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January 15, 2009

Mr. Aaron Yue
Project Manager
California Department of Toxic Substances Control
5796 Corporate Avenue
Cypress, CA 90630

Subject: Performance Assessment Report, Interim Measure No. 3, Injection Well Field, PG&E Topock Compressor Station, Needles, California

Dear Mr. Yue:

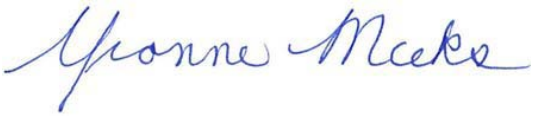
Enclosed is the *Performance Assessment Report* (PAR) for the Interim Measure No. 3 Injection Well Field at the Pacific Gas and Electric Company (PG&E) Topock Compressor Station. The first PAR , IM No. 3 Injection Well Field was submitted on November 30, 2006 in conformance with Department of Toxic Substances Control (DTSC) conditional authorization (Condition 18) to begin operating the IM No. 3 facilities, dated July 15, 2005. In response to the submitted report, DTSC in their January 5, 2007 letter approved continued operation of the IM No. 3 injection wells and also required PG&E to continue submitting a PAR every two years to evaluate the injection well operations and the influence of treated water on aquifer quality.

This PAR documents performance of the injection well operations and the influence of treated water on aquifer quality through December 2008. The report was originally scheduled for agency submittal in November 2008; however, DTSC in their October 30, 2008 email concurred with the PG&E proposal to delay the submission of the biennial report until January 15, 2009 in order to combine the biennial report with the Injection Area Compliance Monitoring Report (CMP) already scheduled for submittal on January 15, 2009.

Attached as Appendix A to the PAR is the *Semiannual Groundwater Monitoring Report, Second Half 2008* for the Interim Measure CMP at the PG&E Topock Compressor Station. This CMP report presents the results of the third and fourth quarter 2008 CMP groundwater monitoring events, and has been prepared in conformance with Colorado River Basin Regional Water Quality Board (Water Board) Order No. R7-2006-0060, as well as with the DTSC's July 15, 2005 letter approving the Compliance Monitoring Plan and June 9, 2006 letter modifying the reporting requirements.

If you have any questions on the PAR or the CMP report, please call me at (805) 546-5243.

Sincerely,



Yvonne Meeks
Topock Remediation Project Manager

cc: Christopher Guerre, DTSC
Robert Perdue, Water Board
Cliff Raley, Water Board
Abdi Haile, Water Board

Enclosures: *Performance Assessment Report*, Interim Measure No. 3, Injection Well Field at the PG&E Topock Compressor Station

Appendix A to the PAR is the *Semiannual Groundwater Monitoring Report, Second Half 2008* for the Interim Measure CMP at the PG&E Topock Compressor Station

Performance Assessment Report
Interim Measure No. 3
Injection Well Field

PG&E Topock Compressor Station
Needles, California

Prepared for

California Department of Toxic Substances Control

On behalf of

Pacific Gas and Electric Company

January 15, 2009

CH2MHILL

155 Grand Avenue, Suite 1000
Oakland, CA 94612

Performance Assessment Report
Interim Measure No. 3 Injection Well Field

PG&E Topock Compressor Station
Needles, California

Prepared for

California Department of Toxic Substance Control

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January 15, 2009

This report was prepared under the supervision of a
California Professional Engineer

John Porcella, P.E.
Project Engineer

Jay Piper
Project Manager

Contents

Tables

Figures

Appendix

Acronyms and Abbreviations

bgs	below ground surface
Cr(T)	total chromium
Cr(VI)	hexavalent chromium
CMP	Compliance Monitoring Program
CW	compliance well
DTSC	California Department of Toxic Substances Control
gpm	gallons per minute
IM	Interim Measure
IM No. 3	Interim Measure No. 3
IW	injection well
µg/L	micrograms per liter
mg/L	milligrams per liter
OW	observation well
PG&E	Pacific Gas and Electric Company
TDS	total dissolved solids
Water Board	California Regional Water Quality Control Board, Colorado River Basin
WDR	Waste Discharge Requirements

SECTION 1.0

Introduction

Pacific Gas and Electric Company (PG&E) is implementing an Interim Measure (IM) to address chromium concentrations in groundwater at the Topock Compressor Station near Needles, California. The IM is implemented under the oversight of California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) and consists of groundwater extraction for hydraulic control of the plume boundaries near the Colorado River floodplain and management of extracted groundwater. The groundwater extraction, treatment, and injection systems collectively are referred to as Interim Measure No. 3 (IM No. 3). Currently, the IM No. 3 facilities include a groundwater extraction system, conveyance piping, a groundwater treatment plant, and an injection well (IW) field for the discharge of the treated groundwater. Figure 1-1 shows the location of the IM extraction, conveyance, treatment, and injection facilities. The injection well field is composed of two injection wells and a network of monitoring wells.

On July 15, 2005, DTSC conditionally authorized PG&E to begin operating the IM No. 3 facilities, including the injection well field (DTSC, 2005a). As part of the authorization, DTSC considered the injection of treated water from the IM No. 3 system as a limited-duration pilot study, authorized through January 31, 2007. DTSC further directed that PG&E assess the performance of the injection well field and submit a report by November 30, 2006.

As directed, on November 30, 2006, PG&E submitted the first biennial *Performance Assessment Report IM No. 3 Injection Well Field* (CH2M HILL, 2006a), documenting performance of the IM No. 3 injection well field during the DTSC-mandated temporary operation period. Based on data presented in the November 2006 Performance Assessment Report, in a letter dated January 5, 2007 (DTSC, 2007a), DTSC approved the continued operations of the IM No. 3 injection wells and required PG&E to continue to submit a performance assessment report every 2 years to evaluate the injection well operations and the influence of treated water on aquifer quality.

This second biennial Performance Assessment Report documents performance of the injection well operations and the influence of treated water on aquifer quality through December 2008. The report was originally scheduled for submittal in November 2008; however, in an email dated October 30, 2008 (DTSC, 2008a), DTSC concurred with the PG&E proposal to delay the submission of the biennial report until January 15, 2009 and combine this report with the *Semiannual Groundwater Monitoring Report, Second Half 2008* for the Interim Measure Compliance Monitoring Program at the PG&E Topock Compressor Station.

The submission of this second biennial report meets the requirement of Condition 18 in DTSC's July 15, 2005 and January 5, 2007 letters to assess the performance of the injection well field as a methodology for management of treated water from the IM No. 3 system beyond the pilot study period. This report briefly describes the background of the project and the IM No. 3 system, including the design basis. The report also discusses injection

system operational performance, injection system maintenance activities, and groundwater quality and hydraulic changes associated with the injection system to provide the rationale for continued subsurface injection of treated groundwater.

1.1 History and Purpose of the Topock Interim Measure

The purpose of the IM at the Topock Compressor Station is to maintain hydraulic control of the groundwater plume boundaries in the Colorado River floodplain until the time that a final corrective action is in place at the site. As defined by DTSC, the performance standard for the IM is to "establish and maintain a net landward hydraulic gradient, both horizontally and vertically, that ensures that hexavalent chromium [Cr(VI)] concentrations at or greater than 20 micrograms per liter [µg/L] in the floodplain are contained for removal and treatment" (DTSC, 2005b).

PG&E began implementing the IM at the PG&E Topock site in March 2004. Initially, groundwater was extracted from a monitoring well cluster, MW-20, located on a bench above and to the west of the Colorado River floodplain (commonly referred to as the MW-20 bench). This operation was eventually replaced by the current groundwater extraction well system. Groundwater extraction began at wells TW-2S and TW-2D in May 2004, at well TW-3D in December 2005, and at well PE-1 in early 2006. Of the four extraction wells, two are currently in normal operation (TW-3D and PE-1).

Prior to the construction and operation of the current groundwater treatment and injection system, a batch treatment plant was located on the MW-20 bench, and treated groundwater was transported offsite for disposal at a permitted facility. While this operation was effective in controlling hydraulic gradients in the vicinity of the floodplain, it also generated a large number of truck trips from the site to the permitted disposal facility to manage the entire flow of extracted groundwater, and the treatment capacity was limited to approximately 80 gallons per minute (gpm) due to space limitations on the MW-20 bench.

Construction of the current IM No. 3 treatment and injection system began in September 2004 and was completed in July 2005. The existing groundwater treatment system is a continuous, multi-step process that involves removing chromium by chemical reduction, precipitation, and filtration, and reducing total dissolved solids (TDS) using reverse osmosis. The treatment plant is designed to treat up to 135 gpm of extracted groundwater. Treatment plant operation yields an effluent (injection) flow rate of approximately 125 gpm. The remaining flow (up to 15 gpm) becomes a reverse osmosis brine stream that is transported offsite for disposal at a permitted facility. Additional information on the treatment process performance and capacities is contained in the *Interim Measures No. 3 Treatment and Extraction System Operation and Maintenance Plan Rev. 1* (CH2M HILL 2006b) and the *Construction Completion Report* (CH2M HILL, 2005a).

Treated groundwater is returned to the aquifer through an injection system consisting of two wells, IW-2 and IW-3. Injection of treated groundwater from IM No. 3 began on July 31, 2005, as authorized by Waste Discharge Requirements (WDR) Order R7-2004-0103 (California Regional Water Quality Control Board, Colorado River Basin Region [Water Board], 2004). Treated groundwater from the Topock IM has been continuously managed through injection since that time.

WDR Order R7-2006-0060 (Water Board, 2006) was issued September 20, 2006 and is the successor to WDR Order No. R7-2004-0103. A revised Monitoring and Reporting Program under Order R7-2006-0060 was issued August 28, 2008 (Water Board, 2008).

In compliance with WDR Order R7-2006-0060, PG&E collects treated effluent samples from the IM No. 3 treatment plant and analyze for dissolved total chromium (Cr[T]), Cr(VI), metals, specific conductance, TDS, turbidity, flow rate, and major inorganic cations and anions and water quality indicator parameters. The results of these analyses are reported quarterly to the Water Board, along with other required information and a summary of operations.

1.2 Description of Groundwater Injection Well Field

Treated effluent from the IM No. 3 treatment plant is pumped through an aboveground pipeline to the injection well field, located nearly 2,000 feet west of the plant. The well field, located on what is referred to as the East Mesa, is composed of two injection wells (IW-2 and IW-3). Surrounding the injection wells are three observation well clusters (OW-1, OW-2, and OW-5) located on the East Mesa. Surrounding the East Mesa are four additional monitoring well clusters, known as the compliance wells (CW-1, CW-2, CW-3, and CW-4). The locations of the injection wells, observation well clusters, and the compliance well clusters are shown in Figure 1-2.

Table 1-1 summarizes information for the three different well types. The injection wells, observation well clusters, and compliance well clusters were installed between December 2004 and February 2005.

TABLE 1-1
Summary of Injection, Observation, and Compliance Wells Design Information and Installation Dates
Performance Assessment Report Interim Measure No. 3 Injection Well Field, Topock Compressor Station, Needles, California

Well Type (IDs)	Description	Work Plan	Installation Date	Installation Report
Injection (IW-2, IW-3)	Six-inch diameter stainless-steel louvered screens connected to mild steel risers using a mechanical coupling device. One hundred and sixty-foot screened interval. Two hundred gpm each design injection capacity.	CH2M HILL, 2004a	December 2004	CH2M HILL, 2005c
Observation (OW-1, OW-2, OW-5)	Monitoring well clusters consisting of three individual completions at various depths. Two-inch Schedule 40 polyvinyl chloride casing and screen. Twenty-foot screened interval.	CH2M HILL, 2004b	September to December 2004	CH2M HILL, 2005c
Compliance (CW-1, CW-2, CW-3, CW-4)	Monitoring well clusters consisting of two individual completions at various depths. Two-inch Schedule 40 polyvinyl chloride casing and screen. Fifty-foot screened interval	CH2M HILL, 2005b	January to February 2005	CH2M HILL, 2005c

Well IW-2 was completed to 340 feet below ground surface (bgs), with a screened interval from 170 to 330 feet bgs. Well IW-3 was completed to 330 feet bgs, with the screened interval

from 160 to 320 feet bgs. The design injection capacity of 200-gpm each provides 50-percent excess capacity above the plant design capacity in each injection well.

Two types of monitoring wells have been installed in the injection well field. Table 1-2 lists the name, well identifications, and monitoring zone of each type.

TABLE 1-2
Summary of Injection Field Monitoring Wells
Performance Assessment Report Interim Measure No. 3 Injection Well Field, Topock Compressor Station, Needles, California

Group Name	Members	Distance from Injection Wells, feet	Monitoring Zones		
			Shallow	Mid-depth	Deep
Observation Wells	OW-1, OW-2, and OW-5	50 to 100	X	X	X
Compliance Wells	CW-1, CW-2, CW-3, and CW-4	300 to 550		X	X

Source: CH2M HILL, 2005c.

The procedures for maintaining the injection wells are described in the IM No. 3 Injection Well Operation and Maintenance Plan (CH2M HILL, 2005d).

1.3 Compliance Monitoring Program

In compliance with the WDRs, a *Groundwater Compliance Monitoring Plan for Interim Measures No. 3 Injection Area* (CH2M HILL, 2005e) was prepared describing how the injection well field would be monitored to assess injection well performance. The observation well clusters, located relatively close to the injection wells, allow the measurement of changes in water chemistry and water levels across the entire aquifer thickness. Data from these wells provide a measure of the degree of vertical mixing of groundwater that is occurring during injection. Monitoring of the observation wells also allows any effects to groundwater quality from injection to be identified and evaluated promptly during the operation of the groundwater injection system. Corrective action can be taken accordingly for any potential negative effects that may arise—such as aquifer plugging, excessive mounding, or mobilization of trace metals from the aquifer matrix—before the effect progresses beyond the injection points.

The four compliance well clusters, located approximately 500 feet from the injection wells, monitor the influence of injection over a much larger area. They are primarily intended for monitoring groundwater quality and ensuring compliance with the waste discharge permit. The compliance well clusters were installed both upgradient and downgradient of the injection wells. They were located so that groundwater would take several years to travel to them from the injection wells (as estimated by groundwater modeling).

On January 22, 2007 (DTSC, 2007b), DTSC approved a modification to the suite of constituents analyzed during quarterly sampling of the Compliance Monitoring Program (CMP) observation wells (CH2M HILL, 2006c). The Water Board concurred in a letter dated January 23, 2007 (Water Board, 2007a). The observation wells are sampled for a limited suite

of constituents during quarterly monitoring events and the full suite of constituents during the semiannual monitoring events. The compliance wells are sampled for the full suite of constituents during the semiannual monitoring events. Groundwater elevation data and field water quality data—including specific conductance, temperature, pH, oxidation-reduction potential, dissolved oxygen, turbidity, and salinity—are also measured during each monitoring event.

Samples are collected from groundwater wells according to the following schedule:

- Nine observation wells (OW-01S, OW-01M, OW-01D, OW-02S, OW-02M, OW-02D, OW-05S, OW-05M, OW-05D) are sampled quarterly for limited suite of constituents, and semiannually for the full suite of constituents.
- Eight compliance monitoring wells (CW-01M, CW-01D, CW-02M, CW-02D, CW-03M, CW-03D, CW-04M, CW-04D) are sampled semiannually for a full suite of constituents.

