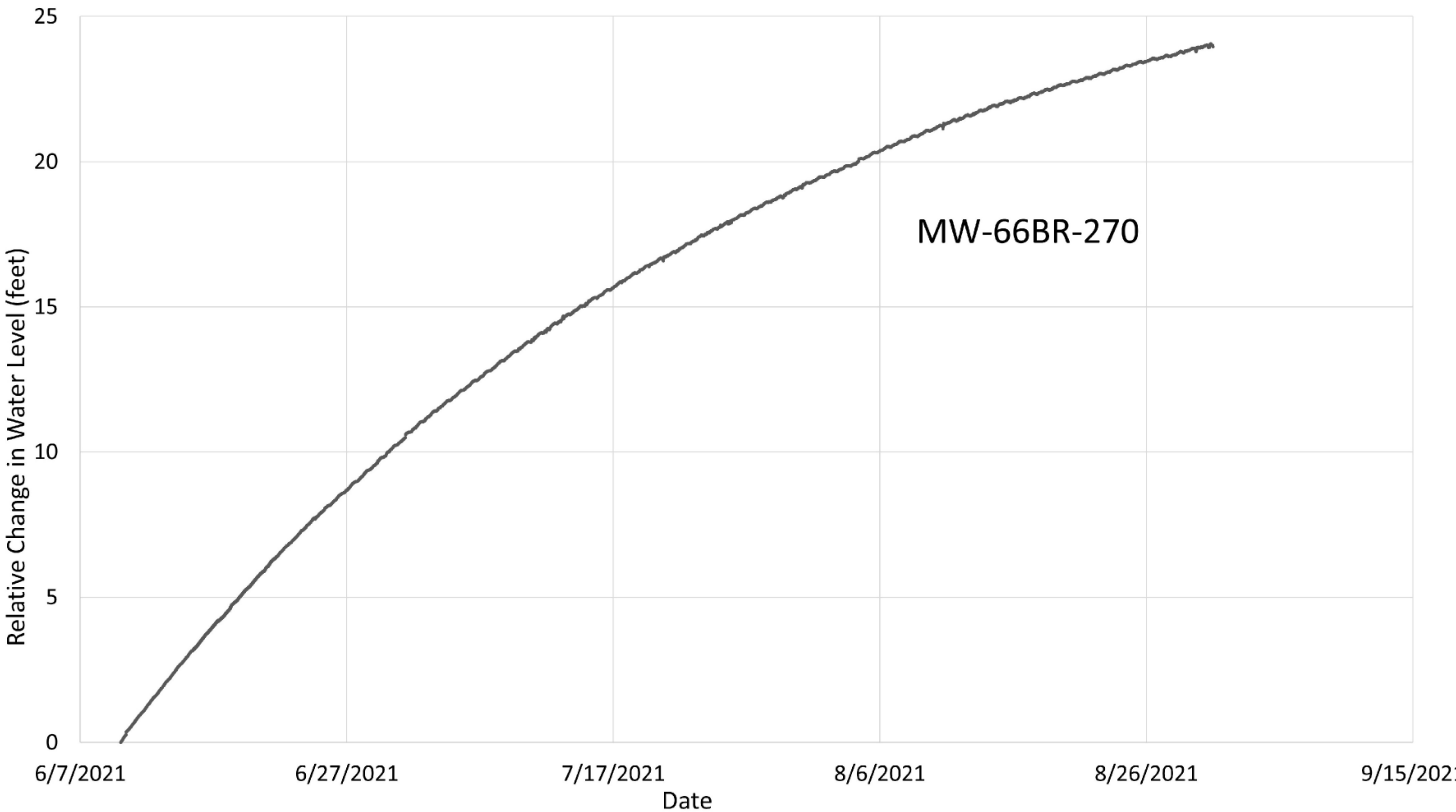


PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

SUMMARY HYDROGRAPH OF
BEDROCK MONITORING WELLS

ARCADIS

FIGURE
19



NOTES:

