Pacific Gas and Electric Company®

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July 1, 2004

Norman Shopay
Project Manager
California Department of Toxic Substances Control
Geology and Corrective Action Branch
700 Heinz Avenue
Berkeley, California 94710

Subject: Performance Monitoring Report No. 6
Interim Measure No. 2
PG&E Topock Compressor Station, Needles, California

Dear Mr. Shopay:

Enclosed is the sixth performance monitoring report for Interim Measure No. 2 for the Topock project. This report was prepared in conformance with Final Interim Measures Work Plan No. 2, and describes the activities performed and monitoring data collected during the period June 1 through 15, 2004. Please contact me at (805) 546-5243 if you have any questions or if you need additional information.

Sincerely,

Terri Herson
for Yvonne Meeks

Enclosure

cc: CWG Members

# Performance Monitoring Report No. 6, PG&E Topock Compressor Station, Interim Measure No. 2, June 1 through 15, 2004

Prepared for

**Pacific Gas and Electric Company**

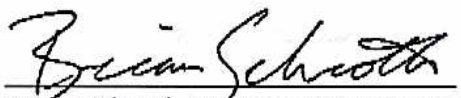
July 1, 2004

CH2MHILL

# Performance Monitoring Report No. 6
# PG&E Topock Compressor Station, Interim Measures No. 2
# June 1 through 15, 2004

Prepared for
Pacific Gas and Electric Company

This work plan was prepared under supervision of a
California Registered Geologist,



Brian Schroth, Registered Geologist No. 7423
Senior Hydrogeologist

# Performance Monitoring Report No. 6, PG&E Topock Compressor Station, Interim Measure No. 2 June 1 through 15, 2004

Pacific Gas and Electric Company (PG&E) is implementing Interim Measure (IM) No. 2 at the Topock Compressor Station in Needles, California, as described in the *Final Interim Measures Work Plan No. 2* prepared by CH2M HILL on March 2, 2004 and *Addenda to Interim Measures Work Plan No. 2,* prepared by CH2M HILL on March 1, 2004. This performance monitoring report describes operational and monitoring information for IM No. 2 for the period between June 1 and June 15, 2004.

This performance monitoring report has been prepared in compliance with the *Final Interim Measures Work Plan No. 2*, which requires reporting of system operations and performance monitoring data. Future reports will be submitted to the Department of Toxic Substances Control (DTSC) on the 1st (for the first half of the preceding month) and the 15th (for the last half of the preceding month) of each month, with the schedule subject to reevaluation and adjustment by DTSC. This schedule will change to monthly with the submittal of the July 15th report. Monthly reports will cover activities of the entire preceding month commencing with the August 15th report.

## System Operations

### System Description

The groundwater extraction system is located within a secured area on the monitoring well MW-20 bench. Groundwater is pumped from an extraction well cluster, TW-2S and TW-2D, which are co-located on the north side of the compound. Per DTSC request, pumping from TW-2S was temporarily terminated on halted on June 11, 2004 and the pumping rate from TW-2D was increased to a minimum rate of 20 gallons per minute (gpm). The DTSC required this change to the pumping operations based on the recommendation from the Geo/hydro Consultative Workgroup. The workgroup anticipates that pumping from TW-2D will have a greater impact on the reversal of groundwater gradient in the deeper water-bearing zone associated with monitoring well MW34-80, where elevated concentrations of chromium were detected during the interim measure field investigation.

Extracted groundwater is stored in holding tanks before transport to an off-site permitted treatment and disposal facility.

## Pumping Operations

Table 1 summarizes the pumping data for the reporting period. A total of 433,443 gallons of groundwater were extracted during this reporting period. The extracted groundwater was manifested as a hazardous waste and transported to United States Filter Corporation in Los Angeles, California for treatment and disposal. Copies of field notes, field logs, and waste manifests are maintained on site. Completed waste manifests from the treatment and disposal facility are sent back to the Topock Station.

Daily inspections include tank inspections, flow measurements, site security, and desert tortoise sitings. Daily logs with documentation of inspections are maintained on site. No rainfall events occurred during this reporting period. No other operational changes were noted during the reporting period.

TABLE 1
Pump Data from TW-2S and TW-2D (June1 through June 15, 2004)
*Performance Monitoring Report No. 6, Topock Compressor Station, Interim Measure No. 2*

| Extraction Well | Reporting Period | | Project To Date | |
|---|---|---|---|---|
| | Average Pumping Rate (gpm) | Volume Pumped (gal) | Average Pumping Rate (gpm) | Volume Pumped (gal) |
| TW-2S | 8.9 | 140,718 | 9.0 | 486,358 |
| TW-2D | 14.4 | 292,725 | 13.2 | 735,230 |
| **Total** | (see note 1) | 433,443 | --- | 1,221,588 |
| | | | Volume Pumped from MW-20 Cluster: | 1,224,325 |
| | | | Total Volume Pumped (gal) | 2,445,913 |
| | | | Total Volume Pumped (ac-ft) | 7.51 |

gpm: gallons per minute.
gal: gallons.
ac-ft: acre-feet.
[1]Pumping from TW-2S was temporarily terminated on June 11, 2004 per DTSC direction and pumping from TW-2D was increased to a minimum of 20 gpm. A combined average pumping rate for this period was not directly calculated, but is on the order of 20 gpm.

Note: "Average Pumping Rate" is an average of the periodic flow meter readings over the reporting period, whereas "Volume Pumped" is based on flow totalizer readings from the beginning and end of the reporting period.

## System Modifications

On May 21, 2004, the United States Bureau of Land Management approved the PG&E work plan to modify the existing facilities to batch treat of the groundwater on site. The on-site treatment will render the groundwater non-hazardous and allow for local disposal options. The modifications started on June 9, 2004 following procurement of equipment. The modifications will be completed in early-July. Pumping operations are continuing during the modifications, with only minor interruptions to allow for activities such as piping modifications. Startup and testing of the batch treatment plant will occur in July 2004, following completion of the modifications.

# Monitoring Data

## Chemical Data

The MW-20 cluster was sampled on May 11, 2004 as part of the bi-monthly sampling event for chromium concentrations and general geochemistry. Lab results from this event are presented in Table 2.

Weekly grab samples were collected from TW-2S, TW-2D, and the combined influent during this reporting period. Samples collected from TW-2S and TW-2D are summarized in Table 3.

## Hydraulic Data

Water levels were recorded at intervals of 30 minutes or less with pressure transducers in multiple wells and two river monitoring stations (I-3 and RRB). The data are typically continuous with only short interruptions for sampling or maintenance. The wells monitored were:

- **Floodplain Wells**: MW-27, MW-28-25, MW-29, MW-30 cluster (2), MW-32 cluster (2), MW-33 cluster (2), MW-34 cluster (2), MW-36 cluster (2), and MW-39 cluster (2).
- **Intermediate Wells**: MW-19, MW-20 cluster (3), MW-26, MW-31 cluster (2), MW-35 cluster (2), TW-2S, TW-2D.
- **Basin Wells**: MW-10, MW-25.

Attachment 1 contains hydrographs for all transducer data collected between May 15 and June 15, 2004.

Pumping continued at TW-2S and TW-2D during June 1 through June 15 at an average rate of approximately 20 gpm.

Analysis of Colorado River water levels (e.g., I-3, RRB, and the Topock Marsh Inlet) and United States Bureau of Reclamation records for Davis Dam discharge show that daily fluctuations in river levels are caused by the release of water from Davis Dam. Water levels at I-3 are shown on all hydrographs provided in Attachment 1. Historic and predicted Davis Dam discharges and river elevations are being evaluated to assist in predicting future river elevations.

# Hydraulic Modeling

A groundwater model has been constructed as a tool to evaluate three-dimensional groundwater flow in the aquifer at the Topock site. The model uses the MicroFem finite element model code. The model domain is bounded on the west by the Park Moabi area, on the north by the Park Moabi Slough, on the east by Topock Marsh, and the south by the Bat Cave Wash drainage area (Figure 1). Data collected during recent pumping tests at Wells TW-1, TW-2S, and TW-2D have been interpreted, and the hydraulic properties estimated from these pumping tests have been input to the model as shown in Table 4.

The alluvial aquifer has been modeled as a three-layer system based on observed head differences between wells screened at different depths. The model layers within the alluvial aquifer do not currently correspond to hydrostratigraphic units, but have been structured based on the elevations of well screens at the site. These have been designated layers 1, 2, and 3, in order of increasing depth. The pumping tests have enabled assignment of both vertical and horizontal hydraulic properties of these model layers. Bedrock is modeled with two additional layers, loosely representing the red fanglomerate and metadiorite basement rocks, respectively. The alluvium and red fanglomerate layers (1-4) pinch out above the site, leaving only the metadiorite bedrock (layer 5) in the mountains. Precipitation recharge is assigned to the Bat Cave Wash catchment area in the mountains above the site, so that the simulated recharge water flows northward in the bedrock layer. When it reaches the Topock Site area, the upper model layers are recharged from the bedrock below and the observed upward gradients are represented in the model.

The Colorado River and associated slough and marsh areas are represented in the model as river boundary conditions. Evapotranspiration is assigned to the uppermost layer in the floodplain area. Model boundary conditions are provided in Table 5.

The model is still in the process of being refined and recalibrated. Although the model calibration is not considered complete at present, the model is currently being used as a working tool to estimate groundwater flow to and from the river. Using Bureau of Reclamation estimates for Davis Dam releases in 2004, seasonal river stage fluctuations were estimated over the course of this calendar year. These estimates are shown on Figure 2. Using the latest hydraulic properties derived from the pumping tests, the net quantity of plume area groundwater discharging to the river was estimated for each month. The portion of the river that receives modeled groundwater flow from the plume area is shown in Figure 4. Using these model results, estimates of required pumping to prevent groundwater discharge were made for each month of 2004. A graphical depiction of these projected pumping rates is provided in Figure 3. Note that for February through May, model simulations predict that no pumping would be required to maintain an inward gradient during these months of high river stage.

Several model simulations have been constructed to illustrate the effects of pumping during October when the river stage is projected to be low. Figures 5 and 6 show the groundwater head contours and flow vectors for model layers 1 and 3, respectively, for the current pumping rate of 20 gpm from Well TW-2D. Note that only limited capture is predicted for layer 3, and there is virtually no effect on layer 1. In order to obtain complete capture, the model predicts at least 100 gpm is required, and the effects are shown in Figures 7 and 8. As stated above, the model is still in development, so these pumping estimates have significant uncertainty. The pumping rate estimated to achieve control in October is 130 gpm (Figure 3), when accounting for inherent inefficiencies in capture and uncertainty in the model projections.

Work remaining to be done to update the model includes:

- Alteration of model layer structure to reflect stratigraphic interpretations from the IM work.

- Recalibration of the model under steady-state conditions with new properties in place. This may include limited alteration of model properties in order to improve agreement with observed historical data.
- Sensitivity analysis of model properties to assess uncertainty in groundwater flow rates to the river. This process will provide better planning information for the IM work and demonstrate the need for additional data, if necessary, to reduce uncertainty.

