Pacific Gas and Electric Company®

Yvonne J. Meeks
Site Remediation - Portfolio Manager
Environmental Affairs

6588 Ontario Road
San Luis Obispo, CA 93405

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

805.546.5243
Internal: 664.5243
Fax: 805.546.5232
E-Mail: YJM1@pge.com

July 31, 2006

Christopher Guerre
Project Manager
California Department of Toxic Substances Control
Permitting and Corrective Action Branch
5796 Corporate Avenue
Cypress, California 90630

Subject: Interim Measures Compliance Monitoring Program
Addendum to the Semiannual Groundwater Monitoring Report, June 2006
PG&E Topock Compressor Station, Needles, California

Dear Mr. Guerre:

Enclosed is the *Addendum to the Semiannual Groundwater Monitoring Report, June 2006* for the Interim Measure Compliance Monitoring Program at the PG&E Topock Compressor Station. In their letter dated June 9, 2006, the California Department of Toxic Substances Control (DTSC) required changes to the format of the Groundwater Monitoring Report based on a review of the third and fourth quarter 2005 CMP monitoring reports. The letter included a memorandum dated March 13, 2006 that provided comments from DTSC's Geological Service Unit (GSU). This Addendum fulfils the requirements of GSU Comments No. 1, 6, and 7.

Please contact me at (805) 546-5243 if you have any questions on the performance monitoring program.

Sincerely,

Julie Eakins for Yvonne Meeks

Yvonne Meeks
Pacific Gas and Electric Company
Senior Environmental Consultant – Onsite

cc. Robert Perdue, RWQCB
Jose Cortez, RWQCB
Liann Chavez, RWQCB
Kate Burger/ DTSC

Enclosure

Addendum to the Compliance Monitoring Program Semiannual Groundwater Monitoring Report, June 2006 for the IM No. 3 Injection Wellfield Area, PG&E Topock Compressor Station

DATE: July 31, 2006

Introduction

This technical memorandum presents an addendum to the *Compliance Monitoring Program* [CMP] *June 2006 Semiannual Groundwater Monitoring Report, Topock Compressor Station, Needles, California* for the Interim Measure No. 3 (IM No. 3) injection well field area (CH2M HILL 2006a). In their letter dated June 9, 2006 (DTSC 2006a), the California Department of Toxic Substances Control (DTSC) required changes to the format of the Groundwater Monitoring Report based on a review of the third and fourth quarter 2005 CMP monitoring reports. The letter included a memorandum dated March 13, 2006 (DTSC 2006b) that provided comments from DTSC's Geological Service Unit (GSU). DTSC required that GSU Comments No. 1, 5, 6, 7, and 8 of the memorandum be addressed in future monitoring reports.

GSU Comment Nos. 5 and 8 relate to data formatting and to the inclusion of additional data in the monitoring report appendices, and were addressed directly in the CMP monitoring report submitted to DTSC on July 14, 2006 (CH2M HILL 2006a). GSU Comment Nos. 1, 6, and 7 relate to additional technical analyses of the monitoring data. The June 2006 data were not received from the laboratory in time to include the response to these comments in the July 14, 2006 submittal. A separate submittal to respond to these three comments was proposed to DTSC in a July 4, 2006 email. This was approved in an email response by Chris Guerre of DTSC on July 10, 2006, which specified a submittal date of July 31, 2006. The responses to the three comments are addressed within this technical memorandum. In the future, the required responses to DTSC's comments will be included within the regularly-scheduled monitoring report submittal.

This addendum to the CMP monitoring report provides the following responses to the GSU comments:

- GSU Comment No. 1 recommends that monitoring reports have a separate section that summarizes which wells are interpreted to have water quality influenced by the treated water injection. A discussion will be added to the analytical results section of the monitoring report that identifies the changes to groundwater quality that are attributed to the injection of treated water and identifies the wells where this condition has been observed. This discussion is provided in this document in a section titled "Influence of Treated Water."

- GSU Comment No. 6 stated that it would be helpful if the reports contained graphical summaries of the analytical data. Time-series analyses of selected analytes will be added to the analytical results section of the monitoring report and are provided in this document in a section titled "Water Quality Hydrographs."
- GSU Comment No. 7 stated that monitoring reports should include a more detailed discussion of the flow characteristics (horizontal and vertical) in the vicinity of the injection wellfield area. Additional discussion on the horizontal and vertical hydraulic effects of injection will be added to the water level measurements discussion of the monitoring report. This discussion is provided in this document in a section titled "Groundwater Flow Characteristics."

While some background information on the CMP sampling program is provided in this technical memorandum in support of the analyses, information concerning the logistics and procedures related to collection of the monitoring data are not covered in this addendum. The *Compliance Monitoring Program June 2006 Semiannual Groundwater Monitoring Report, Topock Compressor Station, Needles, California* for the IM No. 3 injection well field area contains additional information concerning the sampling process and results (CH2M HILL 2006a).

Influence of Treated Water

Injection of treated water began on July 31, 2005. Under Waste Discharge Requirements No. R7-2004-0103, the IM No. 3 groundwater treatment system is required to submit monitoring reports on the operation of the system. These reports contain the analytical results of treated water sampling and, although these reports are used for monitoring compliance with water standards, they are also useful in determining the baseline water quality of the treated water being injected into the IM No. 3 Injection well field. Table 1 provides selected analytical results from three of the monthly reports: August 29, 2005, March 18, 2006, and June 15, 2006. While there are water quality differences between these samples, there are a number of parameters that show relatively consistent concentrations over time. Analytes that are relatively consistent over the injection time period include hexavalent chromium, total chromium, fluoride, molybdenum, nitrate as nitrogen, sulfate, and total dissolved solids. These seven constituents provide a characterization of the effluent that does not appear to vary greatly over time and can serve as a basis for determining if a groundwater monitoring well is being affected by injection. In general terms, treated water has the following characteristics:

- Hexavalent chromium: ND(0.001) milligrams per liter (mg/L)
- Total chromium: ND(0.001) mg/L
- Fluoride: 1.9 mg/L
- Molybdenum: 0.006 to 0.008 mg/L
- Nitrate as nitrogen: 2 to 3 mg/L
- Sulfate: 470 mg/L
- Total dissolved solids: 4000 mg/L

These treated water quality characteristics are meant to serve as a general guideline and not as a statistically representative sampling of the treated water quality over time.

Table 1 also lists the results of baseline sampling for the observation wells (OW) and compliance wells (CW). A full set of nine OW groundwater samples were collected on July 27 and 28, 2005, and a full set of eight CW groundwater samples were collected on September 13 through September 16, 2005. All of these samples are representative of conditions unaffected by injection and serve to characterize the pre-injection water quality. In comparing these sampling results to the treated injection water sampling results, there are some similarities in the constituent concentrations. For example, none of the pre-injection OW or CW deep well samples (OW-01D, OW-02D, OW-05D, CW-01D, CW-02D, CW-03D, and CW-04D) have detectable hexavalent or total chromium, which is similar to the treated injection water. Most of the well samples show concentrations similar to the treated water for two or three constituents, but large differences in concentration from the treated water for the remaining four or five. By considering the entire suite of 7 analytes, it is relatively easy to distinguish between the pre-injection OW and CW water quality and the treated water quality.

Table 2 presents a comparison between the treated water quality and the results from the most recent sampling event, the OW and CW June 2006 semiannual sampling event (May 2, June 6, and June 7, 2006). These samples were collected after approximately 10 months of injection. While the pre-injection OW and CW sample results were significantly different from the treated water quality, a number of the OW and CW June 2006 sample results have changed in that they show a marked similarity to the treated water results. The following wells display the general characteristics of treated water: OW-01M, OW-01D, OW-02M, OW-02D, and OW-05D. OW-05M and CW-01D show some change towards treated water quality concentrations in a number of the constituents. OW-05M displays decreased concentrations of molybdenum and increased concentrations of nitrate and sulfate, while hexavalent chromium, total chromium, and fluoride remain largely unchanged and differ significantly from treated water. CW-01D displays increased concentrations of nitrate and sulfate and decreased concentrations of molybdenum, while hexavalent chromium and total chromium concentrations are largely unchanged but remain at concentrations near the detection limit.

Wells OW-01M, OW-01D, OW-02M, OW-02D, and OW-05D are locations and depths where the treated water injection front has largely replaced the local pre-injection groundwater. Wells OW-5M and CW-01D are locations and depths where the treated water injection front has arrived but has not yet completely displaced the local pre-injection groundwater. Over time, the water quality in these wells will most likely continue to change until they match the general water quality of the treated water. Wells OW-01S, OW-02S, OW-05S, CW-01M, CW-02M, CW-02D, CW-03M, CW-03D, CW-04M, and CW-04D are locations and depths that show no water quality affect of the injection of treated water at this time.

Water Quality Hydrographs

The discussion of analytical results presented in the groundwater monitoring report focuses on the basic statistical representation of the sampling event results and documents exceedances of the proposed interim action levels, which have largely been isolated point occurrences. While the entire quarterly water quality analytical data set was supplied in tabular format within each monitoring report, trends in these data have not been reported upon previously. Trend data could be used to determine when a rapid change has occurred between sampling events, such as the arrival of the injection front. It can also be used to look at more gradual changes that occur over several sampling events, such as seasonal effects or the interaction of treated water with local groundwater and host aquifer material. Thirty-six analytes are currently monitored quarterly; of which, 19 have sufficient detections to make time-series analysis useful. A detection to non-detection ratio of greater than 50 percent was used as the criteria to determine which analyte had a useful time series response. Of these analytes, the majority are in the general minerals category, as common inorganic ionic constituents that are found in all natural waters. Eleven of the 19 analytes were selected for time-series analysis; these analytes are considered to be most representative of the IM No. 3 injection well field area and include chloride, total chromium, fluoride, hexavalent chromium, molybdenum, nitrate as nitrogen, pH, sodium, sulfate, total dissolved solids, and vanadium. Water quality hydrographs (time-series plots) of all 11 analytes in each monitoring well within the IM No. 3 injection wellfield are presented in Figures 1 through 17.

Compliance well water quality hydrographs are presented in Figures 1 through 8. In general, time-series analyses for the selected constituents show no trend in concentration, with only minor variation over time. There are point occurrences of localized high or low values for a number of compounds, but these do not change the overall trend. For example, the initial February 2005 vanadium results appear to be anomalously high for every one of the compliance wells. Subsequent vanadium sampling results show significantly lower concentration and very little variation over time. Fluoride results also tend to show a spiked response, rather than the smooth trend seen in most of the analyte water quality hydrographs. While it is possible that these apparently anomalous point occurrences reflect some natural process, the overall response seen in the compliance well water quality hydrographs supports a natural system that is undergoing only gradual change for the 15-month period. The one exception to this conceptual model comes from the water quality hydrograph response in well CW-01D. CW-01D was previously discussed as a well where the treated water injection front is still interacting or mixing with the local pre-injection groundwater. The trends displayed in the molybdenum, nitrate, and sulfate water quality hydrographs support this, showing a gradual shift from local water quality concentrations towards concentrations that reflect the general treated water characteristics.

Observation well water quality hydrographs (Figures 9 through 17) show the same overall patterns: wells that are identified as affected by treated water injection show a shift in water quality hydrograph response for characteristic parameters, while those identified as being unaffected by injection show no net trends. The water quality change brought on by the arrival of the treated water injection front can be either gradual (OW-5M) or rapid (OW-2D), with most affected wells showing a pattern of change somewhere between the two. Based on the variability in response, movement of treated water is non-uniform laterally between wells. That is, the treated water appears to preferentially move in one direction versus another. This variability in lateral movement of treated water is seen in both the mid and deep interval wells identified as affected by treated water injection. The OW shallow depth wells (OW-01S, OW-02S, and OW-05S) show little water quality variation over time and generally have no net trends over time. The one exception to this behavior is seen in the response for hexavalent chromium and total chromium in well OW-02S, which shows an increasing trend over time that has only recently reached stability. While the hexavalent and total chromium concentrations measured in this well have changed over time, none of the other parameters shows much variability. Total dissolved solids, fluoride, sulfate, and molybdenum are particularly consistent and show that the local groundwater quality is not being affected by outside water sources.

Groundwater Flow Characteristics

The injection well field is located in the East Mesa area of the Topock site (Figure 18). Overall sitewide water level contour maps for shallow wells are prepared quarterly, with flow consistantly being shown to move to the east across the site towards the floodplain. Figure 19, constructed using water level information obtained from a snapshot water level survey conducted on March 8, 2006, presents the groundwater elevation map for the entire Topock site in the upper depth interval (CH2M HILL 2006b).

The effects of injection in the IM No. 3 injection well field are superimposed on the more regional Topock site flow system and, as expected, a groundwater mound has begun to grow. This mound is centered around the injection well IW-02. The monthly potentiometric surfaces presented in the monitoring report mapped the growth of the groundwater mound over time and show that, after 10 months of injection, the mound has increased in height by several tenths of a foot in elevation above the surrounding water level elevations. Figures 20 and 21 present groundwater elevation contours for the average groundwater elevation level of the mound within the mid-depth and deep wells, respectively, using May 15 thru June 15, 2006 averages. As expected with a mound, the deeper potentiometric surface is broader, while the mid-depth potentiometric surface is more localized to the vicinity of the injection well. The mound is elliptical in shape, with the major axis running in a southwest to northeast direction. The lower gradients (broader contours) in the direction of the major axis are an indication that the aquifer permeabilities are greater in this direction, indicating that there may be a preferred direction to flow in this area. This conclusion is supported by the faster arrival of the treated water to the OW-2 well cluster versus other observation wells, with OW-2 being located along the major axis from IW-02.

The direction of vertical flow in the IM No. 3 injection well field area is upward at all of the CW and OW well clusters and also upward between each of the depth intervals in those same well clusters. Table 3 presents the vertical gradient data calculated using the May 15 to June 15, 2006 average groundwater levels. The magnitude of the vertical gradients is similar between clusters and between the depth intervals, indicating that the vertical gradient is of the same order of magnitude throughout the injection area. Vertical gradients calculated in the vicinity of the IM3 injection well field are likely related to the injection of treated water, and are consistent with expected regional groundwater flow within the southern Mohave Valley.

References

CH2M HILL. 2006a. *Compliance Monitoring Program June 2006 Semiannual Groundwater Monitoring Report, Topock Compressor Station, Needles, California.* July 14.

__________. 2006b. *Groundwater and Surface Water Monitoring Report, First Quarter 2006, Topock Compressor Station, Needles, California.* June 1.

Department of Toxic Substances Control (DTSC). 2006a. Letter to PG&E. “Third and Fourth Quarter 2005 Groundwater Monitoring Reports Compliance Monitoring Program for Interim Measures No. 3 Injection Well Field Area, Pacific Gas & Electric Company, Topock Compressor Station, Needles, California”. June 9.

__________. 2006b. Letter to PG&E. “Memorandum: Third and Fourth Quarter 2005 Groundwater Monitoring Reports Compliance Monitoring Program for Interim Measures No. 3 Injection Well Field Area, Pacific Gas & Electric Company, Topock Compressor Station, Needles, California”. March 13.

