

Prepared for:

Cascade Corporation
2201 NE 201st Avenue
Fairview, Oregon 97024

The Boeing Company
P.O. Box 2207, M/S 7A-XA
Seattle, WA 98124

SEMI-ANNUAL PERFORMANCE REPORT

1 APRIL 2013 – 30 SEPTEMBER 2013

TROUTDALE SANDSTONE AQUIFER REMEDY

Prepared by:



Geosyntec Consultants, Inc.
621 SW Morrison Street, Suite 600
Portland, OR 97205



Landau Associates, Inc.
130 2nd Avenue South
Edmonds, WA 98020



S.S. Papadopoulos & Associates, Inc.
7944 Wisconsin Avenue
Bethesda, MD 20814

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**Semi-Annual Performance Report
1 April 2013 – 30 September 2013
Troutdale Sandstone Aquifer Remedy**

Prepared by:



Cindy Bartlett, R.G. 11/27/13
Geosyntec Consultants Date

Approved By:



Christine Kimmel, L.G. 11/27/13
Landau Associates Date

Reviewed by:



Brent Miller, P.E. 11/27/13
Geosyntec Consultants Date

Approved by:



Eric Weber, R.G. 11/27/13
Landau Associates Date

Reviewed by:



Charles Andrews 11/27/13
S.S. Papadopoulos & Associates, Inc. Date

1.0 INTRODUCTION

This report is submitted on behalf of Cascade Corporation (Cascade) and The Boeing Company (Boeing) and summarizes performance and monitoring data for the East Multnomah County, Troutdale Sandstone Aquifer (TSA) remedy. Data presented in this report were collected during the semiannual period of 1 April 2013 through 30 September 2013 as part of the joint remedy being implemented under the Department of Environmental Quality's (DEQ's) Consent Order No. WMCSR-NWR-96-08 (DEQ, 1997).

1.1 Purpose of Report

This report provides an evaluation of TSA remedy performance, including:

- A summary of the remediation system operation, maintenance, and performance monitoring data, and
- An assessment of aquifer restoration progress.

The data presented and evaluated in this report include water level, extraction rate, discharge compliance, and water quality data. Laboratory reports and data validation reports for this period are contained on a compact disc provided with this report.

The project area and site are shown on Figure 2-1. The Lower TSA restoration zones (Zones A, B, C, and D) and the TSA remedy network of extraction wells and monitoring wells as well as the former and current TSA remedy extraction system layouts are shown on Figure 2-2.

Due to groundwater conditions demonstrating TCE concentrations below the MCL, the monitoring program for the Sand and Gravel Aquifer (SGA), located below the TSA aquifer and the second confining layer (CU2), has been reduced to sampling three wells once every 2 years. The locations of the SGA wells are included on Figure 2-2. SGA groundwater elevation data are collected on a semiannual basis and are included the August 2013 sampling event.

2.0 SIGNIFICANT ISSUES, EVENTS, AND ACTIONS

This section summarizes significant issues, events, and actions taken during the semiannual reporting period. The TSA remedy criteria for extraction well pilot shutdown, well and system decommissioning, monitoring well modifications, and changes in sampling frequency are summarized in Table 2-1, the monitoring schedule is summarized in Table 2-2, and a summary of significant documents exchanged with DEQ during the period are presented in Table 2-3.

2.1 EW-23 Pump Replacement

The pump at extraction well EW-23 was replaced in September 2013, due to malfunction likely resulting from electrolysis and corrosion. The well was shutdown for approximately three days during the pump replacement activities. Approximately 80 feet of the pump casing (the section of pipe beneath the water table) were replaced with stainless steel pipe to mitigate potential future corrosion.

2.2 Monitoring Program And Schedule Modifications

Monitoring schedule modifications were implemented during the reporting period, consistent with recommendations presented in the *Semiannual Performance Report: October 1, 2011 through March 31, 2012, TSA Remedy* (Prowell, Landau Associates, and SSPA, 2012). These changes are described below and in the reporting period monitoring schedule presented in Table 2-2.

- Extraction well EW-3 was converted from pilot shutdown to monitoring status, and
- A reduction in monitoring frequency from quarterly to semiannually for monitoring wells D-17(ds), MW-10(ds), MW-17(ds), and MW-18(ds) was approved by DEQ.

2.3 Portland Water Bureau Well Field

During this reporting period, the PWB operated its Columbia South Shore well field from 30 July through 8 August 2013. Because PWB did not operate the well field for over 30 days, TSA remedy contingency monitoring was not conducted, pursuant to the *2012 Monitoring and Contingency Plan* for PWB Pumping Events (Prowell Environmental, 2012).

3.0 EXTRACTION AND TREATMENT SYSTEMS

This section summarizes the operation and performance of the groundwater extraction remedy. The Central Treatment System (CTS) is currently the only remaining extraction and treatment system operating for the remedy. The CTS operates to remove volatile organic compound (VOC) mass and maintain ongoing hydraulic plume control. The location of the CTS compound and the currently operating five extraction wells are shown on Figure 2-2.

3.1 CTS Operational Summary

The CTS and Lower TSA extraction wells EW-1, EW-2, EW-14, EW-16, and EW-23 operated nearly continuously during the six-month reporting period. Four unplanned temporary well shutdowns occurred during the reporting period:

- 25-27 June 2013 – EW-14 offline during sonic cleaning of well;
- 04 September 2013 – EW-16 was taken off-line between 10:40 and 16:30 during installation of TGA pumping well electrical and discharge lines; and
- 16-19 September 2013 - EW-23 offline during replacement of pump and motor.

Upper TSA extraction well EW-3 was converted from pilot shutdown mode to monitoring use in April 2013 following DEQ's approval (15 April 2013). Extraction wells EW-12 and EW-18 remained in pilot shutdown mode during the reporting period.

3.2 Groundwater Extraction Rates

Current operating extraction wells are EW-1, EW-2, EW-14, located in the mound area near the CTS, EW-16 located in the eastern treatment area, and EW-23 on the Boeing property. Well construction data are presented in Table 4-1.

Daily flow data from each well are recorded by the automated Program Logic Controller (PLC) system. Data from the PLC are downloaded weekly and manual inspections and system field checks are conducted biweekly. In addition, pH and temperature data are collected on a weekly basis. Routine system inspections include manual collection of total flow meter readings, filter pressure monitoring, and system inspection and maintenance.

During the reporting period, monthly average extraction rates decreased steadily in EW-1 and EW-2 to approximately 45 and 25 gallons per minute (gpm), relatively. Flow at EW-14 increased from approximately 20 to 30 gpm after the sonar cleaning in June 2013. The extraction rates in EW-16 and EW-23 were relatively stable during the reporting period, averaging 20 and 30 gpm, respectively. Average monthly extraction well flow rates are shown on Figures A-1 through A-5.

Total and average flow data for the semi-annual reporting period are included in Table A-1. Extraction rates and significant repair/cleaning events for the operating TSA extraction wells are noted on Figures A-1 through A-5.

3.3 Treatment System Effluent Compliance

CTS performance data consist of weekly flow, pH, and temperature measurements. In addition, influent and effluent samples are collected from the CTS on a quarterly basis. Permits to discharge treated groundwater effluent from the CTS are presented in Attachment C to TSA Remedy Consent Order No. WMCSR-NWR-96-08 (DEQ, 1997).

CTS data for the reporting period are as follows:

- Flow averaged 162 gpm. The average flow during the 12-month period October 2012 through September 2013 was 170 gpm;
- Effluent pH ranged from 7.9 to 8.0 standard units (SU) and remained within the effluent limits of 6 to 9 SUs;
- Effluent temperature ranged from 57 to 62 degrees Fahrenheit (F); and
- VOCs were not detected in effluent samples.

Flow, pH, temperature, and influent and effluent VOC data for the reporting period, including compliance (or discharge) limits, are presented in Appendix A (Tables A-1 and A-2).

4.0 REMEDY PERFORMANCE SUMMARY

This section summarizes remedy performance data obtained during this reporting period, including groundwater levels and groundwater quality data. Monitoring well construction details and location coordinates are summarized in Table 4-1. Groundwater elevation data are summarized in Appendix B and groundwater quality data are summarized in Appendix C. Laboratory reports along with data validation reports are presented in Appendix D.

4.1 Groundwater Elevations

Groundwater elevations are measured in the five operating Lower TSA extractions wells, one extraction well (EW-18) in pilot shutdown mode, and 60 Upper and Lower TSA monitoring wells. In addition, water levels in three SGA wells are monitored. The monitoring schedule for measuring groundwater levels is included in Table 2-2.

Depths to groundwater are measured using a portable depth to water meter in the monitoring wells, along with pressure transducers located in 15 wells for PWB contingency monitoring. Contingency monitoring is conducted at 7 Upper TSA wells, 5 Lower TSA wells, and 3 SGA wells. Water level data are downloaded monthly from the pressure transducers. Groundwater depths and groundwater elevations summarized in Table B-1. Water level hydrographs for the 15 wells with pressure transducers, for the 13 month period August 2012 through September 2013, are also included in Appendix B on Figures B-2 through B-8.

Precipitation during the semi-annual reporting period (1 April – 30 September 2013) was 14.69 inches as shown in Appendix B, Figure B-1.

4.1.1 Upper TSA Water Levels and Flow Direction

Groundwater levels in the Upper TSA are shown on Figure 4-1a. Groundwater levels and flow directions were similar to previous dry season monitoring events. Groundwater flow in the western portion of the site, west of the mound area, is toward the northeast. Groundwater flow adjacent and south of the mound area flows inward and downward toward Lower TSA extraction wells EW-1, EW-2, and EW-14, and in the area directly west of the mound area towards EW-23 (Figure 4-1a).

4.1.2 Lower TSA Water Levels and Flow Direction

Groundwater elevations in Lower TSA monitoring wells also indicate inward flow towards the extraction wells (Figure 4-1b). Extraction well EW-16 has been operating for over one year since; pumping was resumed at EW-16 in September 2012. Groundwater flow directions do not vary significantly from wet to dry season, although groundwater levels are approximately 5 to 10 feet higher in the wet season.

In the eastern remedy area, groundwater elevations at monitoring wells EW-15 and PMX-198 are significantly elevated in February 2013 but much less so in August 2013; the cause of local mounding in this area is uncertain (Figure 4-1b). Water levels at EW-15 and PMX-198 have been elevated since approximately the time pumping at EW-15 and EW-16 stopped in April 2010.

4.2 Hydraulic Capture

Groundwater levels near the TSA mound area indicate inward horizontal gradients in the central remediation area, due to ongoing remedy pumping (Figures 4-1a and 4-1b). Inward hydraulic gradients are indicative of hydraulic capture and demonstrate the effectiveness of Lower TSA extraction wells EW-1, EW-2, and EW-14 in achieving and maintaining capture. Hydraulic capture is also achieved by the operation of EW-23 and EW-16 for areas upgradient of these wells where isolated TCE concentrations persist above the cleanup level.

4.3 Water Quality

Analytical results for groundwater samples collected during the reporting period are summarized in Appendix C, Table C-1. Graphs of TCE concentrations for monitoring wells in the mound area and the five operating extraction wells from the early 1990s through September 2013 are presented in Figures C-1 through C-8. TCE concentrations from the samples collected in August 2013 are posted and contoured in Figures 5-1a and 5-1b for the Upper and Lower TSA wells, respectively.

4.3.1 Upper TSA

TCE concentrations in the Upper TSA in the western remediation area remain below the MCL with the exception of BOP-61(ds) at 5.6 micrograms per liter ($\mu\text{g/L}$). TCE concentrations at BOP-61(ds) have been relatively stable near the MCL cleanup level since 2006, with concentrations ranging between 4.1 $\mu\text{g/L}$ and 8.0 $\mu\text{g/L}$.

In the central remediation area, near an area where the Cascade TGA plume historically discharged into the TSA and where elevated TCE concentration persist, the TCE concentrations in water table well MW-17(ds) ranged from 69.0 $\mu\text{g/L}$ (May 2013 event) to 36 $\mu\text{g/L}$ (August 2013 event). Groundwater in the vicinity of MW-17(ds) is captured by nearby Lower TSA extraction wells EW-2 and EW-14. At MW-10(ds), located approximately 500 feet south of MW-17(ds), TCE during the current reporting period ranged from 15 to 23 $\mu\text{g/L}$ (Figure C-5).

The highest TCE concentration in Upper TSA mound area wells occurred in well MW-18(ds) at concentrations of 91 $\mu\text{g/L}$ (May 2013) and 83 $\mu\text{g/L}$ (August 2013), as shown in Figure C-6. This

well is located approximately 300 feet east of MW-17(ds). Groundwater near MW-18(ds) is captured by extraction well EW-2.

In the Upper TSA, near the western extent of the TSA mound area, TCE concentrations at BOP-13(ds) ranged from 3.8 µg/L (May 2013) to 4.6 µg/L (August 2013). Prior to the well screen becoming unsaturated (1998), TCE concentrations were approximately 8.4 µg/L. Since recent resaturation (2009), TCE concentrations at BOP-13(ds) have ranged between approximately 3.6 and 15 µg/L, as shown in Figure C-2. At locations further northwest [BOP-31(ds)] and southwest [MW-20(ds)] of the TSA mound area, TCE concentrations are low or below detection limits, as shown in Figures C-3 and C-4.

South of the mound area in well MW-19(ds), TCE concentrations were 1.0 and 2.3 µg/L in the May and August 2013 sampling events, respectively.

4.3.2 Lower TSA

TCE concentrations in the Lower TSA wells located in Zone A (northern portion of the remedy) remained below the MCL during this reporting period and continue to indicate remediation has been completed in this zone.

In Lower TSA Zone B (western portion of the remedy), TCE concentrations were below the MCL during this reporting period with the exception of monitoring well BOP-61(dg). The TCE concentration at BOP-61(dg) was 6.9 µg/L. Groundwater near BOP-61(dg) is captured by extraction well EW-23. TCE concentrations at EW-23 have increased from 1.3 µg/L at the startup of pumping in May 2007 to 6.9 µg/L in February 2013, and decreased to 2.2 µg/L in August 2013.

In Lower TSA Zone C (central remediation area), TCE concentrations remained above the MCL in operating extraction well EW-1 during February and May (6.5 and 6.2 µg/L), but decreased below the MCL for the August 2013 event (2.8 µg/L). TCE concentrations also decreased between the May and August sampling periods at EW-2 (21 and 12 µg/L) and EW-14 (15 and 6.7 µg/L).

In Lower TSA monitoring (non-pumping extraction) well EW-12, TCE concentrations ranged from 4.1 to 6.9 µg/L during this reporting period. Extraction well EW-12 was in pilot shutdown mode in 2007 and converted to a monitoring well in November 2009. TCE concentrations at EW-12 have been above the MCL in quarterly sampling results since August 2010. This well was proposed (SSPA, 2012) and approved (DEQ, 2012) for continued pilot shutdown.

The highest TCE concentration in the Lower TSA Zone C continued to occur in mound area well D-17(ds), screened at the top of the Lower TSA across the water table. TCE concentrations in

quarterly samples ranged from 45 to 73 µg/L during this reporting period. TCE concentrations at this well have fluctuated between 45 to 80 µg/L since resaturation in 2009. Just before this well went dry in 1998, the TCE concentration was approximately 120 µg/L (Figure C-7).