TABLE 4
Model Layer Hydraulic Parameters
*Performance Monitoring Report No. 6, Topock Compressor Station, Interim Measure No. 2*

| Model Layer | Approximate Thickness[a] (ft) | Transmissivity [2] ($ft^2/d$) | Vertical Resistance between Layers[b] (d) | Approximate Anisotropy Ratio[c] ($K_h/K_v$) | Hydrostratigraphic Zone |
|---|---|---|---|---|---|
| 1 | 40 | 2100 | | | Upper UA[d] |
| 2 | 20 | 100 | 70 | 30 | Middle UA[d] |
| 3 | 40 | 750 | 40 | 10 | Lower UA[d] |
| 4 | 20 | 0.6 | 350 | 1 | Red Fanglomerate |
| 5 | 300 | 8 | 5600 | 1 | Metadiorite Bedrock |

Notes:

[a] Thickness is approximate based on screened interval elevations and observed hydraulic head differences in cluster wells.

[b] Estimated using MLU software.

[c] Calculated on the basis of approximate thickness, transmissivity, and vertical resistance.

[d] UA = unconsolidated alluvium (actually a combination of alluvial and fluvial deposits).

TABLE 5
Top Systems in Model
*Performance Monitoring Report No. 6, Topock Compressor Station, Interim Measure No. 2*

| Top System Type | Site Feature | Assigned Rate of Outflow or (Inflow), in/yr | Upper Elevation | Lower Elevation | Vertical Resistance (days) |
|---|---|---|---|---|---|
| Recharge from Precipitation | Bat Cave Wash Drainage Area | (0.6) | NA | NA | NA |
| Evapotranspiration | Floodplain | 0.4 | Land Surface | Land Surface minus 30 feet | NA |
| River[1] | Colorado River, Park Moabi Slough, Topock Marsh | NA | Average Water Surface from Measured Data | Estimated Bed Surface[2] | 10 |

Notes:

[a] Modeled as steady-state condition for slough and marsh. River modeled as steady-state with annual average levels and also with changing monthly or hourly values. River gradient assigned based on transducer data from I-3 and RRB locations.

[b] Average river depth assumed to be 17 feet; slough depth 10 feet; marsh depth 5 feet.

# Future Activities

Reporting of IM No. 2 activities will continue as described in the *Final Interim Measures Work Plan No. 2*. The next status report will be submitted on July 15, 2004 and will cover activities from June 16 to June 30, 2004. Per DTSC request, reporting frequency will switch to monthly following the July 15 submittal. Monthly reports will detail activities from the entire preceding month commencing with the August 15 submittal.

Full-time pumping from TW-2D will continue. A weekly wellhead sample will be collected from TW-2D and analyzed for total chromium, hexavalent chromium, and total dissolved solids. Modifications to the existing facilities to begin batch treatment will continue during the next reporting period.

## Table 2: Analytical Results - MW-20-070, MW-20-100,MW-20-135

| Sample Date | Analytical Method | Analyte | Units | MW-20-070 | MW-20-100 | MW-20-130 |
|---|---|---|---|---|---|---|
| 05/11/2004 | EPA 160.1 | Total dissolved solids | mg/L | 2100 | 3600 | 8300 |
| 05/11/2004 | EPA 300.0 | Bromide | mg/L | ND (0.5) | 0.5 | ND (0.5) |
| | | Chloride | mg/L | 800 | 1300 | 3300 |
| | | Nitrate | mg/L | 10 | 9.6 | 9.8 |
| | | Sulfate | mg/L | 450 | 700 | 1000 |
| 05/11/2004 | EPA 310.1 | Alkalinity as CaCO3 | mg/L CaCO3 | ND (5) | ND (5) | ND (5) |
| | | Alkalinity hydroxide | mg/L CaCO3 | ND (5) | ND (5) | ND (5) |
| | | Alkalinity, Bicarbonate as CaCO | mg/L CaCO3 | 76 | 81 | 62 |
| | | Alkalinity, Total as CaCO3 | mg/L CaCO3 | 76 | 81 | 62 |
| 05/11/2004 | EPA 6010B | Boron | mg/L | 0.4 | 1 | 1.7 |
| | | Calcium | mg/L | 210 | 150 | 280 |
| | | Chromium, dissolved | mg/L | 12 | 3.96 | 7.26 |
| | | Magnesium | mg/L | 48 | 18 | 14 |
| | | Potassium | mg/L | 9.7 | 10 | 26 |
| | | Sodium | mg/L | 490 | 1100 | 2500 |
| 05/11/2004 | SW 7196A | Chromium, hexvalent | mg/L | 11 | 4.74 | 7.71 |
| 05/11/2004 | CF-IRMS | Deuterium | 0/00 | -53 | -37 | -49 |
| | | Oxygen 18 | 0/00 | -5.5 | -2.7 | -5 |

EPA - United States Environmental Protection Agency
SW - Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846)
CF-IRMS - Continuous Flow Mass Spectrometry by Laboratory Standard Operating Procedure
ND = not detected at listed reporting limit
CaCO3 - calcium carbonate
mg/L - milligrams per liter
0/00 - delta value of the sample vs the standard on a per milliliter basis

Table 3
Analytical Results - TW-2 Extraction Wells
Topock Interim Measures No. 2

| Sample Time Relative to TW-2 Pumping Start | TW-2S | | | | TW-2D | | | | TW-2 Combined | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Sample Date** | **Total Dissolved Chromium** mg/L | **Hexavalent Chromium** mg/L | **Total Dissolved Solids** mg/L | **Sample Date** | **Total Dissolved Chromium** mg/L | **Hexavalent Chromium** mg/L | **Total Dissolved Solids** mg/L | **Sample Date** | **Total Dissolved Chromium** mg/L | **Hexavalent Chromium** mg/L | **Total Dissolved Solids** mg/L |
| 6 days | 19-May-04 | 6.61 | 7.36 | 2,620 | 19-May-04 | 7.06 | 7.77 | 7,740 | 19-May-04 | 6.68 | 7.58 | 5,230 |
| 13 days | 26-May-04 | 6.68 | 7.00 | 2,700 | 26-May-04 | 7.15 | 7.47 | 7,620 | 26-May-04 | 7.29 | 7.19 | 5,520 |
| 20 days | 02-Jun-04 | 7.93 | 7.19 | 2,690 | 02-Jun-04 | 7.02 | 7.33 | 7,540 | 02-Jun-04 | 6.93 | 7.33 | 5,350 |
| 27 days | 09-Jun-04 | 6.82 | 7.19 | 2,740 | 09-Jun-04 | 6.98 | 7.41 | 7,540 | 09-Jun-04 | 6.81 | 7.50 | 5,300 |