Tables

TABLE 1

Treated Water Quality Compared to OW and CW Pre-injection Water Quality

Addendum to the CMP Semiannual Groundwater Monitoring Report, PG&E Topock Compressor Station

Location	Sample Date	Hexavalent Chromium	Total Chromium	Fluoride	Molybdenum	Nitrate	Sulfate	TDS
Treated Water	29-Aug-05	ND(0.001)	ND(0.0021)	1.95	0.0083	3.7	450	3620
Treated Water	18-Mar-06	ND(0.001)	ND(0.001)	1.92	0.0082	2.79	482	4040
Treated Water	15-Jun-06	ND(0.002)	ND(0.001)	1.97	0.0062	2.44	471	4090
OW-01S	28-Jul-05	0.0194	0.0235	2.45	0.0172	3.2	114	1320
OW-01M	27-Jul-05	0.0163	0.0189	2.31	0.027	1.01	311	3450
OW-01D	27-Jul-05	ND(0.001)	ND(0.0013)	1.14	0.0461	0.321	441	6170
OW-02S	28-Jul-05	0.0153	0.0148	3.79	0.0356	3.81	126	1090
OW-02M	28-Jul-05	0.0054	0.0057	2.19	0.0324	0.735	342	4380
OW-02D	28-Jul-05	ND(0.001)	ND(0.0012)	0.966	0.0512	0.1	616	9550
OW-05S	28-Jul-05	0.0234	0.0256	2.3	0.0171	3.55	105	1060
OW-05M	28-Jul-05	0.0086	0.0088	2.74	0.0354	0.621	417	5550
OW-05D	28-Jul-05	ND(0.001)	ND(0.0012)	1.11	0.057	0.151	480	8970
CW-01M	15-Sep-05	0.0181	0.0178	2.34	0.0216	1.11	318	2990
CW-01D	15-Sep-05	ND(0.001)	0.0016	0.951	0.0321	0.972	379	6230
CW-02M	15-Sep-05	0.0158	0.0155	2.3	0.0231	0.908	342	3500
CW-02D	15-Sep-05	ND(0.001)	0.0016	0.982	0.0416	0.28	601	8770
CW-03M	16-Sep-05	0.0088	0.0081	2.57	0.0242	0.642	464	4740
CW-03D	16-Sep-05	ND(0.001)	ND(0.001)	1.4	0.0292	0.304	672	9550
CW-04M	13-Sep-05	0.0192	0.019	1.5	0.0123	1.18	240	3310
CW-04D	13-Sep-05	ND(0.001)	ND(0.001)	1.01	0.026	0.188	534	7470

All concentrations in mg/L.
ND(0.001) = Non-detect with a detection limit of 0.001 mg/L.

TABLE 2

Treated Water Quality Compared to OW and CW June 2006 Semiannual Groundwater Sampling Event Water Quality

Addendum to the CMP Semiannual Groundwater Monitoring Report, PG&E Topock Compressor Station

Location	Sample Date	Hexavalent Chromium	Total Chromium	Fluoride	Molybdenum	Nitrate	Sulfate	TDS
Treated Water	29-Aug-05	ND(0.001)	ND(0.0021)	1.95	0.0083	3.7	450	3620
Treated Water	18-Mar-06	ND(0.001)	ND(0.001)	1.92	0.0082	2.79	482	4040
Treated Water	15-Jun-06	ND(0.002)	ND(0.001)	1.97	0.0062	2.44	471	4090
OW-01S	06-Jun-06	0.0186	0.0165	2.2	0.0066	3.45	143	1370
OW-01M	06-Jun-06	0.0014	0.002	1.49	0.0075	2.73	538	4200
OW-01D	06-Jun-06	ND(0.001)	ND(0.001)	2.31	0.0088	3.32	545	4180
OW-02S	06-Jun-06	0.0353	0.0445	4.16	0.0319	4.41	137	1010
OW-02M	07-Jun-06	0.0012	0.0012	1.62	0.0088	2.37	532	4230
OW-02D	07-Jun-06	ND(0.001)	ND(0.001)	1.62	0.0082	3.44	516	4300
OW-05S	07-Jun-06	0.0254	0.0244	2.18	0.0153	3.89	121	995
OW-05M	07-Jun-06	0.0098	0.0086	2.97	0.0195	1.4	497	5100
OW-05D	07-Jun-06	ND(0.001)	ND(0.001)	3.03	0.0118	2.72	539	4220
CW-01M	02-May-06	0.0151	0.0171	2.72	0.0239	0.832	355	3670
CW-01D	06-Jun-06	0.0012	0.0022	3.27	0.0208	3.36	501	4790
CW-02M	02-May-06	0.0155	0.0157	2.82	0.0247	0.821	372	3630
CW-02D	07-Jun-06	0.0033	0.0031	3.26	0.0339	0.385	554	7700
CW-03M	07-Jun-06	0.0113	0.0097	2.28	0.0154	0.594	444	5130
CW-03D	07-Jun-06	0.0031	0.0034	2.23	0.03	0.251	615	8710
CW-04M	06-Jun-06	0.0214	0.0199	1.63	0.0073	1.72	262	3450
CW-04D	06-Jun-06	0.0026	0.0024	2.8	0.0218	0.417	504	7010

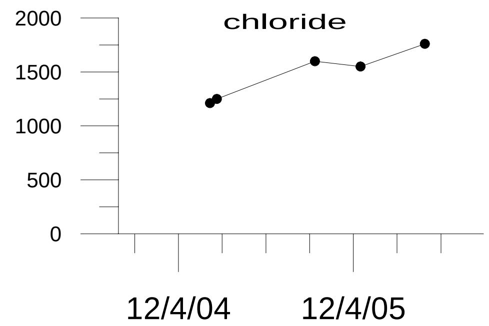
All concentrations in mg/L.
ND(0.001) = Non-detect with a detection limit of 0.001 mg/L.

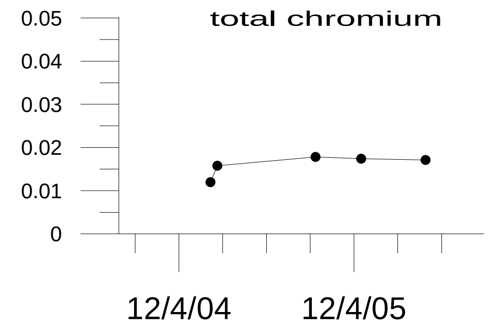
TABLE 3
Vertical Gradients within the OW and CW clusters
Addendum to the CMP Semiannual Groundwater Monitoring Report, PG&E Topock Compressor Station

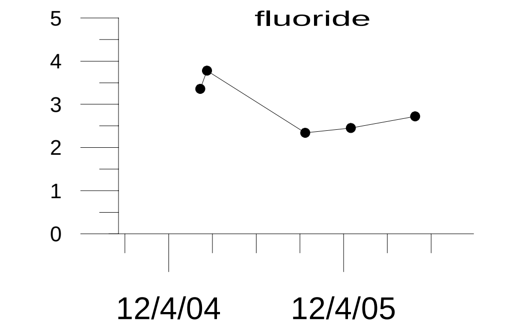
Well Pairs	**Vertical Gradient (ft/ft)[a]**
CW-01D to CW-01M	0.0073
CW-02D to CW-02M	0.0041
CW-03D to CW-03M	0.0079
CW-04D to CW-04M	0.0051
OW-01M to OW-01S	0.0054
OW-01D to OW-01M	0.0047
OW-02M to OW-02S	0.0078
OW-02D to OW-02M	0.0022

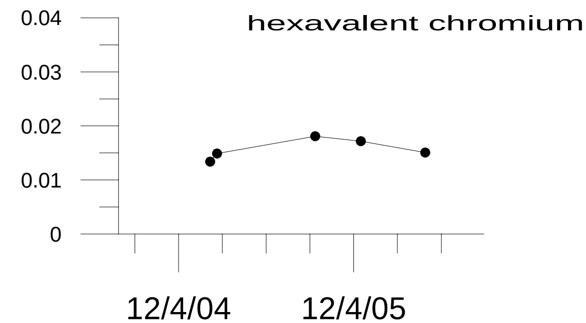
[a] Positive value signifies an upward gradient. Gradients calculated using May 15 through June 15, 2006 average groundwater levels.

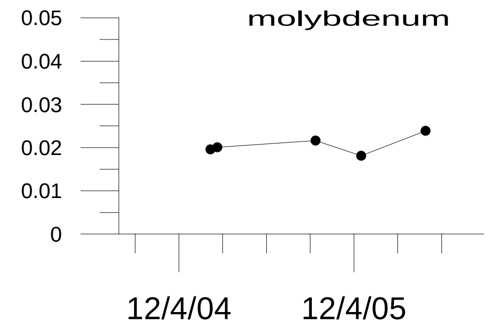
Figures

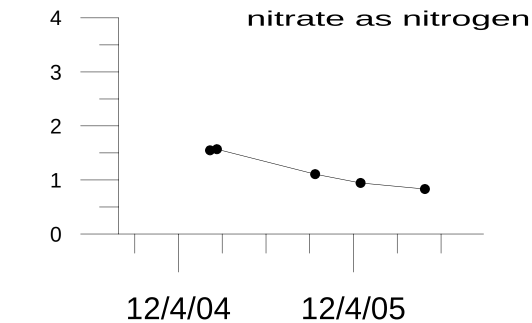


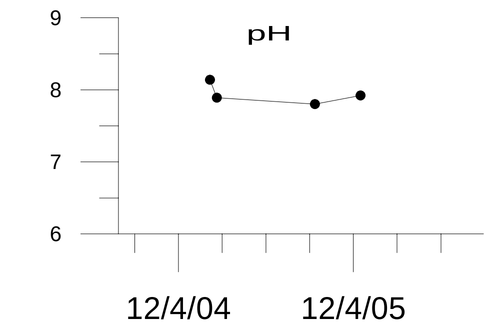


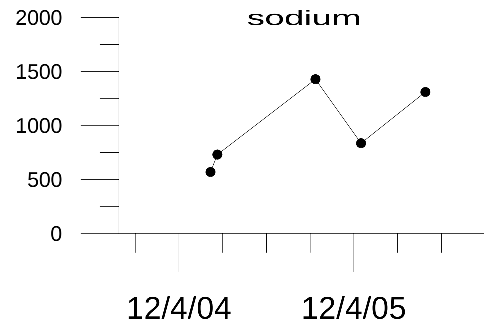


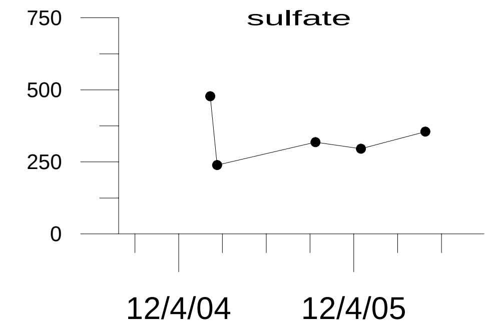


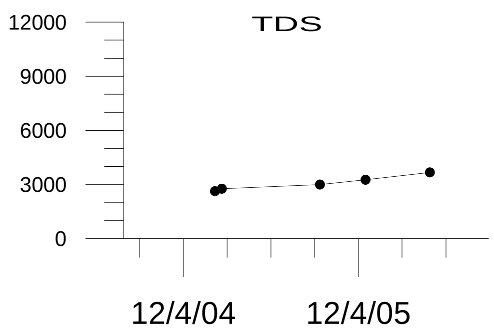


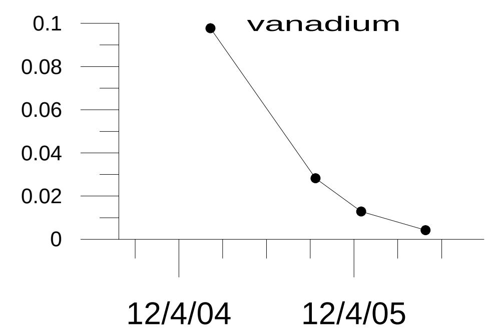






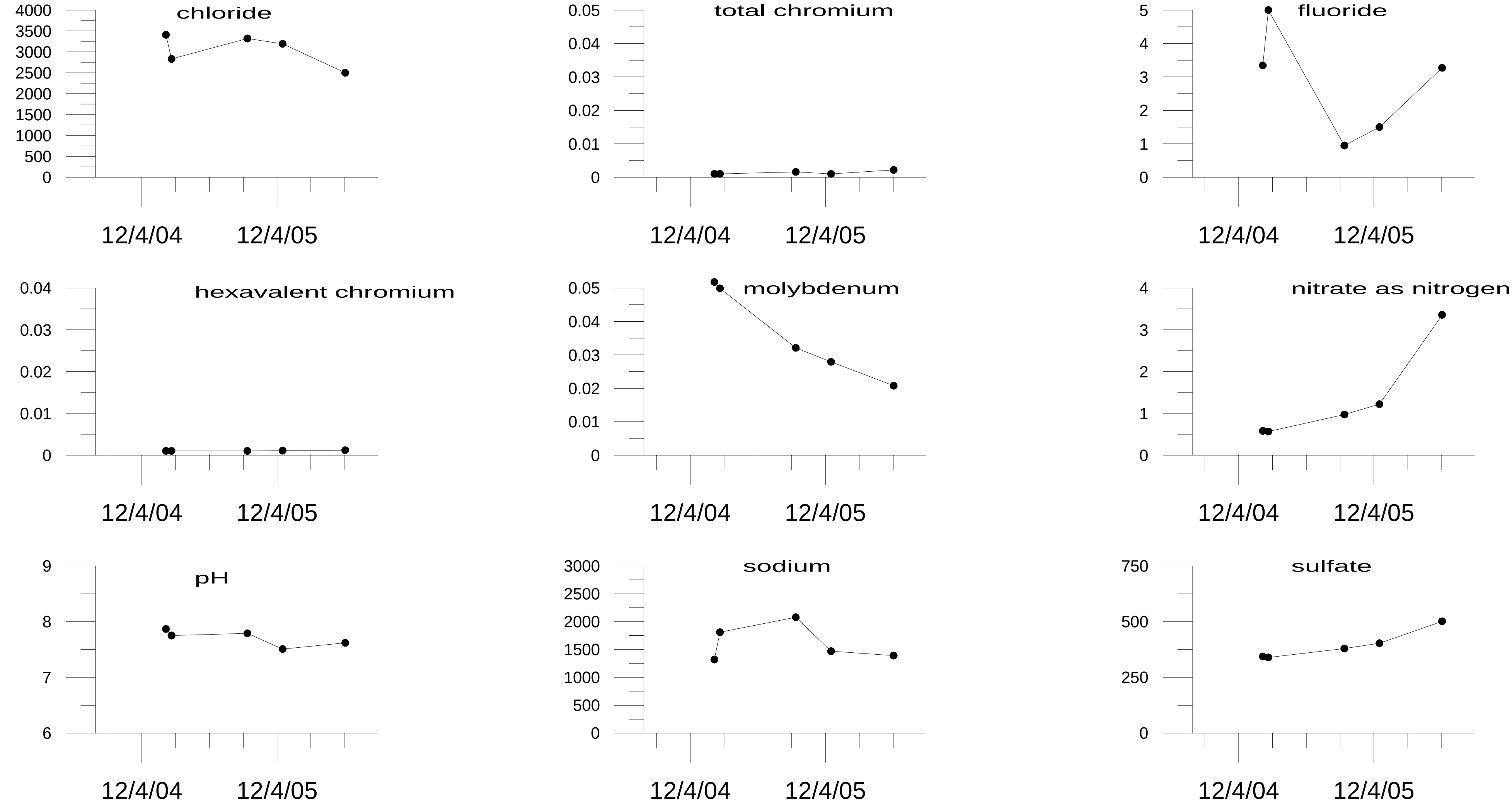


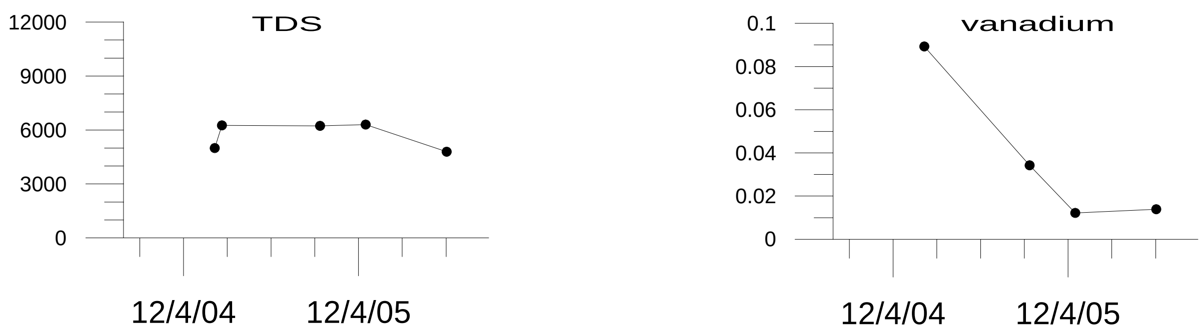




All concentration units in mg/L. pH in pH units

Figure 1
Water Quality Hydrographs
CW-01M
IM3 Compliance Monitoring Program
PG&E Topock Compressor Station
Needles, California