In Lower TSA Zone D (eastern remediation area), TCE concentrations remained below the MCL in remedy monitoring wells with the exception of MW-26(dg). TCE concentrations at MW-26(dg) ranged from 3.1 to 6.5 µg/L during this reporting period. Groundwater in this area is captured by extraction well EW-16.

4.3.3 SGA

Three wells in the SGA were sampled during the August 2013 event: BOP-44(usg), PWB-1(usg) and EMC-2(usg). VOCs were not detected at concentrations above the reporting limits in the three wells during the August 2013 biennial sampling event.

5.0 PERFORMANCE SUMMARY

Significant remedy performance findings are summarized below.

- Groundwater flow directions in the Upper and Lower TSA indicate ongoing inward and downward flow towards the operating extraction wells. The 12-month average flow rate from the five operating extraction wells was 170 gpm. This rate is less than the average rate during the previous reporting period (176 gpm). Extraction rates at EW-14 increased substantially after well maintenance and cleaning activities in July 2013 while the extraction rate at EW-2 continued to decline. Restoration has been achieved in Zone A. Restoration in zone B has been achieved with the exception of an area near EW-23.
- In the Upper TSA, TCE concentrations were above the MCL in two areas during this reporting period: near BOP-61ds, west of the mound area, and near MW-17ds and MW-18ds, in the mound area.
- In the Lower TSA, TCE concentrations above the MCL occurred in the vicinity of the five operating extraction wells. TCE concentrations during the reporting period remained generally stable in mound area extraction wells EW-1, EW-2, and EW-14, TCE concentrations remain above the MCL with the maximum concentrations observed at MW-18ds, where TCE concentrations decreased from 180 µg/L in March 2013 to 83 µg/L in August 2013.
- In Lower TSA Zone D, TCE concentrations remain slightly above the MCL at MW-26dg, and are below the MCL at EW-16. Operation of EW-16 resumed in September 2012 to capture TCE mass present in Zone D.
- The TCE plume continues to be hydraulically captured by remedy operation (Figures 5-1a and 5-1b).
- Performance data continue to indicate that the existing remedy will not restore groundwater in the mound area (Zone C) by 2018, which will be the 20th year of remedy operation. A design criterion for the remedy was a 20-year restoration time frame. The Record of Decision states that if restoration is not achieved within this time frame, that groundwater pump and treat would continue until restoration is complete.

6.0 RECOMMENDATIONS AND PLANNED ACTIVITIES

Water-quality restoration has been achieved in all areas of the SGA, in the Upper and Lower TSA north of Sandy Boulevard, and the western portion of the remedy area in the Upper and Lower TSA. There remains a continued focus on maintaining and improving, if feasible, restoration progress in the central and eastern portion of the remedy area, with emphasis on the highest TCE concentrations near the mound area. The following recommendations are proposed to improve the monitoring programs and optimize the remedy treatment and performance.

6.1 Extraction Well Operation

Continued pumping of operating extraction wells EW-1, EW-2, EW-14, EW-16, and EW-23 is recommended to maintain hydraulic capture, with continued pumping at the current rates.

6.2 Remedy Extraction/Treatment System Modifications

Continued maintenance and scheduled cleaning of the wells will be conducted as needed to meet target extraction pump rates.

- Extraction well EW-1 has a target pumping rate at a minimum of 40 gpm, with the last sonar well cleaning being conducted in July 2012. The extraction rate during this reporting period has ranged from 48 to 70 gpm.
- Extraction well EW-2 has a target pumping above 25 gpm. Since the last sonar cleaning at EW-2 in May 2012, the pumping rate has gradually decreased from 36 to 25 gpm, based on this gradual decrease, a sonar cleaning event will likely be necessary in the next year or two.
- During this reporting period, the extraction rate at EW-14 ranged from 19 to 22 gpm, in April through June 2013, which is near the minimum target pumping rate of 20 gpm. To improve the performance of EW-14, a sonar cleaning was conducted in June 2013. Upon the completion of the sonar cleaning, the pumping rate at EW-14 increased to approximately 35 to 36 gpm.
- The pump rates at EW-16 previously ranged from 14 to 24 gpm, with minimum target pumping rate of 15 gpm. The EW-16 pump was replaced in February 2013 and the resulting pumping rate was 20 gpm in March 2013 and has continued at that rate through September 2013.
- Extraction Well EW-18 has been in pilot shutdown since November 2009, with monitoring occurring on a quarterly basis. TCE concentrations have remained below the

MCL at this well during this entire time. Therefore, it is recommended that EW-18 be considered for decommissioning.

- Pumping rates at EW-23 ranged from 25 to 31 gpm during the reporting period, approximately on-target for the 30 gpm minimum pump rate. This pump failed toward the end of the September 2013 and was replaced with a new pump.

6.3 Monitoring Program and Schedule Modifications

Monitoring program modifications have previously included changes in the remedy monitoring well network, such as well installations or decommissionings, in response to restoration progress and plume shrinkage. Modifications to the monitoring schedule have been proposed based on TCE concentrations less than the MCL or decreasing TCE concentration trends. At this time, the following monitoring program modifications are proposed:

- **Decommission EW-18.** As mentioned above, EW-18 has been in pilot shutdown since November 2009 and is recommended for decommissioning. TCE concentrations at EW-18 have been below the MCL since January 2009, which meet the criteria for decommissioning (Table 2-1).
- **Reduction from semiannually to annually monitoring of EW-15.** Pilot shutdown of this well began in April 2010 and it was deemed a monitoring well as of 2013. TCE has not been detected in EW-15 since August 2010; therefore, this well is eligible for a reduction in the monitoring frequency.
- **Reduction from semiannually to annually monitoring of BOP-22R(ds).** The replacement well was installed in 2008 to replace BOP-22(ds) which may have had leakage from the TGA to the TSA through the borehole seal. TCE concentrations at the replacement well have consistently been below the MCL since December 2008. We recommend reducing the frequency of monitoring at BOP-22R(ds) from semi-annual to annual (August sampling event).
- **Reduction from semiannually to annually monitoring of BOP-60R(ds).** The replacement well was installed in March 2010 to replace well BOP-60(ds) which may have provided a conduit for leakage from the overlying TGA. TCE concentrations have consistently been below the MCL since the installation of the well. The well is located approximately 1,900 ft west of the leading edge of the dissolved plume. We recommend reducing the frequency of monitoring at BOP-60R(ds) from semi-annual to annual (August sampling event).

- **Reduction from semiannually to annually of EW-11.** TCE concentrations at EW-11 have been between 2.0 to 2.7 µg/L since September 2009, and decreased to 1.3 µg /L during the August 2013 sampling event. We recommend reducing the frequency of monitoring at EW-11 from semi-annual to annual.
- **Cessation of sampling PMX-198.** TCE concentrations at PMX-198 have been below the MCL since 2003, with concentrations ranging from below detection limits to 4.4 µg/L. Anomalous elevated water levels have recently (2012-2013) been measured in this well, indicating a possible obstruction in the sampling port. We recommend removing PMX-198 from the remedy monitoring program.
- **Cessation of sampling SGA wells BOP-44(usg), PWB1(usg) and EMC-2(usg).** Since all three wells have had TCE concentrations below the detection limit during this most recent monitoring event, it is recommended that they be removed from the remedy monitoring program. Since they are still a part of the PWB contingency plan, transducers will remain in the wells and be downloaded on a regular basis.

The frequency of monitoring for the TSA and SGA remedy wells currently monitored is summarized in Table 2-2. Changes to the monitoring program that are suggested above are shown in red text in Table 2-2.

7.0 REFERENCES

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TABLES

Table 2-1
Remedy Well Network Criteria
TSA Remedy - East Multnomah County

This table summarizes TSA remedy criteria for extraction well pilot shutdown, well and system decommissioning, monitoring well network modifications, and changes in sampling frequency. These criteria were presented in Section 5 of the eighth TSA annual performance report¹ and are summarized below for ongoing reference.
1. PILOT SHUTDOWN CRITERIA
The following criteria are for TSA extraction well(s) currently in pilot shutdown mode: Well EW-18 - Per DEQ's November 3, 2009 approval: • <i>If TCE concentrations in these pilot shutdown wells increase to levels equal to or above the MCL for two consecutive quarters, extraction at individual wells shall resume.</i> • <i>If TCE remains below the MCL cleanup level for 2 years, DEQ will evaluate potential decommissioning of these wells.</i>
2. MONITORING WELL NETWORK MODIFICATION
Wells may be removed from the monitoring program if a well meets one or more of the following criteria: • <i>TCE concentrations have been consistently non-detectable for 2 or more years.</i> • <i>The well is located outside the limits of the plume and is no longer needed to monitor hydraulic plume control or restoration progress.</i> • <i>The location of a well duplicates another well better suited to evaluate hydraulic control and restoration progress.</i>
3. SAMPLING FREQUENCY MODIFICATIONS
The following criteria serve to standardize current and future monitoring adjustments as restoration progresses over the coming years: <u>Criteria for Increasing Sampling Frequency:</u> • <i>If TCE has been non-detectable for 2 or more years and increases to detectable levels for two consecutive sampling events, the sampling frequency will be increased.</i> • <i>If TCE has been below the MCL for 2 or more years and increases above the MCL for two consecutive sampling events, the sampling frequency will be increased.</i> <u>Criteria for Reducing Sampling Frequency:</u> • <i>If TCE has been consistently non-detectable for the prior 2 years, the sampling frequency may be reduced.</i> • <i>If TCE has been stable to declining for the prior 2 years, the sampling frequency may be reduced.</i>
4. CRITERIA FOR WELL DECOMMISSIONINGS
Extraction and monitoring well decommissionings will be proposed to DEQ if the following criteria are met: • <i>Extraction well decommissioning may be proposed to DEQ if TCE concentrations remain consistently below the MCL in that well for 2 years following pilot shutdown; two consecutive TCE detections at or above the MCL may prompt resumed operation.</i> • <i>Monitoring well decommissioning will be proposed to DEQ if TCE concentrations remain below the MCL during the confirmation sampling round that will be performed 2 years after a well has been removed from the remedy monitoring schedule; if TCE is detected at or above the MCL during the confirmation sampling round, additional monitoring may be required.</i>

¹Landau Associates, Prowell Environmental, Pegasus Geoscience, 2006. Troutdale Sandstone Aquifer Remedial Action Annual Performance Evaluation, April 1, 2005 through March 31, 2006. June 30.

Table 2-2
Performance Monitoring Schedule - 1 April 2013 through 30 September 2013
TSA Remedy - East Multnomah County

Well	Aquifer	Water Level Measurements ^a	Water Quality Sampling ^a	Responsibility
Groundwater Systems				
CTS Influent	—	—	Quarterly	Cascade
CTS Effluent	—	—	Quarterly	Cascade
TSA Extraction Wells				
EW-1 (on)	Lower TSA	Monthly	Quarterly	Cascade
EW-2 (on)	Lower TSA	Monthly	Quarterly	Cascade
EW-14 (on)	Lower TSA	Monthly	Quarterly	Cascade
EW-16 (on)	Lower TSA	Monthly	Quarterly	Cascade
EW-23 (on)	Lower TSA	Monthly	Semiannually	Cascade
TSA Monitoring Wells				
BOP-13(ds)	Upper TSA	Quarterly	Quarterly	Boeing
BOP-13(dg)	Lower TSA	Semiannually	Annually	Boeing
BOP-20(ds)	Upper TSA	Semiannually	Annually	Boeing
BOP-20(dg)	Lower TSA	Semiannually	Annually	Boeing
BOP-21(ds)	Upper TSA	Semiannually	Annually	Boeing
BOP-22R(ds)	Upper TSA	Semiannually/Annually	Semiannually/Annually	Boeing
BOP-22(dg)	Lower TSA	Semiannually	Once per 2 Yrs	Boeing
BOP-23(dg)	Lower TSA	Semiannually	Annually	Boeing
BOP-31(ds)	Upper TSA	Quarterly	Quarterly	Boeing
BOP-31(dg)	Lower TSA	Semiannually	Semiannually	Boeing
BOP-41(ds)	Upper TSA	Semiannually	Once per 2 Yrs	Cascade
BOP-41(dg)	Lower TSA	Semiannually	Once per 2 Yrs	Cascade
BOP-42(ds)	Upper TSA	Semiannually	Annually	Boeing
BOP-42(dg)	Lower TSA	Semiannually	Annually	Boeing
BOP-44(ds)	Upper TSA	Semiannually	Annually	Cascade
BOP-44(dg)	Lower TSA	Semiannually	Once per 2 Yrs	Cascade
BOP-60R(ds)	Upper TSA	Semiannually/Annually	Semiannually/Annually	Boeing
BOP-60(dg)	Lower TSA	Semiannually	Annually	Boeing
BOP-61(ds)	Upper TSA	Semiannually	Semiannually	Boeing
BOP-61(dg)	Lower TSA	Semiannually	Semiannually	Boeing
BOP-62(ds)	Upper TSA	Semiannually	Annually	Boeing
BOP-65(ds)	Upper TSA	Semiannually	Semiannually	Boeing
BOP-66(ds)	Upper TSA	Semiannually	Semiannually	Boeing
BOP-70(ds-215)	Upper TSA	Semiannually	Semiannually	Cascade
BOP-71(ds)	Upper TSA	Semiannually	Semiannually	Cascade
D-16(ds)	Upper TSA	Semiannually	Once per 2 Yrs	Cascade
D-17(ds)	Lower TSA	Quarterly	Quarterly	Cascade
D-17(dg)	Lower TSA	Semiannually	Semiannually	Cascade
D-18(ds)	Upper TSA	Semiannually	Once per 2 Yrs	Cascade
DEQ-1(dg)	Lower TSA	Semiannually	—	Cascade
DEQ-5(ds)	Upper TSA	Semiannually	—	Cascade
DEQ-5(dg)	Lower TSA	Semiannually	—	Cascade
EW-3 (monitoring only)	Upper TSA	Semiannually	Semiannually	Boeing
EW-8 (monitoring only)	Lower TSA	Semiannually	Semiannually	Cascade
EW-11 (monitoring only)	Lower TSA	Semiannually/Annually	Semiannually/Annually	Cascade
EW-12 (monitoring only)	Lower TSA	Semiannually	Quarterly	Cascade
EW-13 (monitoring only)	Lower TSA	Semiannually	Semiannually	Boeing
EW-15 (monitoring only)	Lower TSA	Semiannually/Annually	Semiannually/Annually	Cascade
EW-18 (monitoring only)	Lower TSA	Decommission	Decommission	Cascade
MW-3	TSA	Semiannually	—	Cascade
MW-8(dg)	Lower TSA	Semiannually	Once per 2 Yrs	Cascade
MW-10(ds)	Upper TSA	Quarterly	Quarterly	Cascade

Table 2-2
Performance Monitoring Schedule - 1 April 2013 through 30 September 2013
TSA Remedy - East Multnomah County

Well	Aquifer	Water Level Measurements ^a	Water Quality Sampling ^a	Responsibility
MW-10(dg)	Lower TSA	Semiannually	Annually	Cascade
MW-14R(ds)	Lower TSA	Semiannually	Quarterly	Cascade
MW-17(ds)	Upper TSA	Quarterly	Quarterly	Cascade
MW-18(ds)	Upper TSA	Quarterly	Quarterly	Cascade
MW-19(ds)	Upper TSA	Quarterly	Quarterly	Cascade
MW-20(ds)	Upper TSA	Semiannually	Annually	Cascade
MW-22(dg)	Lower TSA	Semiannually	Once per 2 Yrs	Cascade
MW-24(dg)/EW-5	Lower TSA	Semiannually	Semiannually	Cascade
MW-25(dg)	Lower TSA	Semiannually	Semiannually	Cascade
MW-26(dg)	Lower TSA	Semiannually	Quarterly	Cascade
MW-36(dg)	Lower TSA	Semiannually	Once per 2 Yrs	Cascade
PMX-167 [W. Interlache]	Upper TSA	Semiannually	—	Cascade
PMX-196 [Andrews]	Lower TSA	Semiannually	Once per 2 Yrs	Cascade
PMX-198 [Udd]	Lower TSA	Semiannually/ Discontinue	Annually/ Discontinue	Cascade
PMX-208(dg) [Simpson]	Lower TSA	Semiannually	—	Cascade
PWB-1(uts)	Upper TSA	Semiannually	Once per 2 Yrs	Cascade
PWB-1(lts)	Lower TSA	Semiannually	Annually	Cascade
PWB-2(lts)	Lower TSA	Semiannually	—	Cascade
RPW-1(ds)	Upper TSA	Semiannually	—	Cascade
SGA Monitoring Wells				
BOP-44(usg)	Upper SGA	Semiannually/ Discontinue	Once every 2 yrs/ Discontinue	Cascade
EMC-2(usg)	Upper SGA	Semiannually/ Discontinue	Once every 2 yrs/ Discontinue	Cascade
PWB-1(usg)	SGA	Semiannually/ Discontinue	Once every 2 yrs/ Discontinue	Cascade

NOTES:

^aAnnual monitoring performed in August; semiannual in February and August; quarterly in February, May, August, and November. Two-year monitoring will be performed in August 2015.