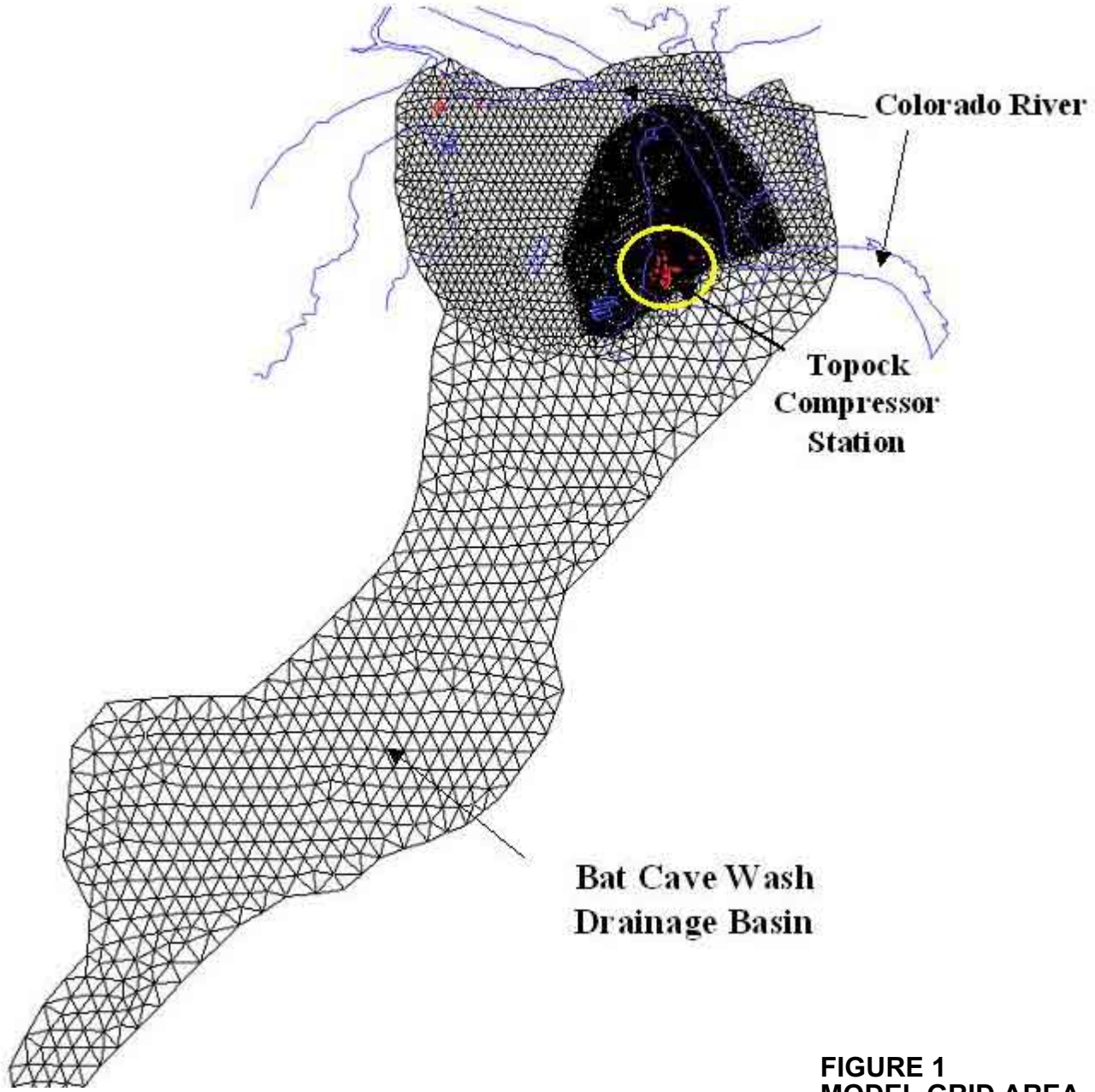



**FIGURE 1**
**MODEL GRID AREA**
PERFORMANCE MONITORING REPORT #6
PG&E COMPRESSOR STATION, NEEDLES, CALIFORNIA

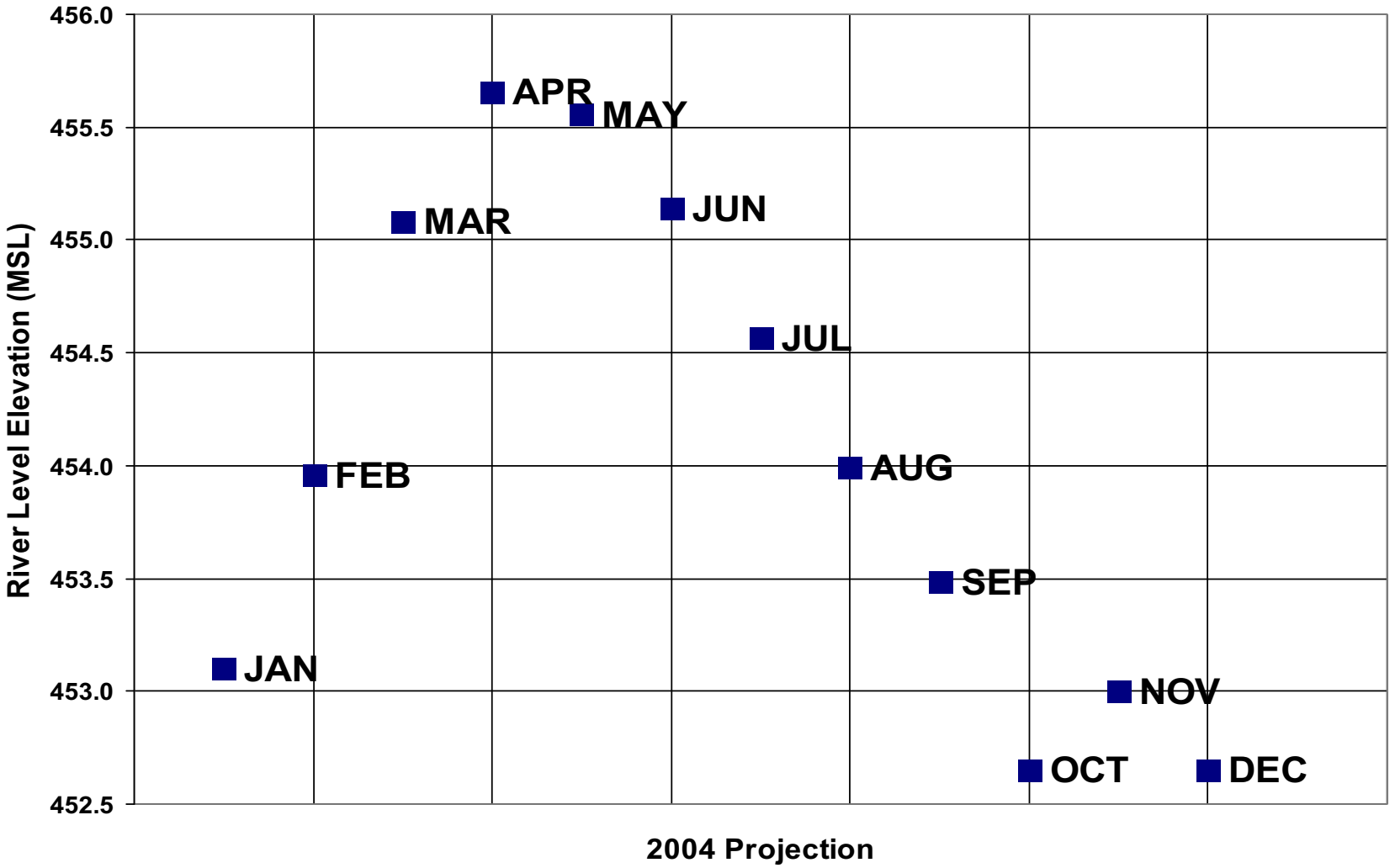



**FIGURE 2**
**PROJECTED 2004 COLORADO RIVER LEVELS NEAR THE TOPOCK SITE**
PERFORMANCE MONITORING REPORT #6
PG&E COMPRESSOR STATION, NEEDLES, CALIFORNIA

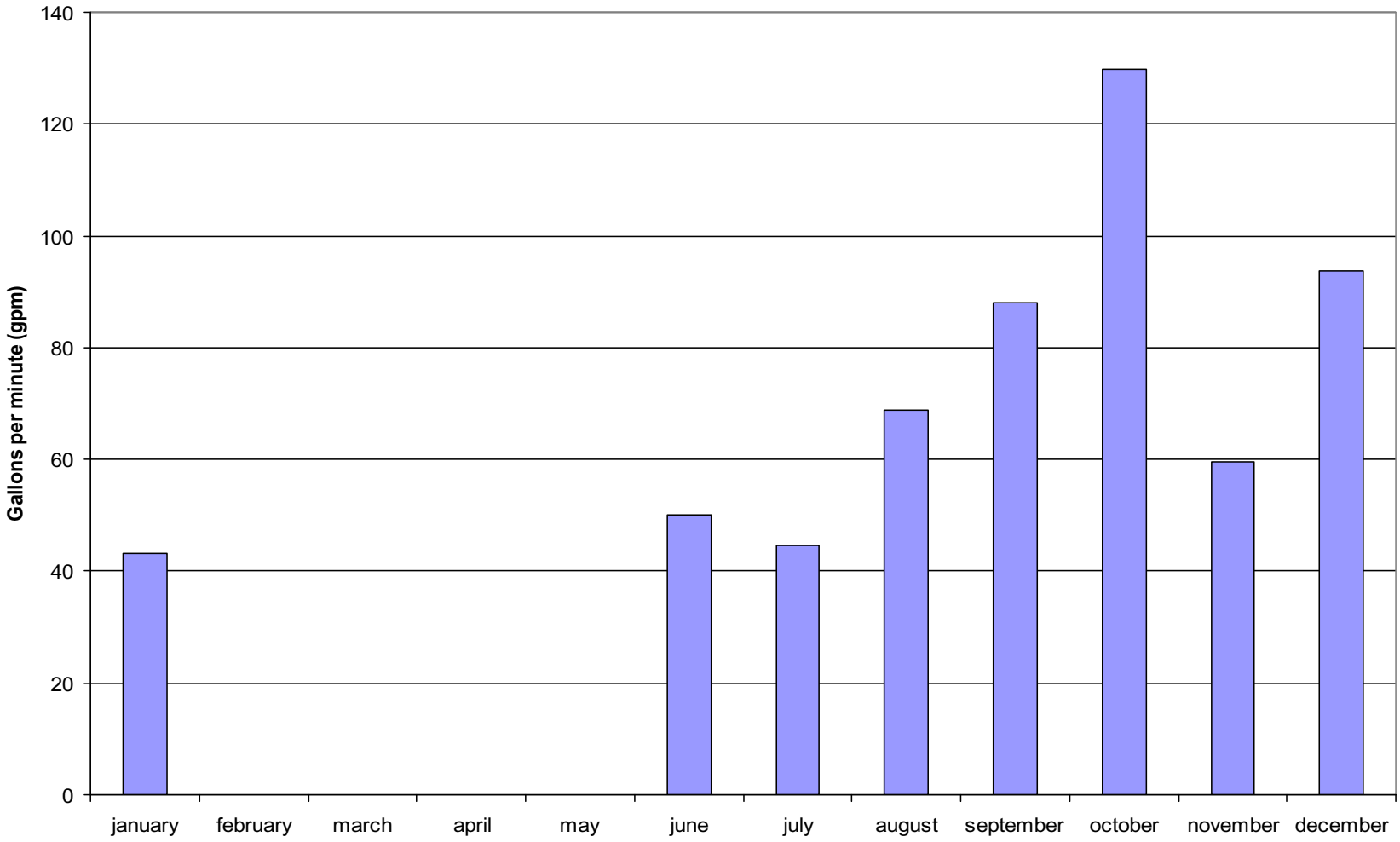



**FIGURE 3**
**ESTIMATED PUMPING REQUIREMENTS FOR HYDRAULIC CONTROL IN 2004**
PERFORMANCE MONITORING REPORT #6
PG&E COMPRESSOR STATION, NEEDLES, CALIFORNIA

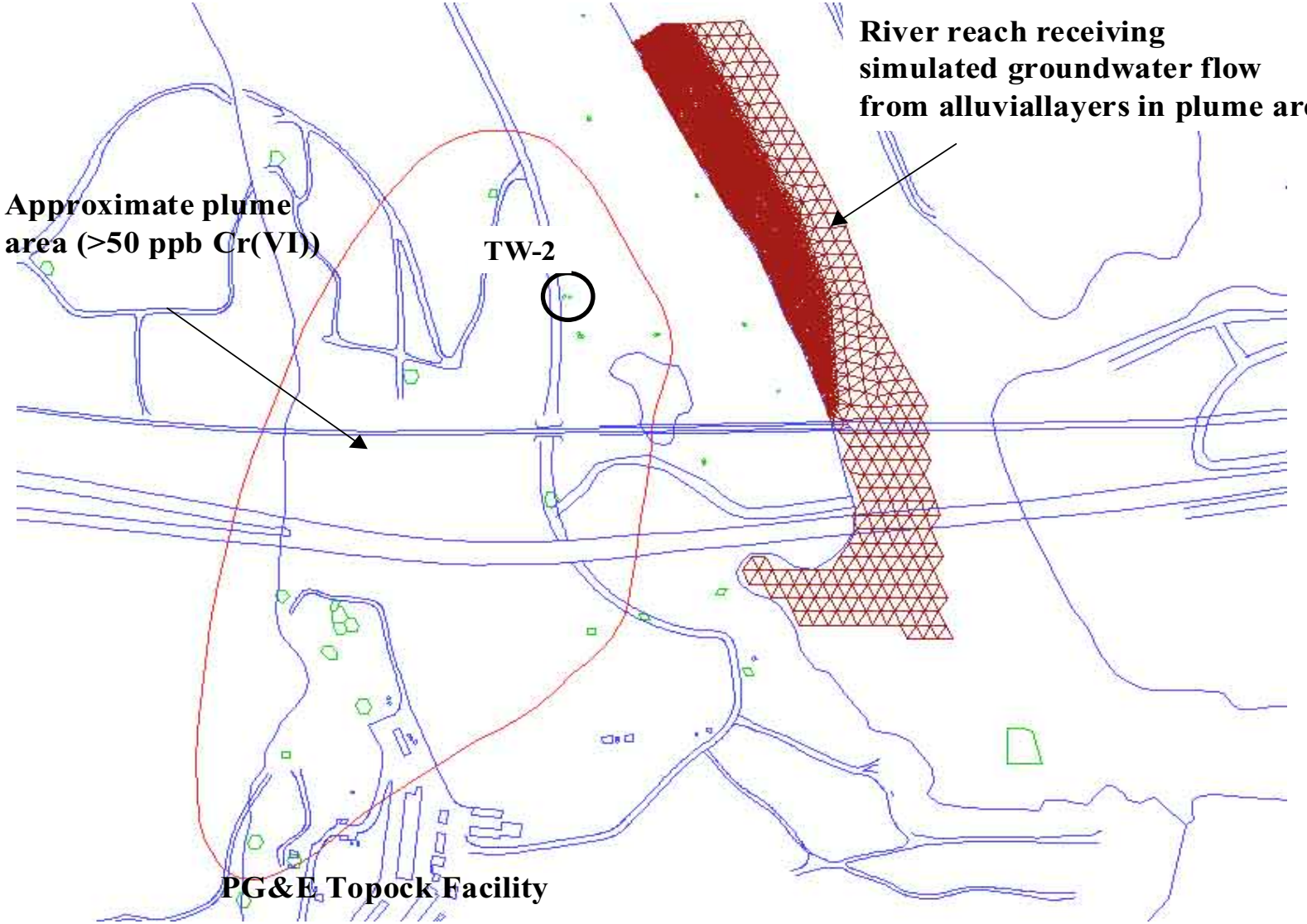



**FIGURE 4**
**MODELED MAP OF COLORADO RIVER REACH THAT RECEIVES PLUME GROUNDWATER**
PERFORMANCE MONITORING REPORT #6
PG&E COMPRESSOR STATION, NEEDLES, CALIFORNIA