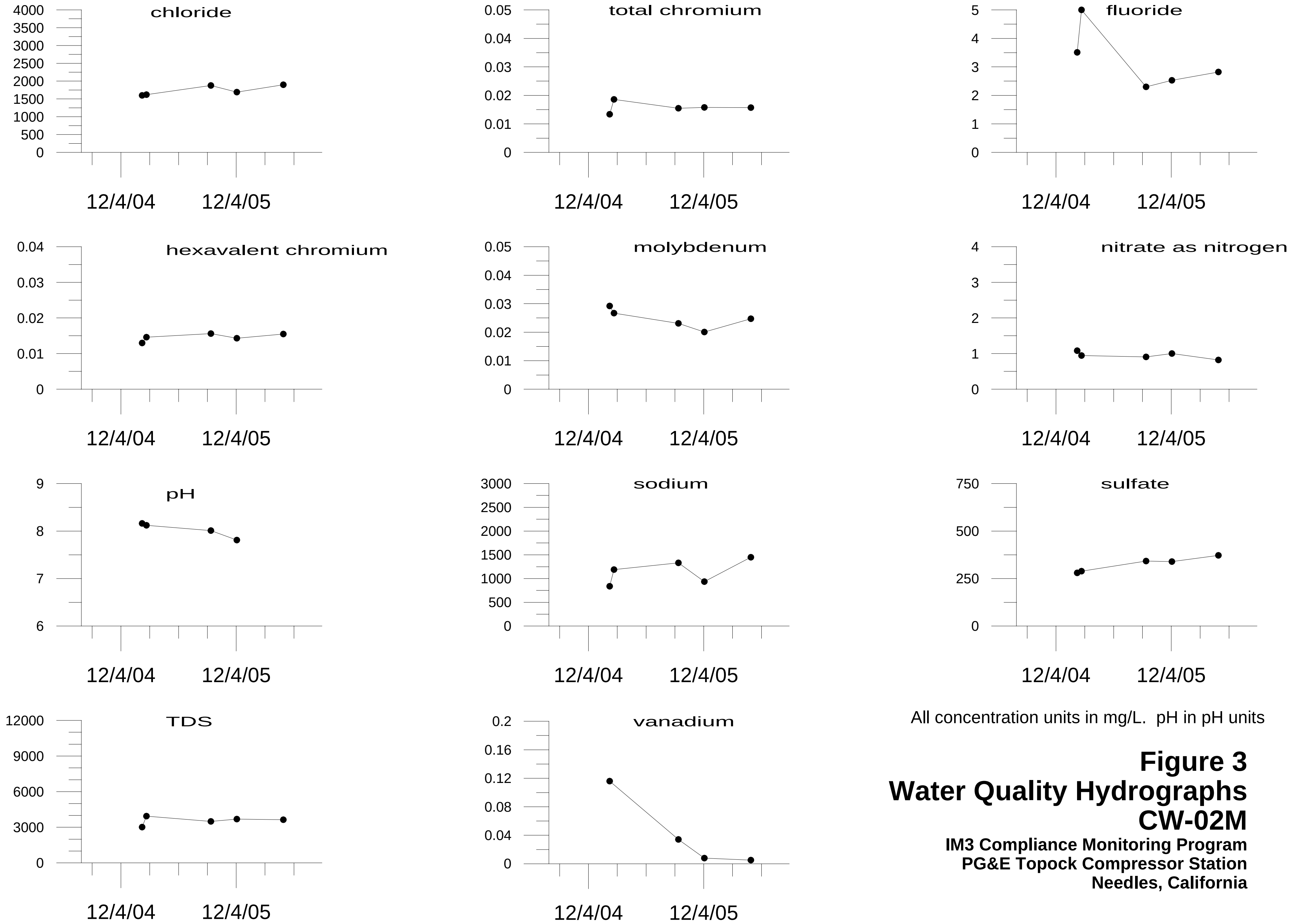




All concentration units in mg/L. pH in pH units

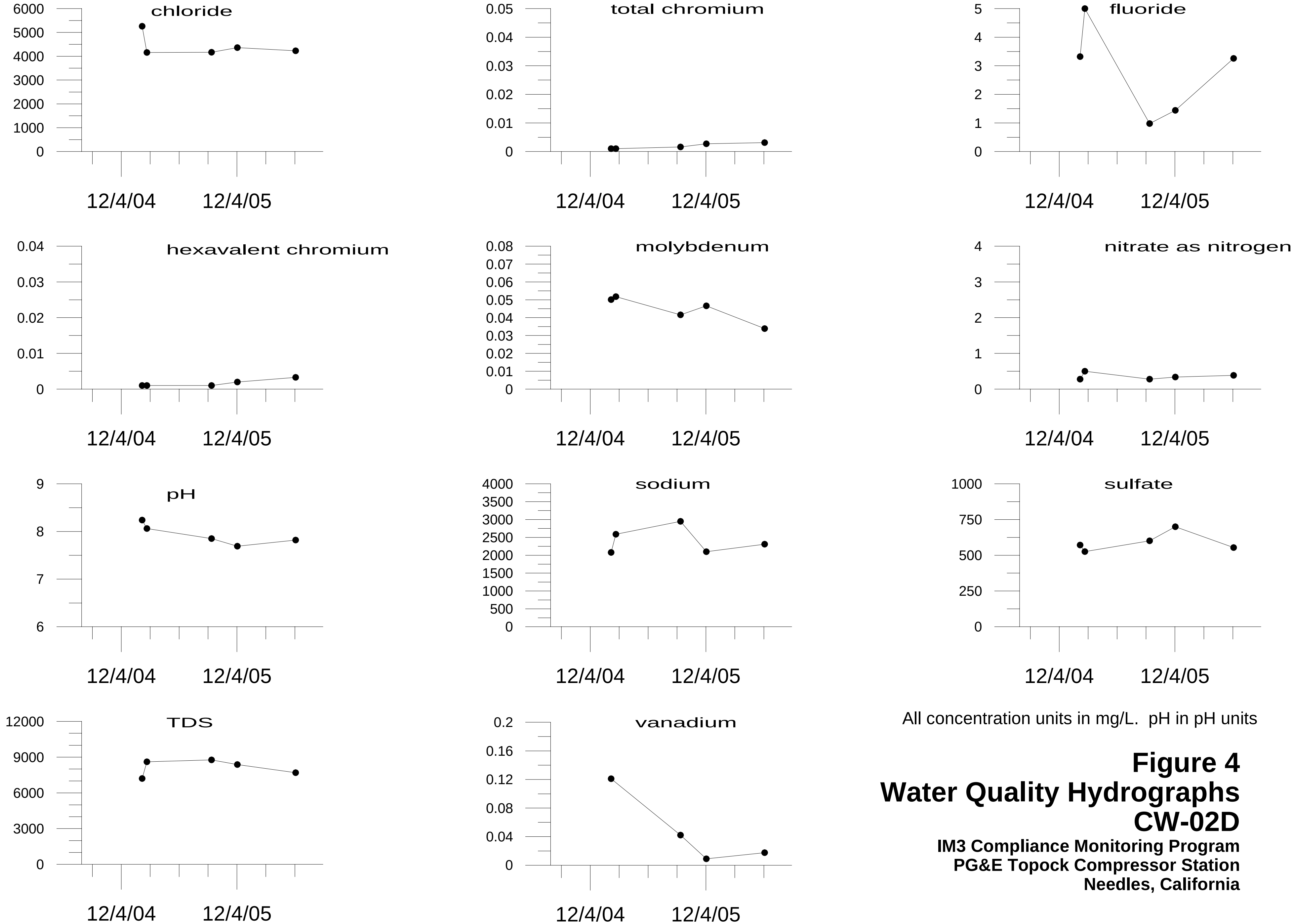
Figure 2
Water Quality Hydrographs
CW-01D

IM3 Compliance Monitoring Program
PG&E Topock Compressor Station
Needles, California



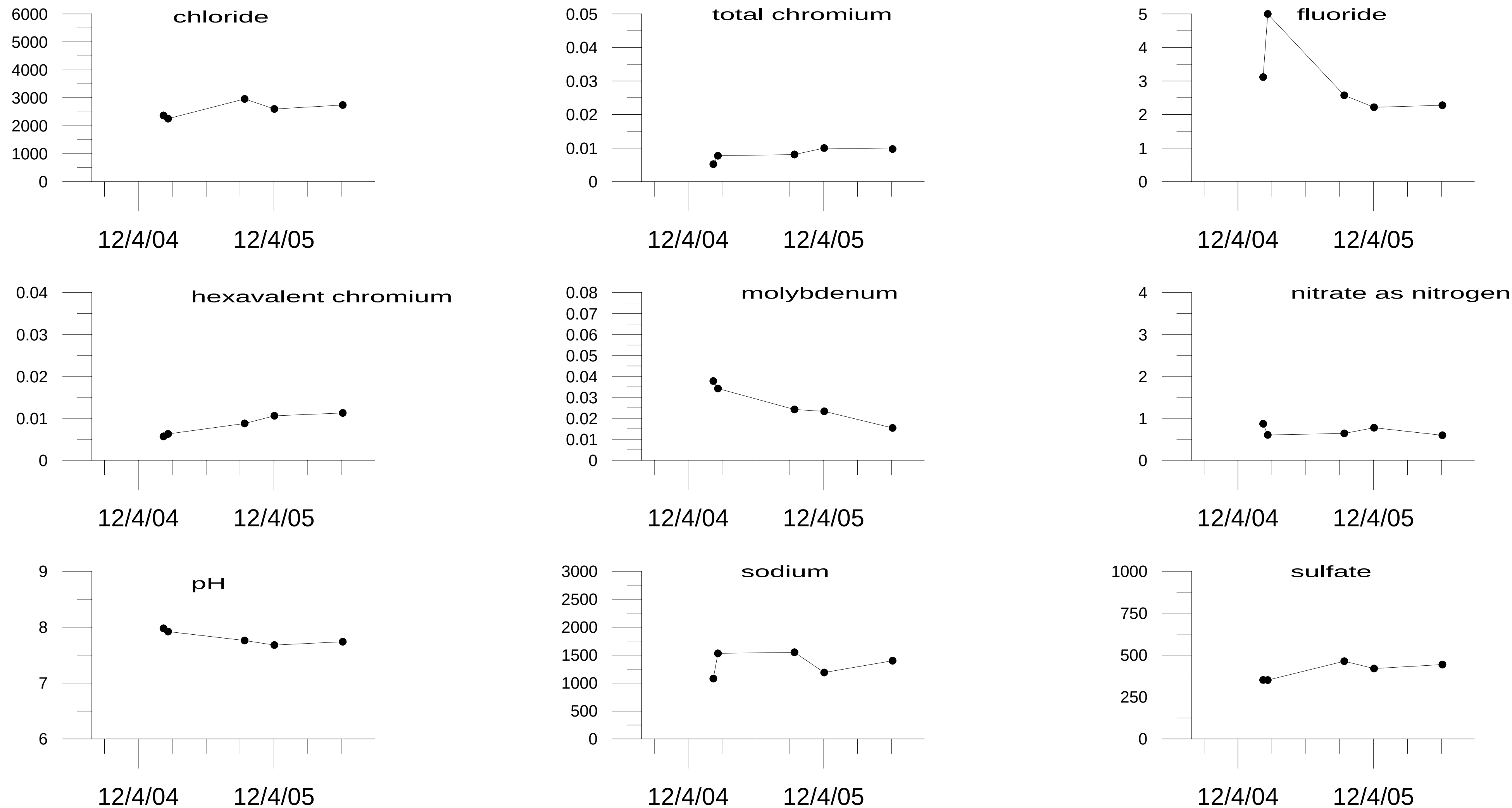
All concentration units in mg/L. pH in pH units

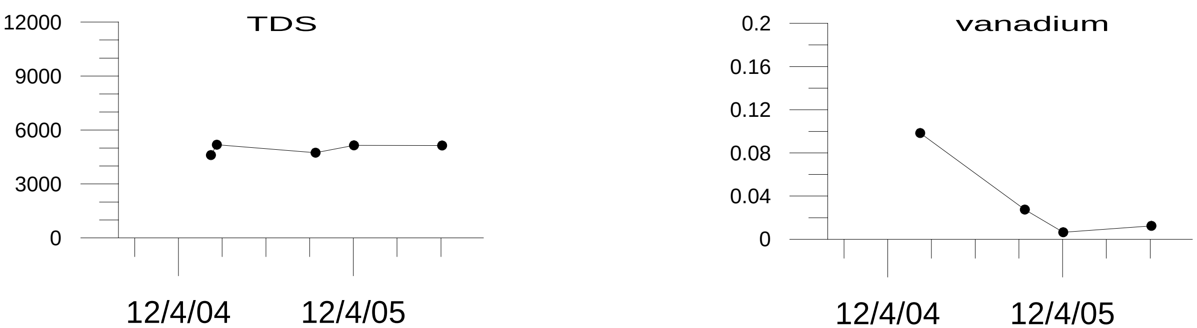
Figure 3
Water Quality Hydrographs
CW-02M
IM3 Compliance Monitoring Program
PG&E Topock Compressor Station
Needles, California