Recommendations for modifications to the Monitoring Schedules are indicated in red.

For well monitoring frequencies that changed during the reporting period, both frequencies are shown above.

1. EW-3 was permanently converted from pilot shutdown status to monitoring well status; sampling frequency reduced to semiannual per DEQ email approval 15 April 2013.
2. D-17(ds), MW-10(ds), MW-17(ds), and MW-18(ds) have changed monitoring frequency from monthly to quarterly per DEQ email approval 15 April 2013.

Table 2-3
Significant Remedy Documents – 1 April 2013 through 30 September 2013
TSA Remedy – East Multnomah County

Date	Document Type	Submitted By	Title	Comment
4/3/13	Letter	Oregon Department of Environmental Quality	Boeing Portland, Cascade TGA Review and TSA Remedy Mound Area Well Installations, DEQ ECSI #635 and #1479	Provides a summary of DEQs understanding of potential sources for the TSA mound area and proposes investigation actions for the TGA.
4/15/2013	Email	Oregon Department of Environmental Quality	Changes in TSA monitoring	DEQ approved changes in TSA monitoring program with conversion of E\extraction well EW-3 from pilot shutdown status to monitoring well status. DEQ also approved and a reduction in monitoring frequency from quarterly to semiannually for monitoring wells D-17(ds), MW-10(ds), MW-17(ds), and MW-18(ds).
7/29/2013	Report	Geosyntec, Landau, and S.S. Papadopoulos	Semi-Annual Performance Report, 1 October 2013 – 31 March 2013, Five Year Remedy Evaluation, TSA Remedy	Included 5-year evaluation of remediation system condition and outlook for future.

Table 4-1
Well Construction Data - 1 April 2013 through 30 September 2013
TSA Remedy - East Multnomah County

				Elevations, ft MSL				
Well	Aquifer Screened	X Coordinate	Y Coordinate	Ground Surface	Measuring Point	Top of Screen	Bottom of Screen	Depth of Boring (ft)
Extraction Wells								
EW-1	Lower TSA	1,497,771.2	689,549.0	124.1	124.04	-27.8	-57.8	183
EW-2	Lower TSA	1,498,903.1	689,252.5	126.2	126.01	-6.8	-46.8	179
EW-14	Lower TSA	1,498,163.8	689,374.1	128.4	127.63	-21.9	-51.9	230
EW-16	Lower TSA	1,500,635.3	689,710.0	84.2	83.71	-40.3	-80.3	198
EW-23	Lower TSA	1,497,018.0	690,569.1	83.8	83.93	-26.2	-66.2	157
Monitoring Wells(& Former Extraction Wells Approved for Monitoring Use)								
BOP-13(ds)	Upper TSA	1,497,672.4	689,432.8	126.7	128.94	9.0	-1.0	132
BOP-13(dg)	Lower TSA	1,497,677.0	689,419.8	127.5	128.71	-41.0	-61.0	193
BOP-20(ds)	Upper TSA	1,496,606.5	691,086.0	78.2	77.45	9.0	-11.0	97
BOP-20(dg)	Lower TSA	1,496,592.5	691,087.0	78.1	77.32	-105.0	-125.0	209
BOP-21(ds)	Upper TSA	1,495,803.0	691,149.4	77.1	78.02	-88.0	-108.0	192
BOP-22R(ds)	Upper TSA	1,495,261.6	691,063.9	84.2	82.91	-158.8	-178.8	310
BOP-22(dg)	Lower TSA	1,495,260.1	691,137.8	81.3	81.05	-239.0	-259.0	338
BOP-23(dg)	Lower TSA	1,497,737.8	690,876.6	75.2	76.96	-26.0	-46.0	125
BOP-31(ds)	Upper TSA	1,497,533.3	690,135.0	97.1	99.04	17.0	7.0	91
BOP-31(dg)	Lower TSA	1,497,534.8	690,149.5	96.5	98.51	-34.0	-54.0	154
BOP-41(ds)	Upper TSA	1,495,162.9	689,871.4	135.7	136.74	-107.0	-127.0	262
BOP-41(dg)	Lower TSA	1,495,164.9	689,889.2	135.2	136.45	-230.0	-250.0	388
BOP-42(ds)	Upper TSA	1,496,462.1	689,632.7	129.3	130.74	-8.0	-28.0	159
BOP-42(dg)	Lower TSA	1,496,447.9	689,633.3	129.5	130.71	-92.0	-112.0	243
BOP-44(ds)	Upper TSA	1,497,206.5	691,983.0	32.5	35.24	-23.0	-43.0	76
BOP-44(dg)	Lower TSA	1,497,225.2	691,983.0	32.6	35.15	-104.0	-124.0	166
BOP-60R(ds)	Upper TSA	1,495,937.7	690,547.9	83.2	82.80	-71.8	-81.8	165
BOP-60(dg)	Lower TSA	1,495,915.9	690,414.3	93.8	93.59	-165.0	-185.0	280
BOP-61(ds)	Upper TSA	1,496,851.9	690,285.1	96.3	94.64	6.0	-4.0	100
BOP-61(dg)	Lower TSA	1,496,843.6	690,290.5	96.2	94.43	-60.0	-70.0	171
BOP-62(ds)	Upper TSA	1,496,066.6	690,031.6	112.1	112.29	-42.0	-51.9	166
BOP-65(ds)	Upper TSA	1,496,445.1	690,159.4	104.4	104.22	2.0	-8.0	113
BOP-66(ds)	Upper TSA	1,496,881.8	690,155.8	103.3	102.97	13.0	3.0	102
BOP-70(ds-215)	Upper TSA	1,495,082.9	691,532.8	65.5	65.15	-144.6	-154.6	285
BOP-71(ds)	Upper TSA	1,494,310.3	691,381.3	85.6	87.88	-185.0	-205.0	308

Table 4-1
Well Construction Data - 1 April 2013 through 30 September 2013
TSA Remedy - East Multnomah County

Well	Aquifer Screened	X Coordinate	Y Coordinate	Elevations, ft MSL				Depth of Boring (ft)
				Ground Surface	Measuring Point	Top of Screen	Bottom of Screen	
D-16(ds)	Upper TSA	1,497,497.5	693,117.3	15.4	16.91	-114.0	-134.0	152
D-16(dg)	Lower TSA	1,497,511.9	693,134.8	15.1	16.84	-206.0	-226.0	247
D-17(ds)	Lower TSA	1,498,097.3	689,575.1	121.9	123.28	12.0	2.0	121
D-17(dg)	Lower TSA	1,498,080.6	689,576.6	121.8	124.61	-30.0	-50.0	178
D-18(ds)	Upper TSA	1,495,386.1	692,820.3	18.1	18.01	-153.0	-163.0	179
D-18(dg)	Lower TSA	1,495,375.5	692,825.6	18.3	18.13	-237.0	-257.0	301
DEQ-1(dg)	Lower TSA	1,500,184.6	688,240.0	151.0	150.58	-53.0	-73.0	235
DEQ-5(ds)	Upper TSA	1,496,861.6	688,831.7	155.9	155.68	19.9	0.0	160
DEQ-5(dg)	Lower TSA	1,496,871.4	688,830.8	155.9	155.95	-58.0	-78.0	240
EW-3	Upper TSA	1,495,948.5	690,357.7	97.1	94.26	-77.9	-102.9	205
EW-8	Lower TSA	1,497,733.0	690,480.3	77.3	77.16	6.8	-33.2	163
EW-11	Lower TSA	1,500,302.8	689,236.9	115.4	114.73	-22.8	-62.8	235
EW-12	Lower TSA	1,497,744.0	690,037.2	94.4	94.14	-16.1	-46.1	197
EW-13	Lower TSA	1,496,697.5	690,134.4	104.5	103.59	-33.5	-73.5	234
EW-15	Lower TSA	1,499,970.7	689,249.7	116.7	116.21	-27.3	-57.3	186
EW-18	Lower TSA	1,498,965.7	689,596.5	106.3	104.50	-13.3	-43.3	159
EMC-2(dg)	Lower TSA	1,499,225.7	692,052.5	44.8	43.51	-75.0	-85.0	140
MW-3	Upper & Lower TSA	1,498,553.4	688,459.8	148.1	147.69	25.0	-53.0	209
MW-8(dg)	Lower TSA	1,498,286.8	689,072.7	137.0	136.21	-41.0	-56.0	199
MW-10(ds)	Upper TSA	1,498,811.1	688,966.5	135.2	134.54	21.0	6.0	135
MW-10(dg)	Lower TSA	1,498,800.6	688,968.3	135.3	135.05	-53.0	-68.0	210
MW-14R(ds)	Lower TSA	1,499,064.0	689,911.0	83.9	83.48	29.0	9.0	76
MW-17(ds)	Upper TSA	1,498,758.3	689,471.1	120.0	121.89	24.0	14.0	110
MW-18(ds)	Upper TSA	1,499,100.4	689,311.7	118.2	117.66	16.0	6.0	118
MW-19(ds)	Upper TSA	1,498,508.3	688,687.2	144.3	144.08	10.0	0.0	170
MW-20(ds)	Upper TSA	1,497,894.7	689,034.5	150.5	152.72	6.0	-4.0	158
MW-22(dg)	Lower TSA	1,499,756.6	689,895.1	82.1	81.65	-42.0	-52.0	142
MW-24(dg)/EW-5	Lower TSA	1,498,403.9	689,963.3	80.5	77.74	8.0	-42.1	127
MW-25(dg)	Lower TSA	1,498,008.4	690,067.2	75.7	75.28	-34.0	-44.0	131
MW-26(dg)	Lower TSA	1,501,401.0	689,348.0	106.3	108.98	-59.0	-69.0	238
MW-36(dg)	Lower TSA	1,499,600.9	690,836.8	79.1	78.84	-31.0	-41.0	162

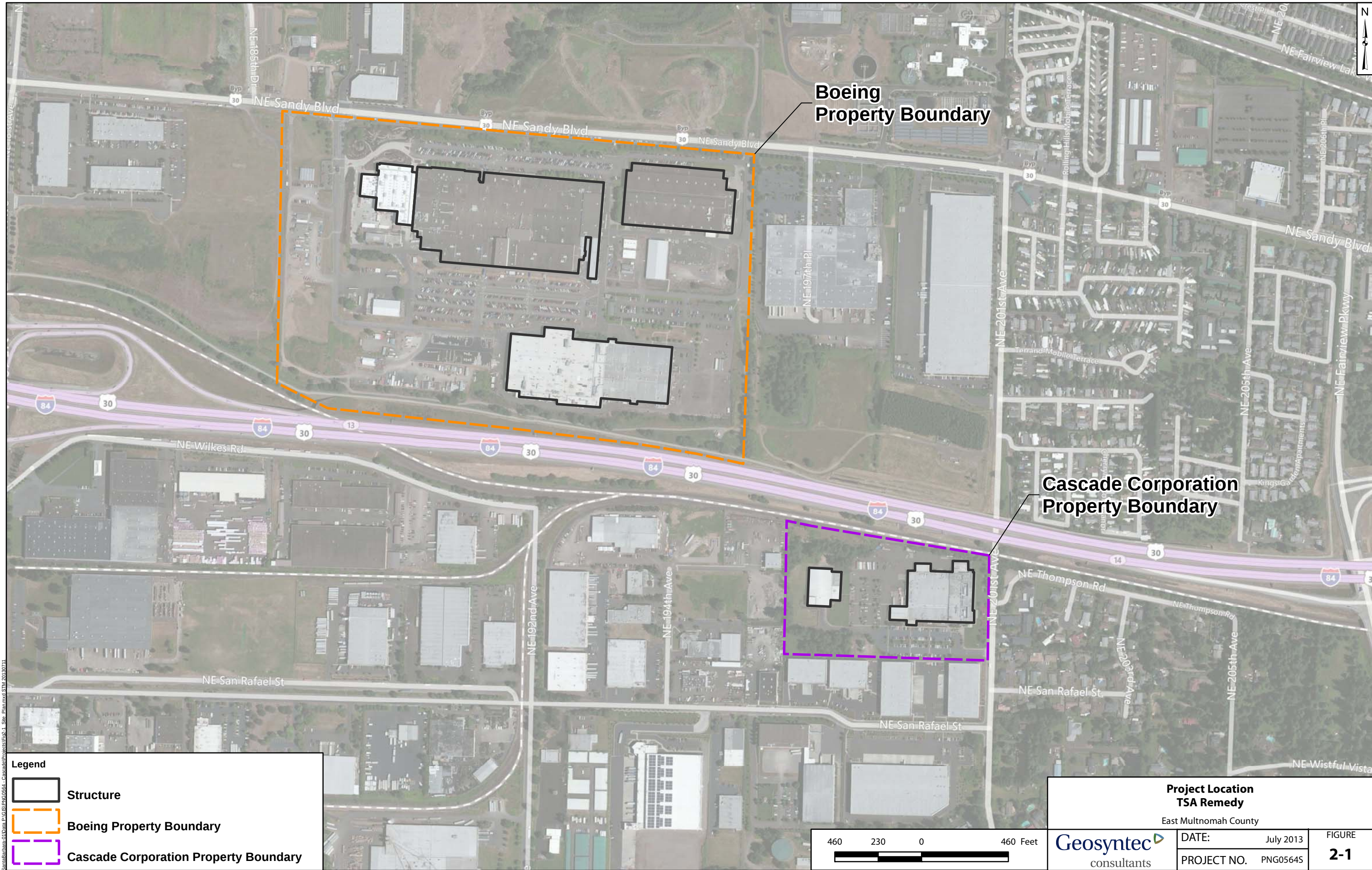
Table 4-1
Well Construction Data - 1 April 2013 through 30 September 2013
TSA Remedy - East Multnomah County