1. Water levels in one well (MW-66BR-270) have been steadily increasing since before the start of the test.

2. Different trend than in other wells.

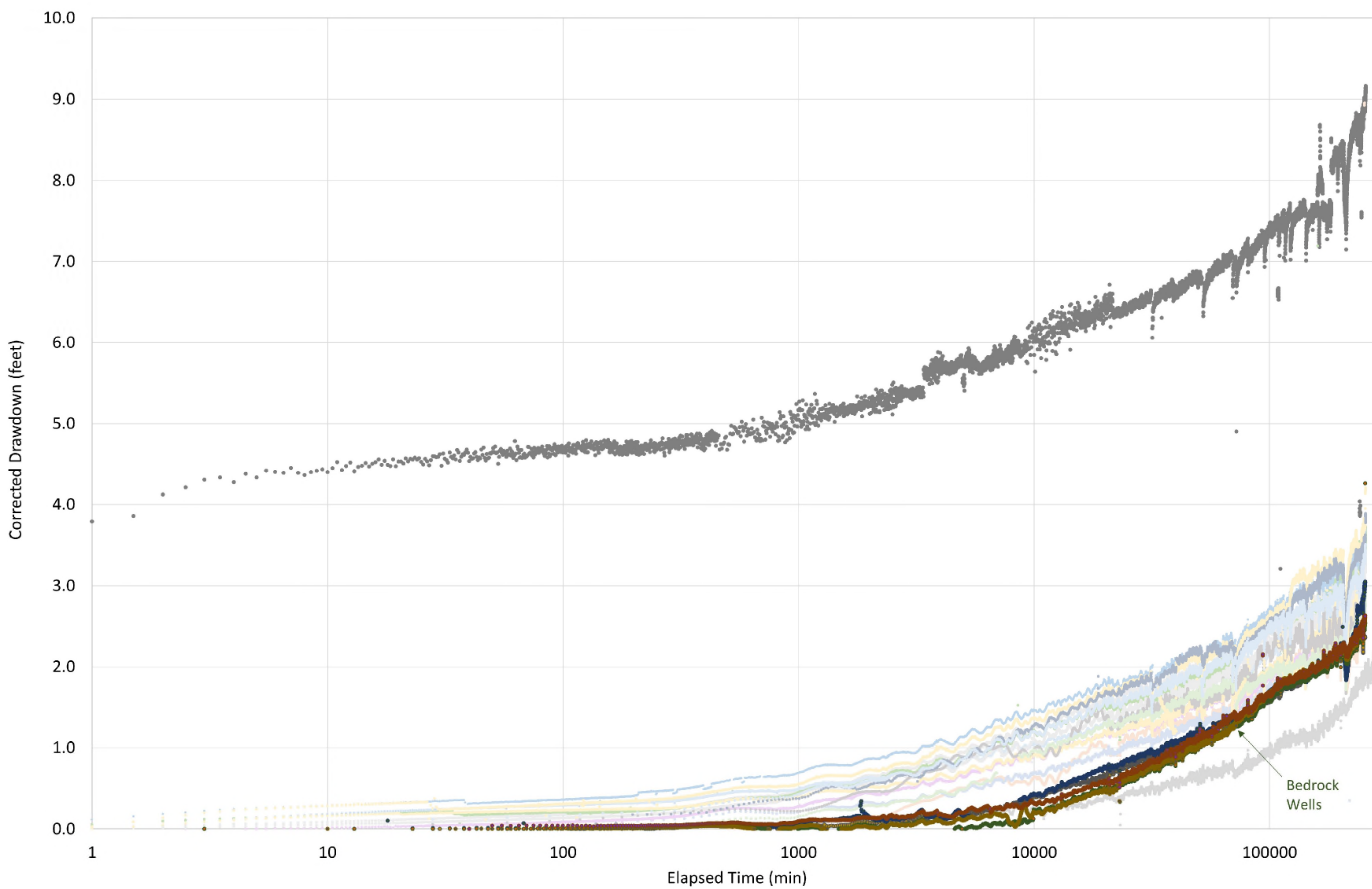
3. Suggests very low transmissivity or poor connection to Alluvial Aquifer.