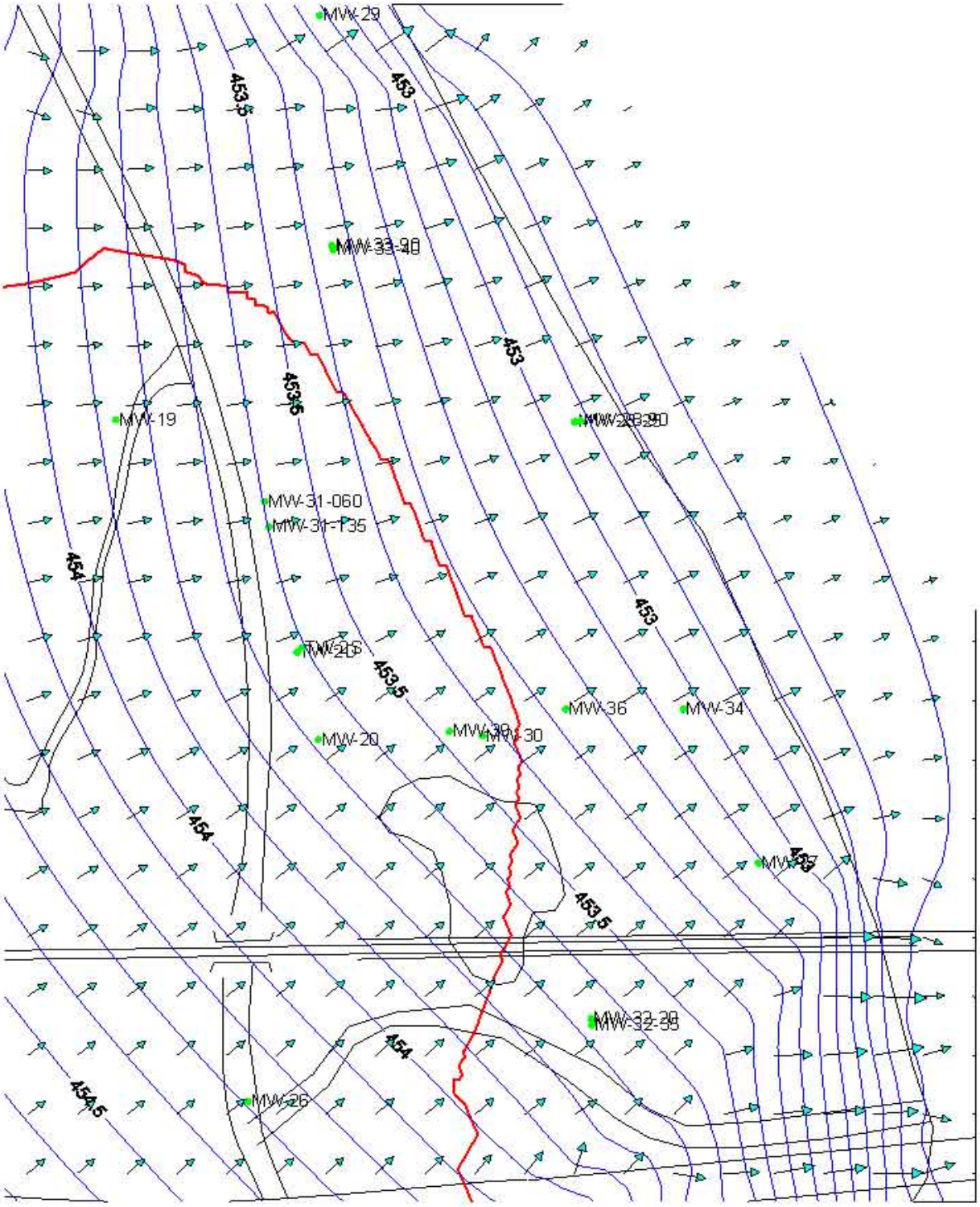



**FIGURE 5**
**SIMULATED HYDRAULIC HEAD CONTOURS AND VECTORS FOR MODEL LAYER 1 WITH A PUMPING RATE OF 20 GPM FROM WELL TW-2D**
PERFORMANCE MONITORING REPORT #6
PG&E COMPRESSOR STATION, NEEDLES, CALIFORNIA

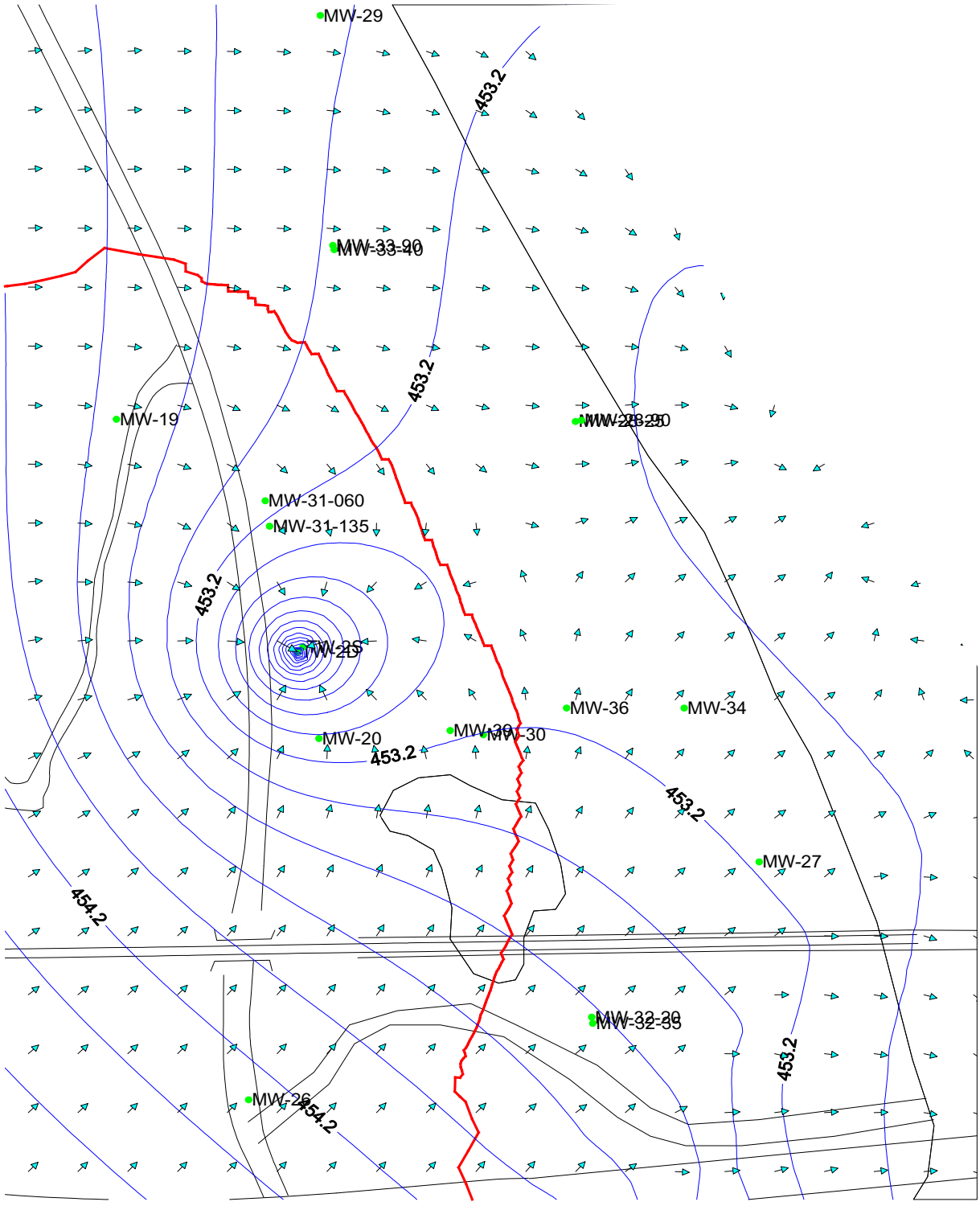



**FIGURE 6**
**SIMULATED HYDRAULIC HEAD CONTOURS AND VECTORS FOR MODEL LAYER 3 WITH A PUMPING RATE OF 20 GPM FROM WELL TW-2D**
PERFORMANCE MONITORING REPORT #6
PG&E COMPRESSOR STATION, NEEDLES, CALIFORNIA