All concentration units in mg/L. pH in pH units

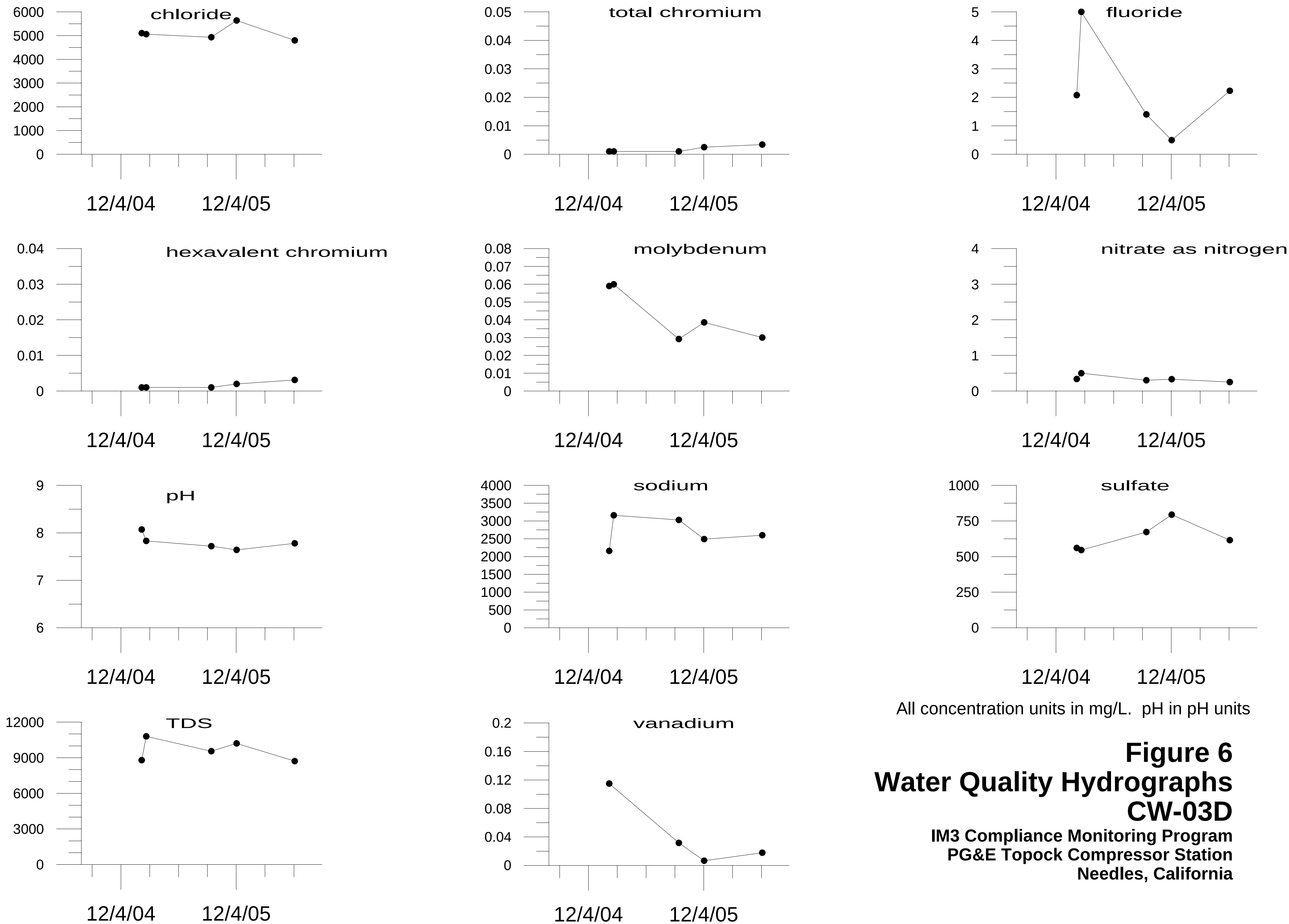
Figure 4
Water Quality Hydrographs
CW-02D
IM3 Compliance Monitoring Program
PG&E Topock Compressor Station
Needles, California





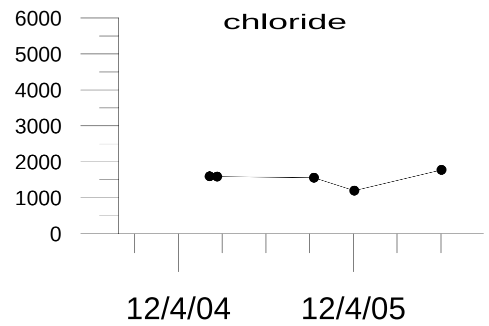
All concentration units in mg/L. pH in pH units

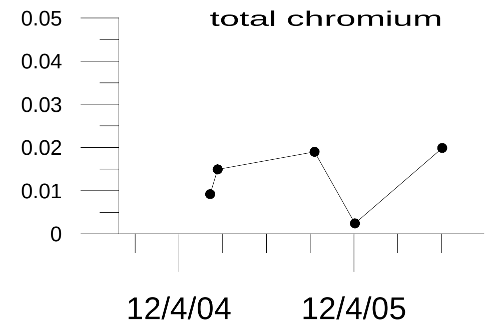
Figure 5
Water Quality Hydrographs
CW-03M
IM3 Compliance Monitoring Program
PG&E Topock Compressor Station
Needles, California

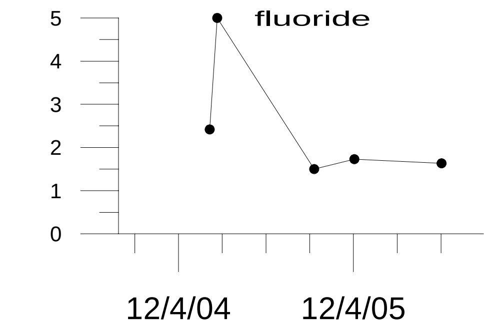


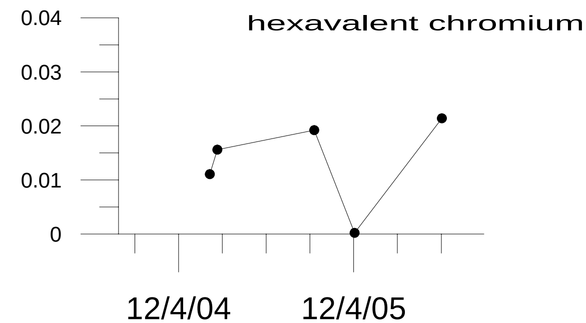
All concentration units in mg/L. pH in pH units

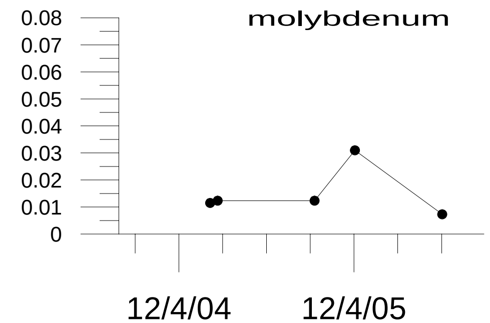
Figure 6
Water Quality Hydrographs
CW-03D
IM3 Compliance Monitoring Program
PG&E Topock Compressor Station
Needles, California

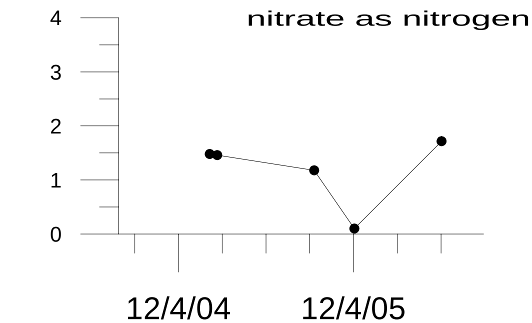


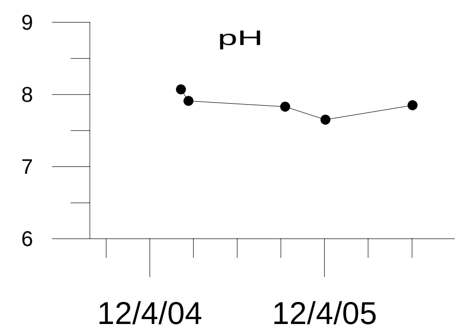


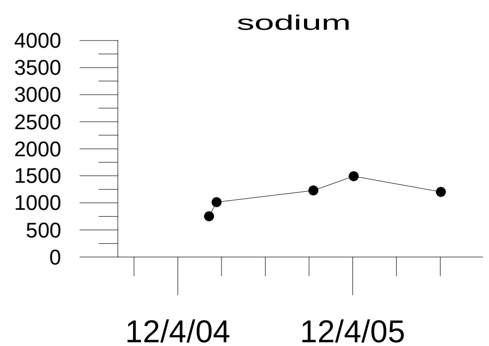


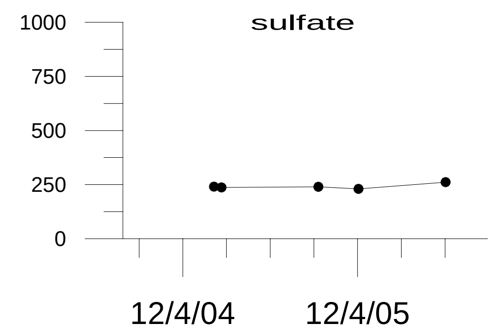


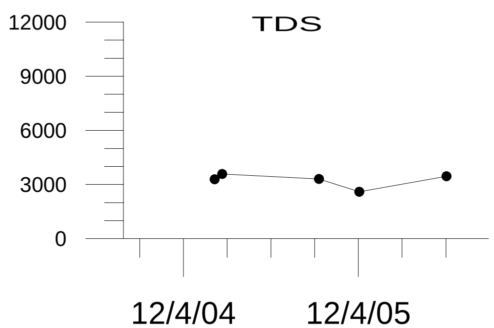


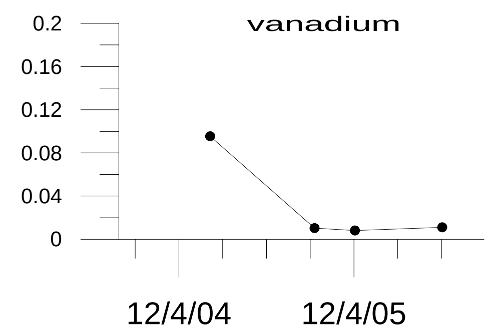








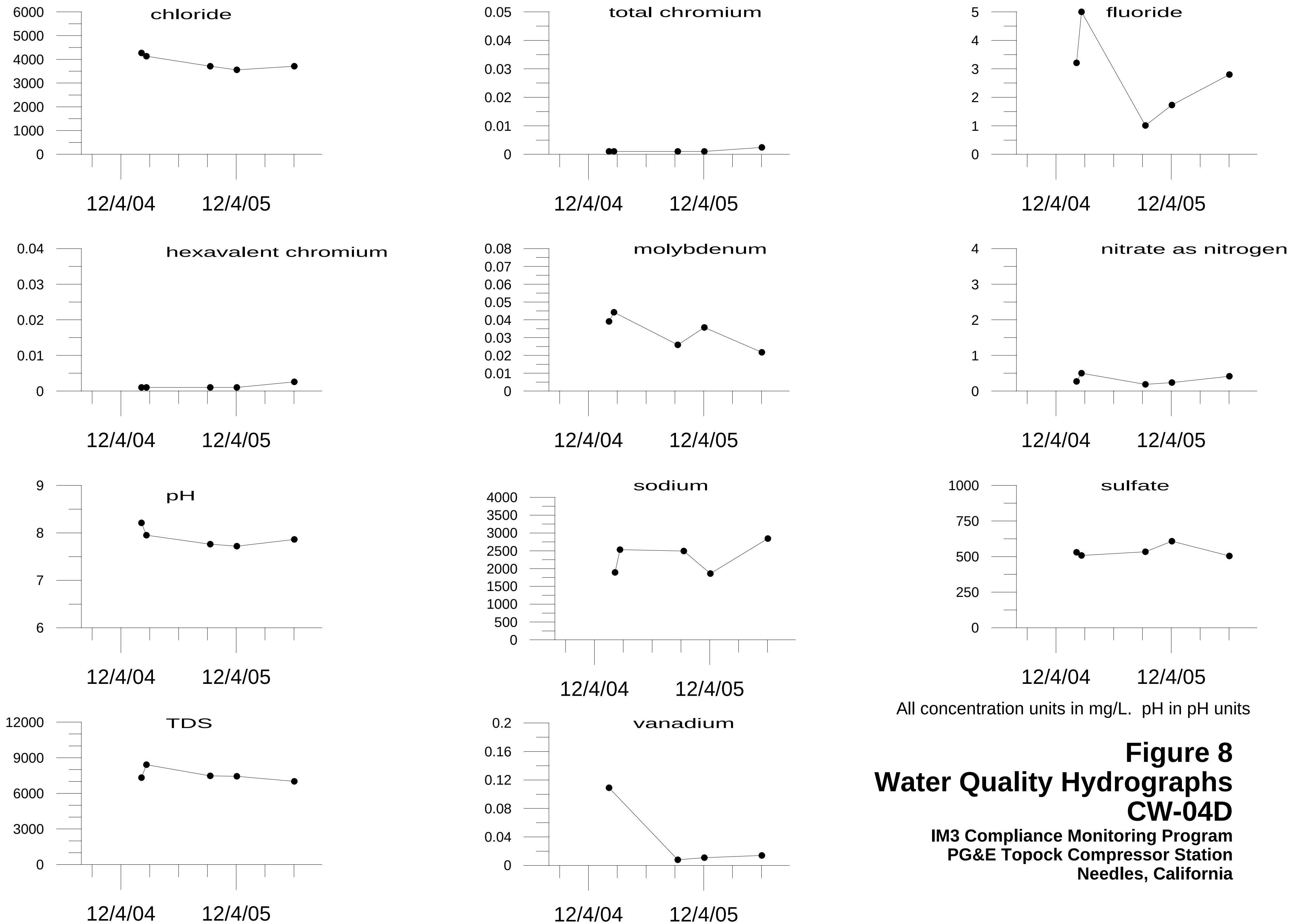




All concentration units in mg/L. pH in pH units

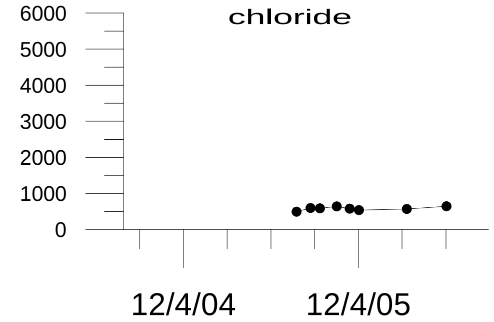
Figure 7
Water Quality Hydrographs
CW-04M

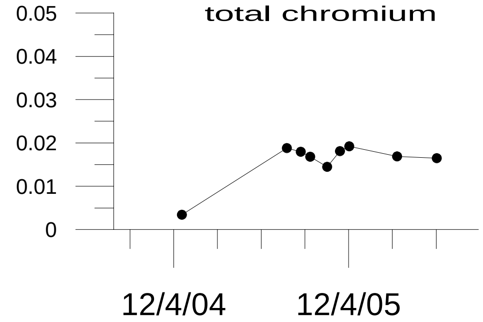
IM3 Compliance Monitoring Program
PG&E Topock Compressor Station
Needles, California