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

SUMMARY HYDROGRAPH OF MW-66BR-270

ARCADIS

FIGURE
20



LEGEND

- MW-68BR-280
- MW-69-195
- MW-70-105
- MW-70BR-225
- MW-70BR-287

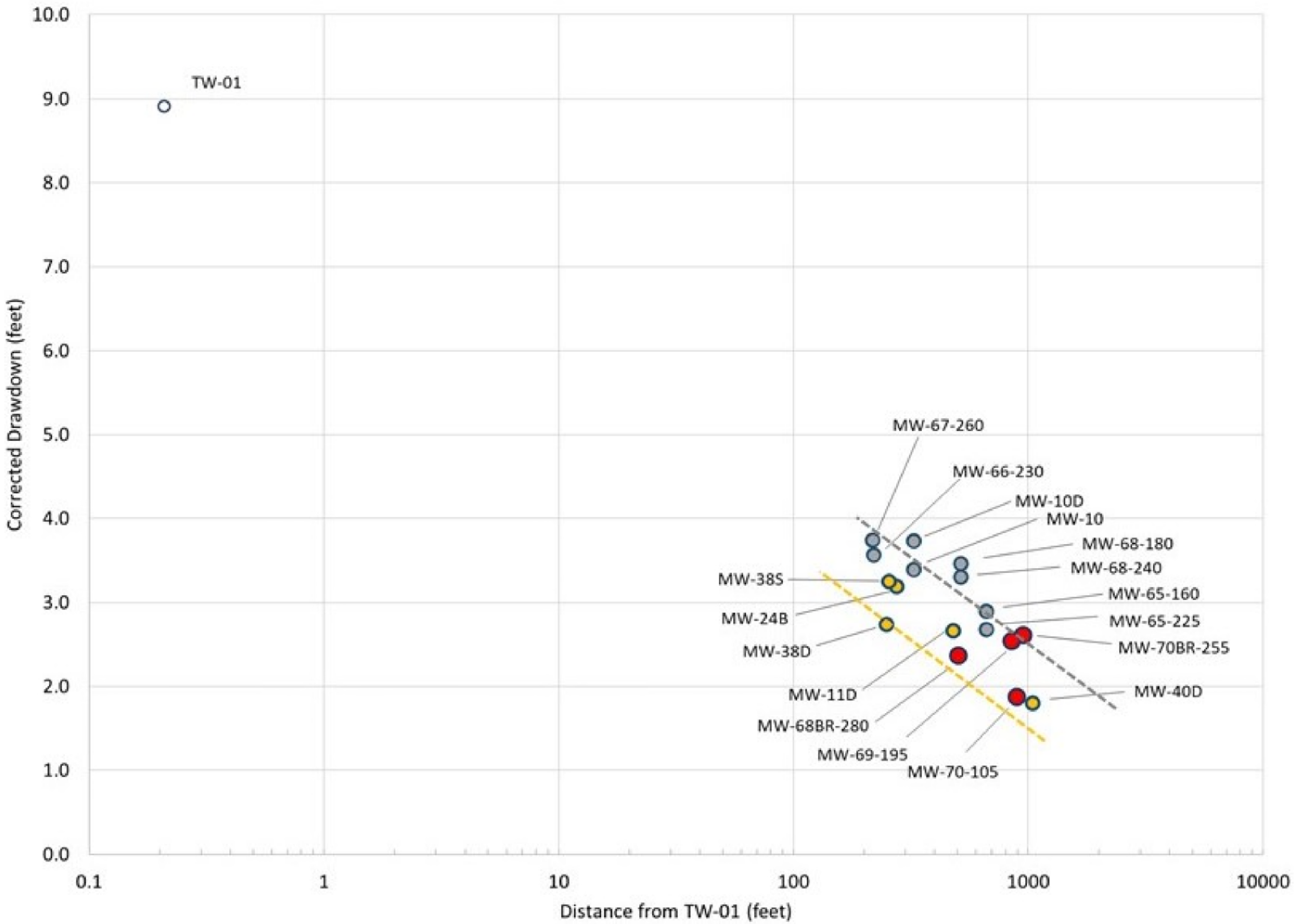
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CORRECTED DRAWDOWN VS TIME SUMMARY:
BEDROCK WELLS VS ALLUVIAL WELLS

ARCADIS

FIGURE
21

T:_ENV\PGE_TOPOCK\GEC\MXD\GMP\TOPOCK_TW-01_PUMP_TEST_REPORT_FIGURES\FINAL\FIGURE21_CORRECTED DRAWDOWN VS TIME SUMMARY BEDROCK WELLS VS ALLUVIAL WELLS.MXD PSI01045 3/4/2022 6:39:08 PM



LEGEND

- Corrected Drawdown for wells south of TW-01
- Corrected Drawdown for wells north of TW-01
- Corrected Drawdown for Bedrock wells
- Corrected Drawdown for wells south of TW-01
- Corrected Drawdown for wells north of TW-01

NOTES:

1. Corrected drawdowns 177 days into test
2. Drawdowns in bedrock wells on the same order as drawdowns in the alluvial wells in the direction of the bedrock at similar distances.
3. Indicates some hydraulic connection between alluvium and bedrock.