On October 16, 2007, the Water Board approved collecting pH measurements in the field rather than through laboratory analysis due to the new 15-minute holding time for laboratory measurements with United States Environmental Protection Agency Method 150.1 (Water Board, 2007b). DTSC provided concurrence for the field pH change in an email dated January 22, 2008 (DTSC, 2008b). This change became effective with the first quarter 2008 sampling event.

On November 13, 2007, the Water Board approved the modification to Cr(VI) analytical methods, which extended the holding time from 24 hours to 28 days (Water Board, 2007c). DTSC provided concurrence for the 28-day holding time for Cr(VI) analyses in an e-mail dated January 22, 2008 (DTSC, 2008b). The first quarter 2008 sampling event was the first event employing the new 28-day holding time for analyzing Cr(VI).

Monitoring data from the CMP have been collected and submitted in conformance with requirements of the WDRs. Quarterly and semiannual groundwater monitoring reports pursuant to the CMP have been completed and submitted to DTSC since startup of the IM No. 3 injection system. The CMP reports are listed in Section 5.0 (CH2M HILL, 2005f-g, 2006d-f, 2007a-d, 2008a-d). The *Semiannual Groundwater Monitoring Report, Second Half 2008 for the Interim Measure Compliance Monitoring Program at the PG&E Topock Compressor Station* is attached as Appendix A.

SECTION 2.0

Injection Well Operational Assessment

2.1 Injection Well Performance

The injection well field is designed to accept all of the treated water from the IM No. 3 treatment plant. This is the primary performance metric. Table 2-1 lists the average injection rate, monthly and cumulative total volume of water injected, and the primary wells in service from August 2005 through December 2008.

TABLE 2-1
Injection Rates and Volumes
Performance Assessment Report Interim Measure No. 3 Injection Well Field, Topock Compressor Station, Needles, California

Date	Average Injection Rate (gpm)	Monthly Total (gallons)	Cumulative Total (gallons)	Primary Injection Well in Service
August-05	58.8	2,626,360	2,626,360	IW-2
September-05	67.2	2,904,094	5,530,454	IW-2
October-05	80.6	3,597,275	9,127,729	IW-2
November-05	74.5	3,216,979	12,344,708	IW-2
December-05	103.5	4,622,252	16,966,960	IW-2
January-06	113.5	5,067,560	22,034,520	IW-2
February-06	121.4	4,896,522	26,931,042	IW-2
March-06	121.1	5,405,223	32,336,265	IW-2
April-06	116.7	5,039,655	37,375,920	IW-2
May-06	118.9	5,305,831	42,681,751	IW-2
June-06	116.9	5,050,593	47,732,344	IW-2
July-06	119.2	5,322,857	53,055,201	IW-2
August-06	121.6	5,429,628	58,484,829	IW-3
September-06	121	5,229,047	63,713,876	IW-3
October-06	122.6	5,473,384	69,187,260	IW-3
November-06	122.1	5,275,516	74,462,776	IW-3
December-06	124.1	5,542,012	80,004,788	IW-3
January-07	123.5	5,510,915	85,515,703	IW-3
February-07	126	5,079,402	90,595,105	IW-3
March-07	123.8	5,525,669	96,120,774	IW-2
April-07	96.5	4,169,396	100,290,170	IW-3

TABLE 2-1
Injection Rates and Volumes
Performance Assessment Report Interim Measure No. 3 Injection Well Field, Topock Compressor Station, Needles, California

Date	Average Injection Rate (gpm)	Monthly Total (gallons)	Cumulative Total (gallons)	Primary Injection Well in Service
May-07	126.8	5,658,656	105,948,826	IW-3
June-07	127.3	5,499,332	111,448,158	IW-3
July-07	122.1	5,448,764	116,896,922	IW-2
August-07	125.8	5,614,418	122,511,340	IW-3
September-07	128.1	5,531,784	128,043,124	IW-3
October-07	128.1	5,717,776	133,760,900	IW-3
November-07	124.1	5,361,317	139,122,217	IW-3
December-07	124.6	5,560,689	144,682,906	IW-3
January-08	123.1	5,492,958	150,175,864	IW-3
February-08	126.5	5,283,674	155,459,538	IW-3
March-08	124.3	5,550,583	161,010,121	IW-3
April-08	93.5	4,040,973	165,051,094	IW-3
May-08	124.2	5,542,847	170,593,941	IW-3
June-08	128.6	5,553,857	176,147,798	IW-3
July-08	127.4	5,685,501	181,833,299	IW-3
August-08	127.7	5,702,022	187,535,321	IW-2
September-08	120.2	5,193,691	192,729,012	IW-3
October-08	125.7	5,613,447	198,342,459	IW-2
November-08	128.4	5,548,109	203,890,568	IW-3
December-08	124.2	5,542,252	209,432,820	IW-3

Source: The injection flow rate is measured by flow meters mounted in the piping leading into IW-02 and IW-03. Data are logged in the IM No. 3 control system from which this information is reported.

The performance of the two injection wells has been monitored since they went into service on July 2005. A summary of operational status of IM No. 3 injection wells from July 2005 through December 2008 is presented in Table 2-2. Performance is measured in terms of specific injectivity and capacity, which is typically measured in gpm of flow per foot of increased and decreased head in the well, respectively. Over time, the specific injectivity of injection wells typically declines due to plugging of pores from suspended solids in the injectate, precipitation of minerals in the well bore, air entrapment in the formation, or biofouling.

TABLE 2-2
Operational Status of Interim Measures No. 3 Injection Wells from July 2005 – December 2008
Performance Assessment Report Interim Measure No. 3 Injection Well Field, Topock Compressor Station, Needles, California

Time Period	Primary Injection Well in Service	Comments
July 31, 2005 to Fourth Quarter 2005	IW-2	
First Quarter 2006	IW-2	Injection occurred primarily at IW-2, except during periods of operational testing, when injection was divided equally between IW-2 and IW-3.
Second Quarter 2006	IW-2	
Third Quarter 2006	IW-3	In August 2006, IW-2 went offline for routine maintenance, and injection commenced at IW-3.
Fourth Quarter 2006	IW-3	Injection occurred at IW-3, except during routine maintenance.
First Quarter 2007	IW-3	Injection occurred at IW-3 and switched over to IW-2 on March 8.
Second Quarter 2007	IW-3	Injection occurred at IW-3 from April 3 through June 20. Injection switched to IW-2 on June 20 and continued through July 20, 2007.
Third Quarter 2007	IW-3	Injection occurred at IW-3 after July 20. Injection occurred at IW-2 on August 30 for an injection test and then returned to IW-3 after August 31.
Fourth Quarter 2007	IW-3	Injection occurred at IW-3 and then switched to IW-2 on September 25 for routine maintenance. Injection returned to IW-3 after October 9.
First Quarter 2008	IW-3	Injection occurred at IW-3 only. From February 5 through February 13, well maintenance activities were conducted at IW-2.
Second Quarter 2008	IW-3	Injection occurred at IW-3 only. IM-3 system offline from April 21 through April 28 due to routine maintenance. Backwashing occurred at IW-3 on April 9, May 7, May 15, May 22, June 3, and June 4, 2008.
Third Quarter 2008	IW-3	Injection occurred primarily at IW-3. Injection also occurred at IW-2 for short period on July 25 and from August 12-31, 2008. Backwashing events occurred at IW-3 on June 17, June 27, July 9, July 15, July 17, July 18, August 12, August 13, September 2, September 3, and from September 23-25, 2008. Backwashing events occurred at IW-2 from September 9-11, 2008.
Fourth Quarter 2008	IW-3	Injection occurred primarily at IW-2 in October 2008, IW-3 in November 2008, and approximately equally between IW-2 and IW-3 in December 2008. Backwashing events occurred at IW-2 on October 7-8, 2008 and on November 25, 2008. Backwashing events occurred at IW-3 on November 4-5, 2008 and on December 8, 9 and 11, 2008.

Injection Well IW-2

As indicated in Table 2-1, for the first reporting period (August 2005 through October 2006), IW-2 was used almost exclusively. The initial specific capacity of IW-2 was approximately 33 gpm per foot based on the initial step rate discharge test conducted after well installation and development in December 2004. In summer of 2005, the specific injectivity of well IW-2 was measured as approximately 18 to 20 gpm foot. Six backwashing events were conducted between July and November 2006. This effort restored the specific injectivity at IW-2 with a gain of approximately 2 gpm per foot with each backwash event. Periodic backwashing of the injection wells continues to be a routine well maintenance activity.

Over time, well IW-2 exhibited progressive loss in specific injectivity that backwashing was not able to reverse. Well rehabilitation efforts were conducted on November 13, 2007 to examine the condition of the well casing and screen. Moderate geochemical fouling in the form of a precipitate (i.e., minerals) was observed sporadically in the well. The precipitation of minerals was believed to be the principal cause of the decrease in specific injectivity. The specific capacity at IW-2 measured on February 5, 2008 approximately 14.8 gpm per foot.

Following the diagnostic assessment described above, from February 4 through February 13, 2008 aggressive well rehabilitation efforts were implemented at IW-2. Mechanical development methods, including brushing, bailing, over-pumping and surging, and airlift swabbing, were employed to remove the solids and precipitate buildup. These efforts resulted in a measured increase in the specific capacity from 7 to 18 gpm per foot once the well was returned to service.

Injection Well IW-3

Figure 2-1 indicates changes in specific injectivity at IW-3 by comparing pre-backwash and corresponding post-backwash events starting March 2008 through December 2008. The pre-backwash specific injectivity measured on March 18, 2008 was noted to be 9.2 gpm per foot. In November 2008, the pre-backwash specific injectivity measured on November 4 was noted to be 8.5 gpm per foot. After implementing a series of backwashing events, the post-backwash specific injectivity measured on November 11, 2008 was noted to be 12.2 gpm per foot, indicating net increase of 3.7 percent. The IW-3 backwashing efforts have maintained a specific injectivity ranging from about 8 to 15 gpm per foot.

Backwashing of IW-3 will continue for the near future to gain further improvements in specific injectivity. The injection wells will then be operated on an alternating schedule with each well receiving injection for close to 2 weeks, then off-line for 2 weeks with a backwash event before being returned to service. That schedule will result in 6 months' of idle time and twelve backwash events per well per year. If performance indicates a drop in specific injectivity, then the wells will either be backwashed more frequently than the current schedule or rehabilitated using more aggressive methods.

It is important to note that each individual injection well currently has sufficient capacity to inject the entire capacity of the treatment plant effluent. The system has adequate spare capacity, and the maintenance program is implemented to maintain sufficient capacity for operation. The proposed maintenance schedule will evaluate the relative benefit of frequent backwashing during the year versus focusing backwashing efforts at the end of the year on an annual maintenance schedule.

2.2 Effect of Injection on Groundwater Levels

The injection at IW-3 has been operating at flow rates between 93.5 gpm and 128.6 gpm since November 2006, as shown in Table 2-1. Groundwater levels have been monitored in all observation and compliance wells since several months prior to the initiation of injection. Figures 2-2 through 2-8 present hydrographs that illustrate groundwater elevation trends and vertical hydraulic gradients observed over the reporting period at the observation and compliance monitoring wells. Average vertical gradients have been upward at the observation well and compliance well clusters since injection began. This is consistent with expectations. Because the injection wells are screened in the deeper portions of the aquifer, the injection tends to increase the head in the deep and middle portions of the aquifer more than in the shallow portions. Groundwater levels in the middle and deep observation and compliance wells respond more quickly to changes in injection rate than shallow water levels. This is primarily due to the semi-confined nature of the aquifer in middle and lower zones. Confined and semi-confined aquifers typically have storage coefficients several orders of magnitude smaller than unconfined aquifer systems and, therefore, respond much more quickly to changes in hydraulic stress. Moreover, the aquifer response of the middle and deep wells to the injected water is generally comparable for both the biennial reporting periods (first biennial reporting period August 2005 through October 2006, and the current biennial reporting period November 2006 through December 2008).

Figures 2-9 and 2-10 present recent water-level contour maps for middle and deep wells using October 2008 data. Similarly, Figures 2-11 and 2-12 present water-level contour maps for middle and deep wells using August 15, 2006 and September 15, 2006 averages. For the past 2 years, the injection rate at IM No. 3 injection well field has averaged approximately 123 gpm. After 2 years, the water-level contours are comparable for both middle and deep wells, respectively, indicating that the groundwater levels in the middle and deep zones are currently in near hydraulic steady-state with the current rate of injection. It is, therefore, not anticipated that continued injection at the current rate will result in any further significant changes in groundwater level, flow directions, or velocities in the injection well field.

The groundwater mound associated with injection is broader and flatter in the deep zone. The mound in the middle zone is more localized around the injection wells. This is consistent with the spinner log results from both injection wells, which showed higher permeability in the deep zone. The mound displays less than a foot of total height in either middle or deep zones, as measured by the difference between observation well and compliance well groundwater elevations, as shown in Figures 2-9 and 2-10. This represents a slight increase in the magnitude of the horizontal gradient, although this increase is localized to the area of the mound itself. Outside of the defined mound area there is no significant affect of injection on groundwater levels.

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. In aquifers in alluvial fan depositional environments, the permeability is often higher in the down-fan direction and lower in the cross-fan direction. This is due to the higher degree of connectedness of the sand and gravel layers in the direction of stream flow on the former fans. The orientation of the long axis of

the mound near the injection well field is northeast-southwest and generally consistent with the likely alignment of alluvial fans in the area.

SECTION 3.0

Influence of Treated Water on Aquifer Water Quality

3.1 Treatment Plant Effluent Water Quality and Groundwater Quality Before and After Injection

Injection of treated water began on July 31, 2005. As required by WDR No. R7-2004-0103 and R7-2006-0060 for the IM No. 3 groundwater treatment system, PG&E is required to submit monthly monitoring reports on the operation of the treatment system. These reports contain the analytical results of treated water effluent sampling and, as such, are useful in evaluating the baseline water quality of the treated water being delivered to the IM No. 3 injection well field. Since operations began, treated groundwater quality has always met or exceeded the limits specified in the WDR.

The treated water has certain characteristics that can be used as a "signature" to determine when that water reaches a monitoring well. Parameters that are relatively constant in treated groundwater effluent are most useful in identifying the effluent signature. These include Cr(VI), Cr(T), fluoride, molybdenum, nitrate as nitrogen, sulfate, and TDS. 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 (based on August 2005 through October 2008 analytical results [CH2M HILL, pending]):

- Cr(VI): typically below detection limits (1.0) µg/L
- Cr(T): typically below detection limits (1.0) µg/L
- Fluoride: approximately 2 milligrams per liter (mg/L)
- Molybdenum: approximately 8 µg/L
- Nitrate/nitrite as nitrogen: approximately 3 mg/L
- Sulfate: approximately 470 mg/L
- TDS: approximately 4,200 mg/L

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

A full set of nine observation well groundwater samples were collected on July 27 and 28, 2005, and a full set of eight compliance well groundwater samples were collected on September 13 through September 15, 2005. These samples are considered representative of conditions unaffected by injection and serve to characterize the pre-injection water quality. By considering the set of seven parameters and focusing on those parameters that show significant differences, it is relatively easy to distinguish between the pre-injection water quality at the monitoring wells and the treated water effluent quality.