Well	Aquifer Screened	X Coordinate	Y Coordinate	Elevations, ft MSL				Depth of Boring (ft)
				Ground Surface	Measuring Point	Top of Screen	Bottom of Screen	
PMX-167 [W. Interlachen]	Upper TSA	1,499,941.3	693,617.5	45.0	44.84	----- Not Available -----		50
PMX-196 [Andrews]	Lower TSA	1,500,927.4	689,964.2	88.3	89.27	18.0	-2.0	110
PMX-198 [Udd]	Lower TSA	1,500,285.7	689,411.6	118.9	117.54	-30.0	-80.0	192
PMX-208(dg) [Simpson]	Lower TSA	1,499,450.8	690,374.5	80.2	81.14	-15.0	-35.0	115
PWB-1(uts)	Upper TSA	1,498,555.2	692,656.5	13.9	15.98	-51.0	-71.0	86
PWB-1(lts)	Lower TSA	1,498,563.4	692,649.2	14.0	16.48	-98.0	-118.0	134
PWB-2(lts)	Lower TSA	1,499,982.2	693,633.6	45.1	44.32	-20.0	-40.0	90
RPW-1(ds)	Upper TSA	1,498,538.9	693,219.5	10.9	15.90	-63.0	-103.0	119
VW-17d-42.5	CU1	----- Not Available -----		120.0	-----	82.5	77.5	45
VW-17d-75.0	Upper TSA	----- Not Available -----		120.0	-----	65.0	45.0	95
VW-75d-95.5	Upper TSA	----- Not Available -----		120.0	-----	44.5	24.5	130
BOP-44(usg)	SGA	1,497,207.4	691,933.2	24.6	34.25	-181.0	-191.0	219
EMC-2(usg)	SGA	1,499,258.5	691,965.1	52.9	47.15	-104.0	-114.0	175
PWB-1(usg)	SGA	1,498,550.0	692,646.6	13.7	16.59	-149.0	-169.0	183

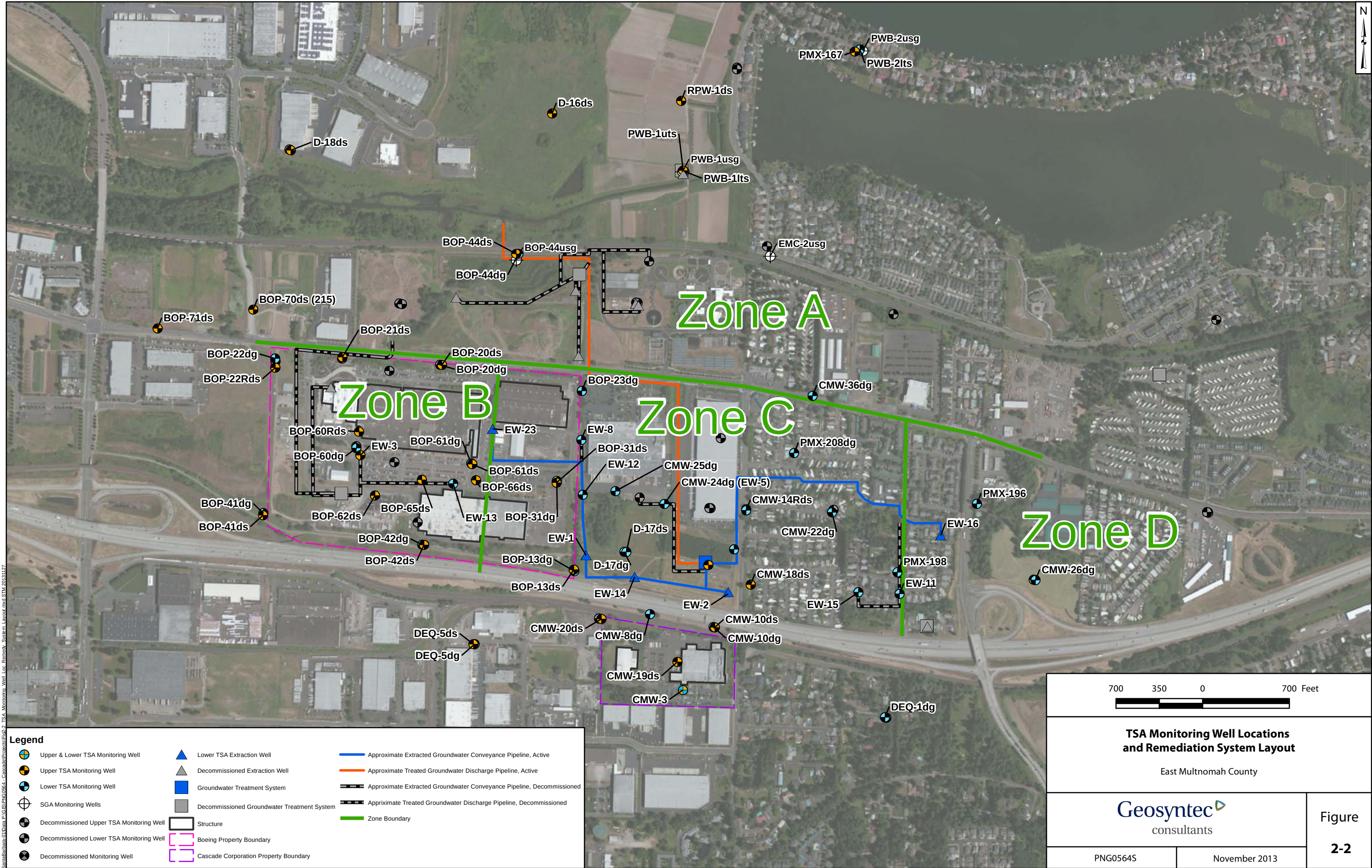
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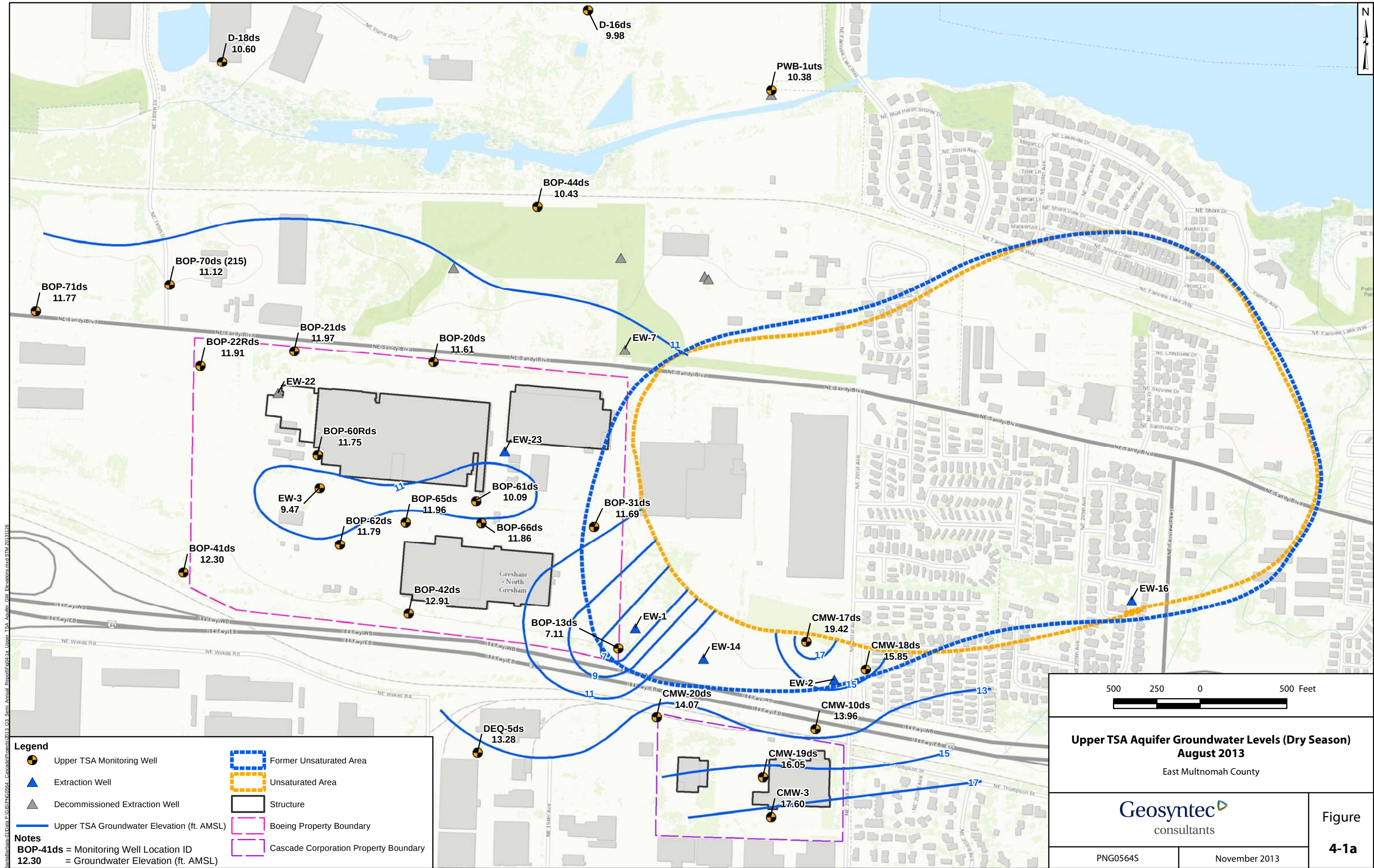
1. D-16(dg) and EMC-2(dg) are monitored solely for PWB pumping events and are not included in the baseline remedy monitoring program.
2. EW-3 was approved for conversion from pilot shutdown status to monitoring well status, per DEQ's approval in an April 15, 2013 email.

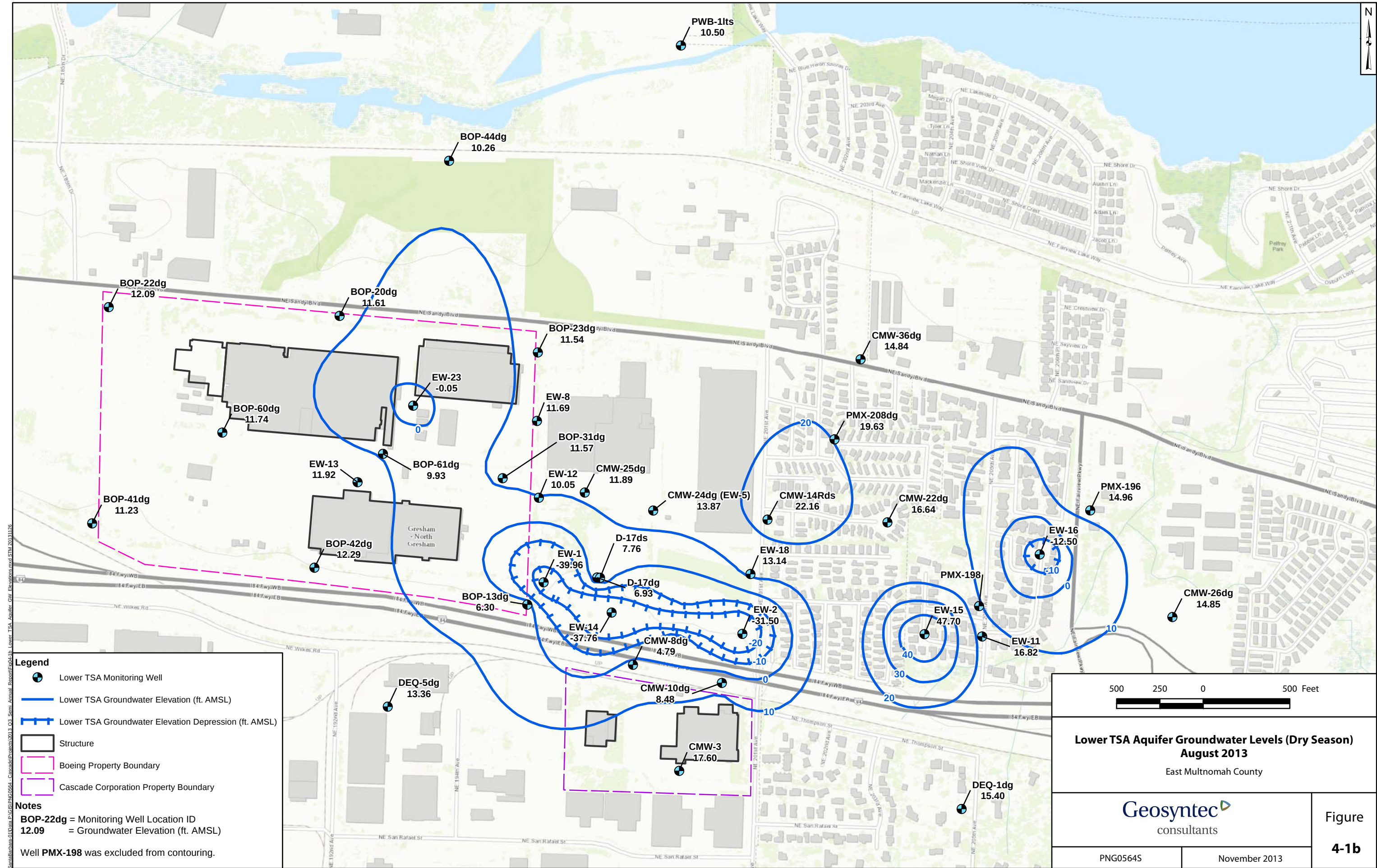
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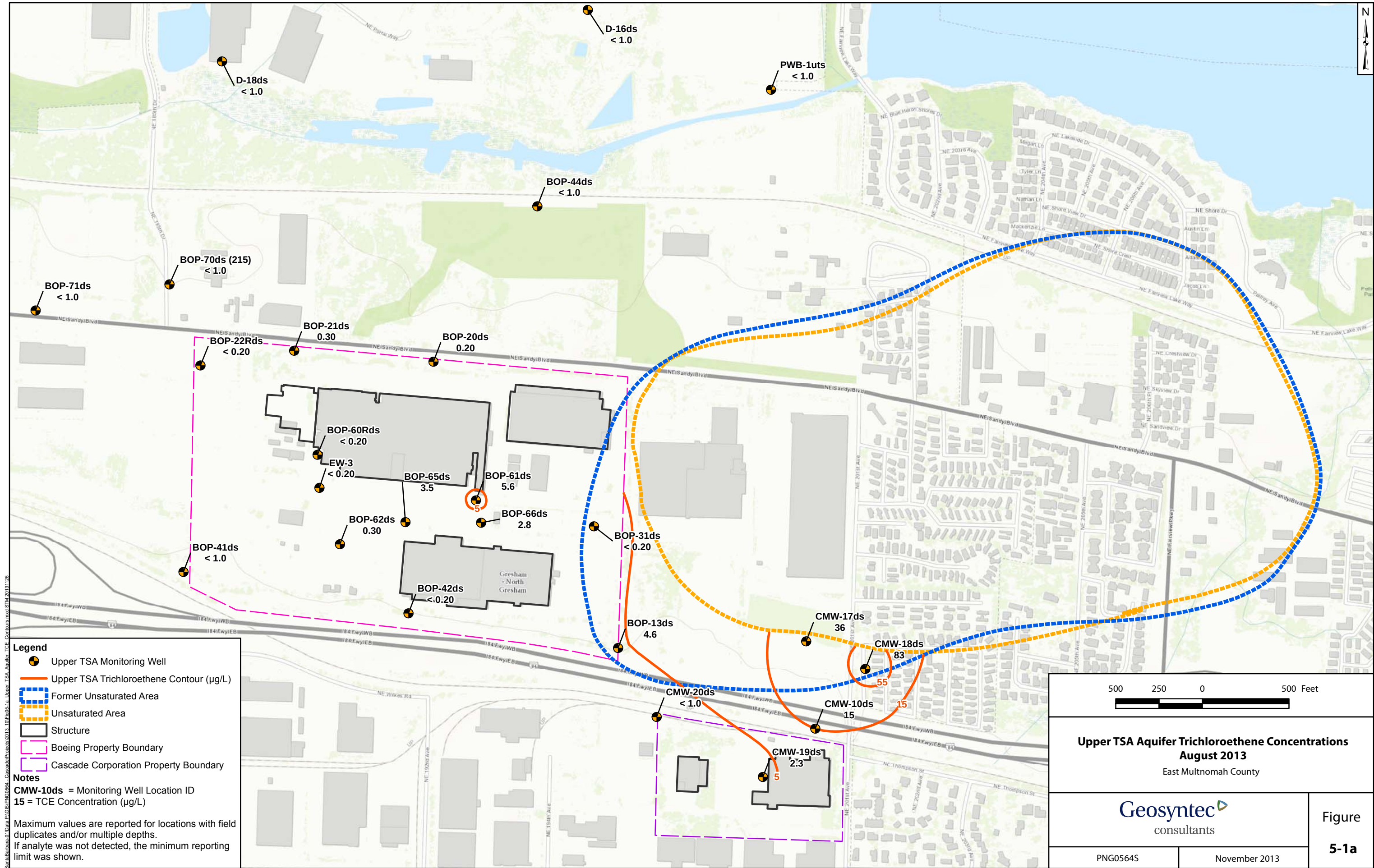