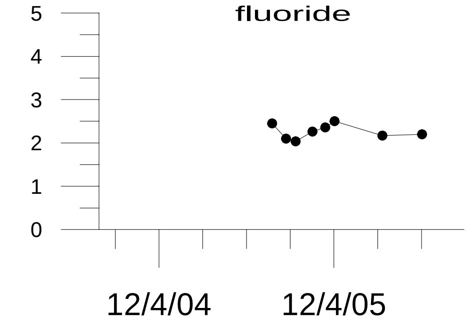


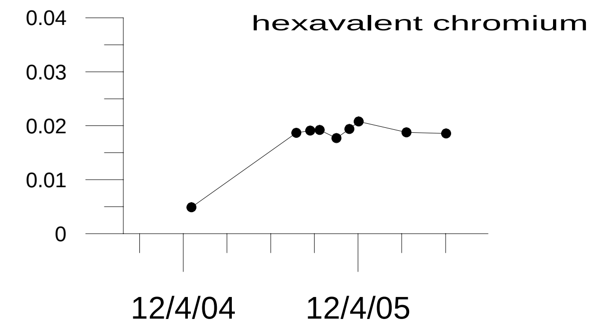
All concentration units in mg/L. pH in pH units

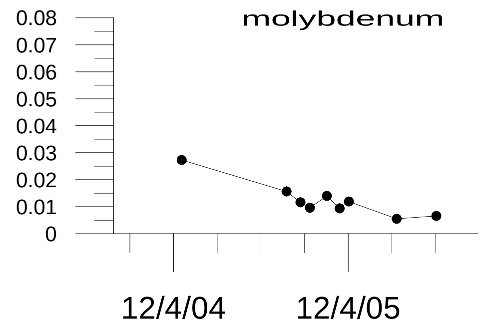
Figure 8
Water Quality Hydrographs
CW-04D
IM3 Compliance Monitoring Program
PG&E Topock Compressor Station
Needles, California

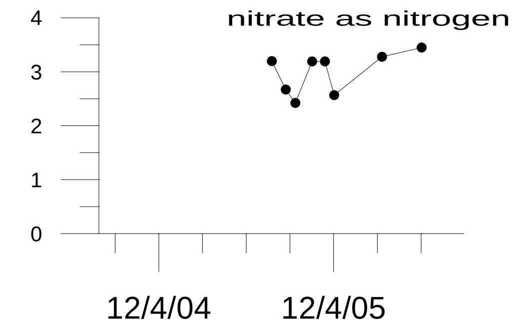


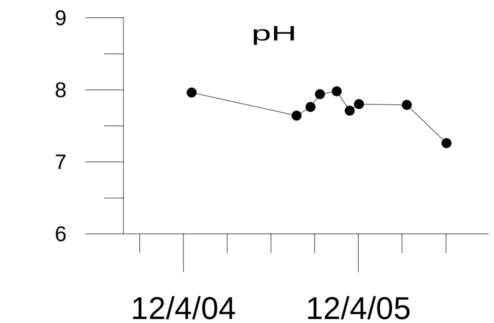


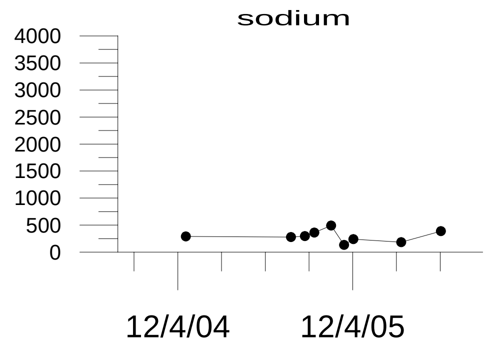


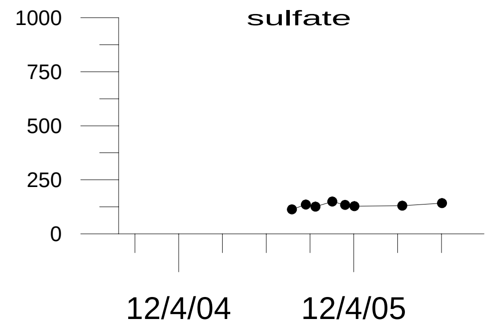


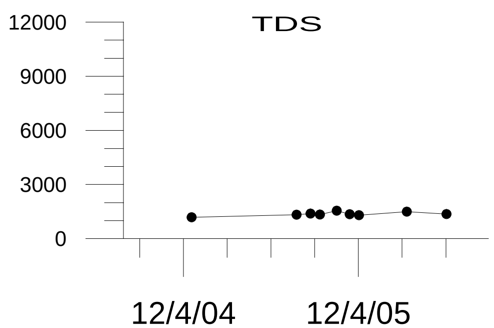


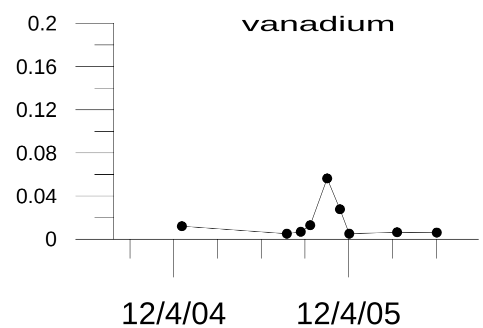






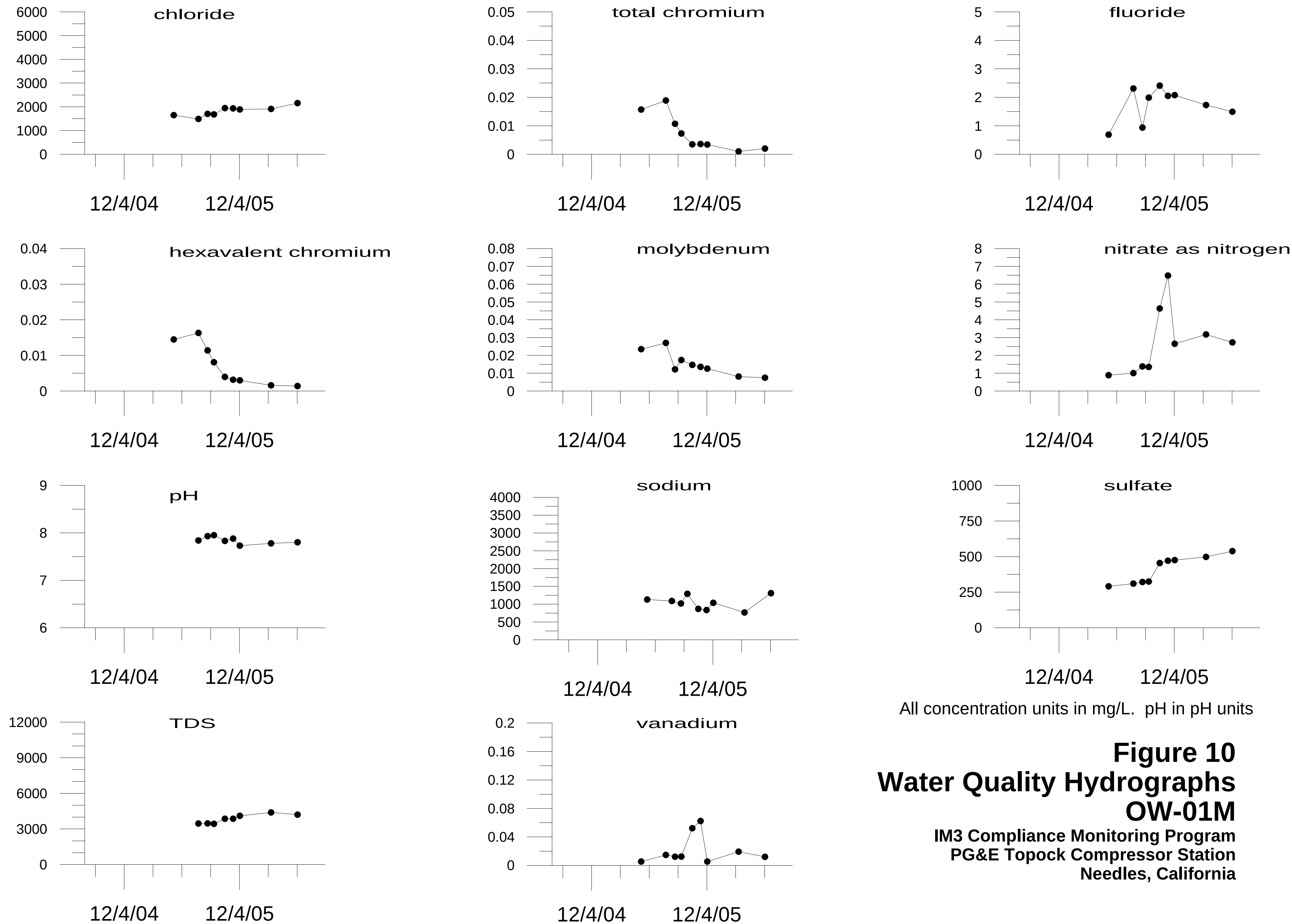






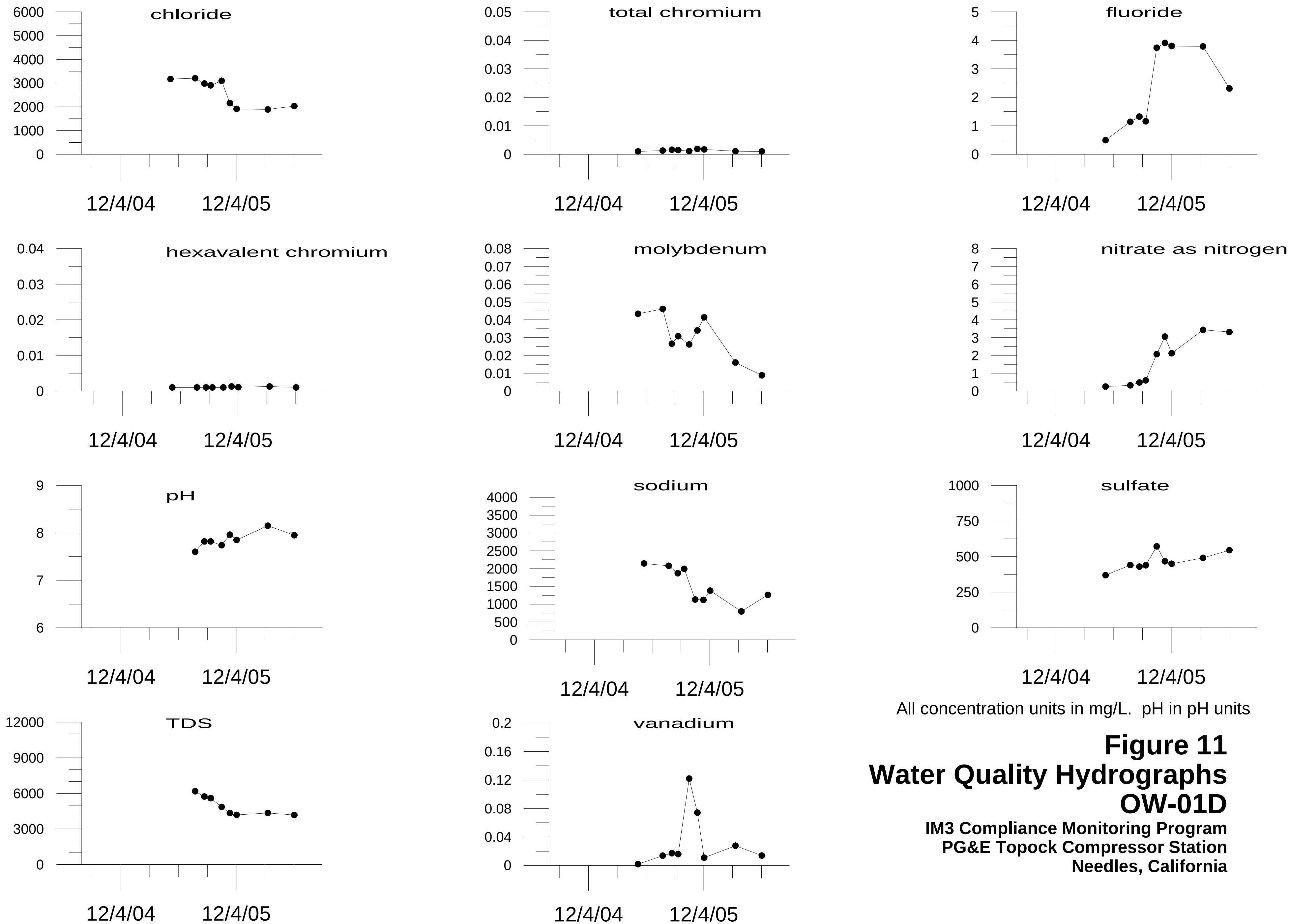
All concentration units in mg/L. pH in pH units

Figure 9
Water Quality Hydrographs
OW-01S
IM3 Compliance Monitoring Program
PG&E Topock Compressor Station
Needles, California



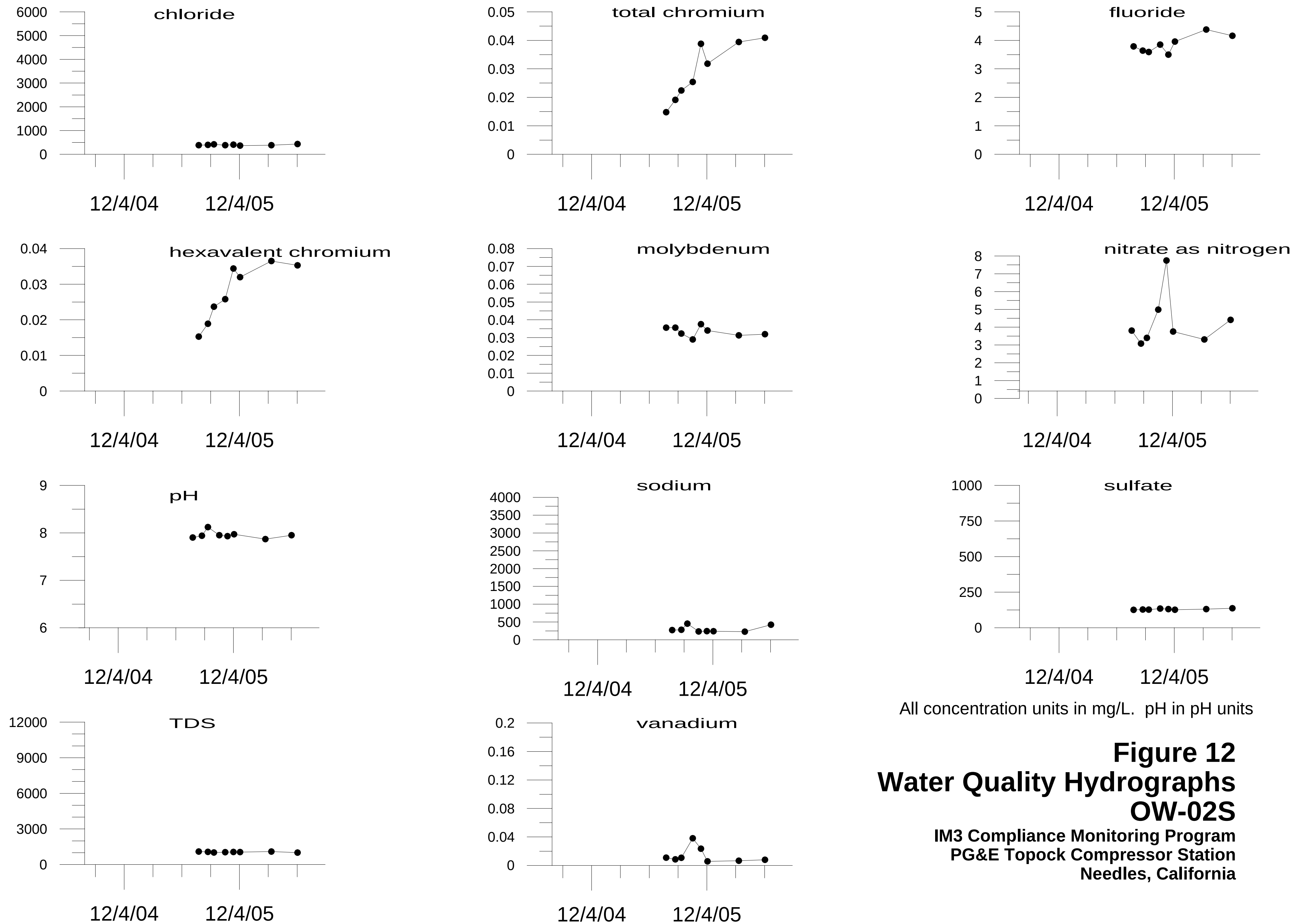
All concentration units in mg/L. pH in pH units