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

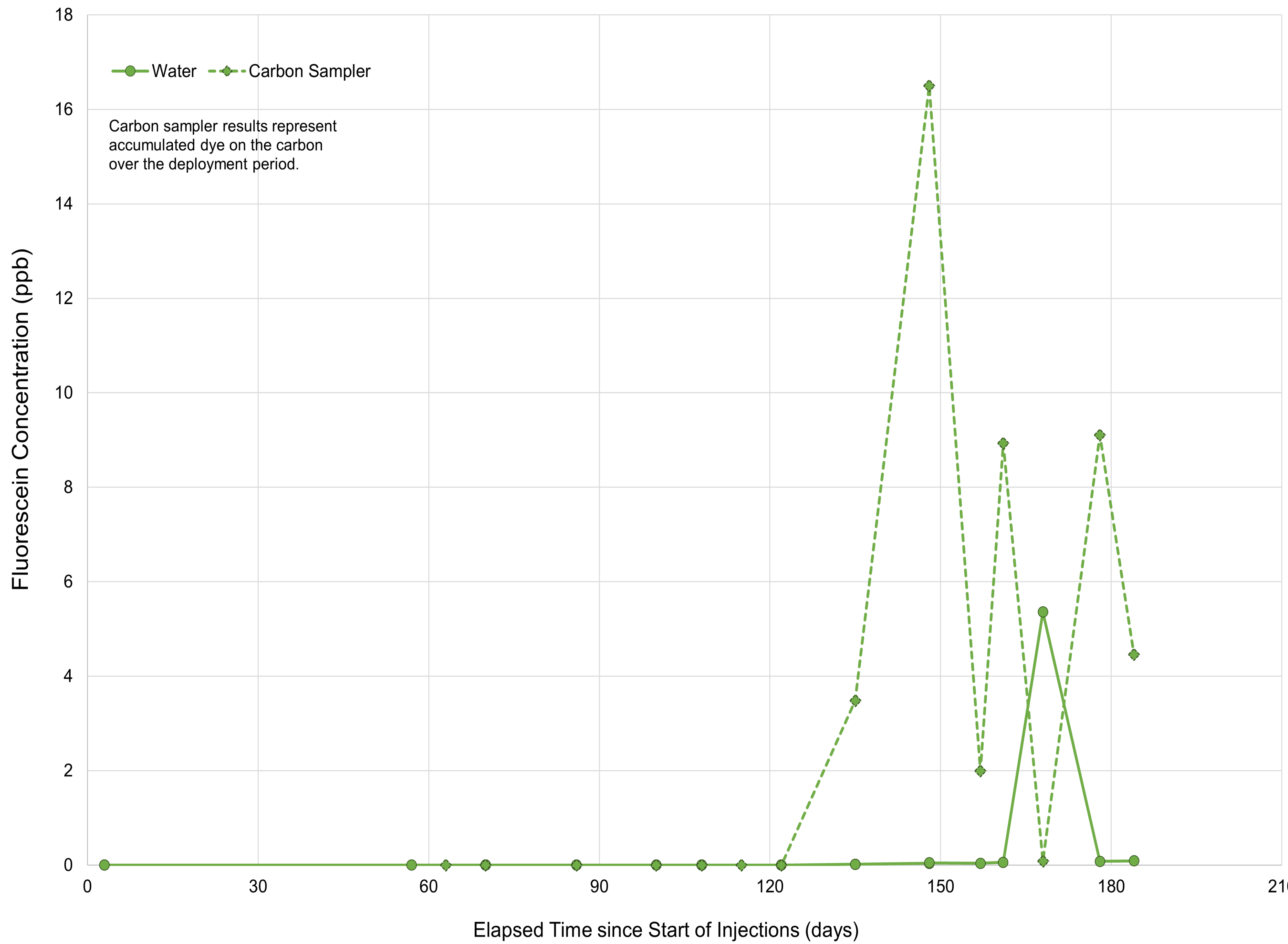
CORRECTED DRAWDOWN VS DISTANCE SUMMARY: BEDROCK WELLS VS ALLUVIAL WELLS

ARCADIS

FIGURE
22

T:_ENV\PGE_TOPOCK\GEC\MXD\GMP\TOPOCK_TW-01_PUMP_TEST_REPORT_FIGURES\FINAL\FIGURE22_CORRECTED DRAWDOWN VS DISTANCE SUMMARY BEDROCK WELLS VS ALLUVIAL WELLS.MXD PSI01045 03/04/2022 4:24:01 PM