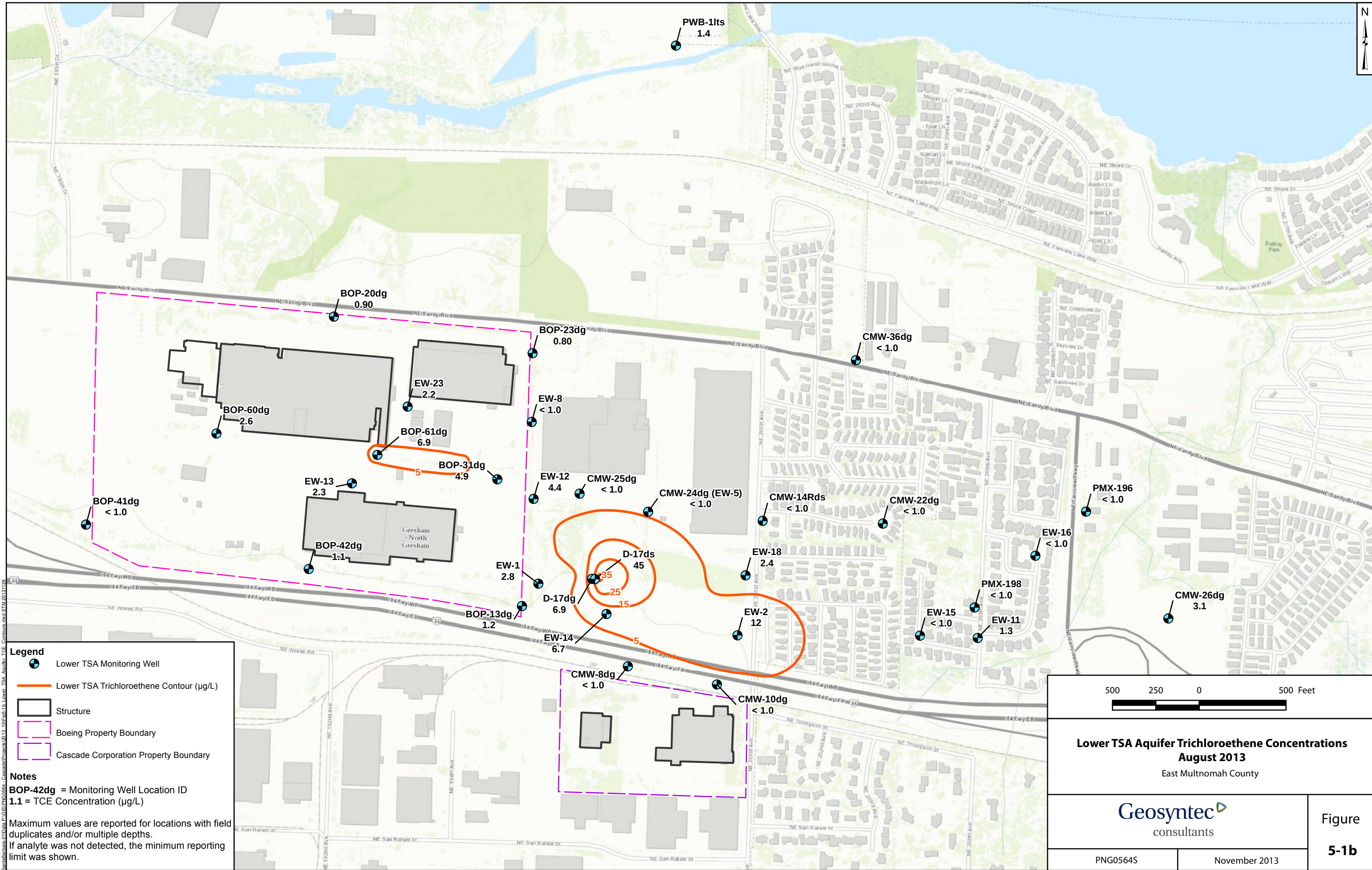
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APPENDIX A

Extraction Rate Profiles

Table A-1
TSA Extraction Rates and 12-M onth Averages- through 30 September 2013
TSA Remedy - East Multnomah County

Zone	12-Mo. Avg.	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13
<i>Zone B</i>	30	29	31	27	33	31	30	31	30	31	30	31	25
EW-23	30	29	31	27	33	31	30	31	30	31	30	31	25
<i>Zone C</i>	119	125	127	126	125	124	123	121	118	111	117	114	102
EW-1	66	71	72	71	71	71	71	70	69	64	59	53	48
EW-2	31	36	36	35	34	34	32	31	30	28	26	25	23
EW-14	23	18	19	20	20	20	20	20	20	19	31	35	32
<i>Zone D</i>	21	23	24	23	24	16	21	20	20	20	20	20	21
EW-16	21	23	24	23	24	16	21	20	20	20	20	20	21
TSA Cong	170	178	182	177	182	172	174	172	168	162	167	165	148

NOTES:

Monthly average flow rates are shown in gallons per minute for each well.

Wells that have not operated during the last 12 months are not shown.

1. EW-14 down during sonic cleaning 25-27 June 2013.
2. EW-16 was taken off-line for 6 hours on 4 September 2013 during connection of pump in MW-49 (TGA well).
3. EW-23 offline during repairs and replacement of pump and motor 16-19? September 2013.

Table A-2
Discharge Monitoring Summary -Cental Treatment System
1 April 2013 through 30 September 2013
TSA Remedy - East Multnomah County

Parameter	Discharge Limitations ^a	Unit	Sample Date	System Discharge			Number of Exceedances	Sample Frequency
				Min	Avg	Max		
April 2013								
pH	6.0 – 9.0	su	—	7.89	7.9	8.0	0	Weekly
Temperature	—	°F	—	—	58	—	—	Weekly
Flow	—	gpm	—	168	172	178	—	Daily
May 2013								
Trichloroethene	5.0	□g/L	5/8/13	<0.5	<0.5	<0.5	0	Quarterly
1,1-Dichloroethene	7.0	□g/L	5/8/13	<0.5	<0.5	<0.5	0	Quarterly
cis-1,2-Dichloroethene	70	□g/L	5/8/13	<0.5	<0.5	<0.5	0	Quarterly
Tetrachloroethene	5.0	□g/L	5/8/13	<0.5	<0.5	<0.5	0	Quarterly
Vinyl Chloride	2.0	□g/L	5/8/13	<0.5	<0.5	<0.5	0	Quarterly
pH	6.0 – 9.0	su	—	7.78	7.9	8.0	0	Weekly
Temperature	—	°F	—	—	61	—	—	Weekly
Flow	—	gpm	—	162	168	172	—	Daily
June 2013								
pH	6.0 – 9.0	su	—	7.91	7.9	8.0	0	Weekly
Temperature	—	°F	—	—	60	—	—	Weekly
Flow	—	gpm	—	158	162	166	—	Daily
July 2013								
pH	6.0 – 9.0	su	—	7.9	7.9	8.0	0	Weekly
Temperature	—	°F	—	—	61	—	—	Weekly
Flow	—	gpm	—	156	167	174	—	Daily
August 2013								
Trichloroethene	5.0	□g/L	8/20/13	<1.0	<1.0	<1.0	0	Quarterly
1,1-Dichloroethene	7.0	□g/L	8/20/13	<1.0	<1.0	<1.0	0	Quarterly
cis-1,2-Dichloroethene	70	□g/L	8/20/13	<1.0	<1.0	<1.0	0	Quarterly
Tetrachloroethene	5.0	□g/L	8/20/13	<1.0	<1.0	<1.0	0	Quarterly
Vinyl Chloride	2.0	□g/L	8/20/13	<1.0	<1.0	<1.0	0	Quarterly
pH	6.0 – 9.0	su	—	7.99	8.0	8.0	0	Weekly
Temperature	—	°F	—	—	61	—	—	Weekly
Flow	—	gpm	—	157	165	173	—	Daily
September 2013								
pH	6.0 – 9.0	su	—	7.99	8.0	8.0	0	Weekly
Temperature	—	°F	—	—	59	—	—	Weekly
Flow	—	gpm	—	121	143	161	—	Daily

NOTES:

^aDischarge limitations for the CTS are per Attachment C to DEQ Consent Order No. WMCSR-NWR-96-08 dated 2/14/97.

□g/L = micrograms/liter; °F = degrees Fahrenheit; gpm = gallons per minute; su = standard units.

Table A-3
TSA Extraction Well
Monthly Average Flow and Total
TSA Remedy - East Multnomah County

Month	Average Flow Rate (gallons per minute)											Total
	Sandstone		Zone B	Zone B/C	TSA Cong – Zone C					TSA Cong – Zone D		
	EW-3	EW-22	EW-13	EW-23	EW-1	EW-2	EW-14	EW-15	EW-18	EW-11	EW-16	
Jan-08	137	135	13	66	50	25	18	14	0	0	66	524
Feb-08	130	240	13	68	50	26	28	14	0	0	104	673
Mar-08	129	242	26	68	51	26	25	14	16	0	63	660
Apr-08	129	241	23	68	48	26	22	14	10	0	48	629
May-08	130	241	22	65	45	26	23	16	0	0	52	620
Jun-08	130	236	20	66	42	25	24	15	0	0	48	606
Jul-08	113	165	13	66	43	24	22	14	13	0	40	513
Aug-08	123	195	14	65	40	24	22	15	16	0	37	551
Sep-08	122	186	9	68	36	23	22	13	0	0	27	506
Oct-08	114	172	15	68	34	23	24	12	0	0	29	491
Nov-08	28	—	13	68	32	23	22	12	10	0	24	232
Dec-08	123	—	12	61	31	24	21	12	10	0	21	315
Jan-09	113	—	10	51	33	24	21	12	0	0	23	287
Feb-09	136	—	13	57	33	26	23	11	0	0	27	326
Mar-09	142	—	13	58	0	25	21	13	2	0	24	298
Apr-09	142	—	13	54	38	24	25	17	16	0	21	350
May-09	142	—	13	51	0	24	25	15	0	0	19	289
Jun-09	141	—	12	50	0	23	26	12	0	0	15	279
Jul-09	140	—	11	44	39	20	26	15	15	0	25	335
Aug-09	115	—	11	55	36	18	24	12	16	0	21	308
Sep-09	125	—	12	70	7	19	25	8	3	0	15	284
Oct-09	131	—	12	68	0	19	25	11	0	0	18	284
Nov-09	133	—	10	66	29	19	23	11	0	—	18	309
Dec-09	54	—	0	57	34	18	21	11	—	—	18	213
Jan-10	0	—	0	56	31	18	16	11	—	—	17	149
Feb-10	0	—	0	65	29	19	17	11	—	—	17	158
Mar-10	0	—	0	66	28	19	16	11	—	—	18	158
Apr-10	0	—	0	67	27	19	21	11	—	—	18	163
May-10	0	—	0	67	26	19	26	—	—	—	—	138
Jun-10	0	—	0	66	25	20	25	—	—	—	—	136
Jul-10	0	—	0	65	23	19	25	—	—	—	—	132
Aug-10	0	—	0	67	21	19	24	—	—	—	—	131
Sep-10	0	—	0	66	19	22	25	—	—	—	—	132
Oct-10	0	—	0	72	19	27	29	—	—	—	—	146
Nov-10	0	—	0	69	19	26	27	—	—	—	—	141
Dec-10	0	—	0	63	20	17	26	—	—	—	—	126
Jan-11	0	—	0	61	21	32	26	—	—	—	—	140
Feb-11	0	—	0	67	34	32	25	—	—	—	—	158
Mar-11	0	—	0	67	82	27	23	—	—	—	—	199
Apr-11	0	—	0	65	82	25	22	—	—	—	—	194
May-11	0	—	0	67	81	25	22	—	—	—	—	195
Jun-11	0	—	0	67	79	25	22	—	—	—	—	193
Jul-11	0	—	0	68	68	23	22	—	—	—	—	181
Aug-11	0	—	0	39	63	23	23	—	—	—	—	148

Table A-3
TSA Extraction Well
Monthly Average Flow and Total
TSA Remedy - East Multnomah County