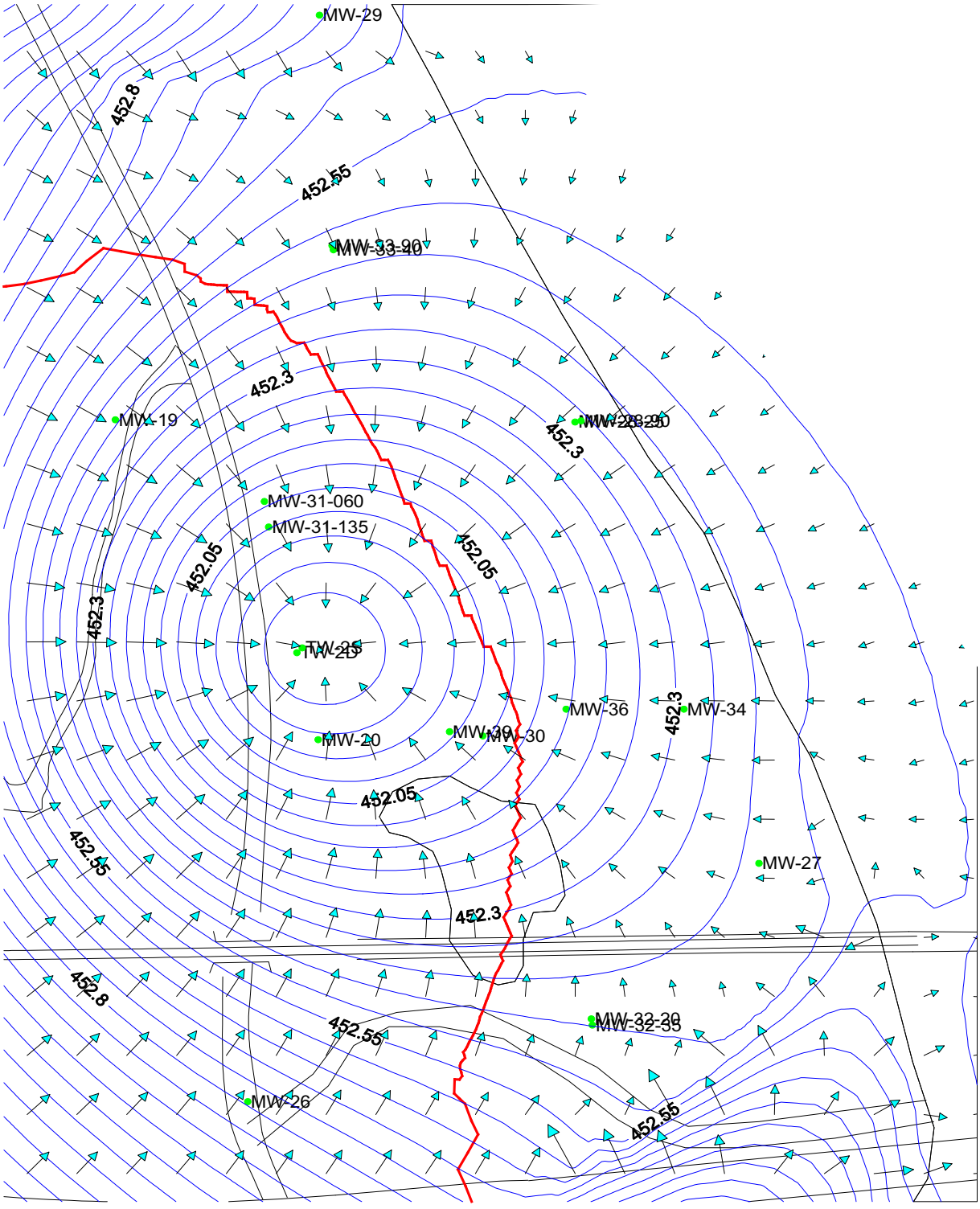



**FIGURE 7**
**SIMULATED HYDRAULIC HEAD CONTOURS AND VECTORS FOR MODEL LAYER 1 WITH A PUMPING RATE OF 100 GPM FROM WELL TW-2D**
PERFORMANCE MONITORING REPORT #6
PG&E COMPRESSOR STATION, NEEDLES, CALIFORNIA

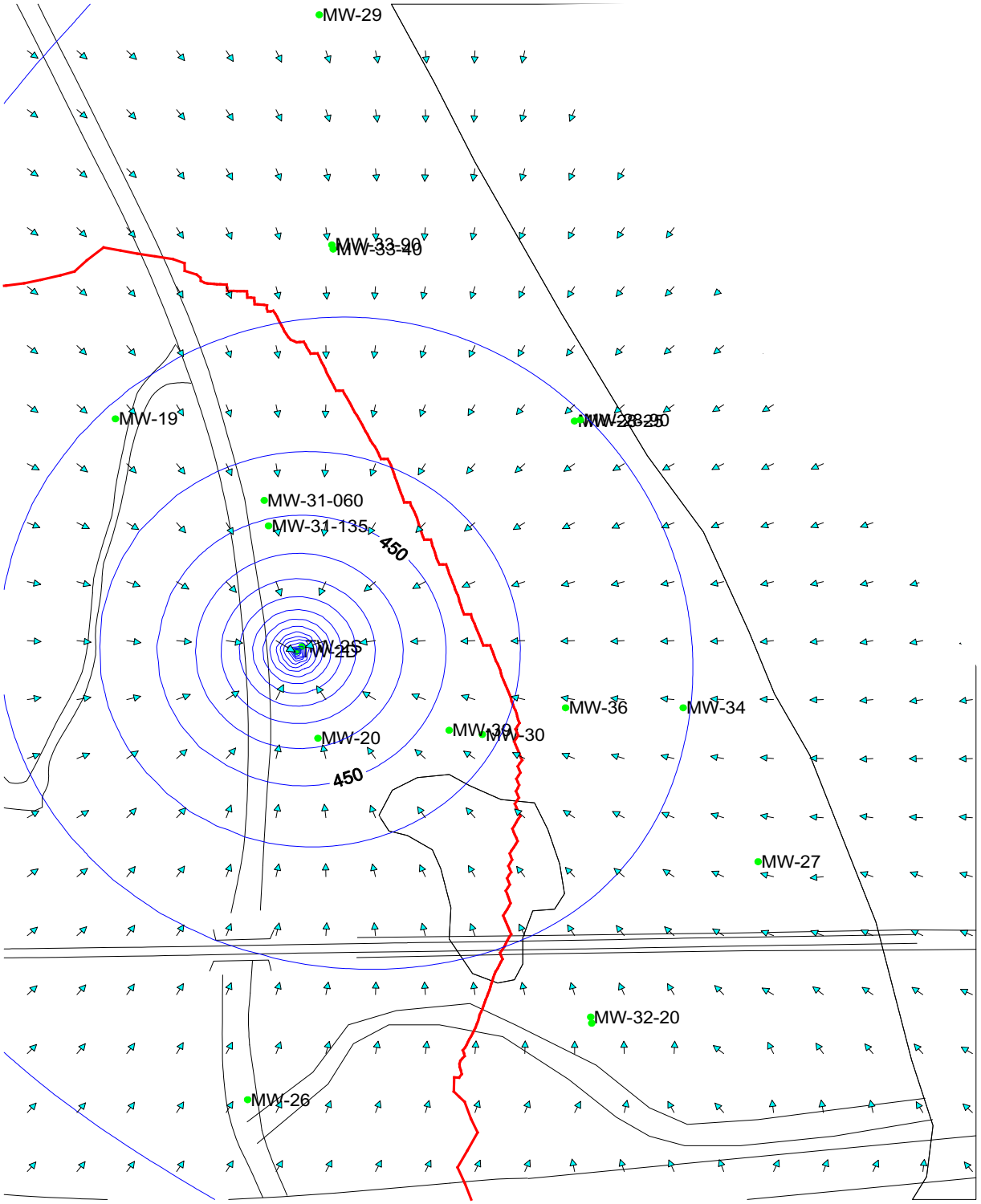
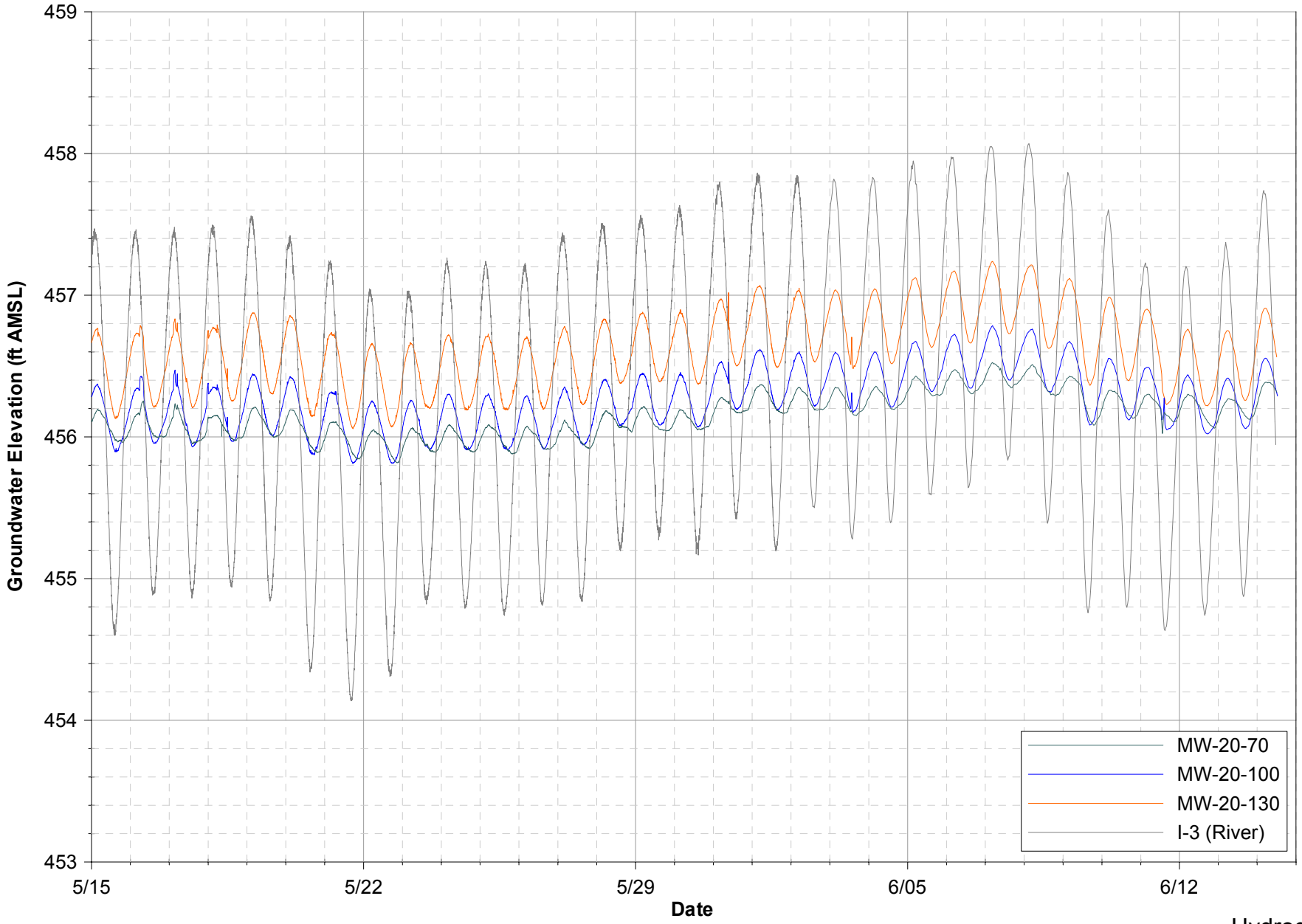



**FIGURE 8**
**SIMULATED HYDRAULIC HEAD CONTOURS AND VECTORS FOR MODEL LAYER 3 WITH A PUMPING RATE OF 100 GPM FROM WELL TW-2D**
PERFORMANCE MONITORING REPORT #6
PG&E COMPRESSOR STATION, NEEDLES, CALIFORNIA

# Attachment 1
# Hydrographs




Note: Data subject to review.