NOTE:
ppb - parts per billion



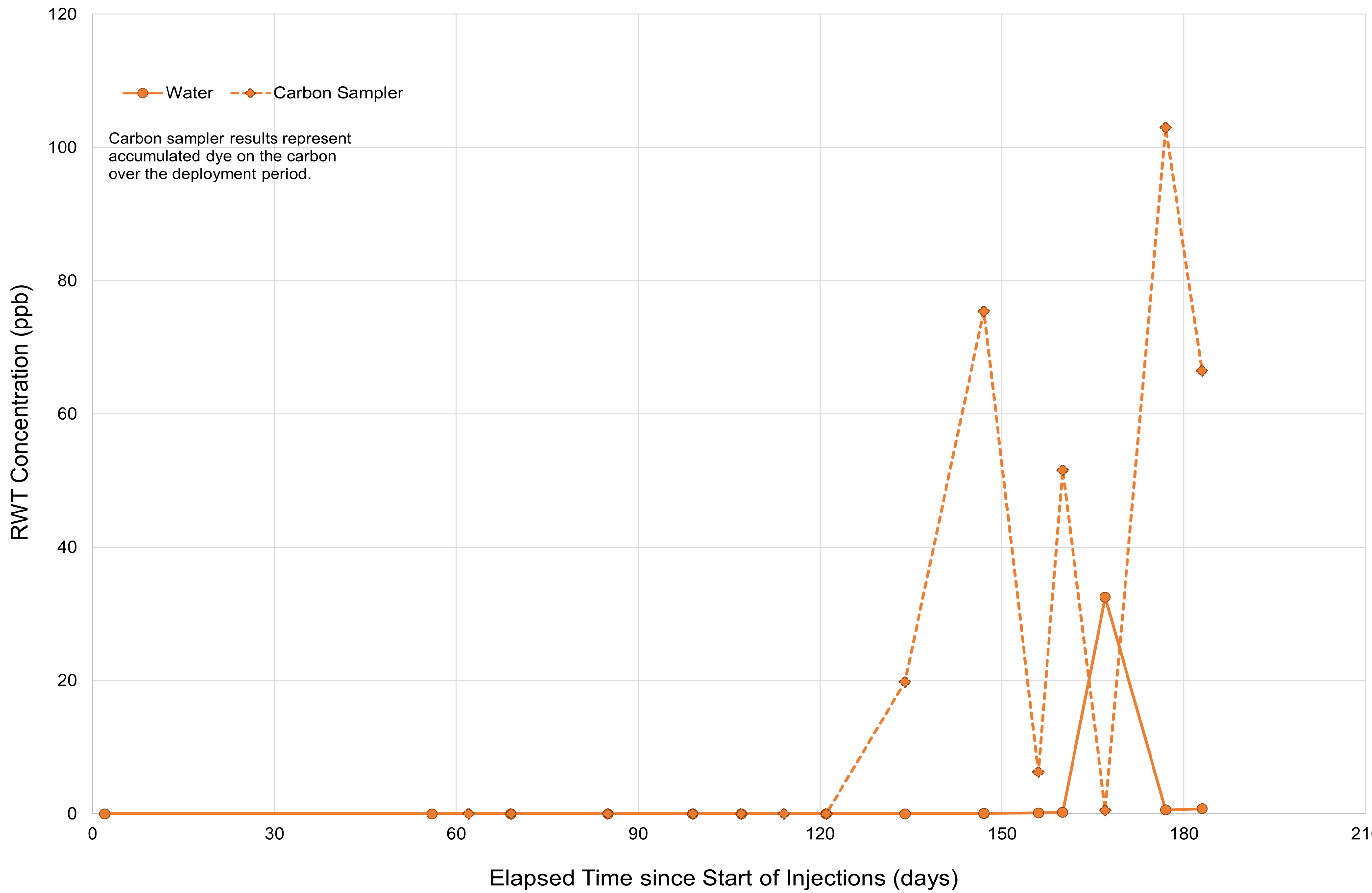
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