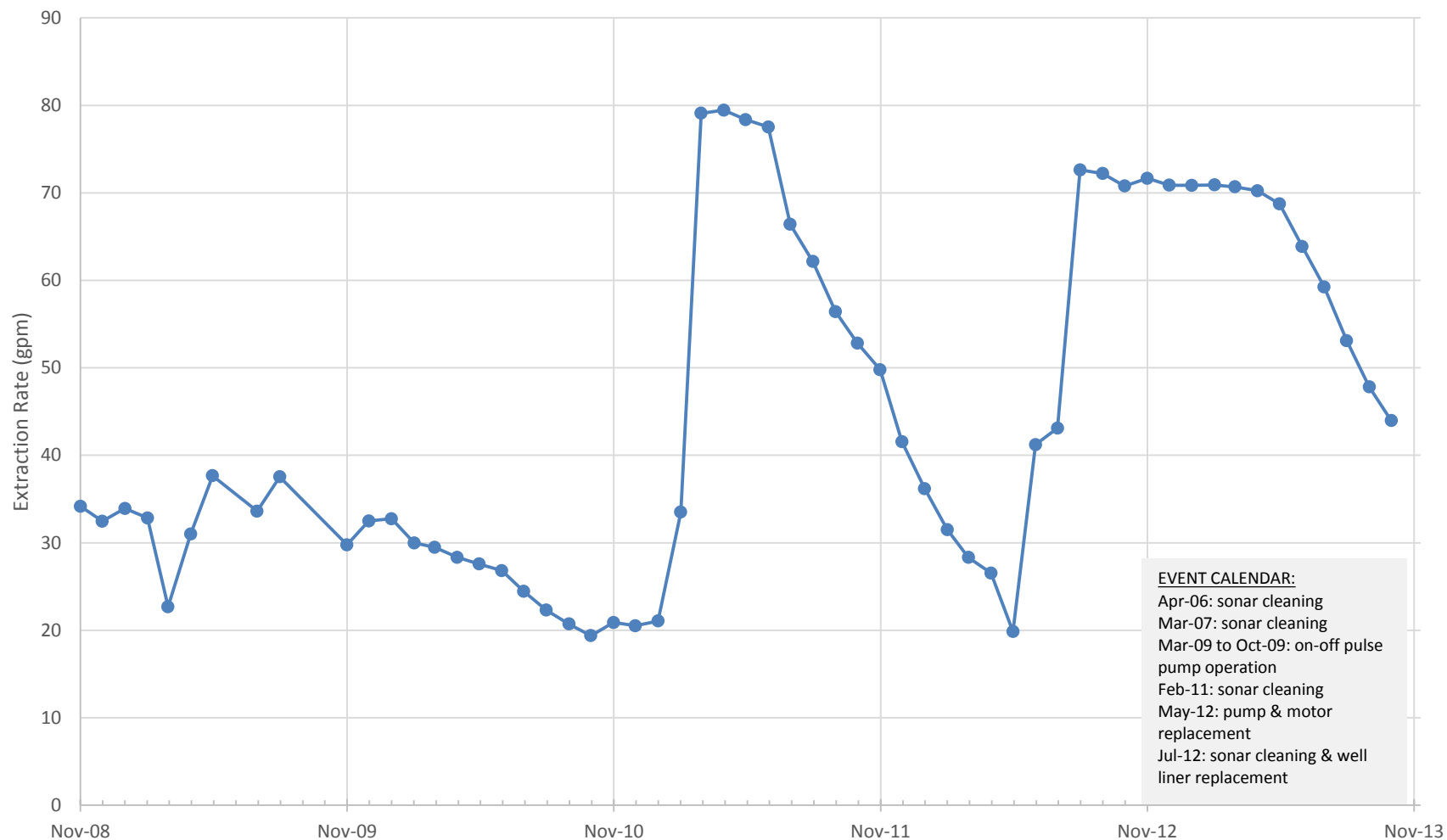
M onth	Average Flow Rate (gallons per minute)											Total
	Sandstone		Zone B	Zone B/C	TSA Cong – Zone C					TSA Cong – Zone D		
	EW-3	EW-22	EW-13	EW-23	EW-1	EW-2	EW-14	EW-15	EW-18	EW-11	EW-16	
Sep-11	0	—	0	31	56	21	23	—	—	—	—	131
Oct-11	0	—	0	30	52	20	22	—	—	—	—	124
Nov-11	0	—	0	29	52	20	23	—	—	—	—	124
Dec-11	0	—	0	30	41	19	23	—	—	—	—	113
Jan-12	0	—	0	30	35	18	23	—	—	—	—	106
Feb-12	0	—	0	30	31	18	22	—	—	—	—	101
Mar-12	0	—	0	29	28	18	23	—	—	—	—	98
Apr-12	0	—	0	29	26	17	24	—	—	—	—	96
May-12	0	—	0	29	22	21	24	—	—	—	—	96
Jun-12	0	—	0	29	42	38	24	—	—	—	—	133
Jul-12	0	—	0	28	49	37	22	—	—	—	—	136
Aug-12	0	—	0	29	74	37	22	—	—	—	19	181
Sep-12	0	—	0	27	73	36	18	—	—	—	23	177
Oct-12	0	—	0	30	72	36	21	—	—	—	24	183
Nov-12	0	—	0	31	72	35	19	—	—	—	23	180
Dec-12	0	—	0	28	73	35	21	—	—	—	22	179
Jan-13	0	—	0	33	72	34	21	—	—	—	22	182
Feb-13	0	—	0	31	72	34	20	—	—	—	14	171
Mar-13	0	—	0	30	72	32	22	—	—	—	20	177
Apr-13	0	—	0	31	70	31	20	—	—	—	20	172
May-13	0	—	0	30	69	30	20	—	—	—	20	168
Jun-13	0	—	0	31	64	28	19	—	—	—	20	162
Jul-13	0	—	0	30	59	26	31	—	—	—	20	167
Aug-13	0	—	0	31	53	25	35	—	—	—	20	165
Sep-13	0	—	0	25	48	23	32	—	—	—	21	148
Reporting period average:			—	30	60	27	26	—	—	—	20	164

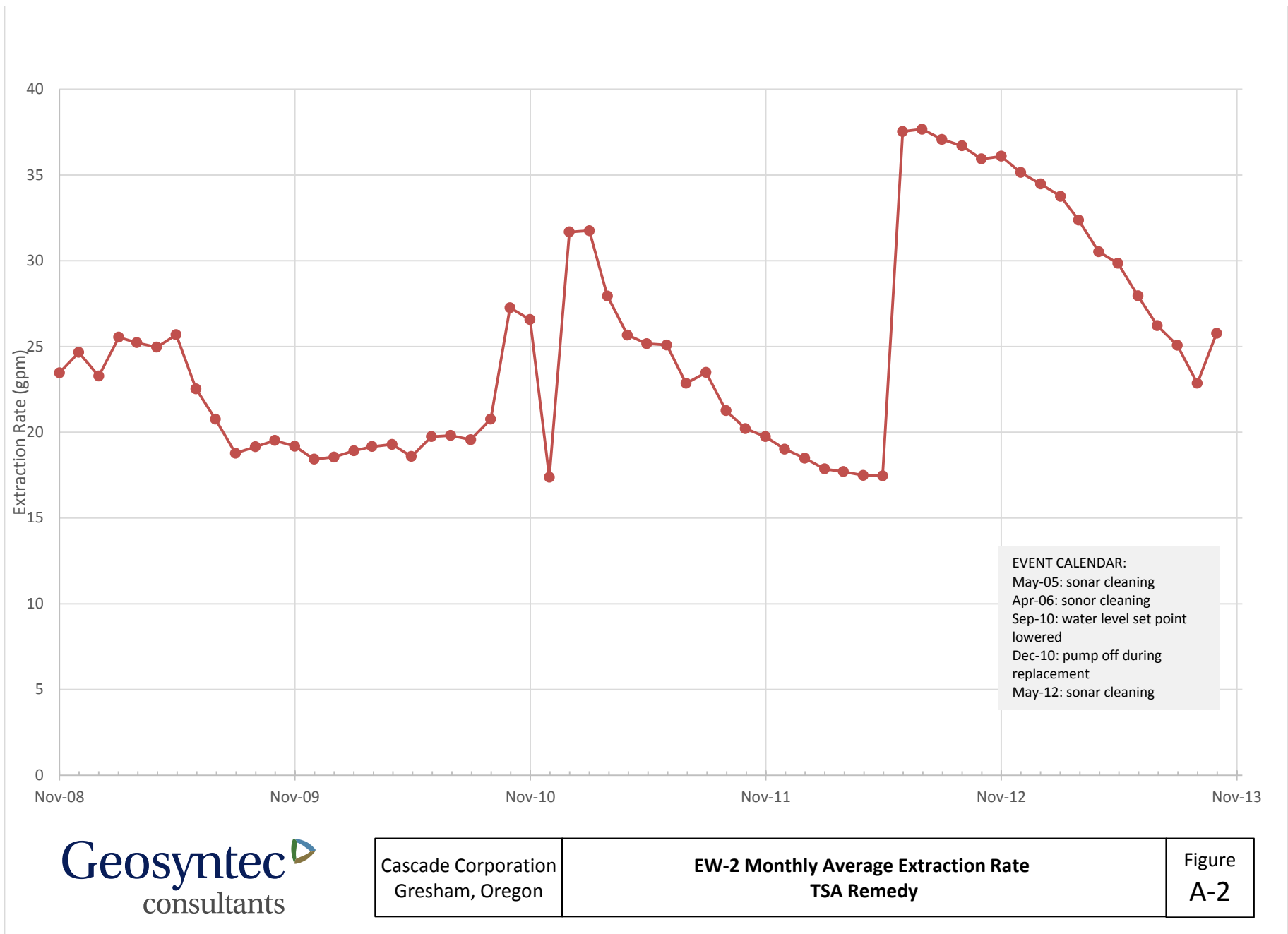
NOTES:

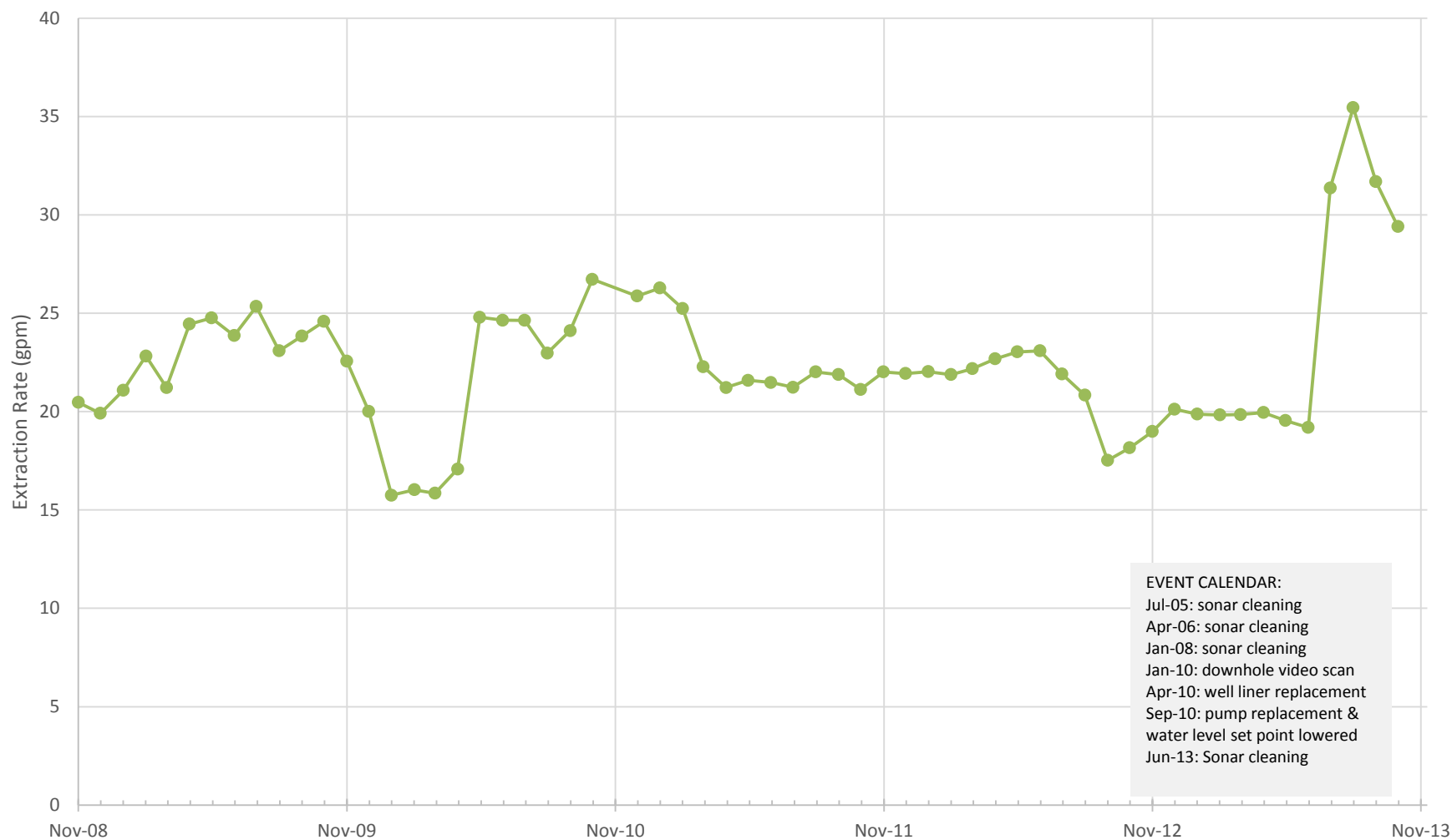
Data shown submitted to DEQ in monthly progress and/or quarterly data reports.

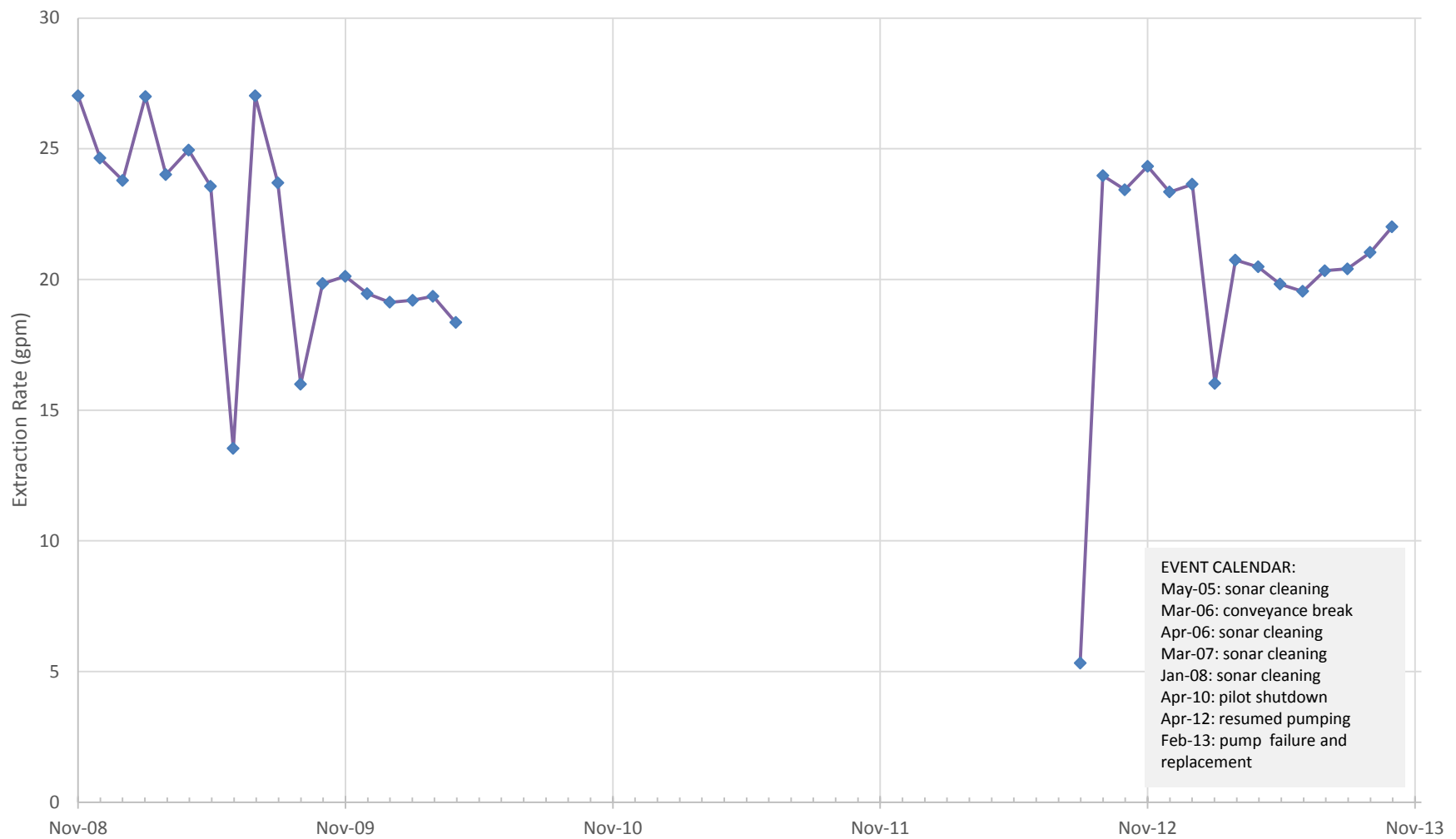
Average flow rates above are based on PLC electronic records, except where short term electronic data is not available; for these instances manual flow rates are used.