Hydrograph
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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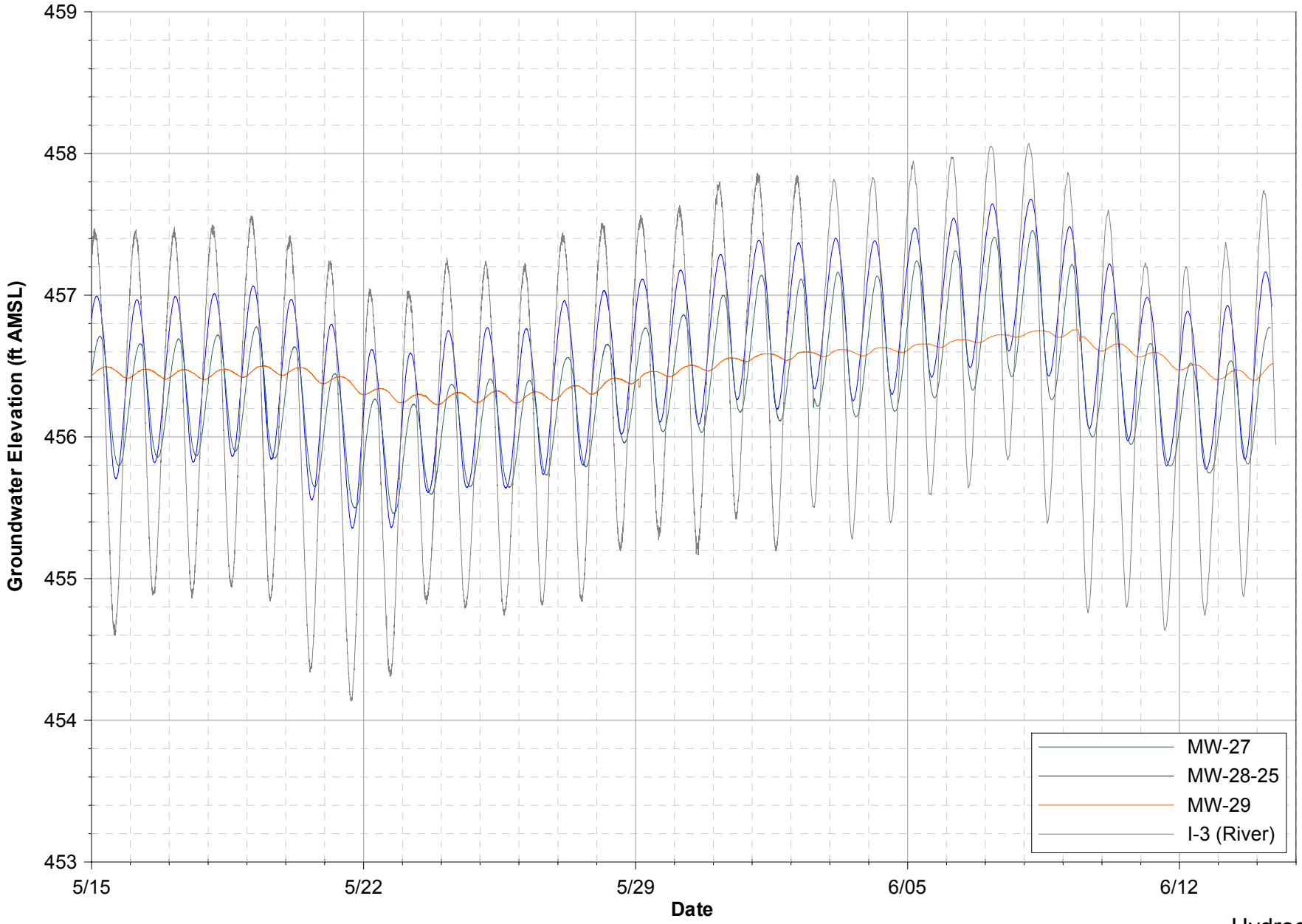


Hydrograph

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

Note: Data subject to review.

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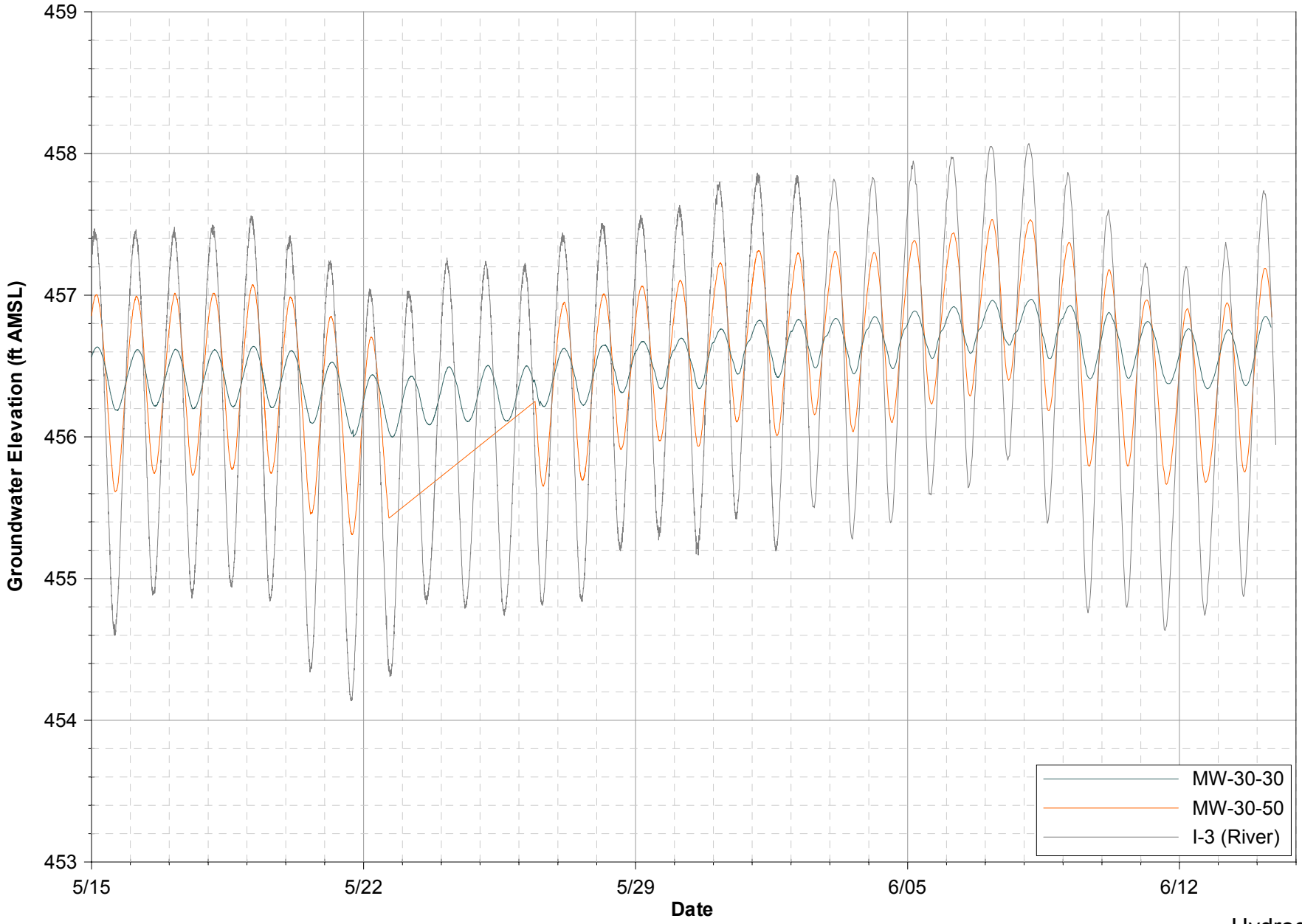


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Hydrograph
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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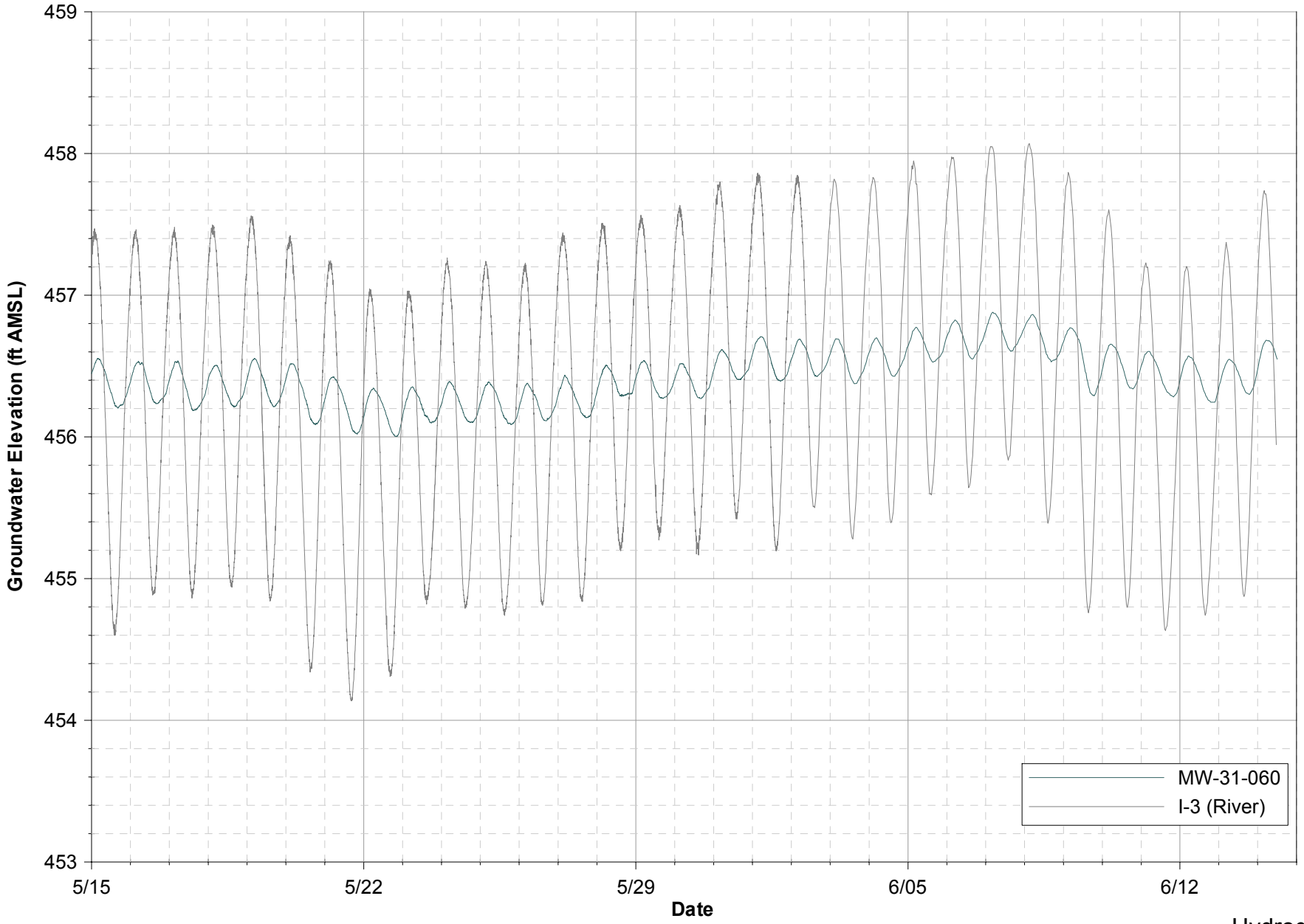