Figure 10
Water Quality Hydrographs
OW-01M
IM3 Compliance Monitoring Program
PG&E Topock Compressor Station
Needles, California



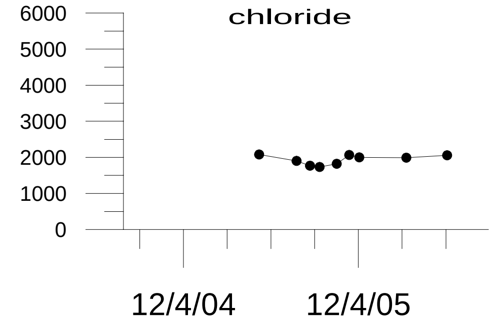
All concentration units in mg/L. pH in pH units

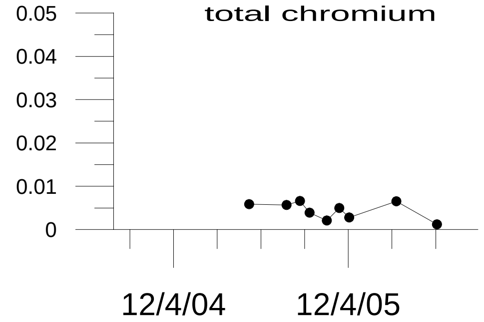
Figure 11
Water Quality Hydrographs
OW-01D
IM3 Compliance Monitoring Program
PG&E Topock Compressor Station
Needles, California

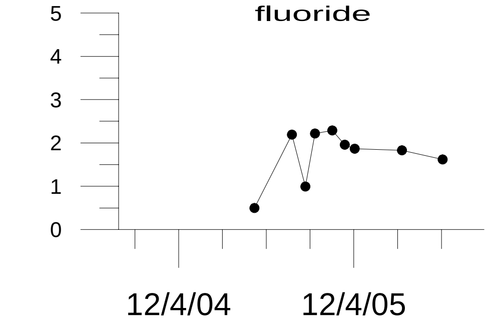


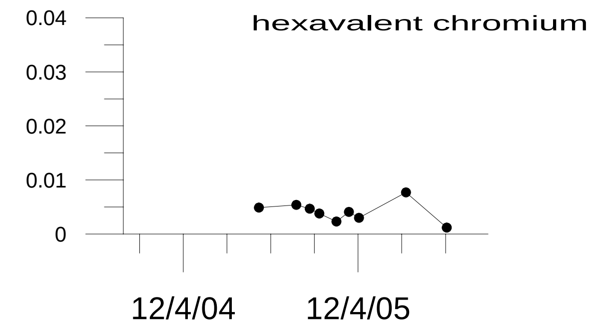
All concentration units in mg/L. pH in pH units

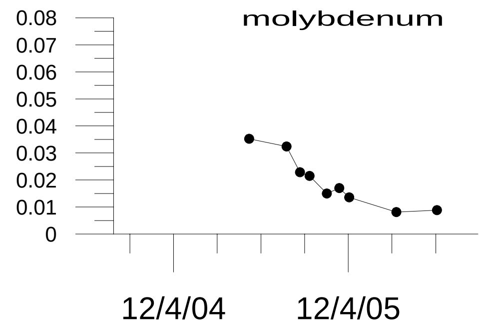
Figure 12
Water Quality Hydrographs
OW-02S
IM3 Compliance Monitoring Program
PG&E Topock Compressor Station
Needles, California

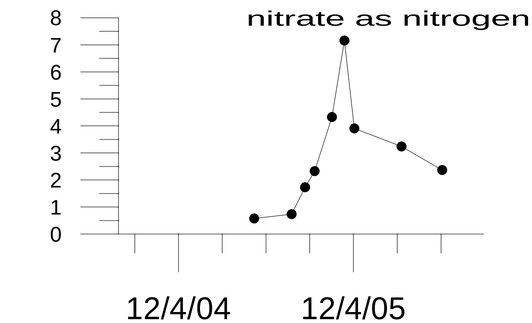


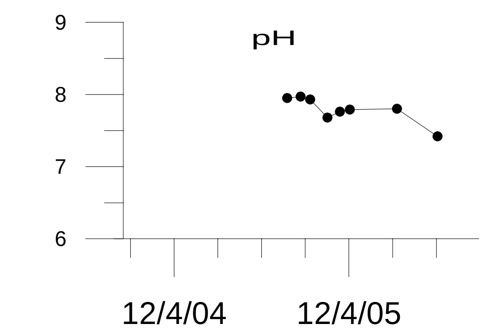


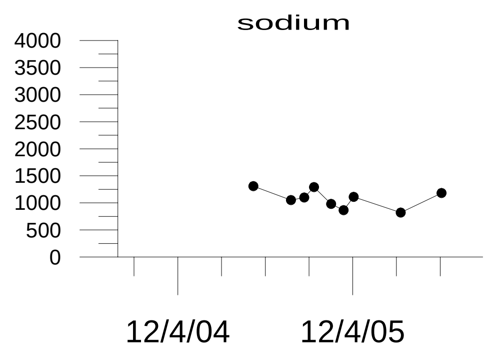


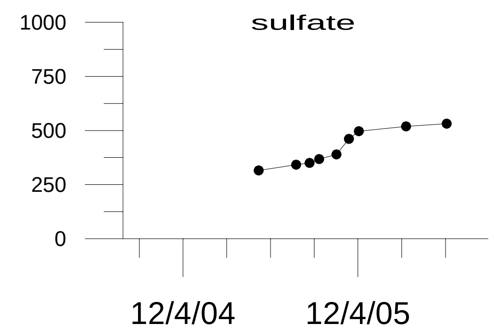


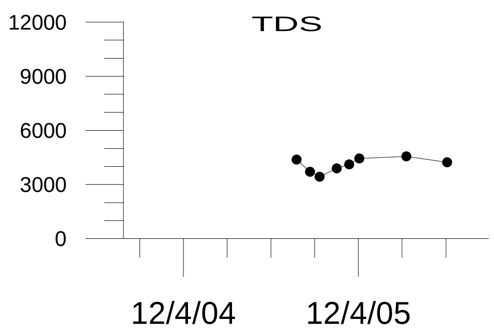


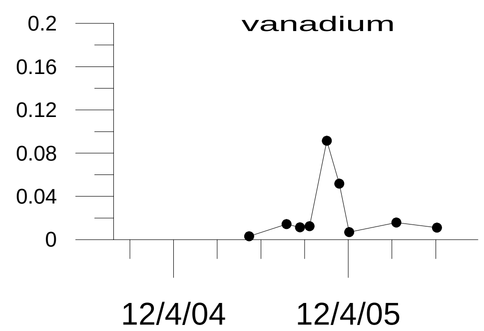






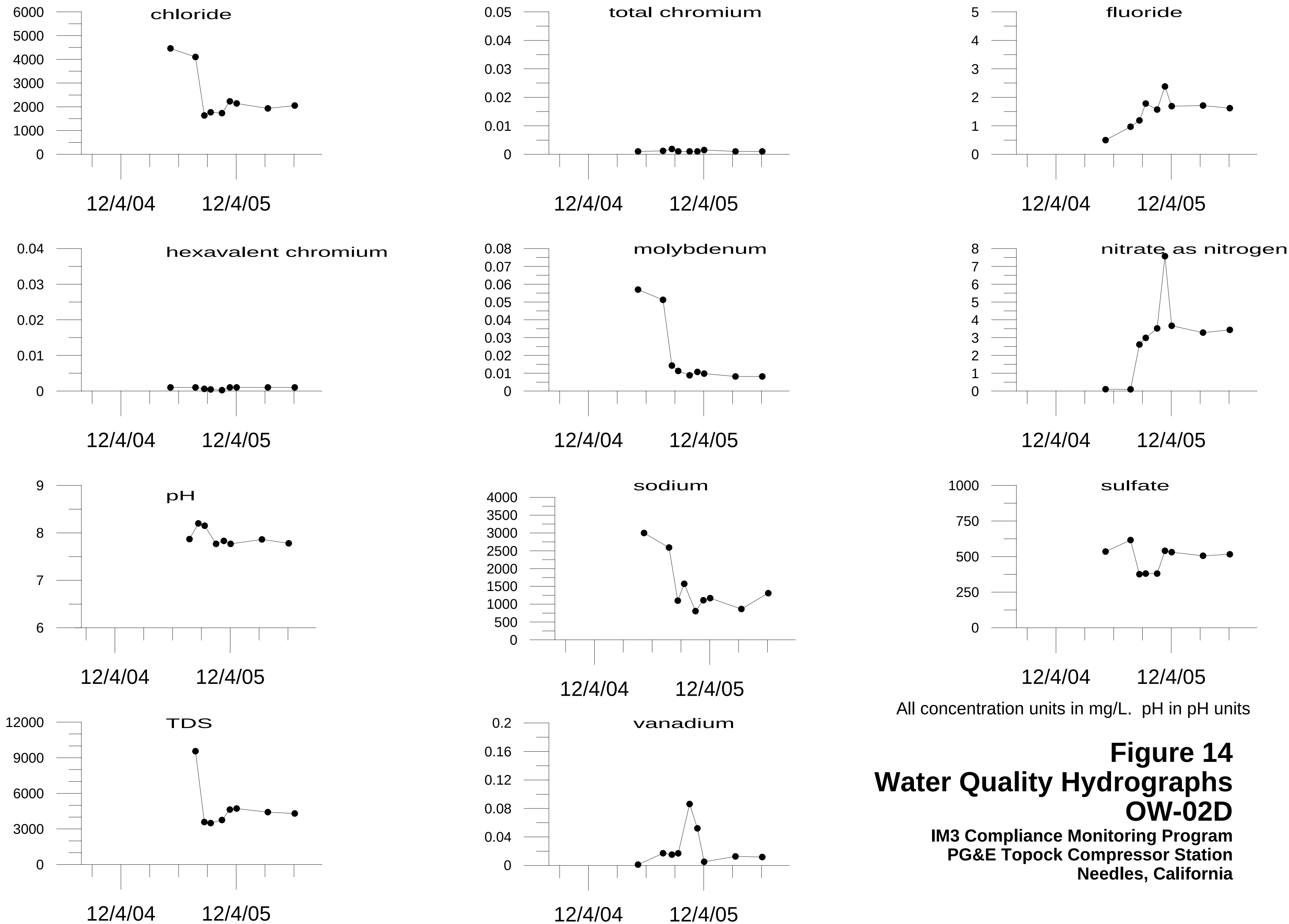






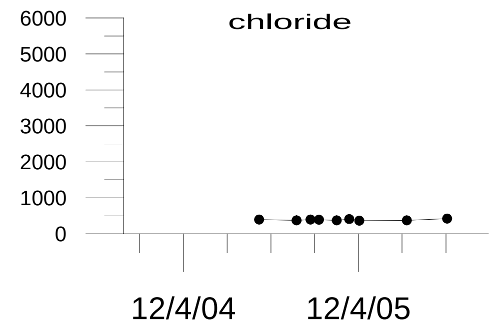
All concentration units in mg/L. pH in pH units

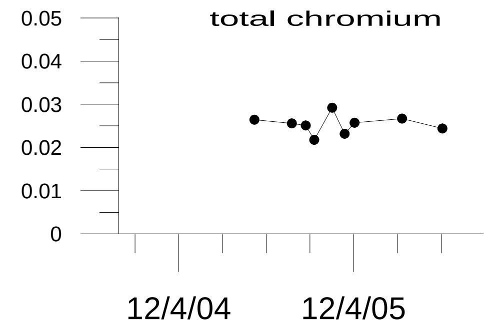
Figure 13
Water Quality Hydrographs
OW-02M
IM3 Compliance Monitoring Program
PG&E Topock Compressor Station
Needles, California

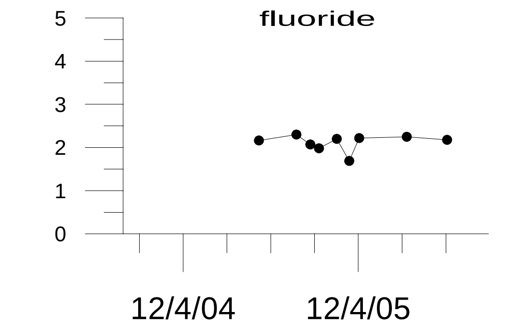


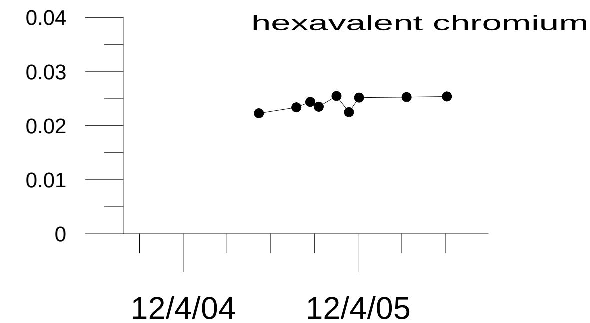
All concentration units in mg/L. pH in pH units

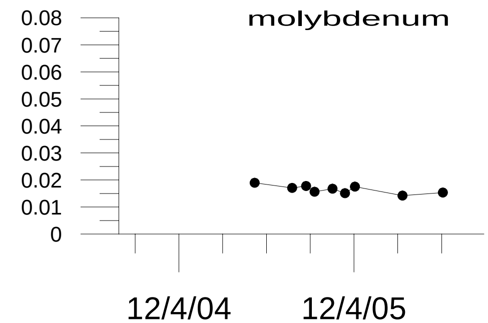
Figure 14
Water Quality Hydrographs
OW-02D
IM3 Compliance Monitoring Program
PG&E Topock Compressor Station
Needles, California