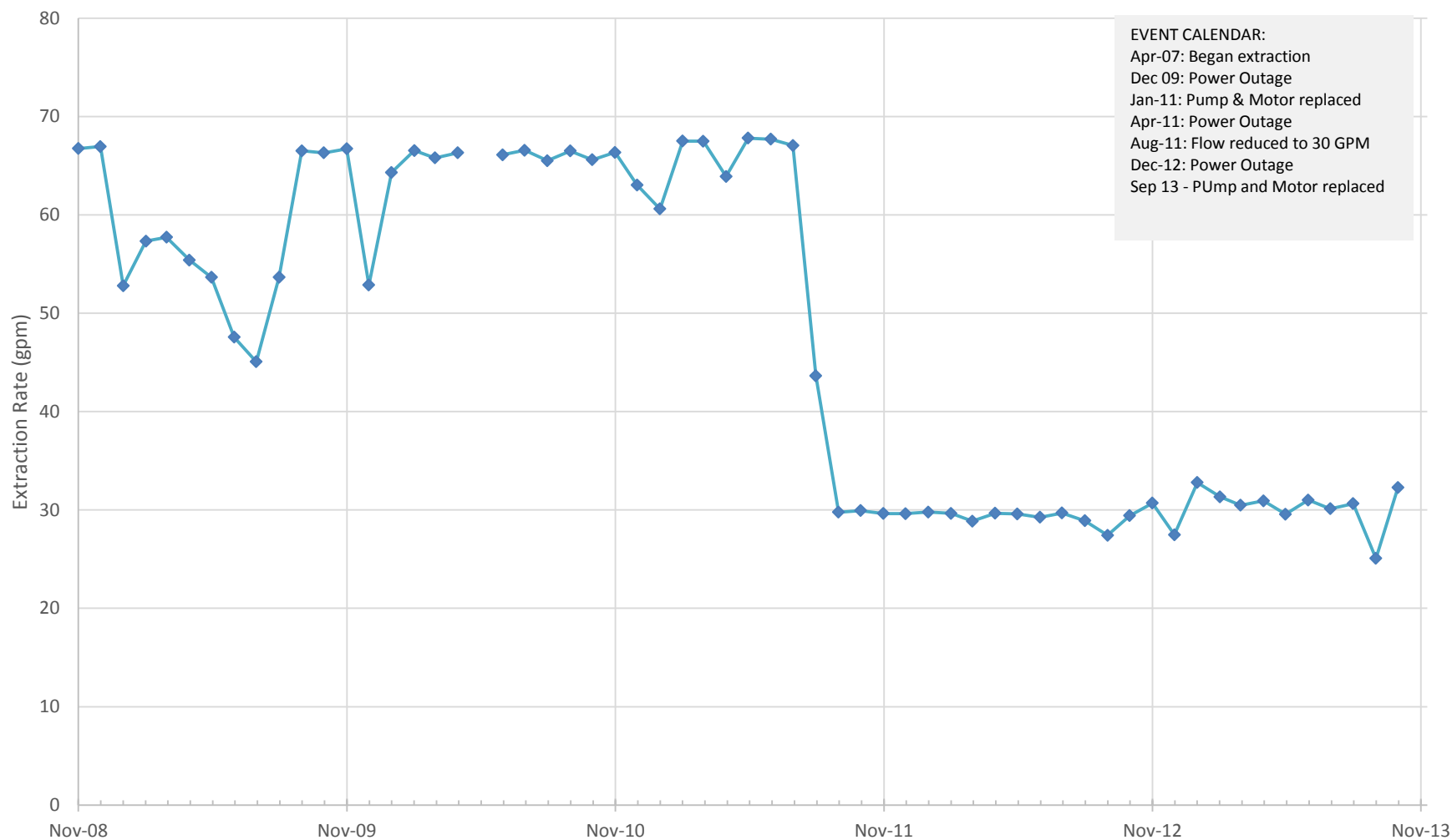
"—" = well permanently removed from remedy extraction network (i.e., converted to monitoring use or decommissioned)

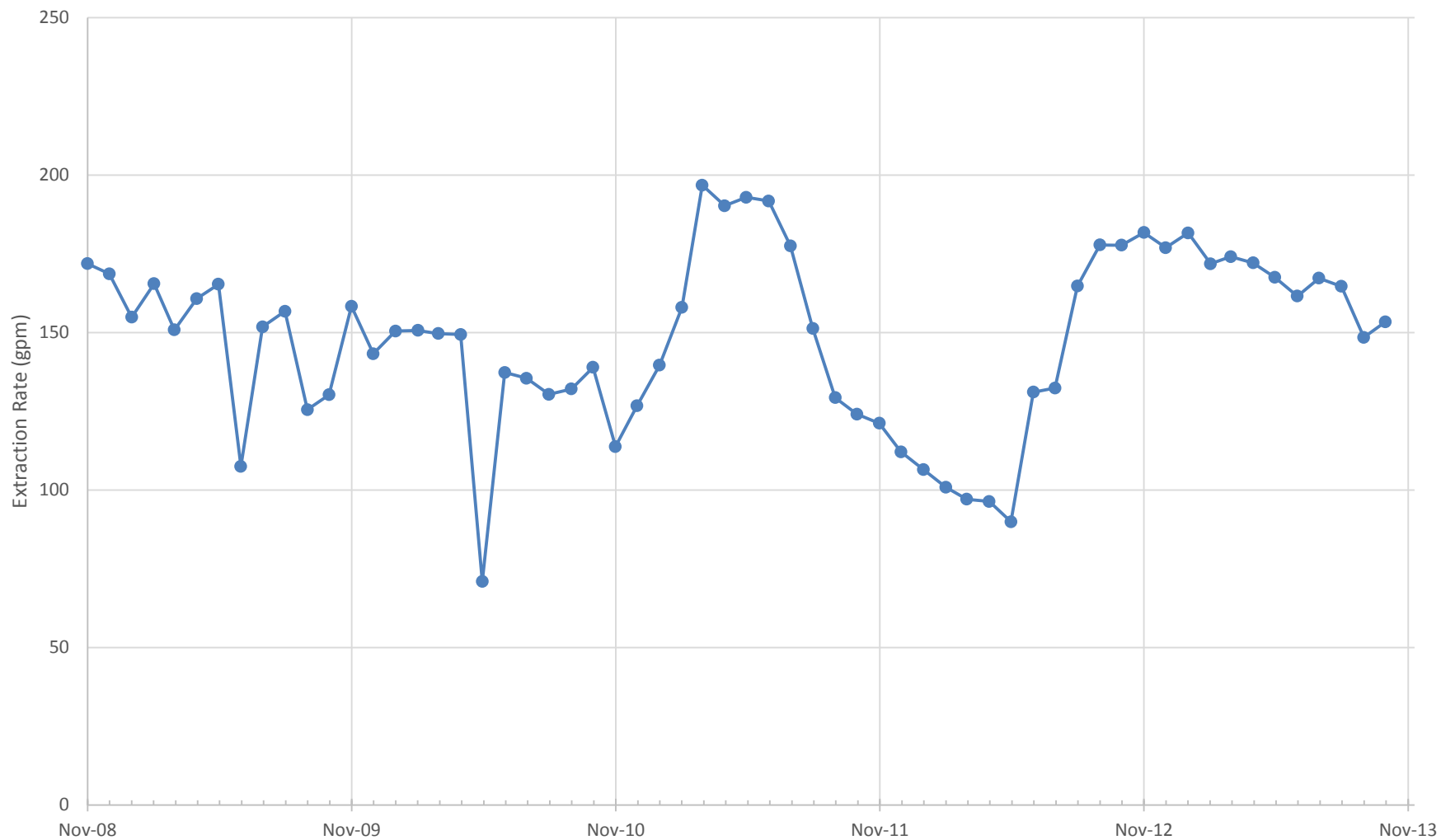












APPENDIX B

Groundwater Elevation Data

Table B-1
Groundwater Elevations - 1 April 2013 through 30 September 2013
TSA Remedy - Gresham, Oregon

Well ID	Date	Time	Top of Casing Elevation (ft, MSL)	Depth to Water (ft below TOC)	Groundwater Elevation (ft, MSL)
Extraction Wells					
EW-1	4/4/13	12:04	124.04	156.33	-32.29
EW-1	5/2/13	12:50	124.04	160.29	-36.25
EW-1	6/3/13	10:15	124.04	161.41	-37.37
EW-1	7/1/13	10:30	124.04	161.91	-37.87
EW-1	8/18/13	8:13	124.04	164.88	-40.84
EW-2	4/4/13	11:56	126.01	157.53	-31.52
EW-2	5/2/13	12:46	126.01	157.49	-31.48
EW-2	6/3/13	10:13	126.01	157.31	-31.30
EW-2	7/1/13	10:23	126.01	157.41	-31.40
EW-2	8/18/13	8:06	126.01	157.60	-31.59
EW-14	4/4/13	13:21	127.63	169.06	-41.43
EW-14	5/2/13	13:50	127.63	164.30	-36.67
EW-14	6/3/13	12:06	127.63	161.18	-33.55
EW-14	7/1/13	11:47	127.63	141.86	-14.23
EW-14	8/18/13	8:19	127.63	165.58	-37.95
EW-16	4/4/13	11:35	83.71	95.44	-11.73
EW-16	5/2/13	12:39	83.71	96.77	-13.06
EW-16	6/3/13	9:54	83.71	92.77	-9.06
EW-16	7/1/13	10:03	83.71	94.84	-11.13
EW-16	8/18/13	8:25	83.71	96.00	-12.29
EW-18	2/7/13	9:53	104.50	106.78	-2.28
EW-18	8/18/13	10:08	104.50	91.36	13.14
EW-23	4/4/13	11:46	83.93	81.37	2.56
EW-23	5/2/13	12:30	83.93	81.23	2.70
EW-23	6/3/13	10:06	83.93	81.89	2.04
EW-23	7/1/13	10:14	83.93	81.65	2.28
EW-23	8/18/13	8:34	83.93	84.81	-0.88
Monitoring Wells					
BOP-41(ds)	8/18/13	15:40	136.74	124.44	12.30
BOP-41(dg)	8/18/13	15:30	136.45	125.22	11.23
BOP-44(ds)	8/18/13	15:06	35.24	24.81	10.43
BOP-44(dg)	8/18/13	15:05	35.15	24.89	10.26
BOP-70(ds-215)	8/18/13	15:58	65.15	54.03	11.12
BOP-71(ds)	8/18/13	15:17	87.88	76.11	11.77
D-16(ds)	8/18/13	16:13	16.91	6.93	9.98
D-17(ds)	5/8/13	9:57	123.28	114.58	8.70
D-17(ds)	8/18/13	9:11	123.28	115.52	7.76
D-17(dg)	8/18/13	9:17	124.61	117.68	6.93
D-18(ds)	8/18/13	16:02	18.01	7.41	10.60
DEQ-1(dg)	8/18/13	17:00	150.58	135.18	15.40

Table B-1
Groundwater Elevations - 1 April 2013 through 30 September 2013
TSA Remedy - Gresham, Oregon

Well ID	Date	Time	Top of Casing Elevation (ft, MSL)	Depth to Water (ft below TOC)	Groundwater Elevation (ft, MSL)
DEQ-5(ds)	8/18/13	14:13	155.68	142.40	13.28
DEQ-5(dg)	8/18/13	14:14	155.95	142.59	13.36
EW-8	8/18/13	12:41	77.16	65.47	11.69
EW-11	8/18/13	11:38	114.73	97.91	16.82
EW-12	8/18/13	9:36	94.14	84.09	10.05
EW-15	8/18/13	11:41	116.21	68.51	47.70
MW-3	8/18/13	17:07	147.69	130.09	17.60
MW-8(dg)	8/18/13	14:30	136.21	131.42	4.79
MW-10(ds)	5/8/13	13:43	134.54	120.53	14.01
MW-10(ds)	8/18/13	14:37	134.54	120.58	13.96
MW-10(dg)	8/18/13	14:39	135.05	126.57	8.48
MW-14R(ds)	8/18/13	10:45	83.48	61.32	22.16
MW-17(ds)	5/8/13	9:05	121.89	102.20	19.69
MW-17(ds)	8/18/13	9:58	121.89	102.47	19.42
MW-18(ds)	5/8/13	11:50	117.66	101.84	15.82
MW-18(ds)	8/18/13	13:50	117.66	101.81	15.85
MW-19(ds)	5/8/13	13:30	144.08	127.91	16.17
MW-19(ds)	8/18/13	13:57	144.08	128.03	16.05
MW-20(ds)	8/18/13	14:20	152.72	138.65	14.07
MW-22(dg)	8/18/13	10:56	81.65	65.01	16.64
MW-24(dg) (EW-5)	8/18/13	10:27	77.74	63.87	13.87
MW-25 (dg)	8/18/13	13:20	75.28	63.39	11.89
MW-26(dg)	8/18/13	12:08	108.98	94.13	14.85
MW-36(dg)	8/18/13	11:08	78.84	64.00	14.84
Interlachen W (PMX-167)	8/18/13	16:45	44.84	33.10	11.74
Andrews (PMX-196)	8/18/13	11:46	89.27	74.31	14.96
Udd (PMX-198)	8/18/13	11:20	117.54	6.51	111.03
Sandy Mobile (208dg)	8/18/13	11:03	81.14	61.51	19.63
PWB-1(uts)	8/18/13	16:26	15.98	5.60	10.38
PWB-1(lts)	8/18/13	16:25	16.48	5.98	10.50
PWB-2(lts)	8/18/13	16:46	44.32	33.35	10.97
RPW-1(ds)	8/18/13	16:20	15.90	3.92	11.98