FLUORESCEIN CONCENTRATION IN TW-01

ARCADIS

FIGURE
23

T:_ENV\PGE_TOPOCK\GEC\MXD\GMP\TOPOCK_TW-01_PUMP_TEST_REPORT_FIGURES\FINAL\FIGURE23_FLOURESCEIN CONCENTRATION IN TW-01.MXD PSI01045 3/4/2022 5:28:06 PM



NOTES:

1. RWT - Rhodamine WT
2. ppb - parts per billion

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

RHODAMINE WT CONCENTRATION IN TW-01

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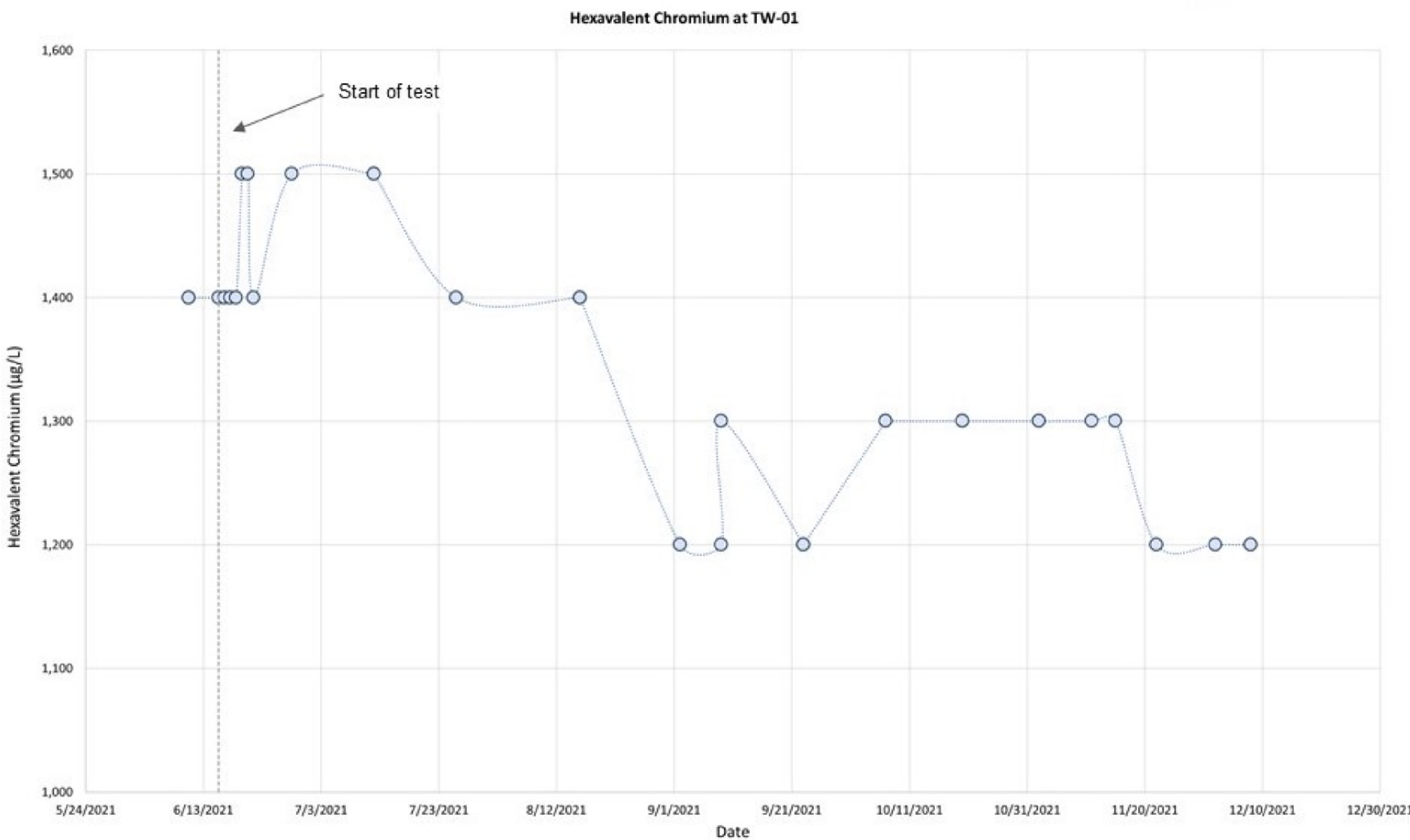
FIGURE
24



NOTE:

µg/L - microgram per Liter

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CR6 CONCENTRATIONS IN WELL TW-01

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FIGURE
25

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