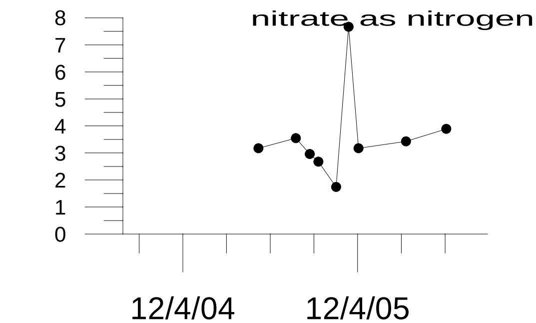


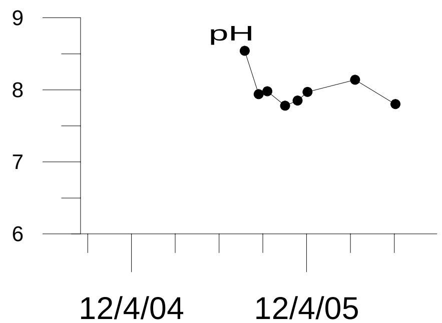


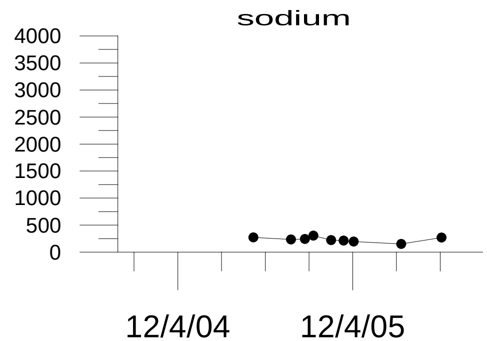


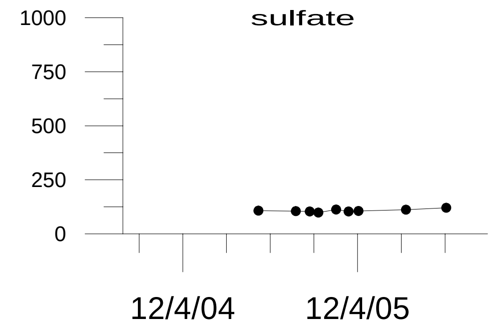


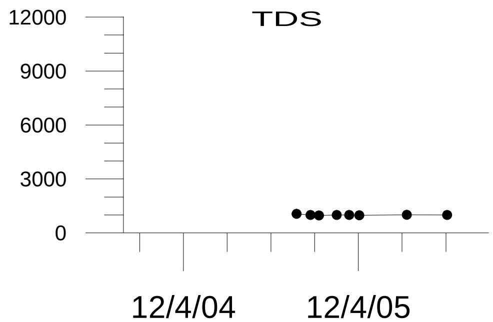


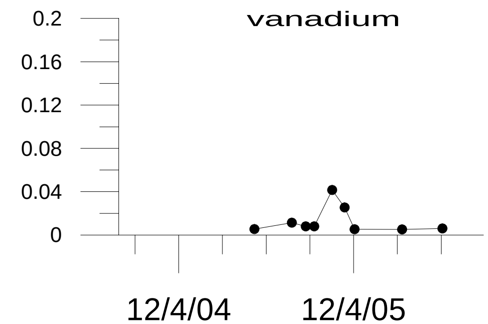






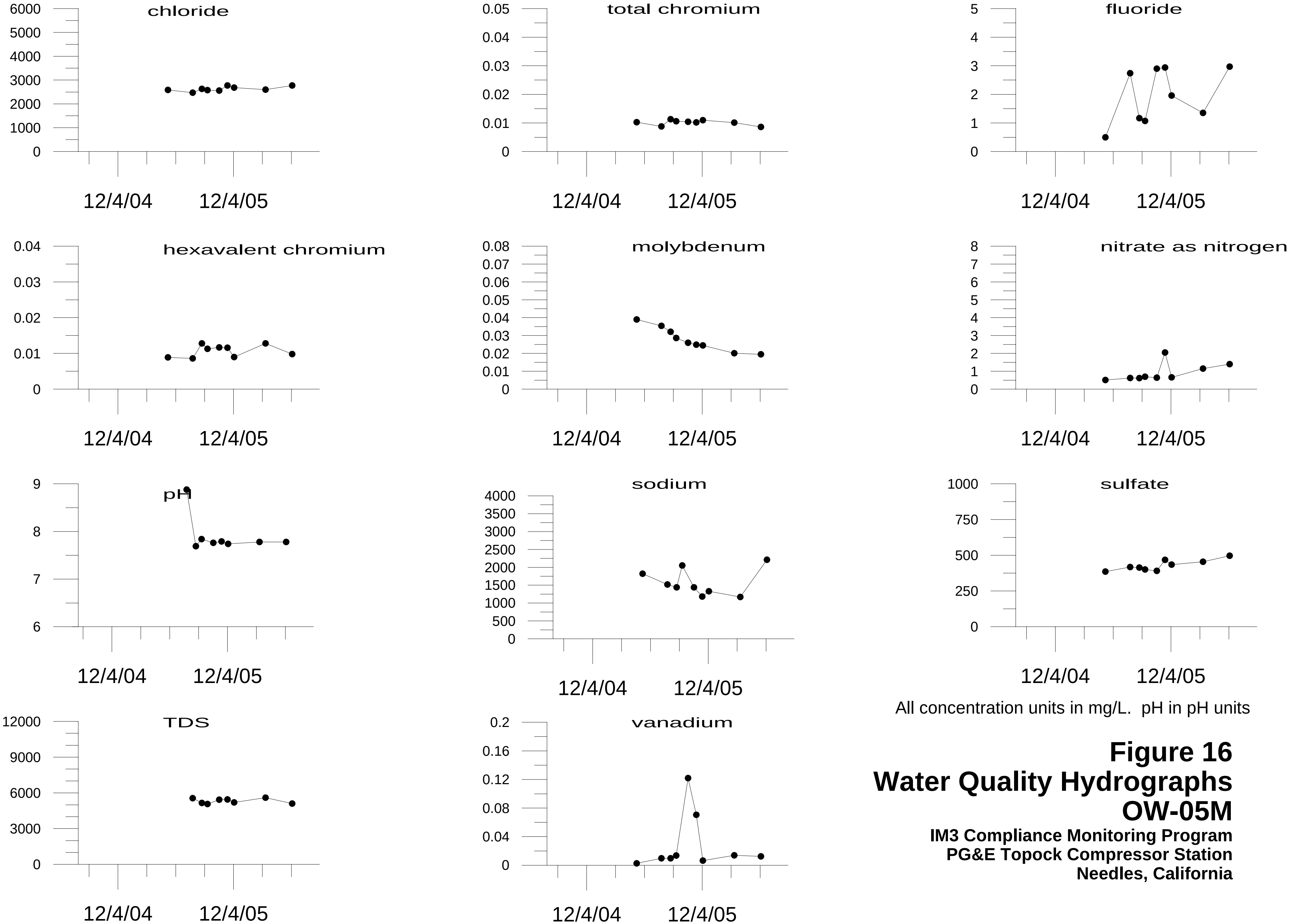






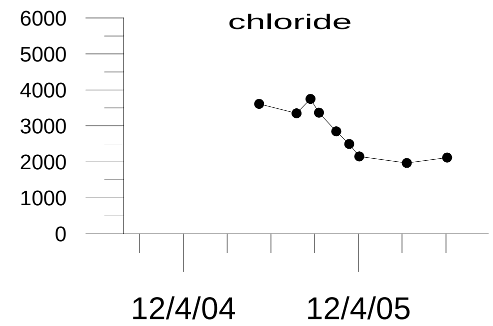
All concentration units in mg/L. pH in pH units

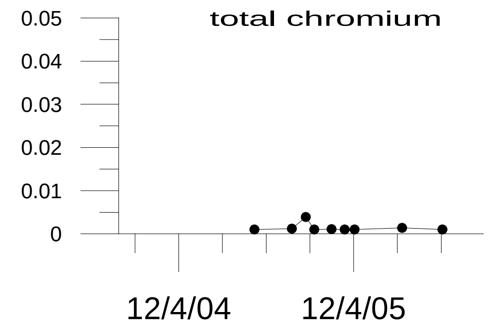
Figure 15
Water Quality Hydrographs
OW-05S
IM3 Compliance Monitoring Program
PG&E Topock Compressor Station
Needles, California

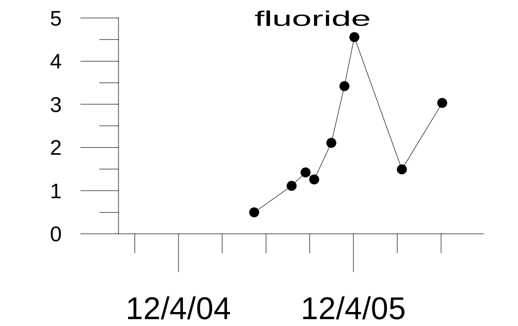


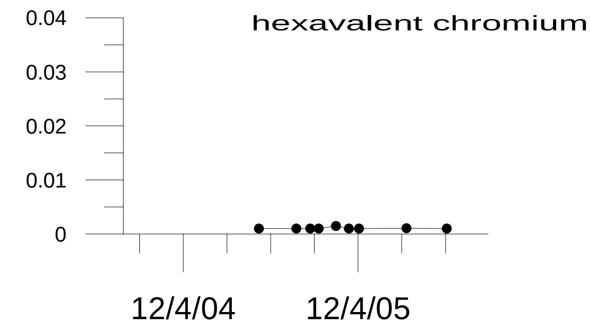
All concentration units in mg/L. pH in pH units

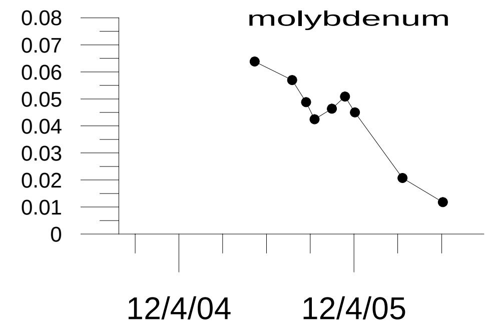
Figure 16
Water Quality Hydrographs
OW-05M
IM3 Compliance Monitoring Program
PG&E Topock Compressor Station
Needles, California

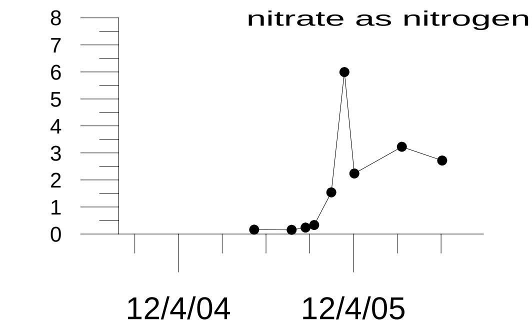


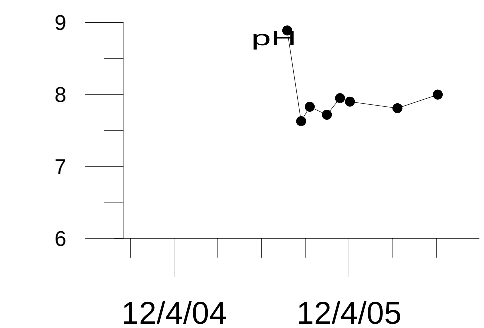


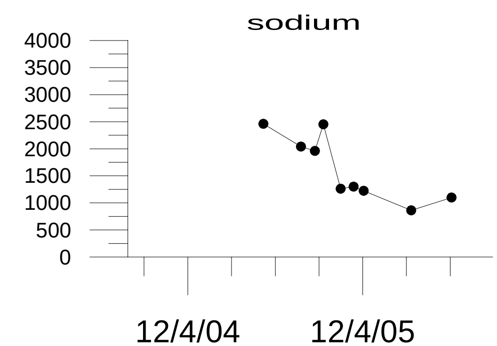


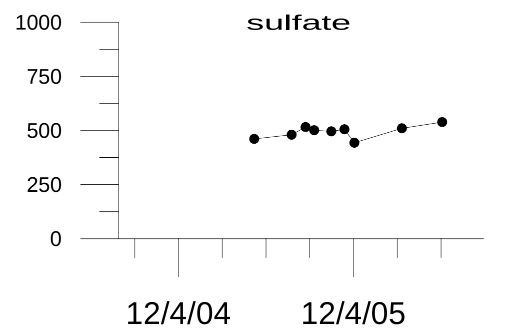




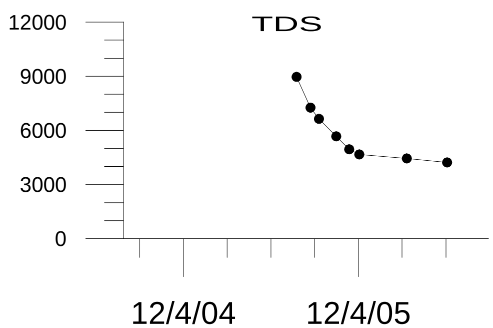








All concentration units in mg/L. pH in pH units



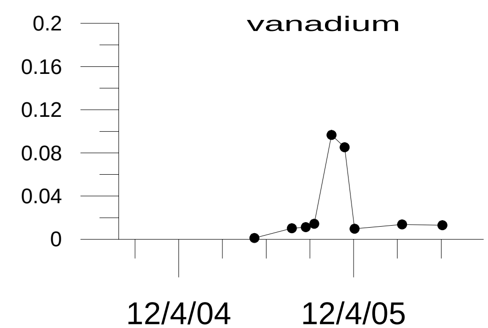


Figure 17
Water Quality Hydrographs
OW-05D
IM3 Compliance Monitoring Program
PG&E Topock Compressor Station
Needles, California

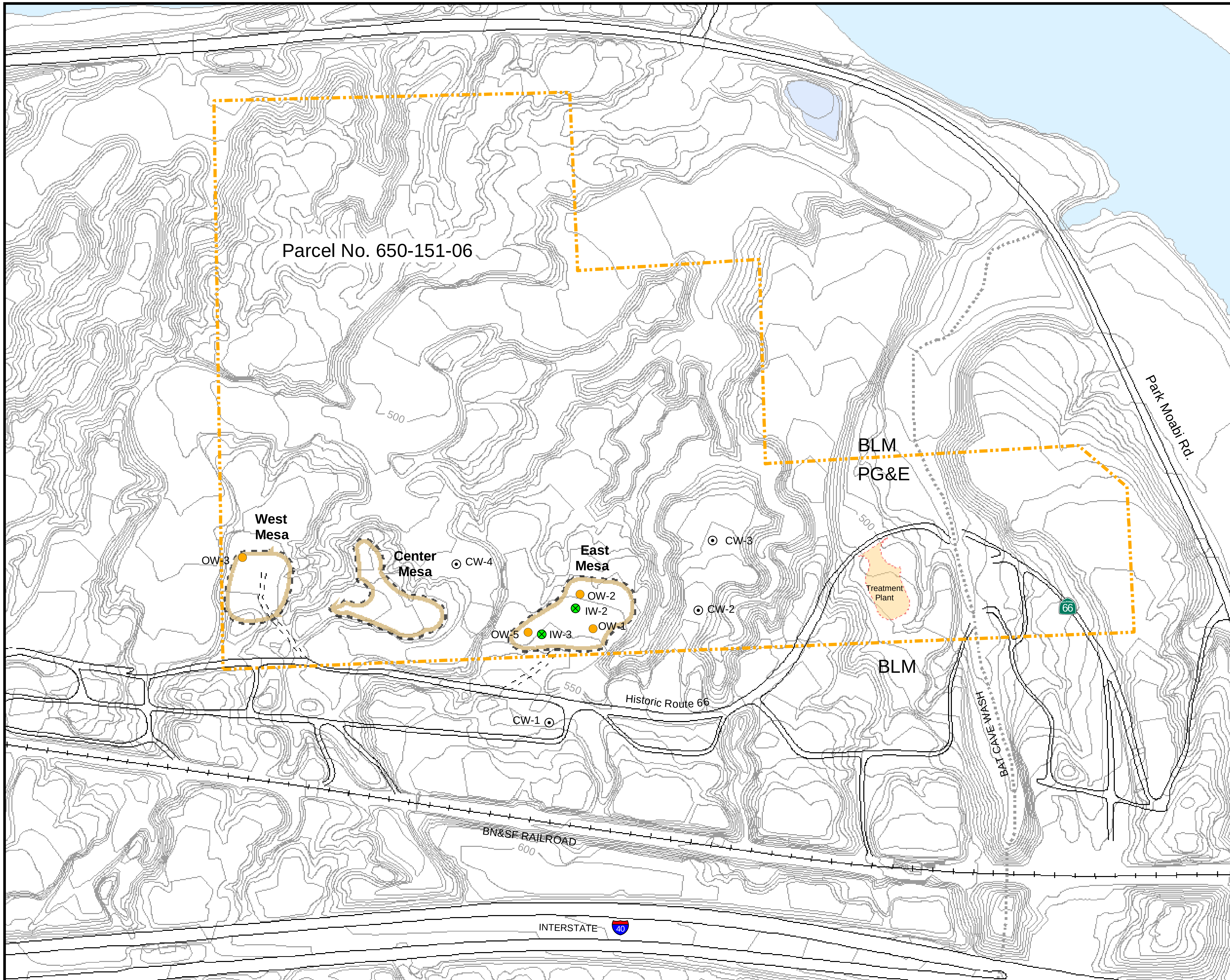


FIGURE 18
CMP MONITORING LOCATI0NS
IM-3 COMPLIANCE MONITORING PROGRAM
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