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Hydrograph
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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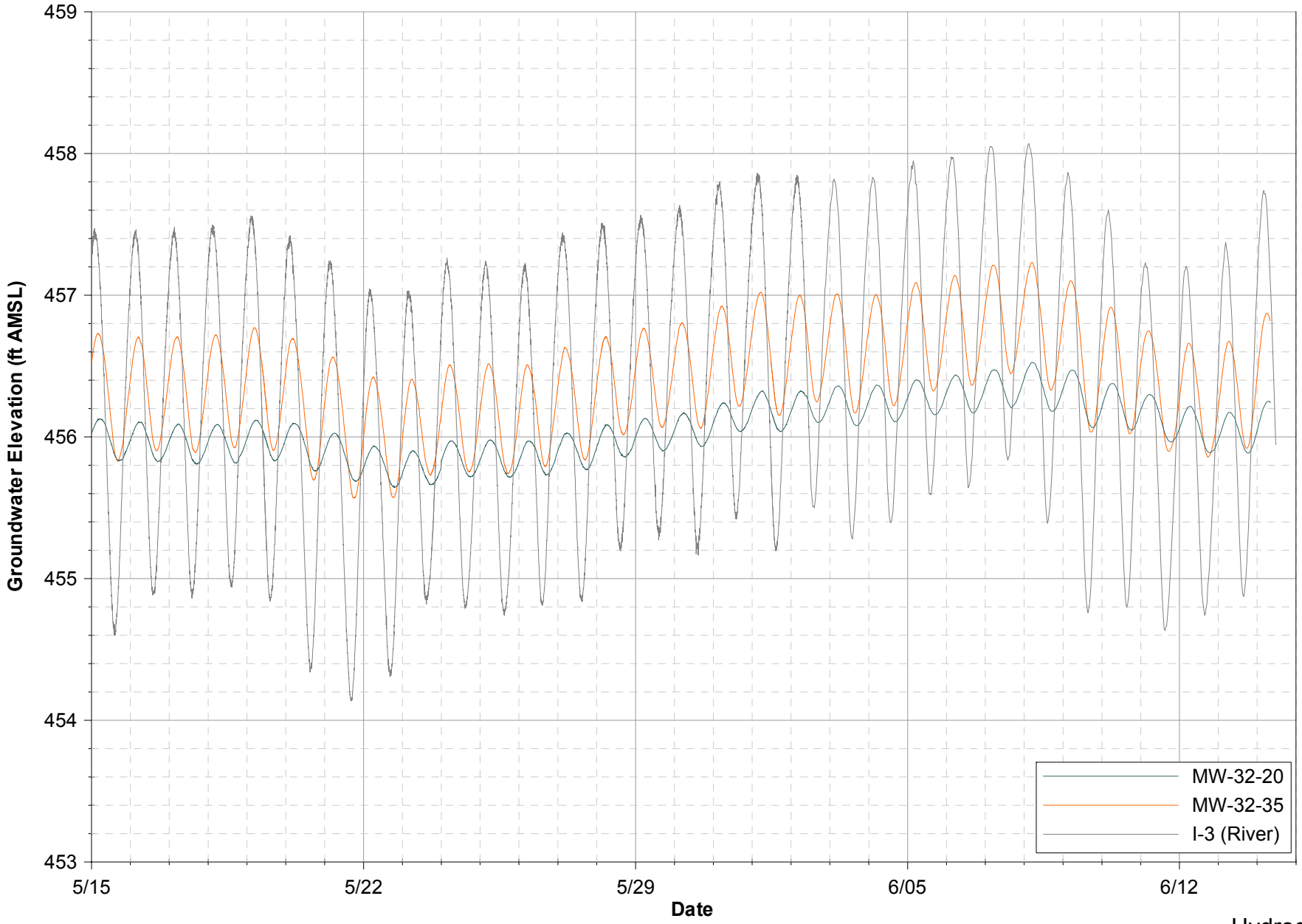


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PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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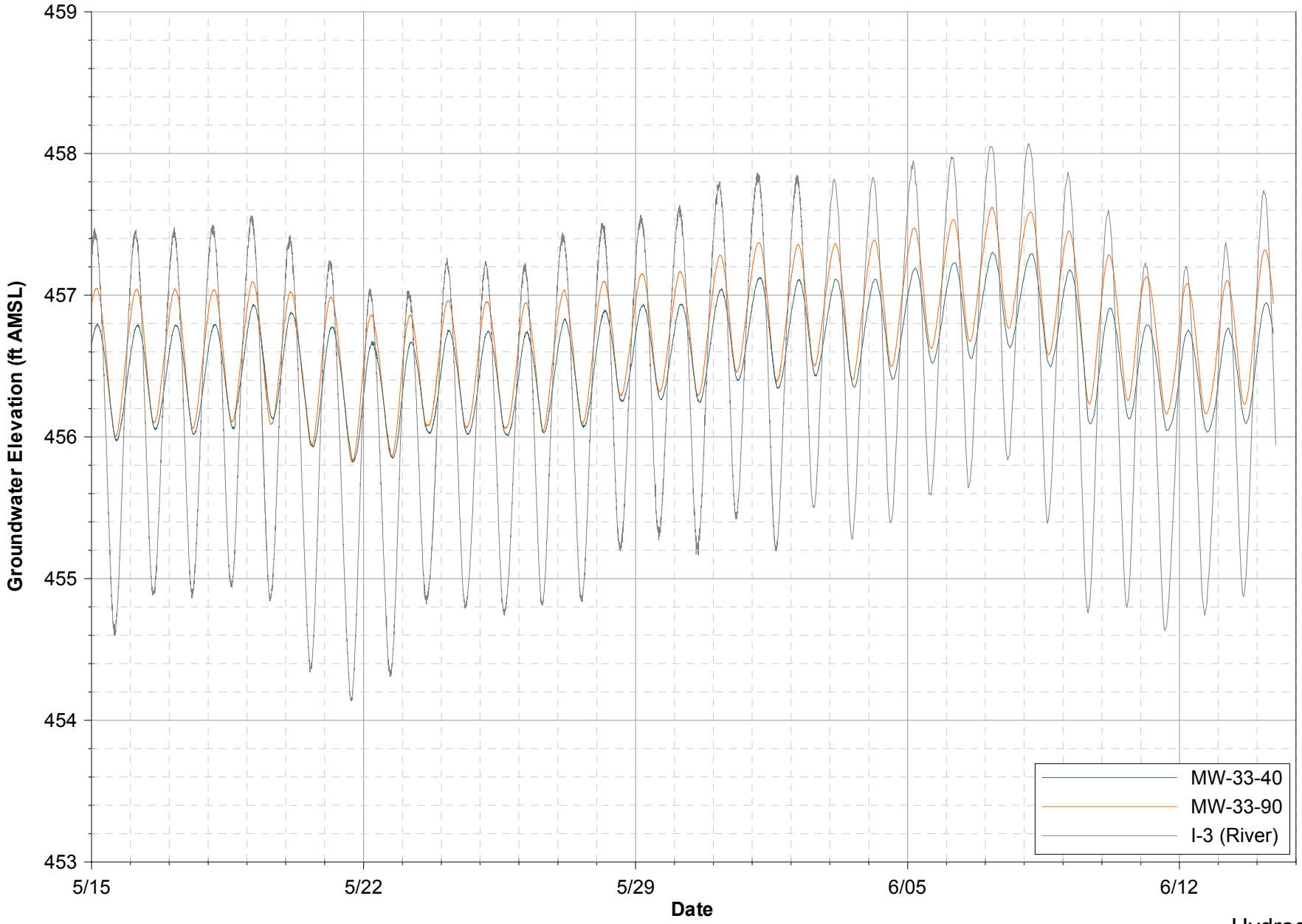


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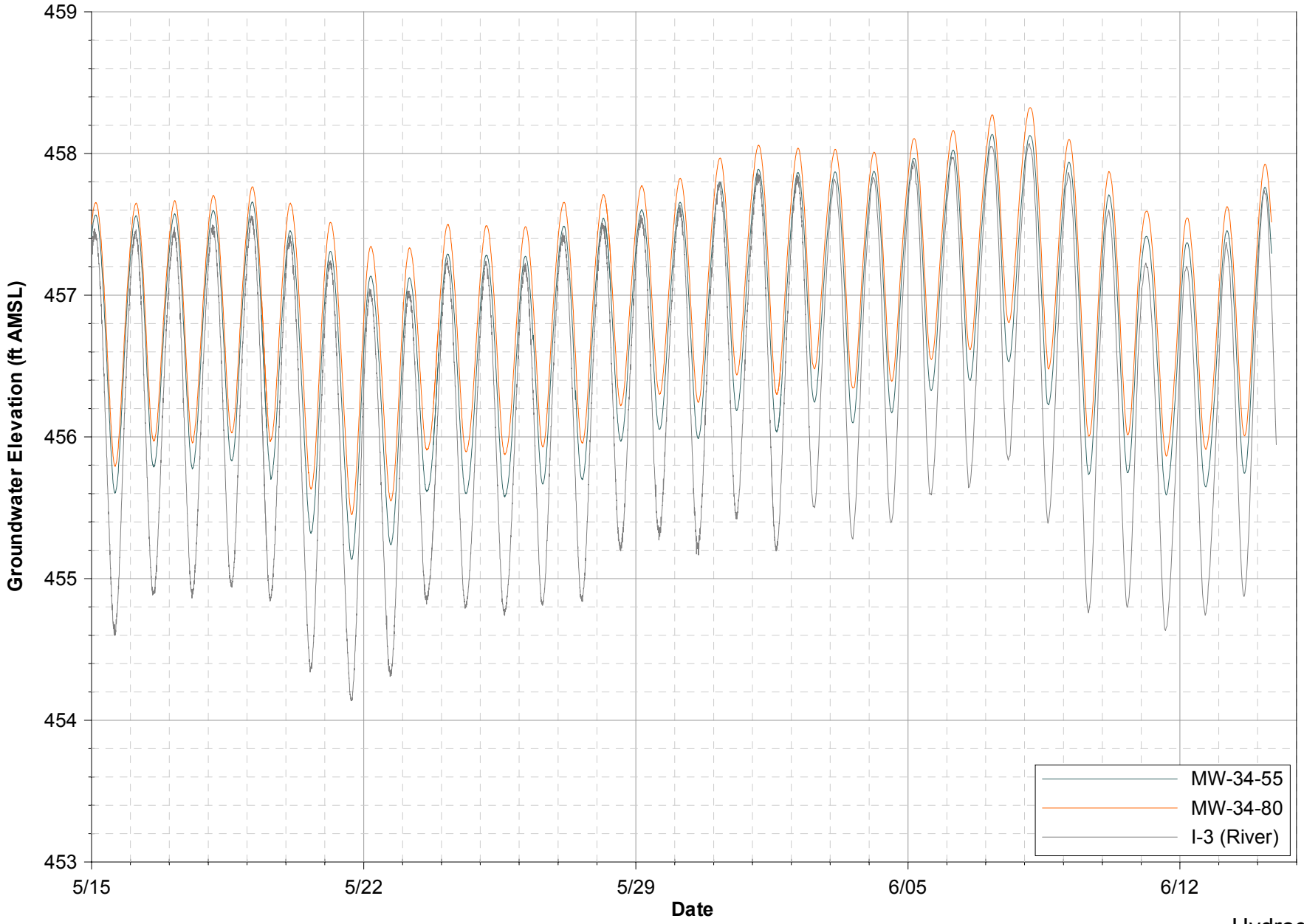