Wells OW-1M, OW-1D, OW-2M, OW-2D, OW-5M, OW-5D, CW-1M, CW-1D, CW-2D, CW-3D, and CW-4D are locations and depths where the treated water injection front has largely replaced the local pre-injection groundwater. To date, all shallow observations wells (wells OW-1S, OW-2S, and OW-5S) show no water quality effects due to injection of treated water, indicating that injected water has not reached these depths and locations.

3.2 Water Quality Trends

Trends in water-quality monitoring data have been 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. Eleven 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 have sufficient detections to make time series analysis useful. The analytes include chloride, Cr(T), fluoride, Cr(VI), molybdenum, nitrate/nitrite as nitrogen, pH, sodium, sulfate, TDS, and vanadium. Water quality hydrographs (time-series plots) of these 11 analytes in each observation and compliance well within the IM No. 3 IW field are presented in Figures 3-1 through 3-5. The graphs are divided into the three depth (shallow, mid, and deep) intervals for the observation wells, followed by the two intervals for the compliance wells. The average effluent water quality information is also presented on these figures for comparative purposes. (Starting with first quarter 2008, pH measurements on groundwater samples were no longer made through laboratory analysis due to the new 15-minute holding time for laboratory measurements with United States Environmental Protection Agency Method 150.1. Treatment plant effluent samples were unaffected by this change.)

Observation well water quality hydrographs are presented in Figures 3-1 through 3-3. These hydrographs show the same overall patterns: wells that are identified as affected by treated water injection show a shift in water quality 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 step-wise (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 middle and deep interval wells identified as affected by treated water injection.

The shallow-depth observation wells (OW-1S, OW-2S, and OW-5S) show little water-quality variation over time and generally have remained constant during monitoring. TDS, sodium, chloride, vanadium, molybdenum, and sulfate are particularly consistent with baseline pre-injection concentrations and show that the local groundwater quality at shallow depths is not being affected by injection of treated water.

Compliance well water quality hydrographs are presented in Figures 3-4 and 3-5. Wells CW-1D, CW-2D, and CW-3D show a decreasing concentration in TDS and chloride. Similarly, well CW-1M shows decreasing trends in Cr(VI) and Cr(T). These changes are attributed to the arrival of injection water.

During the second half 2008, none of the samples collected from shallow, middle, and deep wells exceeded the interim action level of 32.6 µg/L for Cr(VI). During the second half 2008, samples collected from one well, OW-2S, exceeded the water-quality objective of 28 µg/L for Cr(T). The August 5, 2008 and November 3, 2008 samples from well OW-2S had concentrations of 30.8 µg/L and 29.3 µg/L, respectively. For these exceedances, the results are not considered to be the result of injection of treated groundwater, as the effluent concentration of Cr(T) from the IM No. 3 treatment plant is normally not detected at a reporting limit of 0.2 µg/L (CH2M HILL, 2008e). Cr(T) and Cr(VI) concentrations at OW-2S have been consistently above the water-quality objectives since November 2005. This exceedance of Cr(T) is thus considered reflective of the natural variance in background water quality.

3.3 Evaluation of Need for Shallow Compliance Monitoring Wells

As of the 4th Quarter 2008, the chemical signature of the injected water has been observed at three deep observation wells, but none of the shallow observation wells. The absence of injected water in the nearby shallow observation wells is consistent with an anisotropic aquifer system where horizontal permeability (Kh) is greater than vertical permeability (Kv). Anisotropy is typical of alluvial aquifer systems. Analysis of pumping tests conducted in IW-2 and IW-3 has shown Kh/Kv ratios ranging from 50 to 140. This ratio indicates that water would move preferentially in the horizontal direction, rather than the vertical direction. Based on the water-quality monitoring data from the observation wells and the hydraulic data from the injection well tests, the influence of the injection is expected to be seen first in the middle and deep monitoring wells and only much later in the shallow wells.

It is not known when significant water quality changes will occur in the shallow observation wells but, at a minimum, it has lagged beyond the occurrence at deeper depths by 38 months. It is highly unlikely that adverse effects due to injected water would be observed in the shallow zone at the more distant compliance wells prior to being observed in the deeper zones at those locations. If any indication of adverse affects from injection is observed in the mid-depth or deep compliance monitoring wells, shallow wells could be installed in sufficient time to observe any effects of injection in the shallow zone. Considering the cultural sensitivity of the area where the compliance wells are installed, shallow compliance monitoring wells are not recommended for installation unless adverse effects from injection are observed in deep or middle wells. Based on the performance of the injection system since its start and the results of recent groundwater quality sampling, it is not necessary to install these shallow wells at this point in time.

SECTION 4.0

Summary and Recommendations

The IM No. 3 groundwater injection system has operated successfully since July 31, 2005 and has been shown to be an effective strategy for management of treated groundwater generated through implementation of the IM at the PG&E Topock Compressor Station. The following summarizes the performance highlights of the injection system.

- **Predicted aquifer response**: The aquifer has responded hydraulically to the injection as expected. The groundwater mound near the injection wells is predominantly in the middle and deep aquifer zones and appears to show the influence of preferential permeability in the deep zone. The direction of preferential flow appears to be in a – northeast/southwest direction parallel with the depositional grain of the alluvial fan in the area of the injection wells. Preferential flow along the axis of an alluvial fan results from the alignment of sand and gravel layers along the stream channels as the fan is deposited (Fetter, 1994).
- **No adverse affect to aquifer water quality**: There are no indications of adverse affects to aquifer water quality as a result of the injection. No unexpected or adverse geochemical reactions have been observed. The water quality in the middle and deep zones is generally improving in areas where the injected water has displaced the native groundwater. Injected water has not directly affected the shallow aquifer zone, although some water quality changes observed in the shallow zone may be associated with changes in localized groundwater flow directions associated with the injection.
- **Limited effect on shallow groundwater**: As anticipated, injected water is moving almost entirely through the aquifer in the middle and deep zone. Very little effect has been seen in the shallow observation wells. Adverse effects of injection, if any, would therefore be seen first in the middle and deep zones, with a significant lag in time before arriving at shallower depths. Installation of shallow compliance wells is not recommended unless adverse affects of injection are observed in the middle and deep zones.
- **Successful injection well operation**: The injection wells have performed without significant problems for the second biennial reporting period, maintaining sufficient injection capacity throughout operation. IW-3 was primarily used during the second biennial reporting period, with IW-2 in intermittent operation. Backwashing implemented at IW-3 has improved and sustained the specific injectivity with each backwash event (Figure 2-1). Moreover, alternate use of both the injection wells has most likely improved the efficiency and allowed smooth operation of the IM No. 3 injection well field. Backwashing will be implemented as needed to increase and improve efficiency at both injection wells.
- **Improved environment and safer operations**: Operating the injection wells reduces the adverse environmental and safety impacts associated with the trucking of treated groundwater to a permitted offsite facility (off-site disposal of the 203 million gallons

injected through November 2008 would have required over 38,000 tanker truck trips). Reduced truck traffic results in lower vehicle emissions and reduces the chance of accidents.

For these reasons, PG&E plans continued operation of the injection system, under DTSC oversight, as an effective method for managing the treated water and as an integral part of IM No. 3 system operations.

SECTION 5.0

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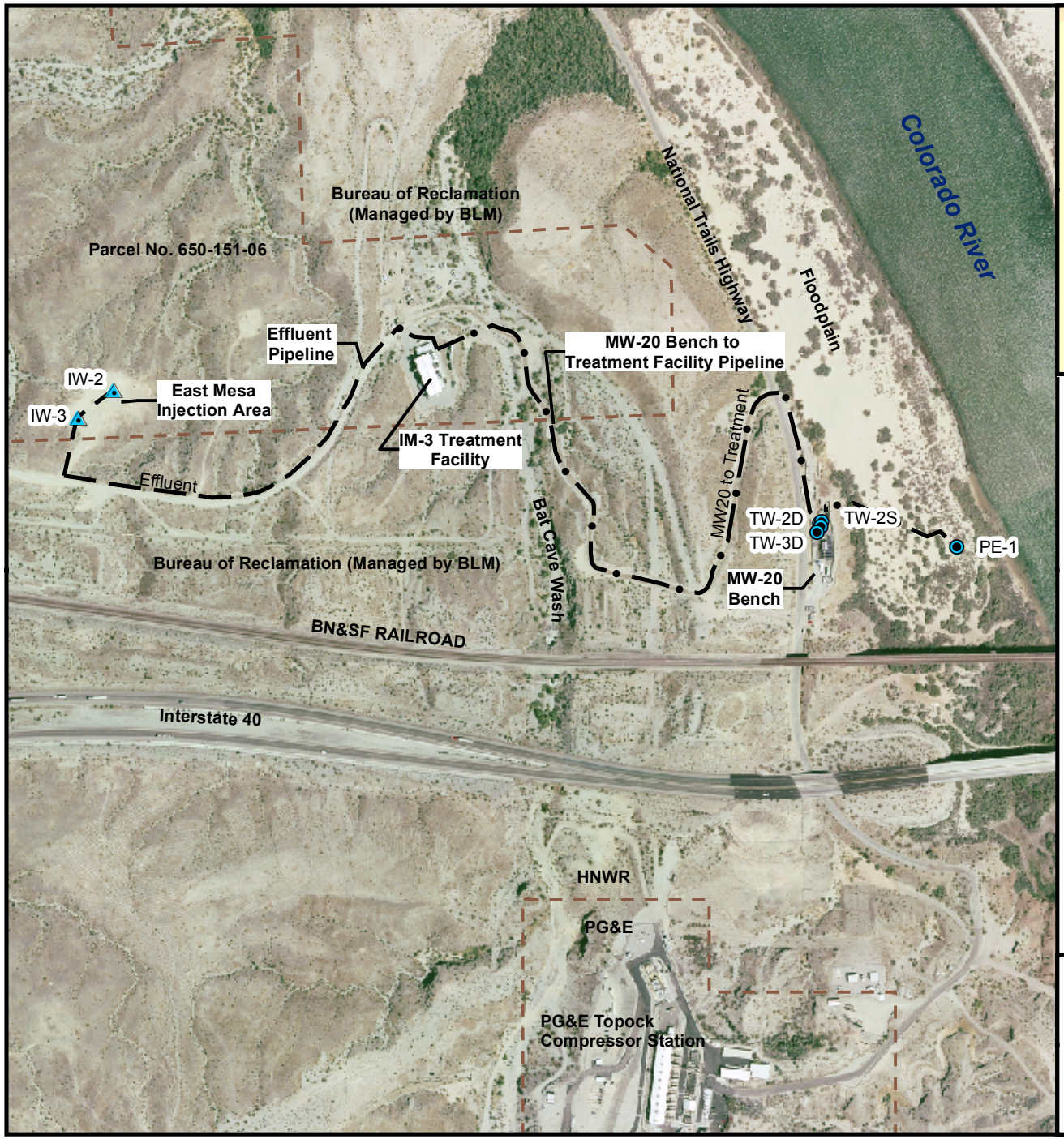
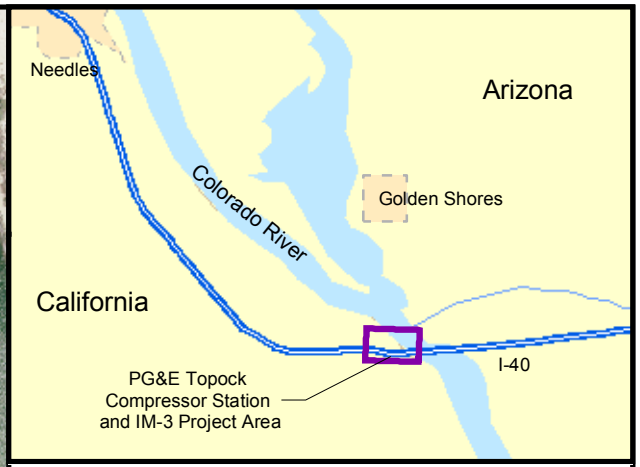




N

0 550 1,100 Feet

1 inch equals 550 feet

LEGEND

- PG&E Property Line
- Existing IM Extraction Well
- Existing IM Injection Well
- Treatment Facility Pipeline

Notes: Location map shows Interim Measures No.3 (IM-3) facilities as of of January 2006. Aerial photography taken May 2005.