SFO \\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MXD\2005\IM3_PROJECT_AREA.MXD IM3_PROJECT_AREA.PDF 4/4/2005 11:41:08

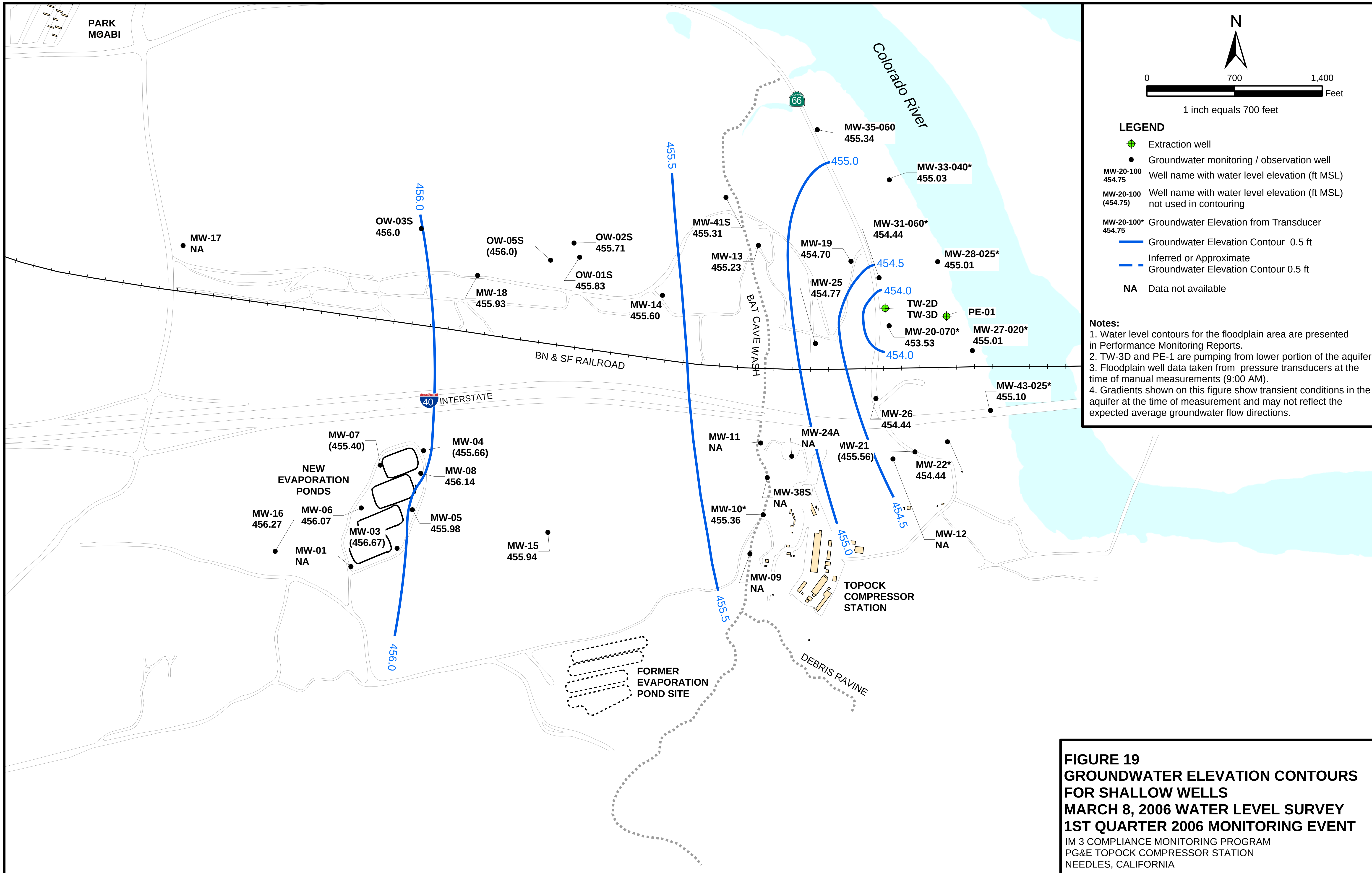
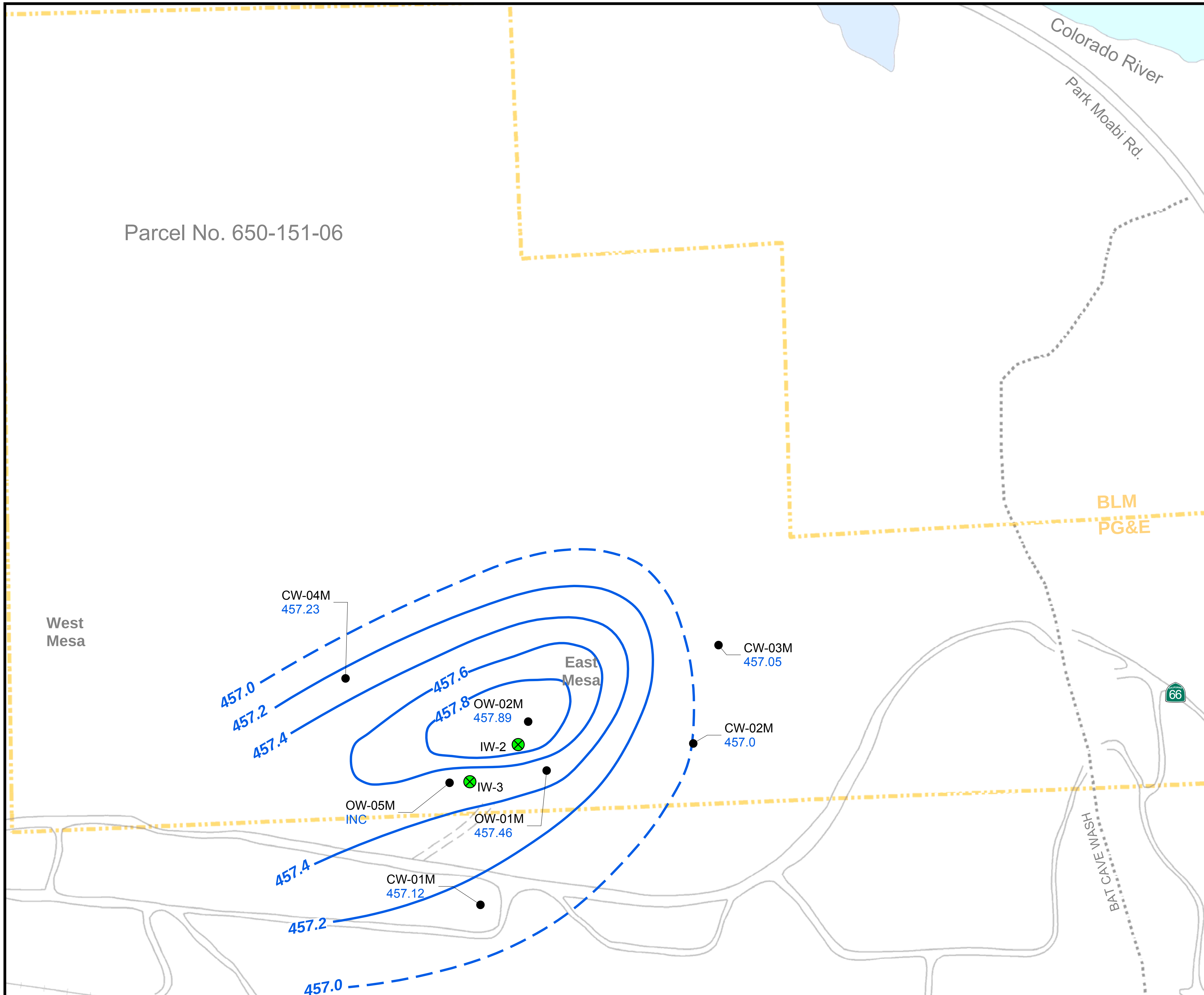


FIGURE 19
GROUNDWATER ELEVATION CONTOURS FOR SHALLOW WELLS
MARCH 8, 2006 WATER LEVEL SURVEY
1ST QUARTER 2006 MONITORING EVENT
IM 3 COMPLIANCE MONITORING PROGRAM
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

BAO \\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MXD\2005\GMP_SITE_SNAP_UA_MAR06.MXD



N

0 250 500 Feet

1 inch equals 250 feet

California State Plane NAD83 Zone 5 US Feet

LEGEND

Groundwater Monitoring, Compliance, and Observation Well

IM-3 Injection Well

Groundwater Elevations for Mid-depth Wells in IM-3 Injection Area

MW-41M **454.75** Salinity and temperature adjusted groundwater head elevation in feet above mean sea level (MSL)

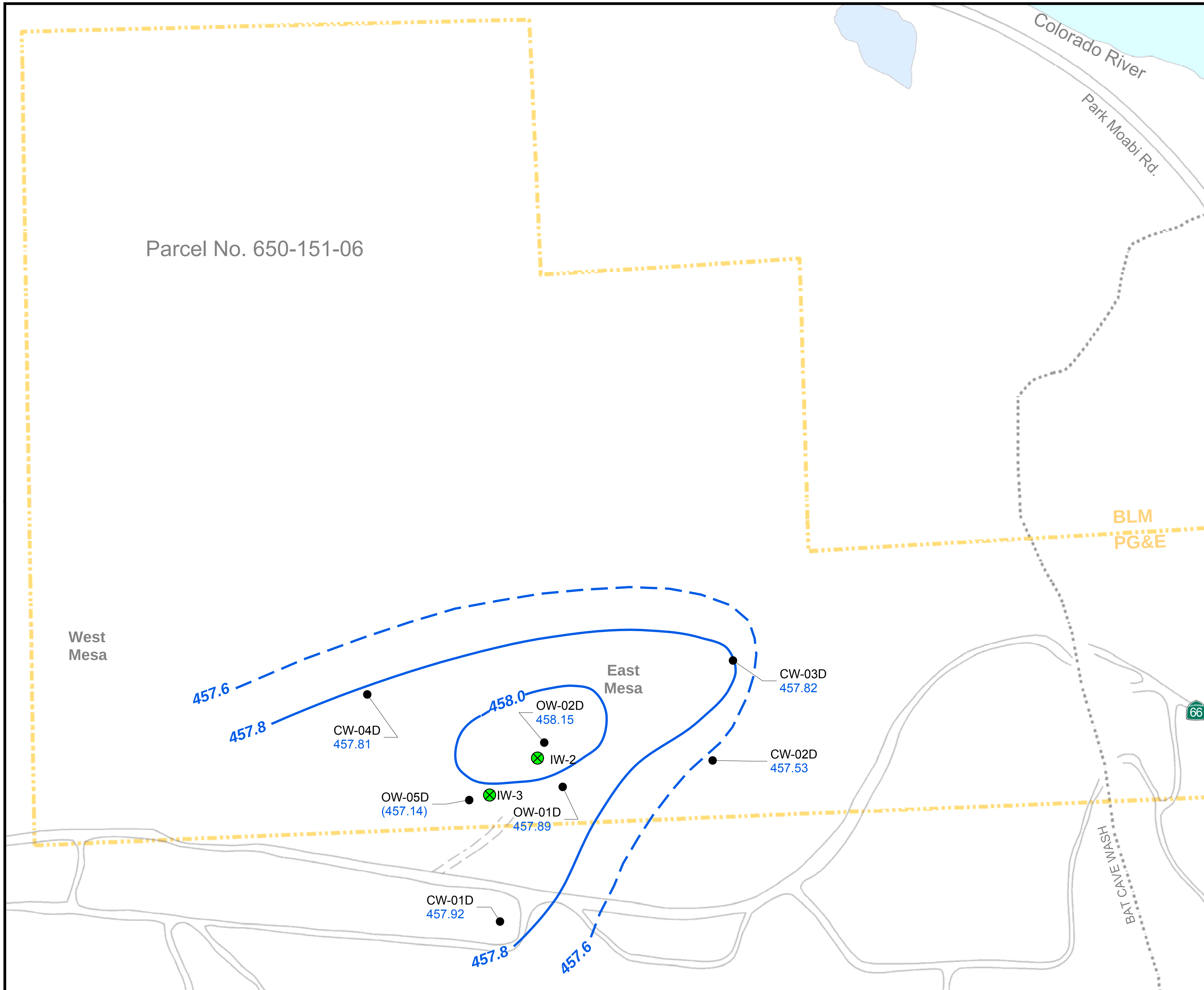
Groundwater elevation contour in feet above MSL (0.2 foot interval), dashed where inferred

Note: Average monthly groundwater elevations are calculated with pressure transducer data measured at 30 minuet intervals.
INC = Data incomplete or unavailable over reporting period.

FIGURE 20
GROUNDWATER ELEVATION CONTOURS FOR MID-DEPTH WELLS
MAY 15 TO JUNE 15, 2006
IM-3 COMPLIANCE MONITORING PROGRAM
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

\\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MXD\2006\GW\IM3_GW_ELEV_MID_5-15_6-15-06.MXD



N

0 250 500 Feet

1 inch equals 250 feet

California State Plane NAD83 Zone 5 US Feet

LEGEND

- Groundwater Monitoring, Compliance, and Observation Well
- IM-3 Injection Well

Groundwater Elevations for Deep Wells in IM-3 Injection Area

MW-41M 454.75 — Salinity and temperature adjusted groundwater head elevation in feet above mean sea level (MSL)

Groundwater elevation contour in feet above MSL (0.2 foot interval), dashed where inferred

Notes: Gradients on this figure show transient conditions in the aquifer at the time of measurement and may not reflect the expected average annual groundwater flow directions.

OW-05D excluded from contouring.

Data posted and contoured from monthly average heads measured with tranducers at 30 minuet intervals.

FIGURE 21
GROUNDWATER ELEVATION CONTOURS FOR DEEP WELLS
MAY 15 THROUGH JUNE 15, 2006

IM-3 COMPLIANCE MONITORING PROGRAM
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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