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PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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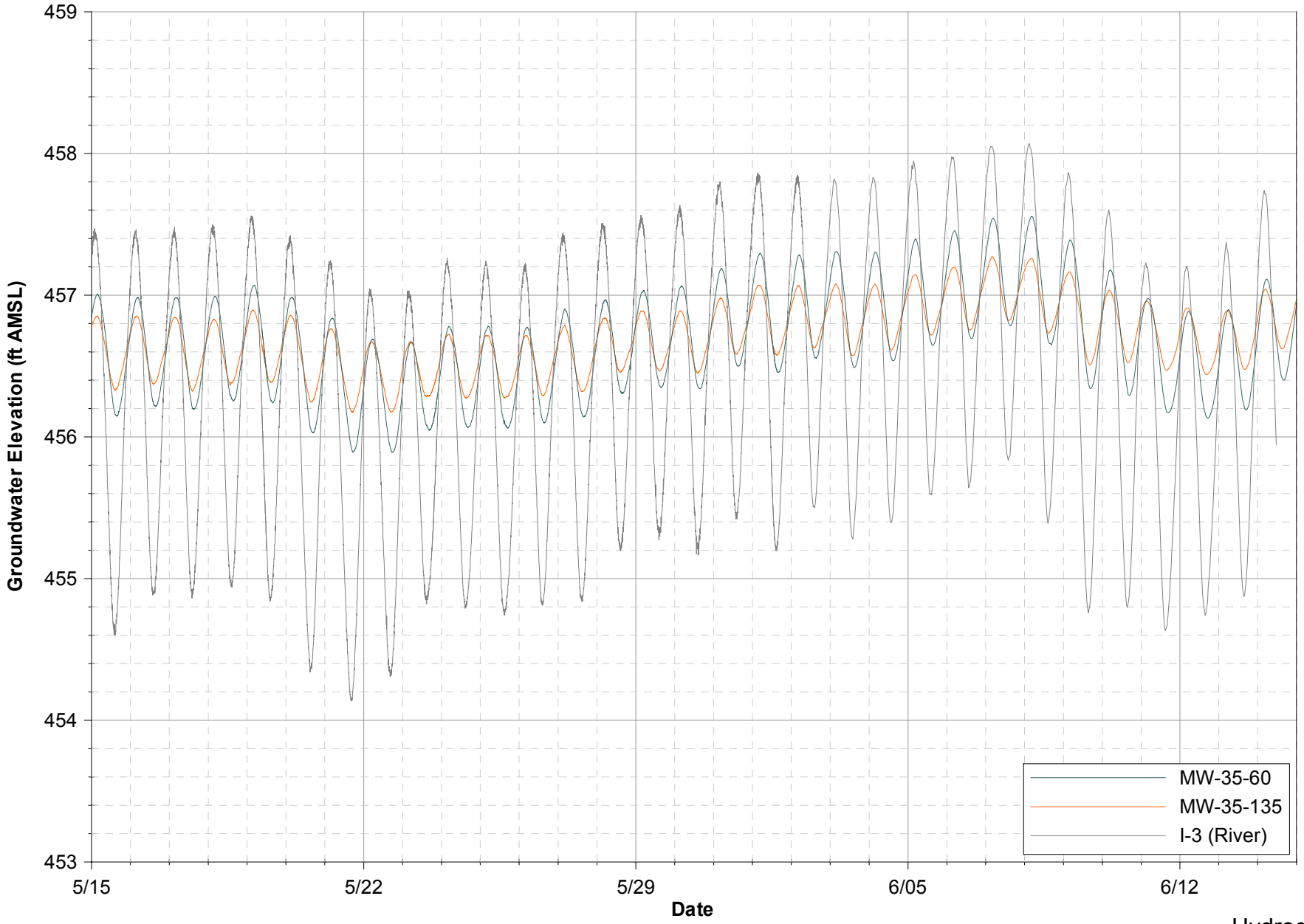


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NEEDLES, CALIFORNIA

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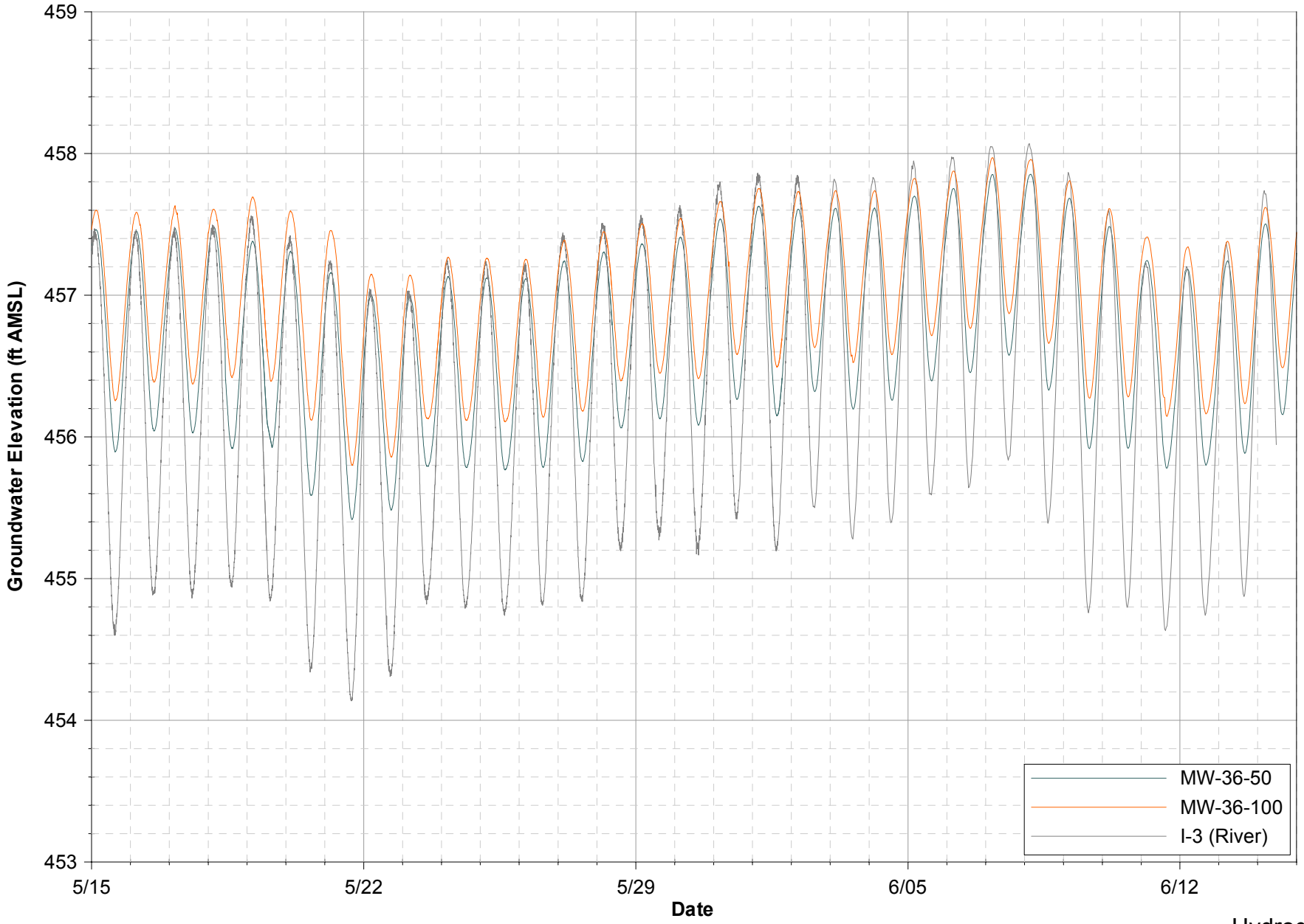


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PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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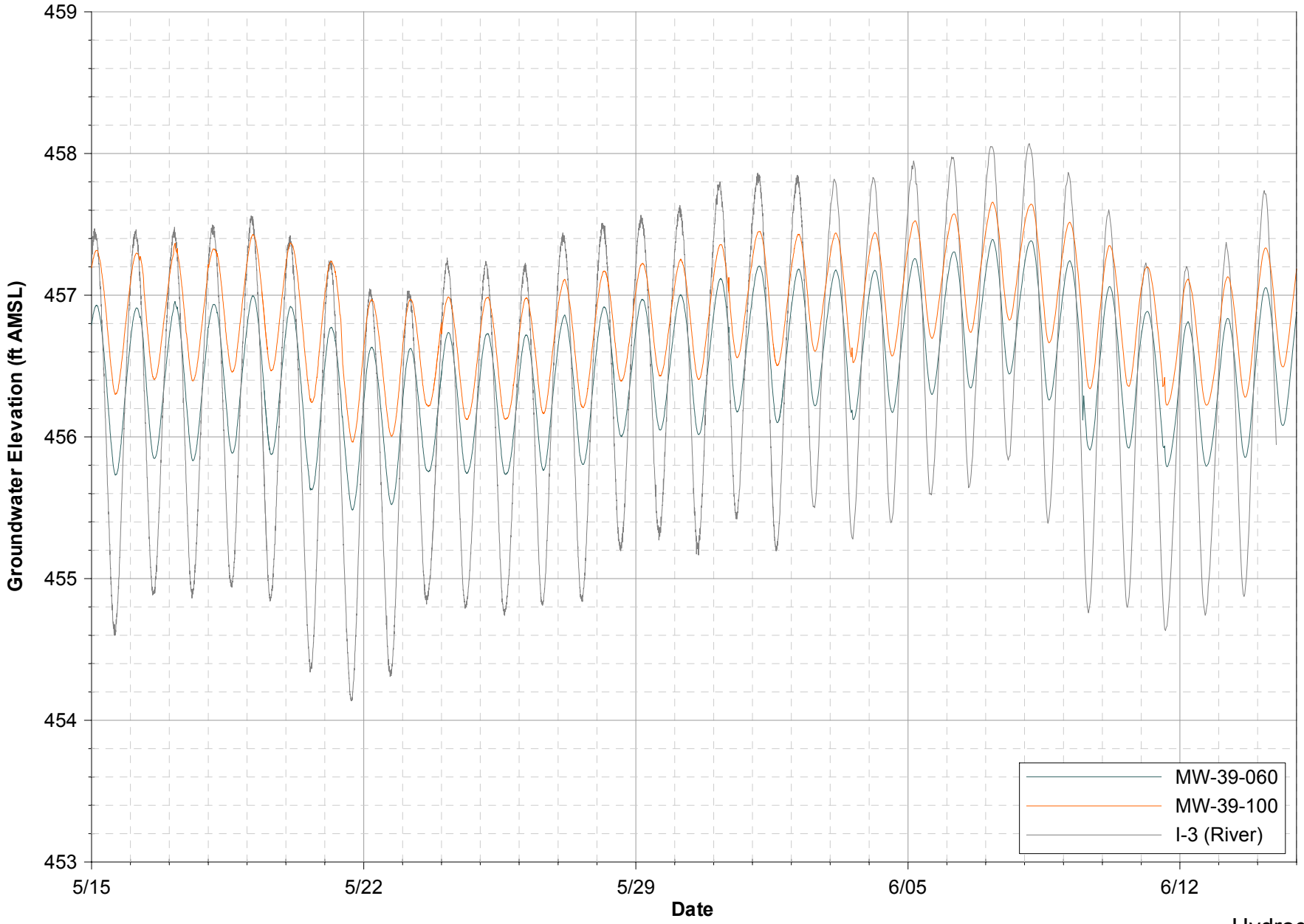


Note: Data subject to review.

Hydrograph
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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