FIGURE 1-1
SITE LOCATION AND LAYOUT

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

CH2MHILL

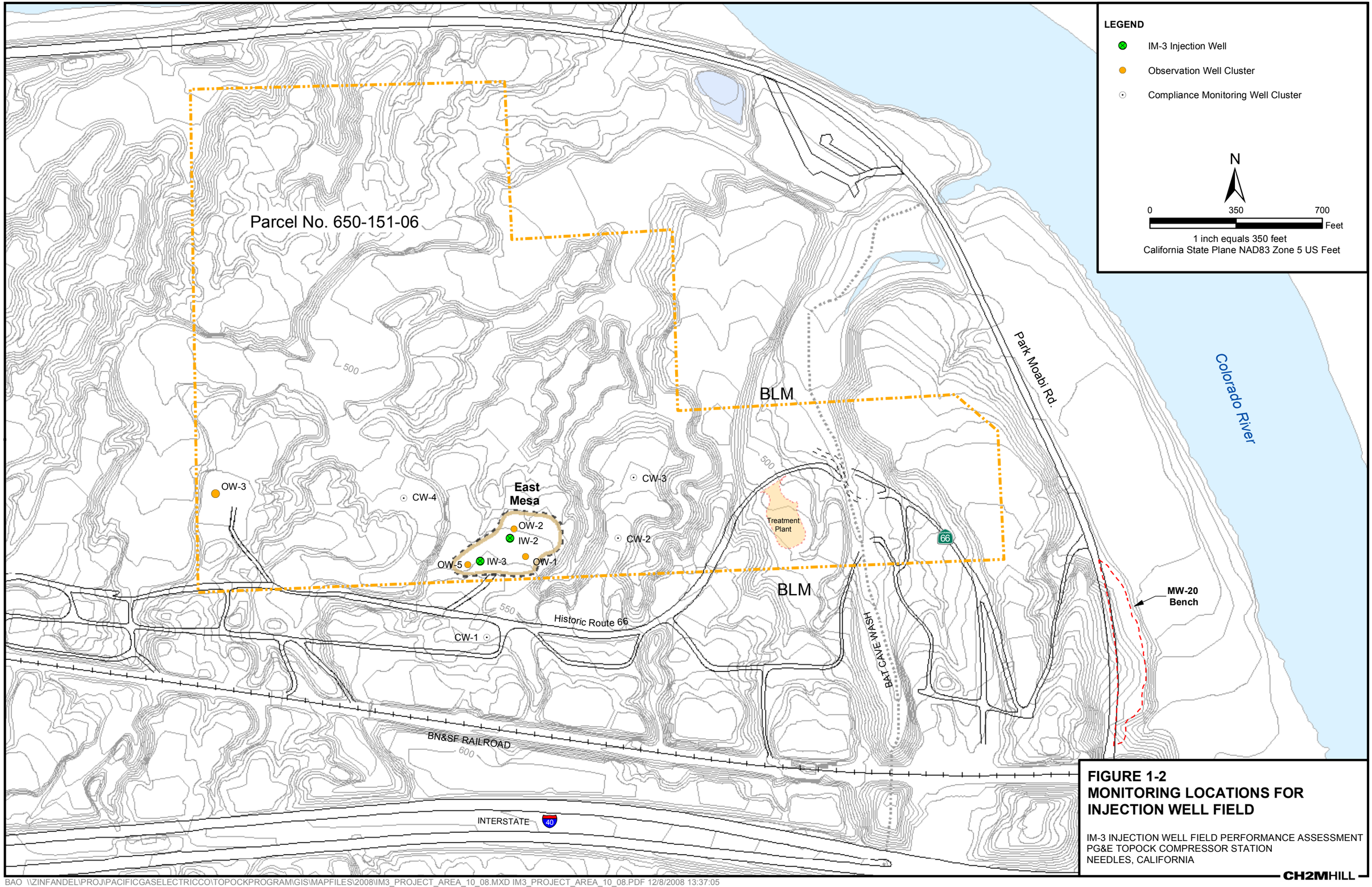
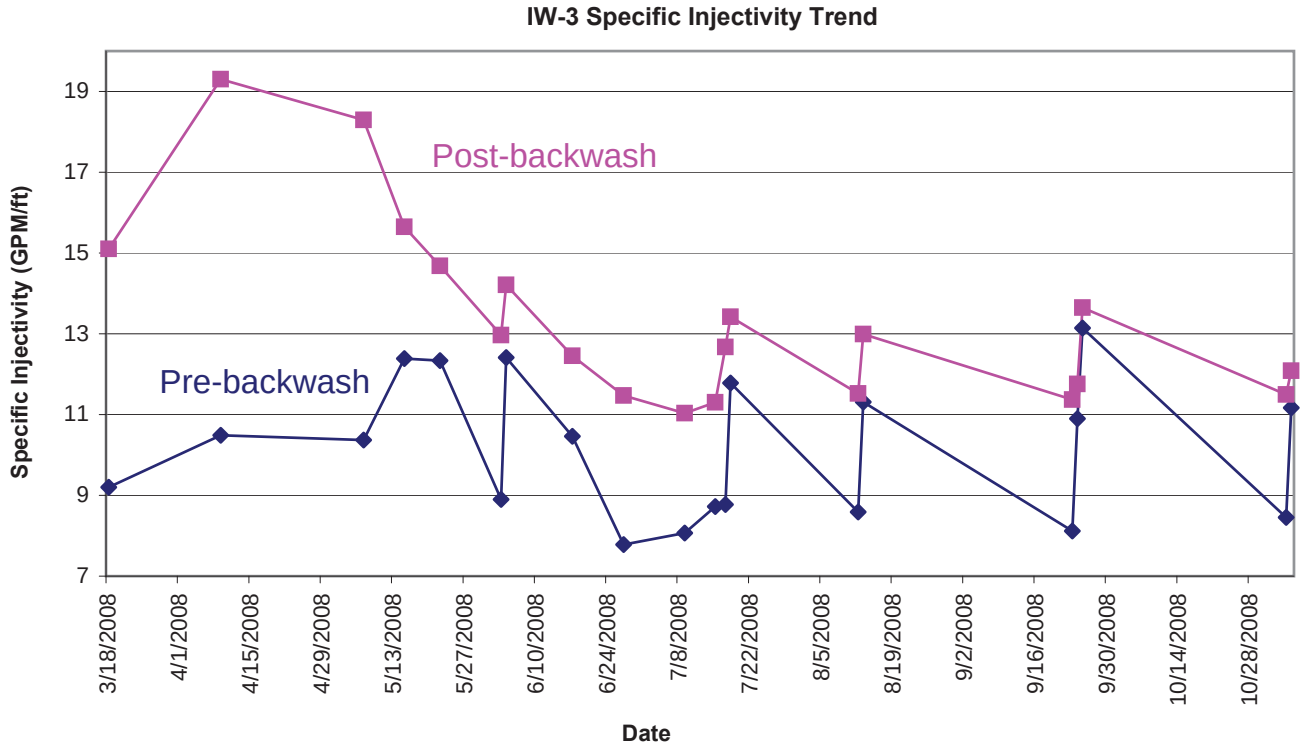


FIGURE 1-2
MONITORING LOCATIONS FOR INJECTION WELL FIELD

IM-3 INJECTION WELL FIELD PERFORMANCE ASSESSMENT
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



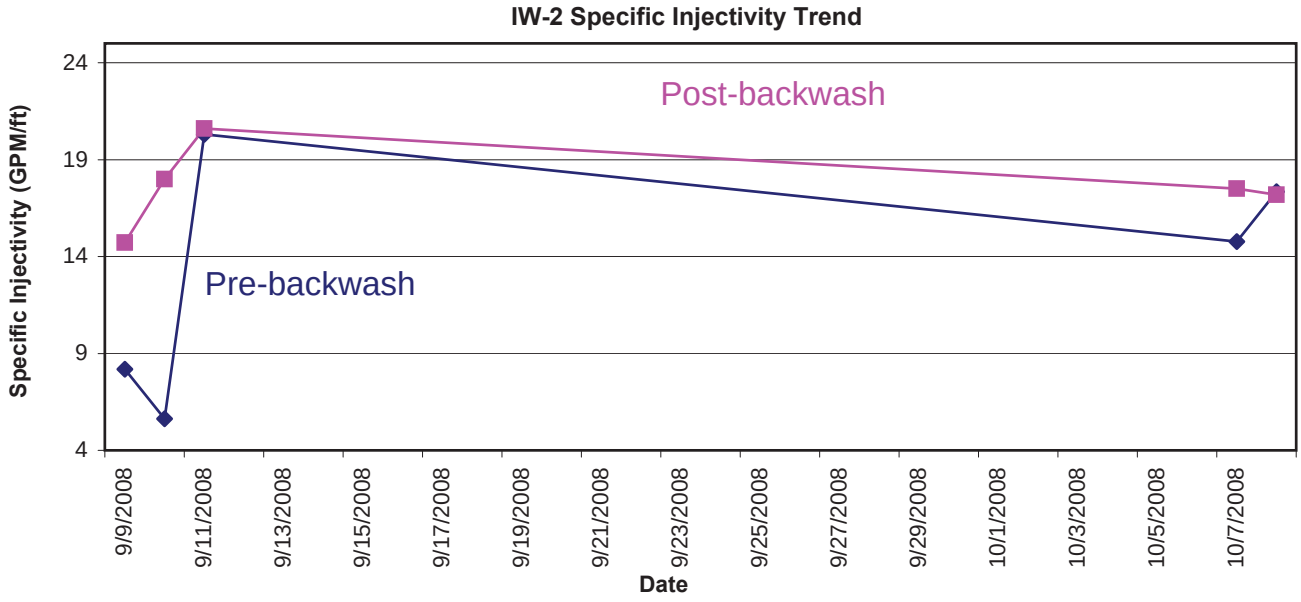
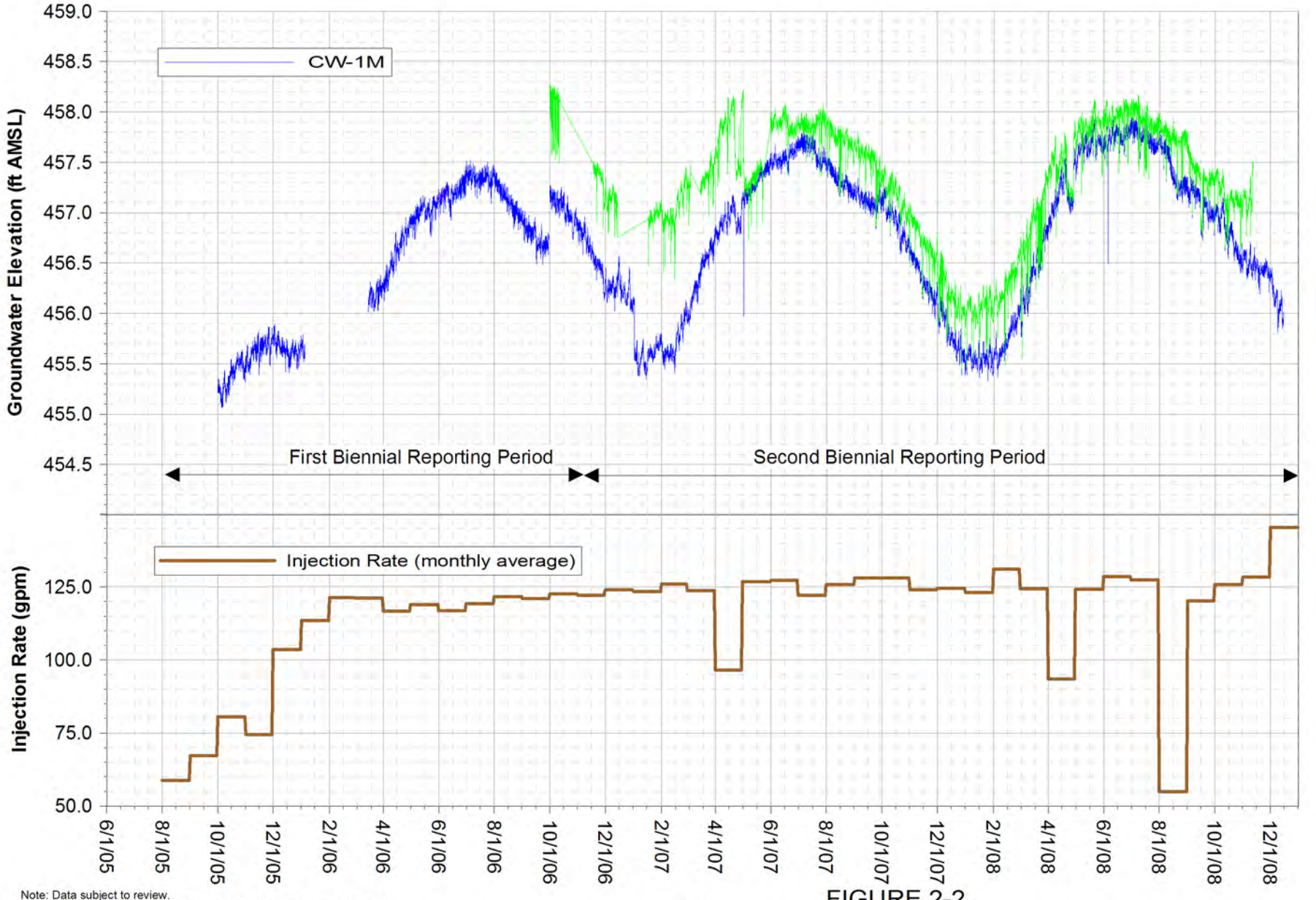


FIGURE 2-1
IW-2 AND IW-3 SPECIFIC INJECTIVITY TREND AFTER BACKWASHING
IM-3 INJECTION WELL FIELD PERFORMANCE ASSESSMENT
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



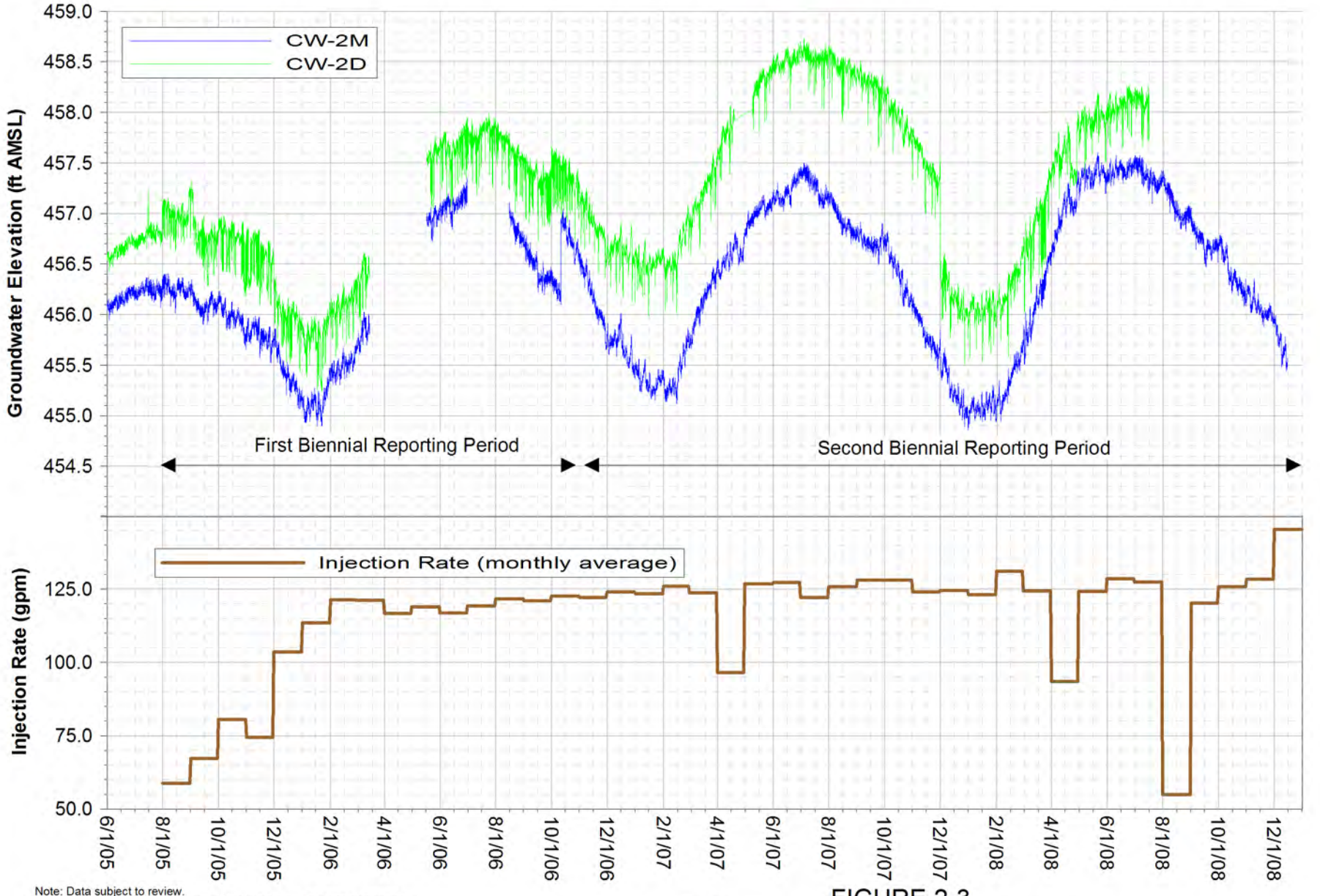
Note: Data subject to review.
Following were primary injection wells in service for the reporting period:

- IW-2 August 2005 – July 2006
- IW-3 August 2006 – February 2007
- IW-2 March 2007
- IW-3 April 2007 – June 2007
- IW-2 July 2007
- IW-3 August 2007 - July 2008
- IW-2 August 2008
- IW-3 September 2008
- IW-2 October 2008
- IW-3 November 2008

Additional details are provided in Table 2-1 and Table 2-2.

FIGURE 2-2
CW-1 HYDROGRAPHS AND IW INJECTION RATE
PERFORMANCE ASSESSMENT REPORT
INTERIM MEASURE NO. 3 INJECTION WELL FIELD
PG & E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

CH2MHILL



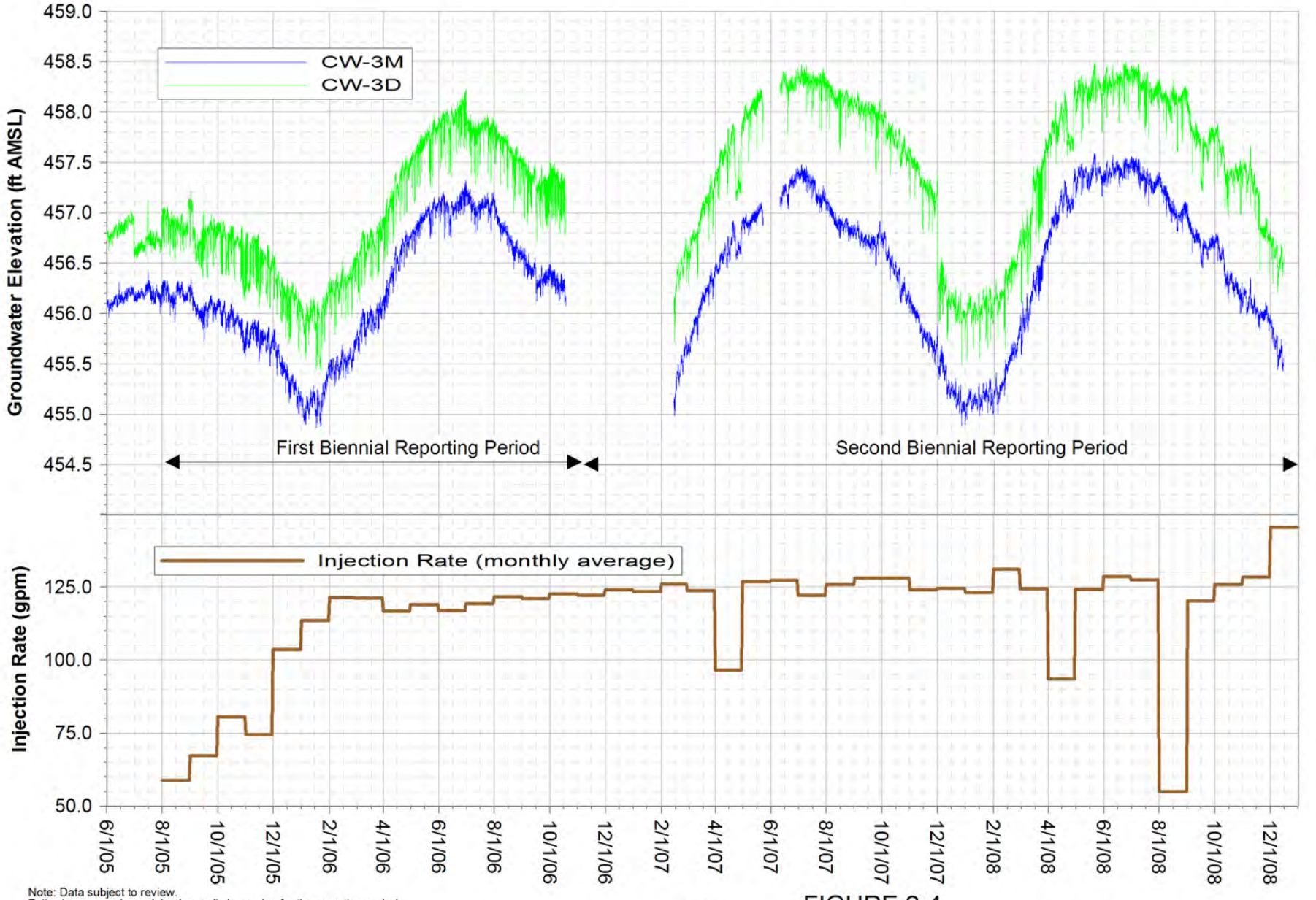
Note: Data subject to review.
Following were primary injection wells in service for the reporting period:

- IW-2 August 2005 – July 2006
- IW-3 August 2006 – February 2007
- IW-2 March 2007
- IW-3 April 2007 – June 2007
- IW-2 July 2007
- IW-3 August 2007 - July 2008
- IW-2 August 2008
- IW-3 September 2008
- IW-2 October 2008
- IW-3 November 2008

Additional details are provided in Table 2-1 and Table 2-2.

FIGURE 2-3
CW-2 HYDROGRAPHS AND IW INJECTION RATE
PERFORMANCE ASSESSMENT REPORT
INTERIM MEASURE NO. 3 INJECTION WELL FIELD
PG & E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

CH2MHILL



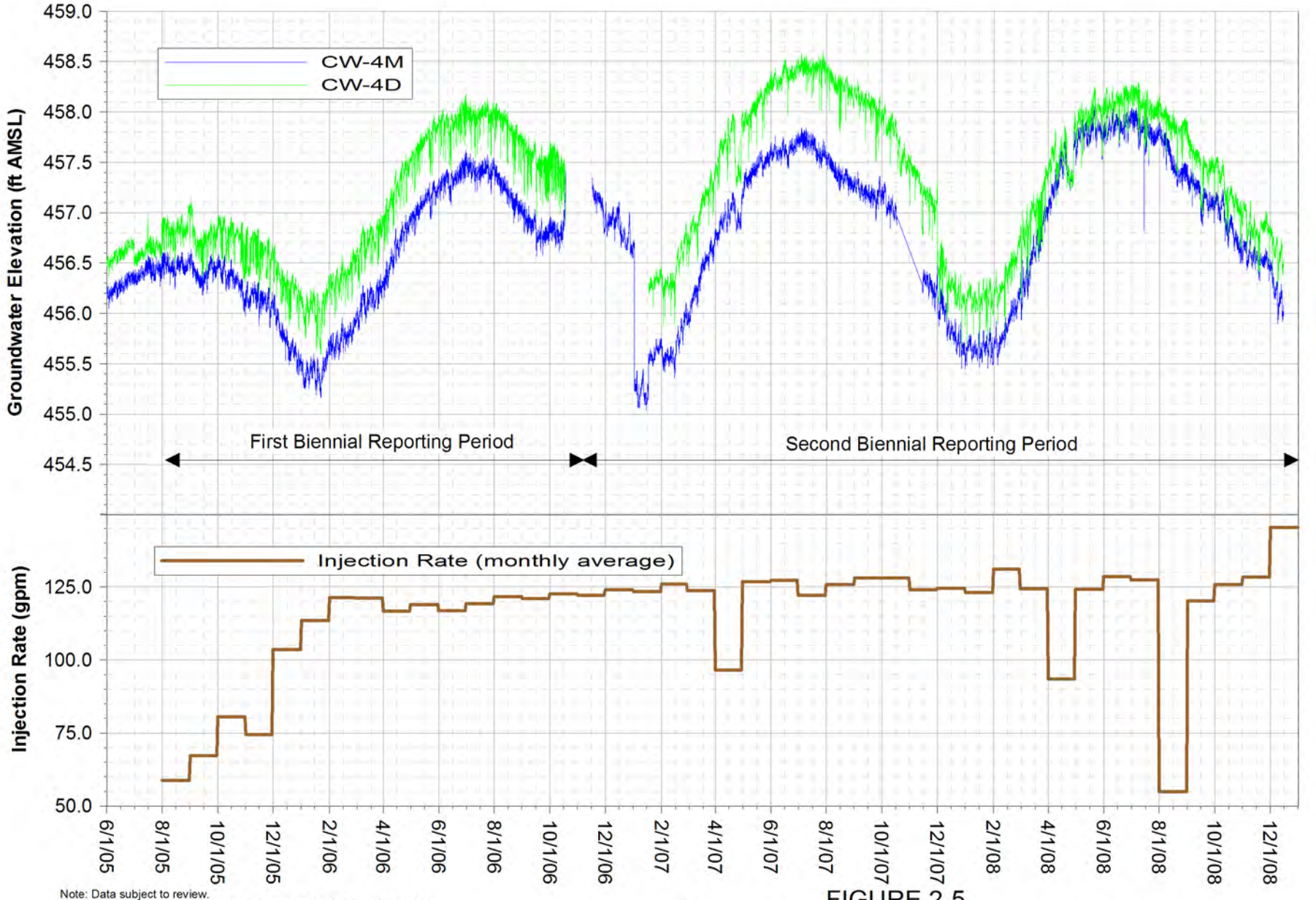
Note: Data subject to review.
Following were primary injection wells in service for the reporting period:

- IW-2 August 2005 – July 2006
- IW-3 August 2006 – February 2007
- IW-2 March 2007
- IW-3 April 2007 – June 2007
- IW-2 July 2007
- IW-3 August 2007 - July 2008
- IW-2 August 2008
- IW-3 September 2008
- IW-2 October 2008
- IW-3 November 2008

Additional details are provided in Table 2-1 and Table 2-2.

FIGURE 2-4
CW-3 HYDROGRAPHS AND IW INJECTION RATE
PERFORMANCE ASSESSMENT REPORT
INTERIM MEASURE NO. 3 INJECTION WELL FIELD
PG & E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

CH2MHILL



Note: Data subject to review.
Following were primary injection wells in service for the reporting period:

- IW-2 August 2005 – July 2006
- IW-3 August 2006 – February 2007
- IW-2 March 2007
- IW-3 April 2007 – June 2007
- IW-2 July 2007
- IW-3 August 2007 - July 2008
- IW-2 August 2008
- IW-3 September 2008
- IW-2 October 2008
- IW-3 November 2008

Additional details are provided in Table 2-1 and Table 2-2.

FIGURE 2-5
CW-4 HYDROGRAPHS AND IW INJECTION RATE
PERFORMANCE ASSESSMENT REPORT
INTERIM MEASURE NO. 3 INJECTION WELL FIELD
PG & E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

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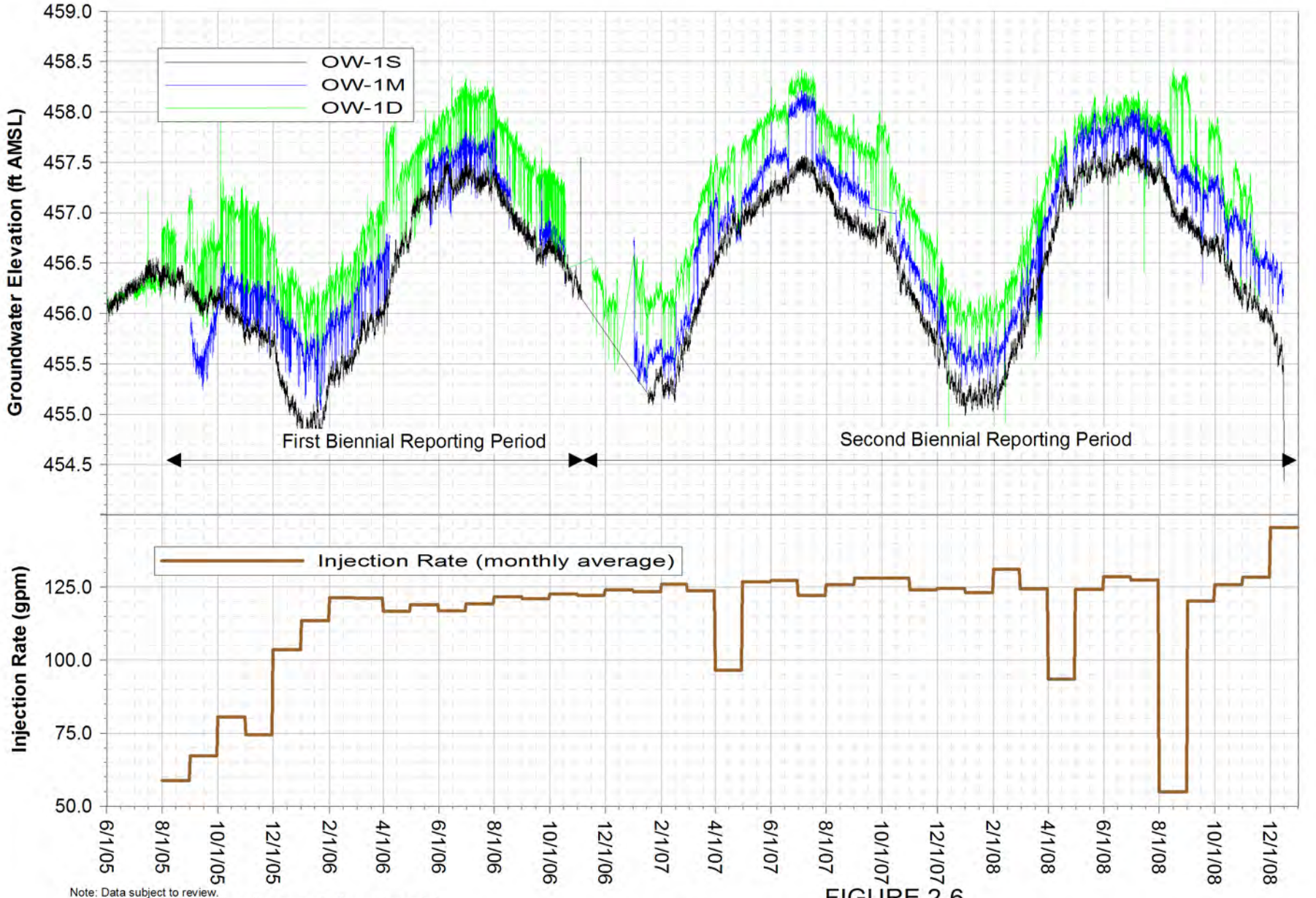


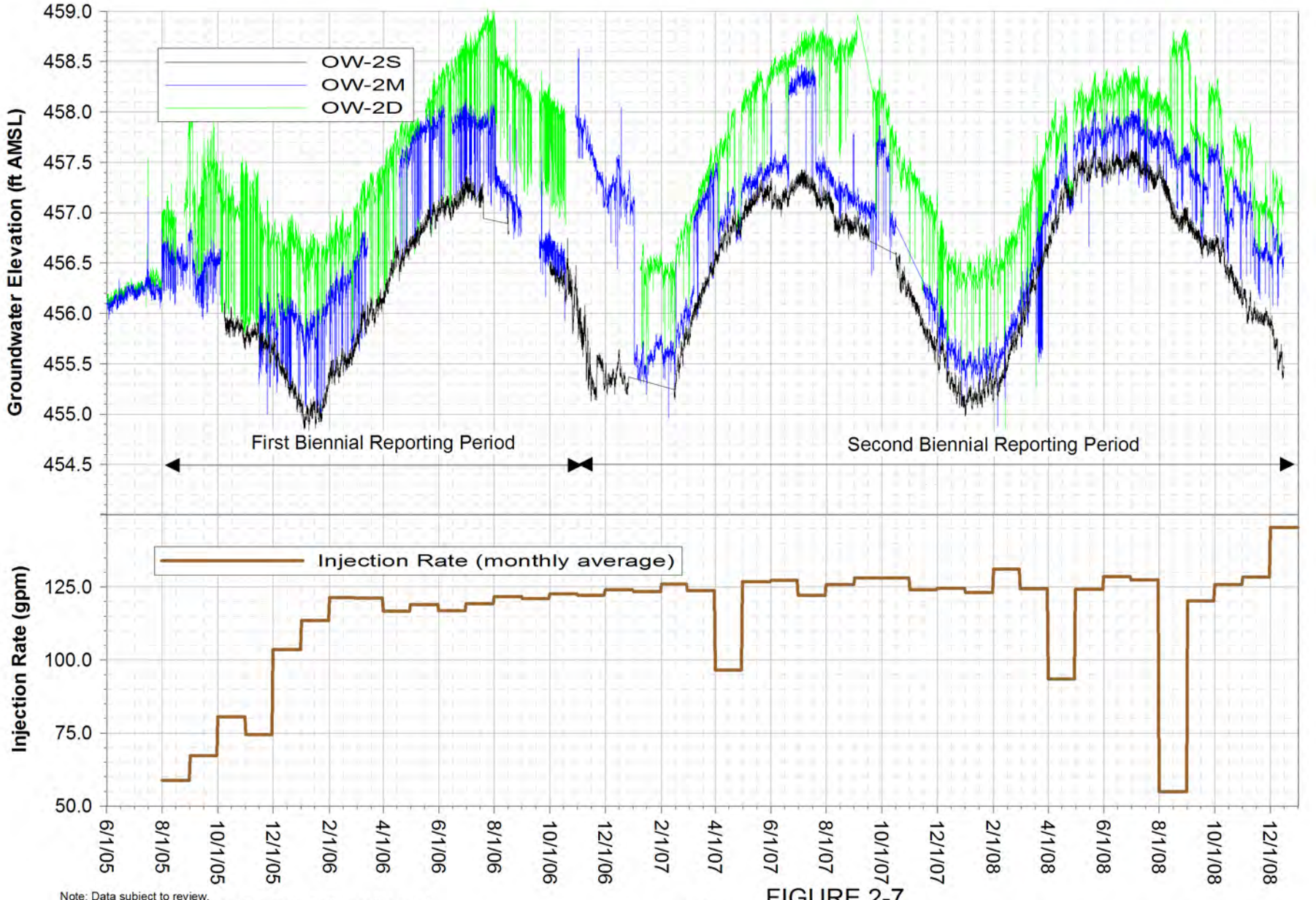
Note: Data subject to review.
Following were primary injection wells in service for the reporting period:

- IW-2 August 2005 – July 2006
- IW-3 August 2006 – February 2007
- IW-2 March 2007
- IW-3 April 2007 – June 2007
- IW-2 July 2007
- IW-3 August 2007 - July 2008
- IW-2 August 2008
- IW-3 September 2008
- IW-2 October 2008
- IW-3 November 2008

Additional details are provided in Table 2-1 and Table 2-2.

FIGURE 2-6
OW-1 HYDROGRAPHS AND IW INJECTION RATE
PERFORMANCE ASSESSMENT REPORT
INTERIM MEASURE NO. 3 INJECTION WELL FIELD
PG & E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

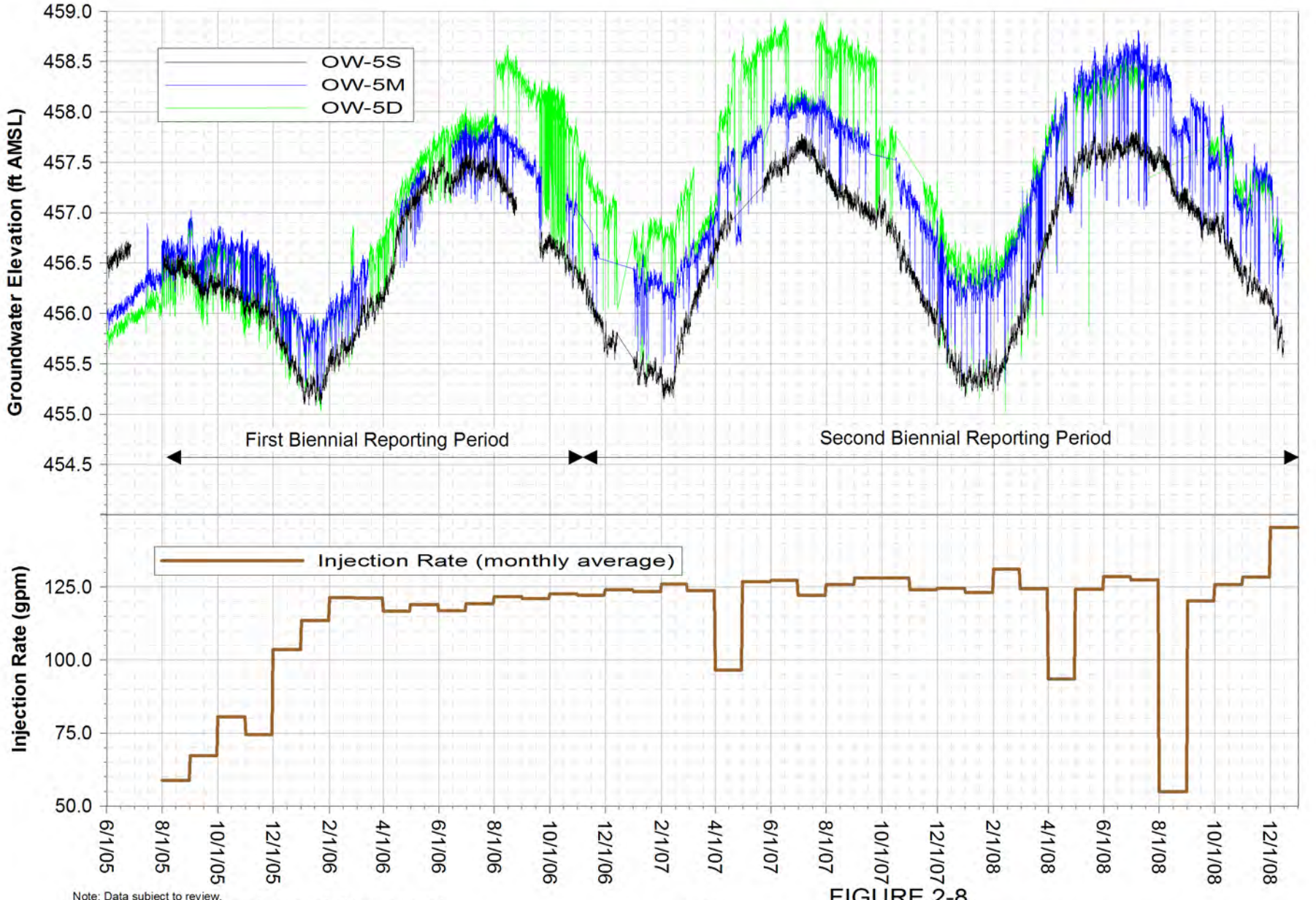
CH2MHILL



Note: Data subject to review.
Following were primary injection wells in service for the reporting period:
IW-2 August 2005 – July 2006
IW-3 August 2006 – February 2007
IW-2 March 2007
IW-3 April 2007 – June 2007
IW-2 July 2007
IW-3 August 2007 - July 2008
IW-2 August 2008
IW-3 September 2008
IW-2 October 2008
IW-3 November 2008
Additional details are provided in Table 2-1 and Table 2-2.

FIGURE 2-7
OW-2 HYDROGRAPHS AND IW INJECTION RATE
PERFORMANCE ASSESSMENT REPORT
INTERIM MEASURE NO. 3 INJECTION WELL FIELD
PG & E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

CH2MHILL



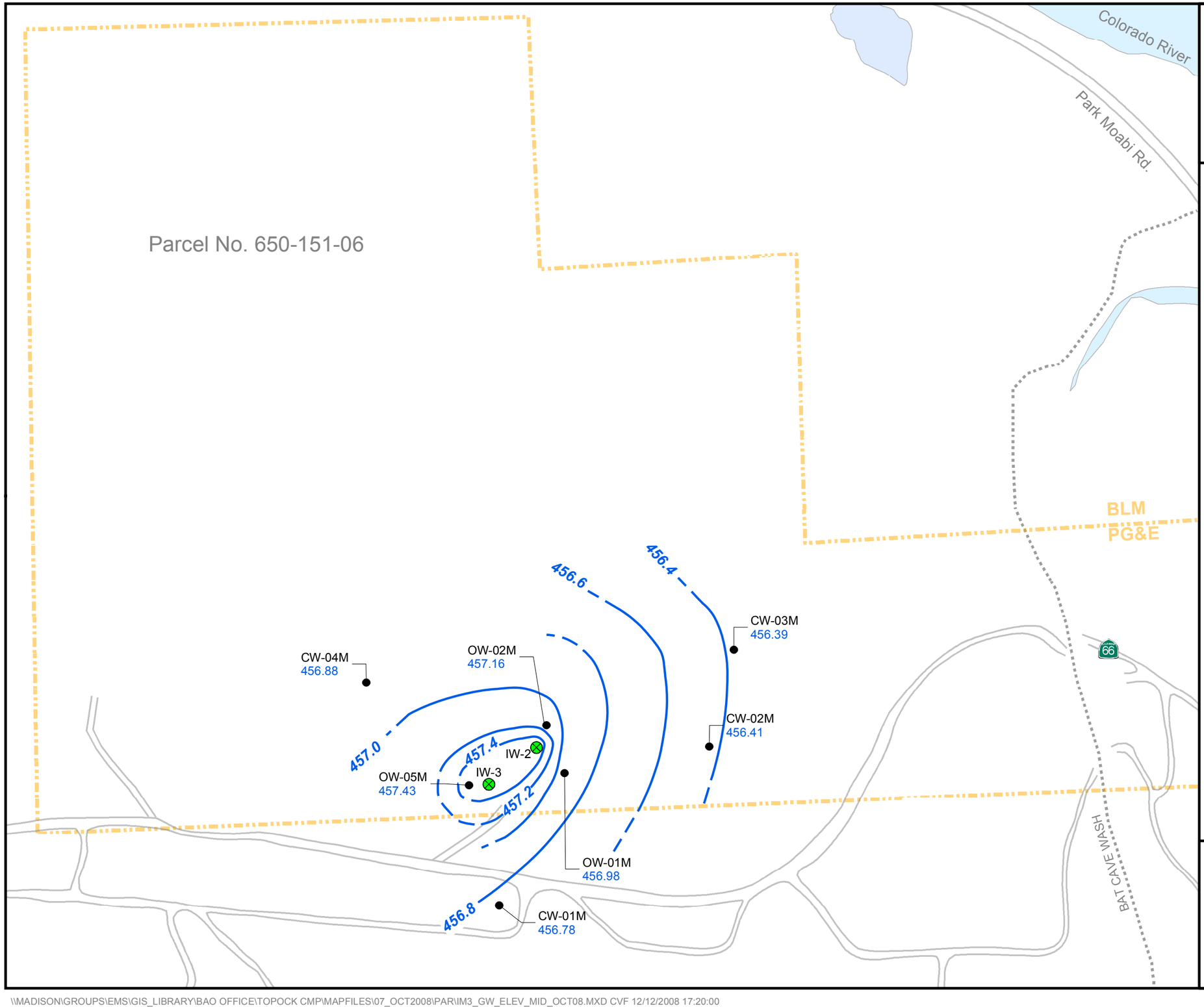
Note: Data subject to review.
Following were primary injection wells in service for the reporting period:

- IW-2 August 2005 – July 2006
- IW-3 August 2006 – February 2007
- IW-2 March 2007
- IW-3 April 2007 – June 2007
- IW-2 July 2007
- IW-3 August 2007 - July 2008
- IW-2 August 2008
- IW-3 September 2008
- IW-2 October 2008
- IW-3 November 2008

Additional details are provided in Table 2-1 and Table 2-2.

FIGURE 2-8
OW-5 HYDROGRAPHS AND IW INJECTION RATE
PERFORMANCE ASSESSMENT REPORT
INTERIM MEASURE NO. 3 INJECTION WELL FIELD
PG & E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

CH2MHILL



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

- OW-02M 457.16 — 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

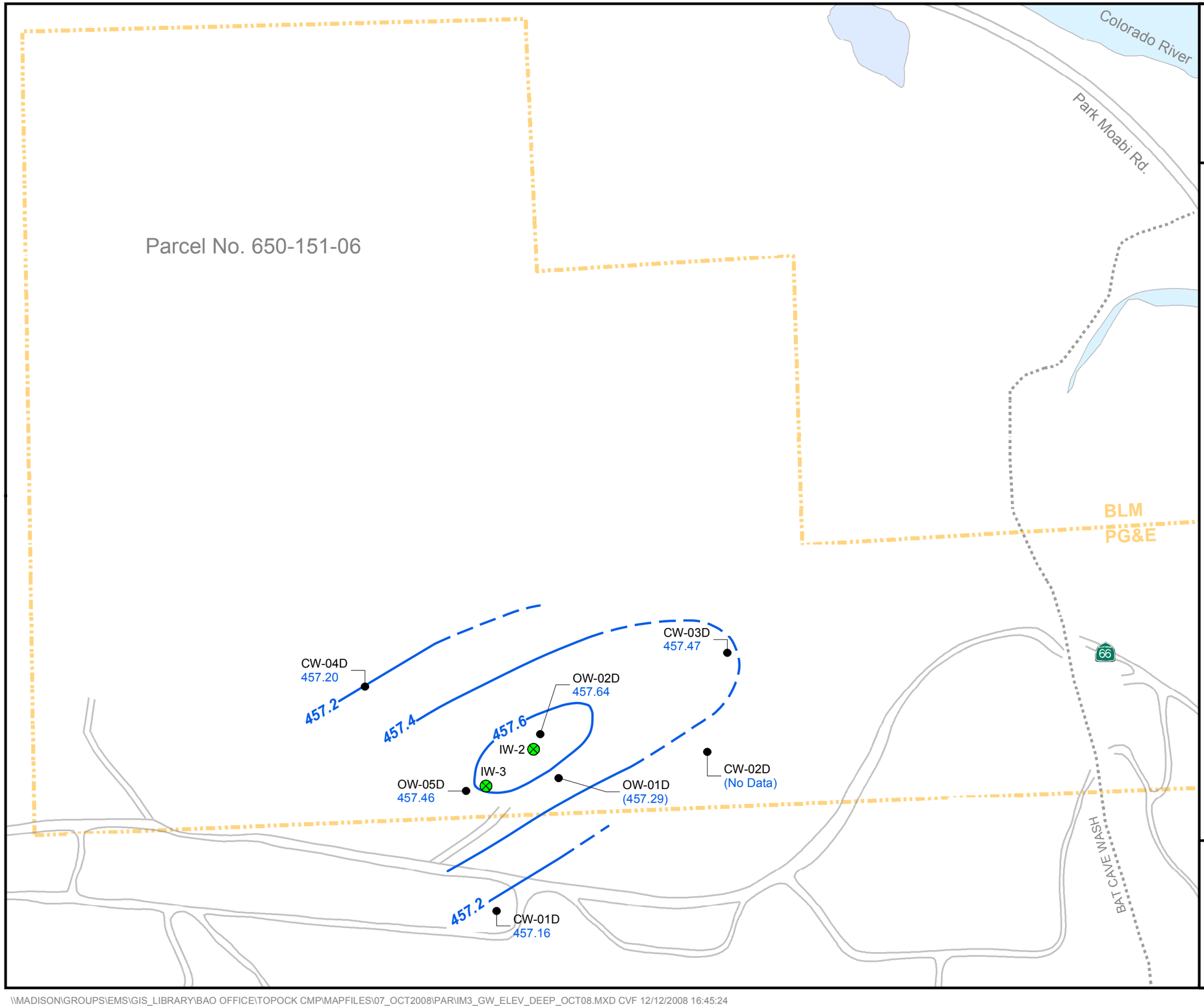
Notes:
Data posted and contoured from monthly average heads measured with transducers at 30 minute intervals.

FIGURE 2-9
AVERAGE GROUNDWATER ELEVATION CONTOURS FOR MID-DEPTH WELLS OCTOBER 1 TO OCTOBER 31, 2008

IM3 COMPLIANCE MONITORING PROGRAM
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

\\MADISON\GROUPS\EMS\GIS_LIBRARY\BAO OFFICE\TOPOCK CMP\MAPFILES\07_OCT2008\PAR\IM3_GW_ELEV_MID_OCT08.MXD CVF 12/12/2008 17:20:00



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

- OW-05D 457.46 — 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:
Data posted and contoured from monthly average heads measured with tranducers at 30 minute intervals. (OW-01D) andexcluded from contouring. CW-02D transducer failed.

FIGURE 2-10
AVERAGE GROUNDWATER ELEVATION CONTOURS FOR DEEP WELLS OCTOBER 1 TO OCTOBER 31, 2008

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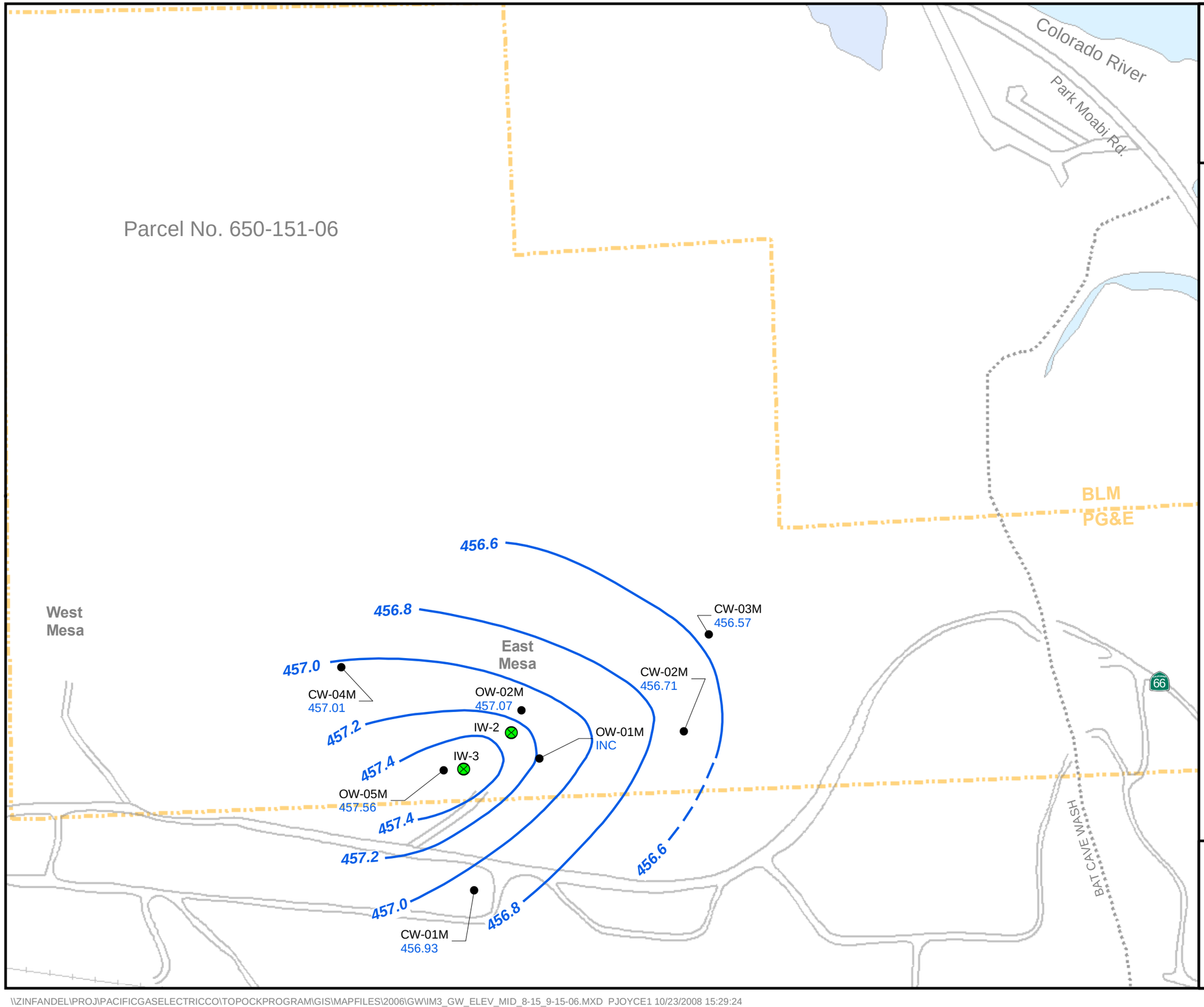
\\MADISON\GROUPS\EMS\GIS_LIBRARY\BAO OFFICE\TOPOCK CMP\MAPFILES\07_OCT2008\PAR\IM3_GW_ELEV_DEEP_OCT08.MXD CVF 12/12/2008 16:45:24



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

- **OW-02M** 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 minute intervals.
OW-1M transducer data incomplete over reporting period.
OW-2M data is the average from 8/15/2006 through 8/30/2006, the transducer failed after this date.

FIGURE 2-11
AVERAGE GROUNDWATER ELEVATION CONTOURS FOR MID-DEPTH WELLS AUGUST 15 TO SEPTEMBER 15, 2006

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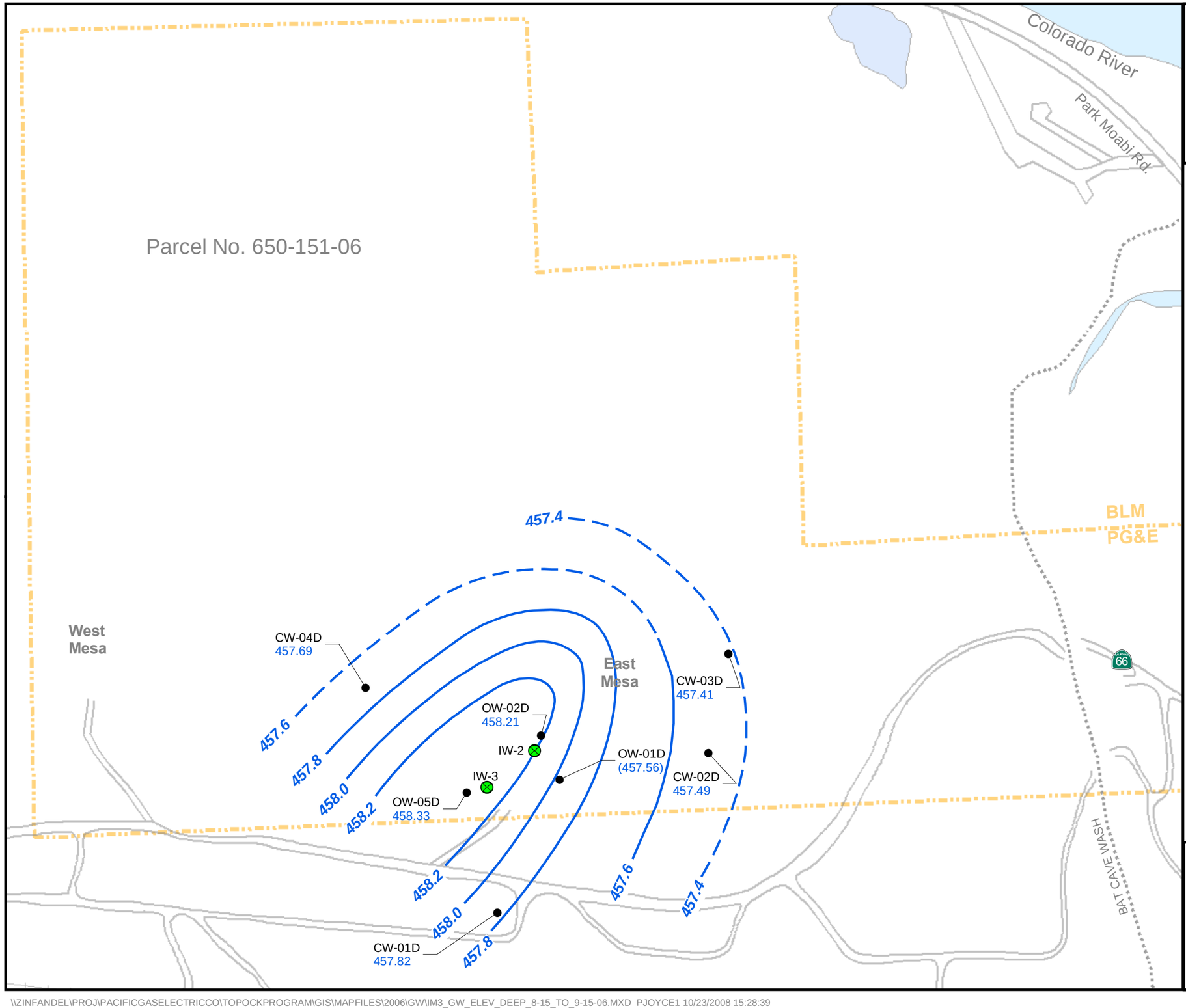
\\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2006\GW\IM3_GW_ELEV_MID_8-15_9-15-06.MXD PJOYCE1 10/23/2008 15:29:24



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

- **OW-05D** 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:
Data posted and contoured from monthly average heads measured with tranducers at 30 minute intervals. (OW-1D) excluded from contouring.

FIGURE 2-12
AVERAGE GROUNDWATER ELEVATION CONTOURS FOR DEEP WELLS AUGUST 15 TO SEPTEMBER 15, 2006

IM3 COMPLIANCE MONITORING PROGRAM
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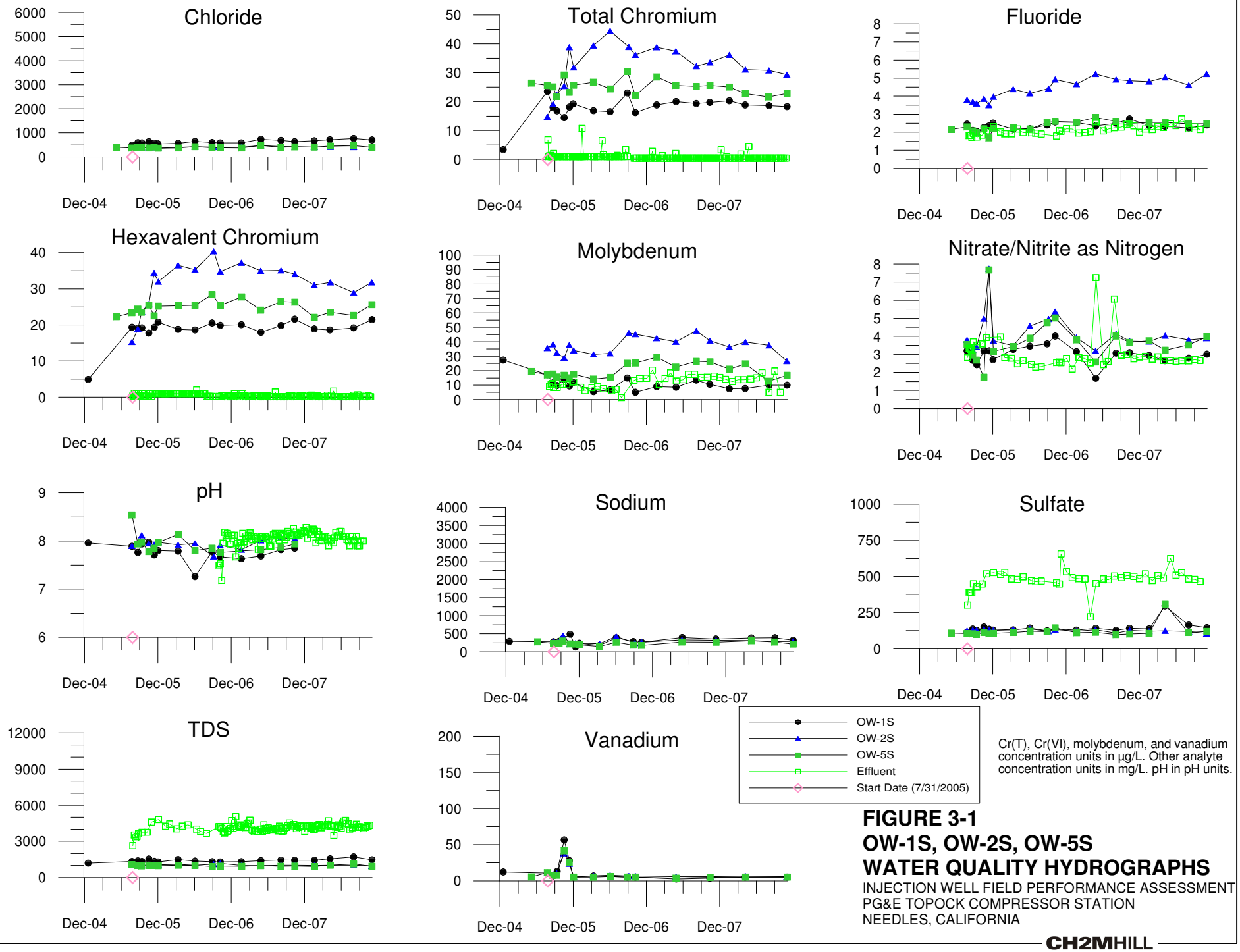
\\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2006\GW\IM3_GW_ELEV_DEEP_8-15_TO_9-15-06.MXD PJOYCE1 10/23/2008 15:28:39



Cr(T), Cr(VI), molybdenum, and vanadium concentration units in µg/L. Other analyte concentration units in mg/L. pH in pH units.

FIGURE 3-1
OW-1S, OW-2S, OW-5S
WATER QUALITY HYDROGRAPHS
INJECTION WELL FIELD PERFORMANCE ASSESSMENT
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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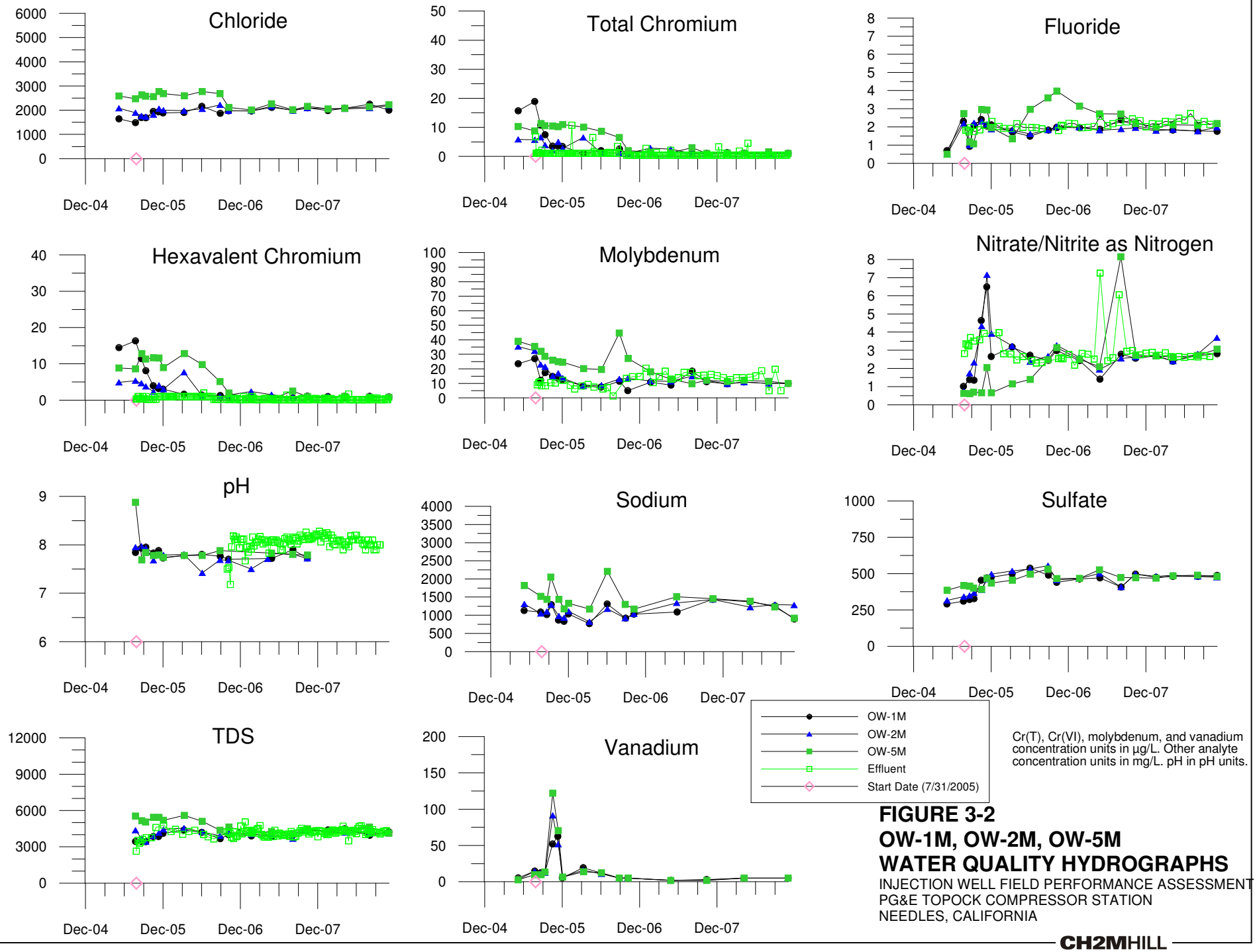

Cr(T), Cr(VI), molybdenum, and vanadium concentration units in µg/L. Other analyte concentration units in mg/L. pH in pH units.

FIGURE 3-2
OW-1M, OW-2M, OW-5M
WATER QUALITY HYDROGRAPHS
INJECTION WELL FIELD PERFORMANCE ASSESSMENT
PG&E TOPOCK COMPRESSOR STATION
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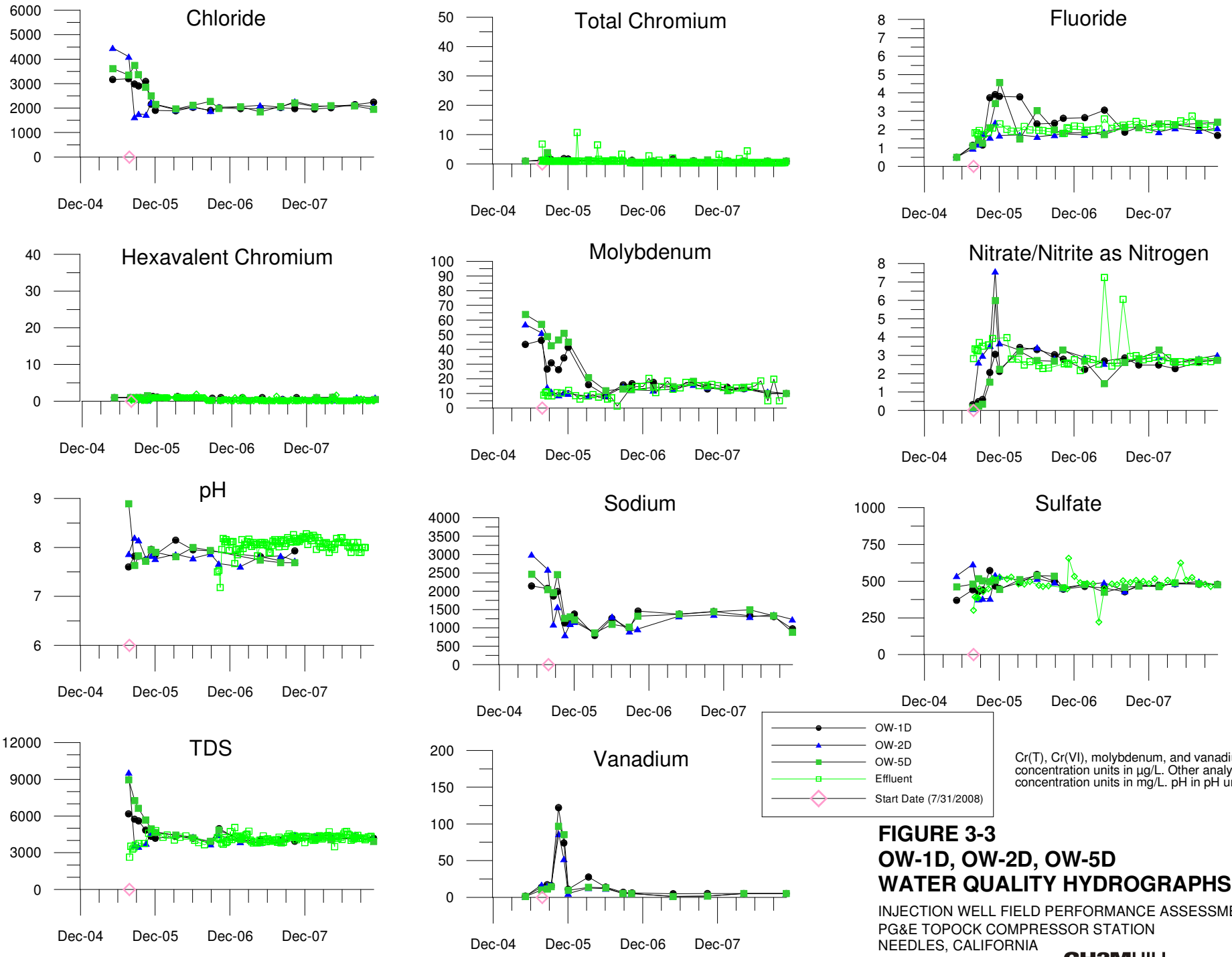

Cr(T), Cr(VI), molybdenum, and vanadium concentration units in µg/L. Other analyte concentration units in mg/L. pH in pH units.

FIGURE 3-3
OW-1D, OW-2D, OW-5D
WATER QUALITY HYDROGRAPHS

INJECTION WELL FIELD PERFORMANCE ASSESSMENT
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NEEDLES, CALIFORNIA

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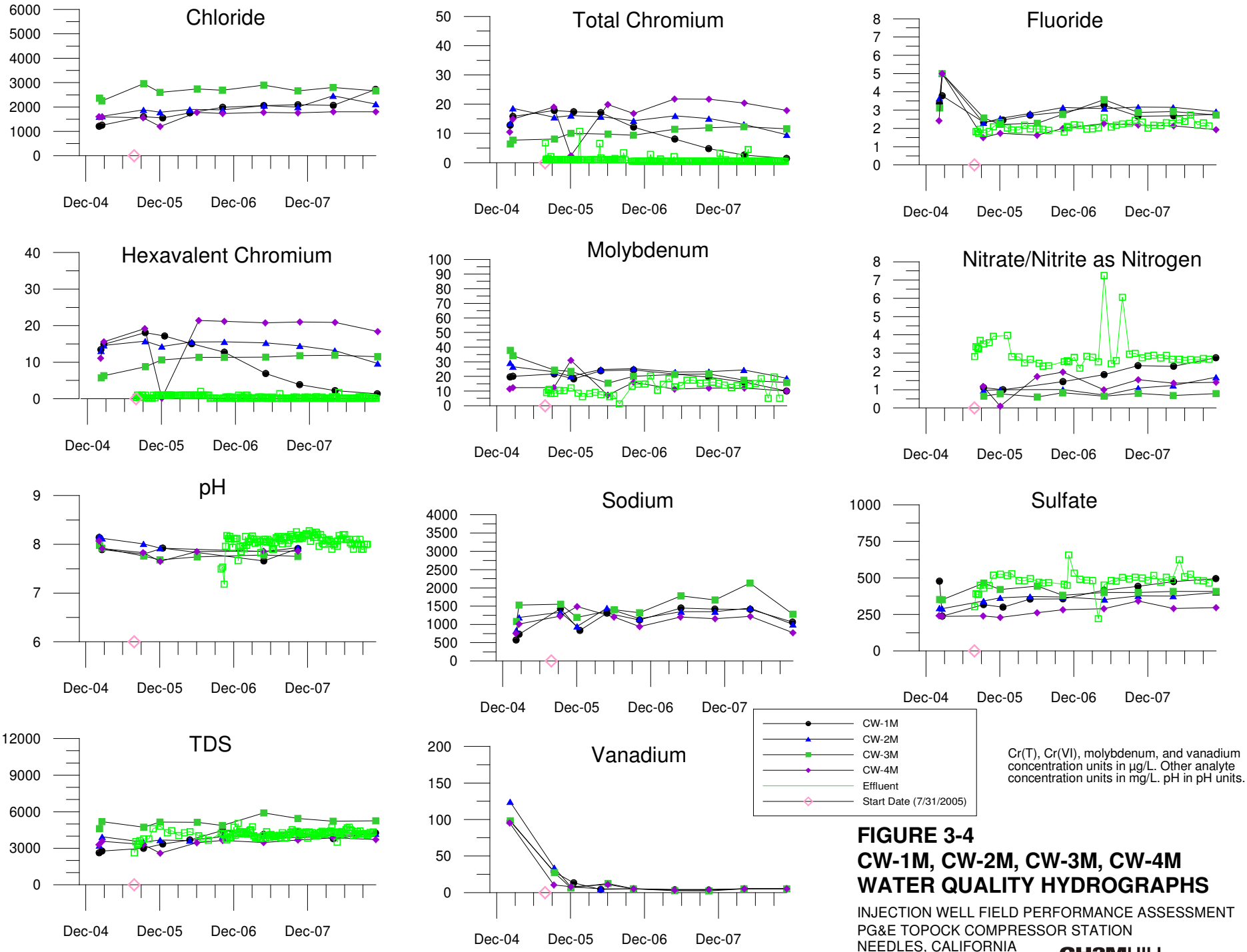

FIGURE 3-4
CW-1M, CW-2M, CW-3M, CW-4M
WATER QUALITY HYDROGRAPHS

INJECTION WELL FIELD PERFORMANCE ASSESSMENT
PG&E TOPOCK COMPRESSOR STATION
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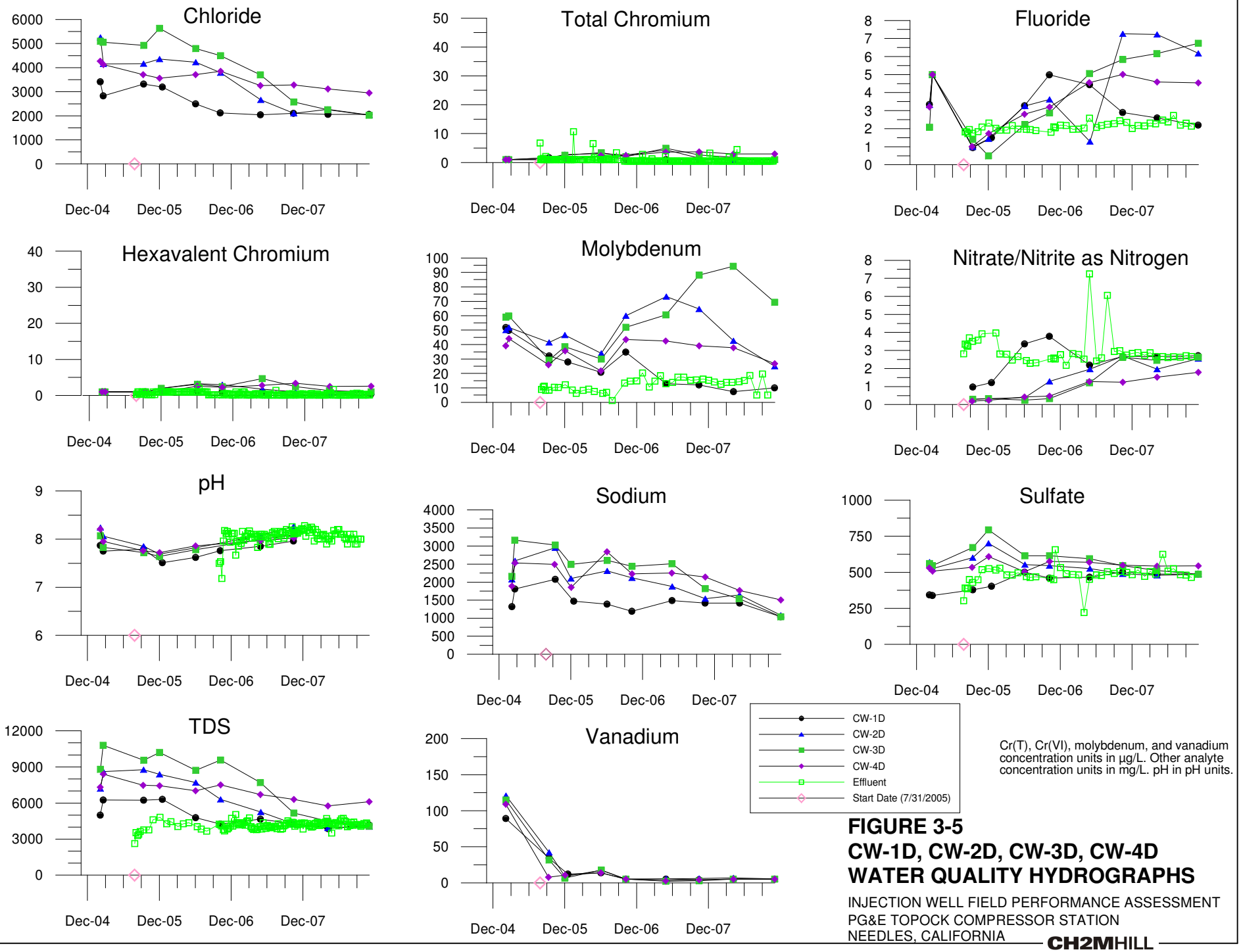

Cr(T), Cr(VI), molybdenum, and vanadium concentration units in µg/L. Other analyte concentration units in mg/L. pH in pH units.

FIGURE 3-5
CW-1D, CW-2D, CW-3D, CW-4D
WATER QUALITY HYDROGRAPHS

INJECTION WELL FIELD PERFORMANCE ASSESSMENT
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Appendix A

Semiannual Groundwater Monitoring Report, Second Half 2008 for the Interim Measure Compliance Monitoring Program at the PG&E Topock Compressor Station