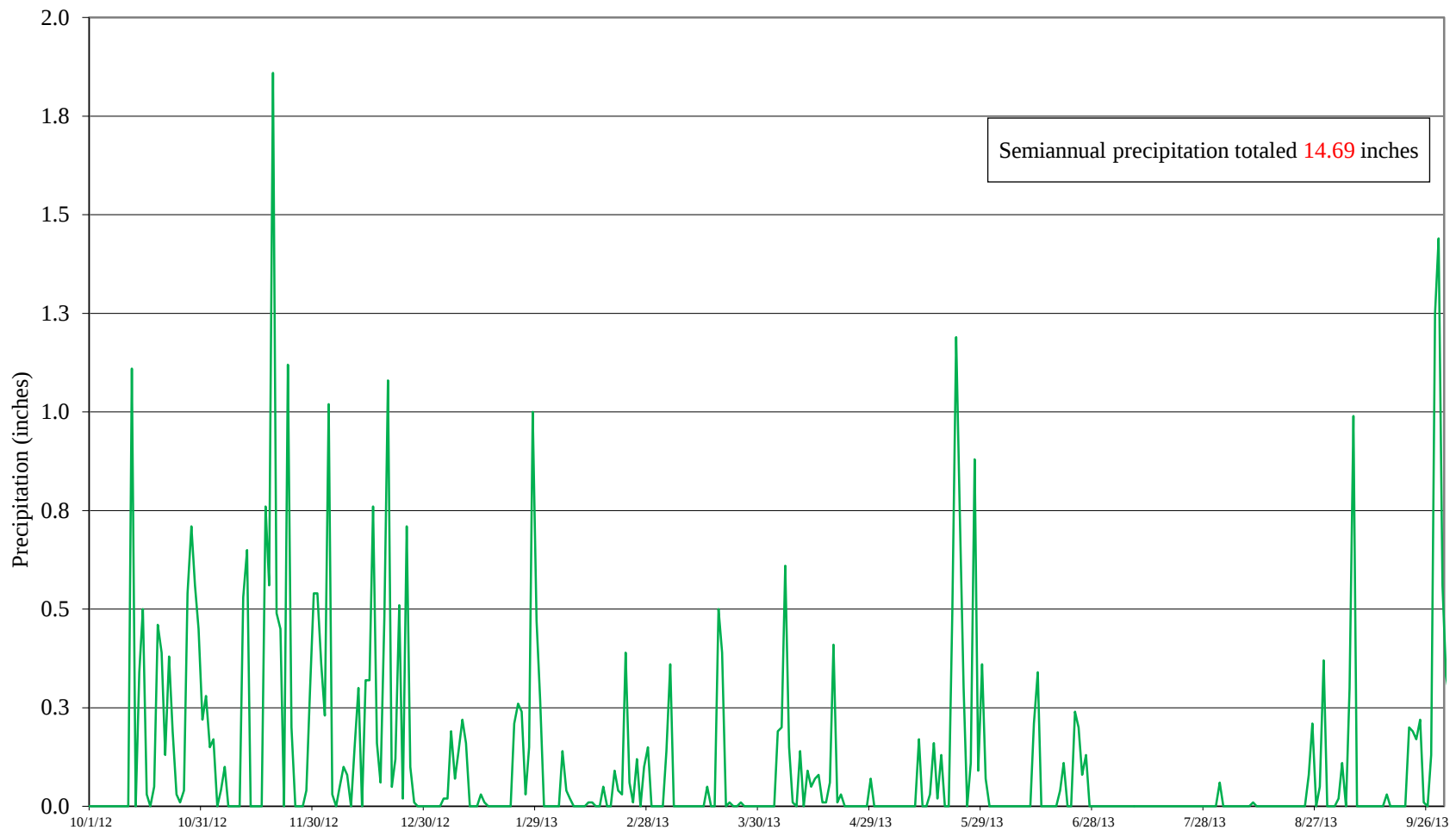
Notes:

ft. MSL = feet above mean sea level

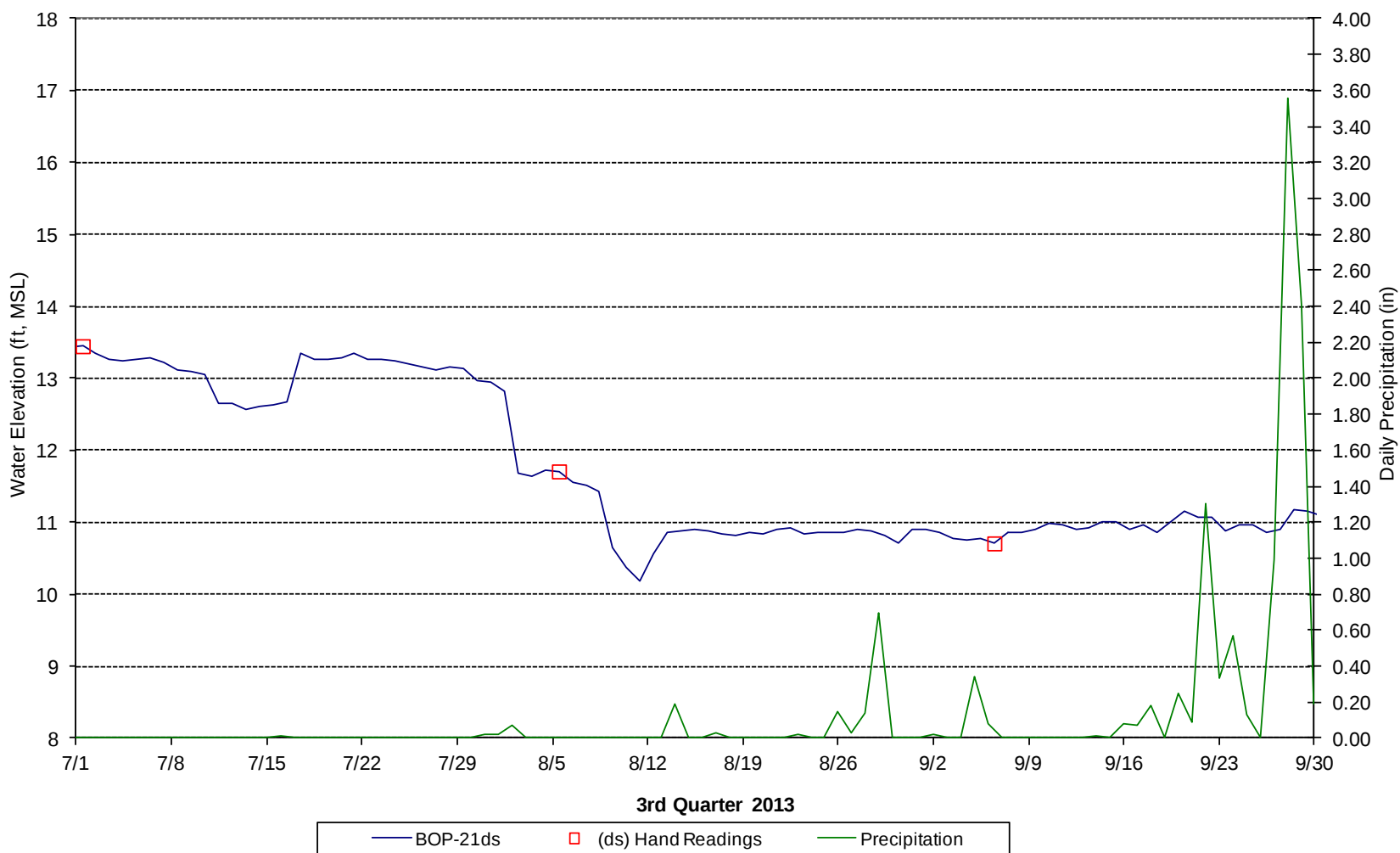
TOC = top of casing.

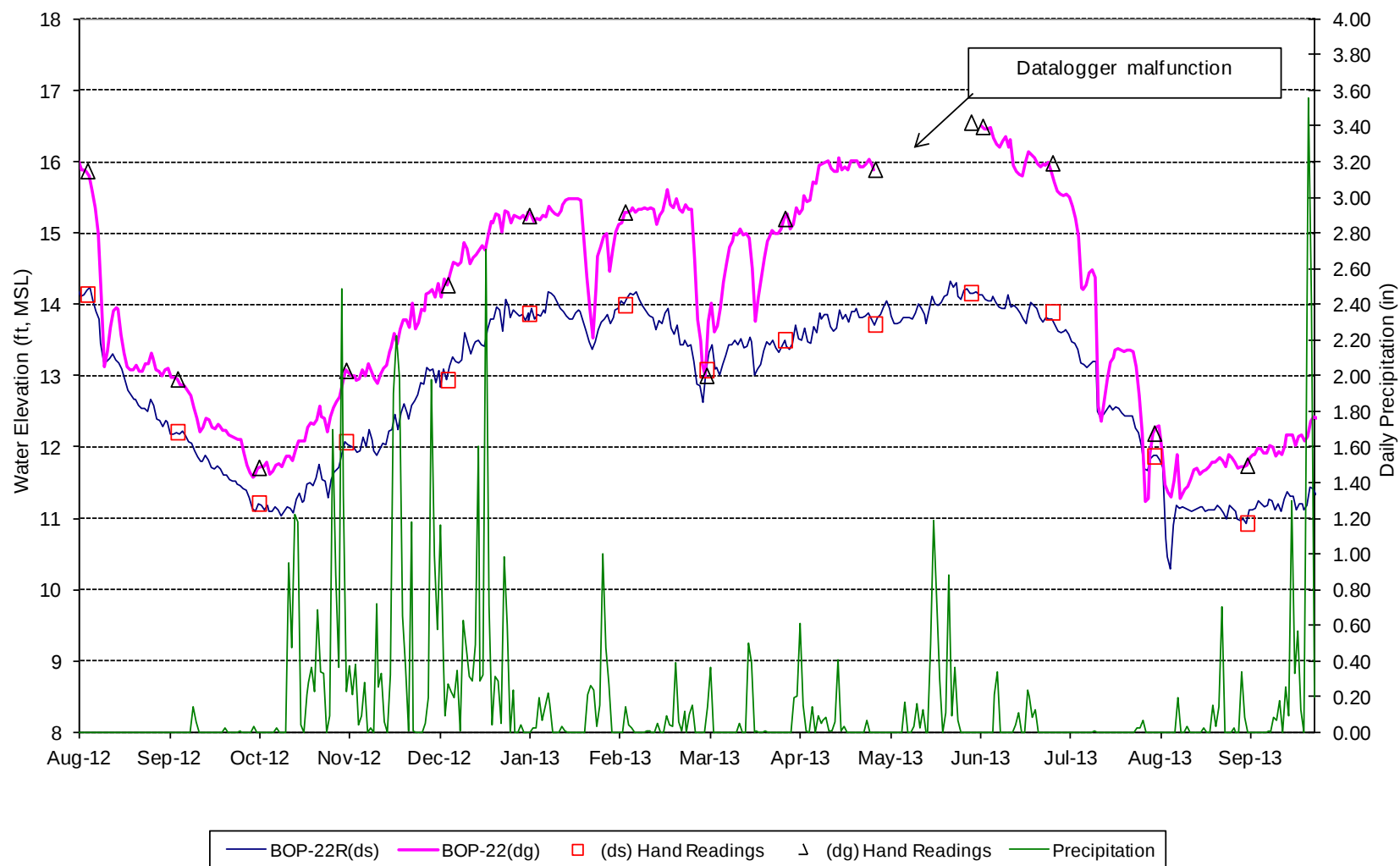
1. D-17ds, MW10ds, MW17ds and MW18ds are measured quarterly to assess mound area trends per DEQ approval in 15 April 2013 email.

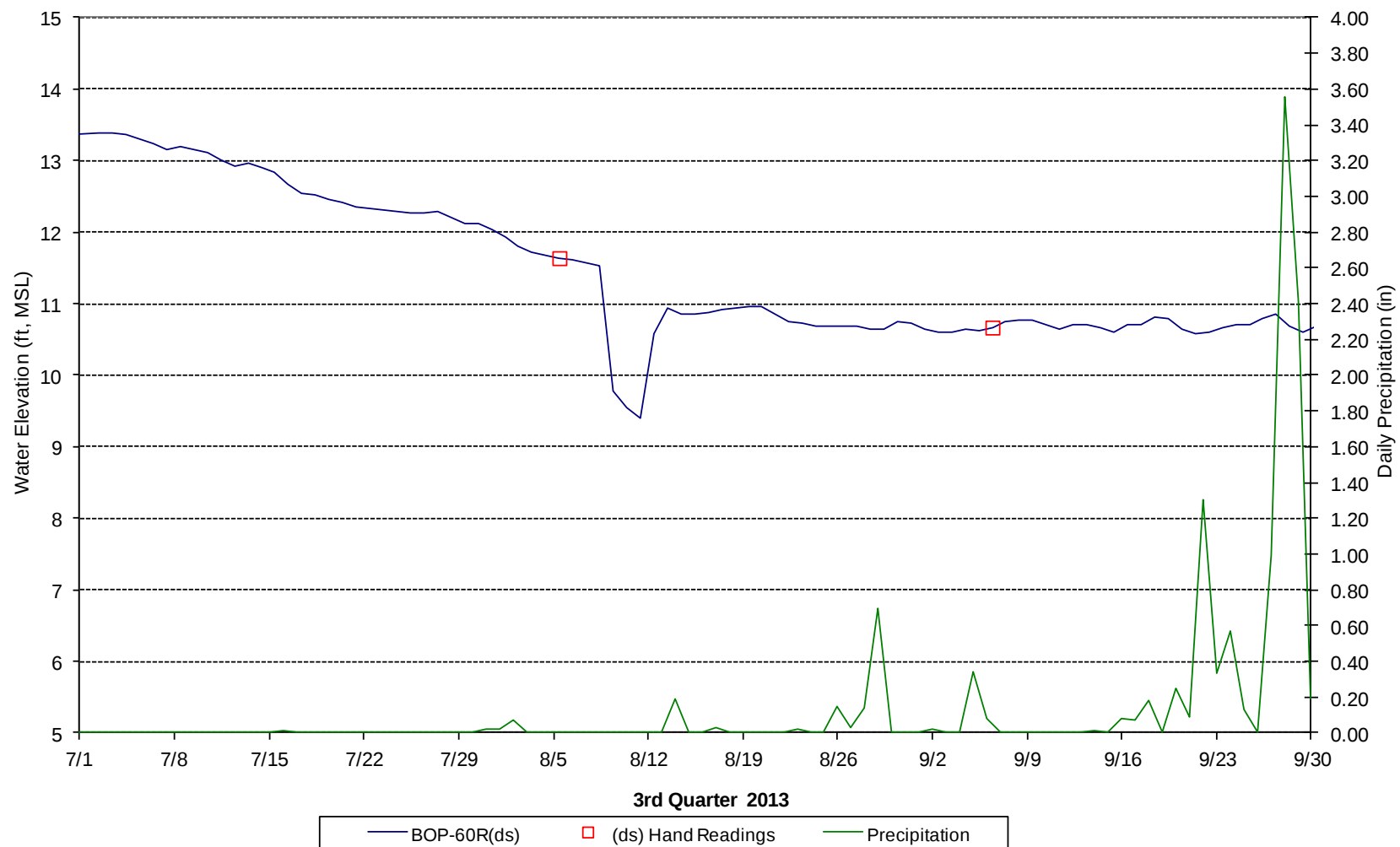
2. EW-3 was approved for conversion from pilot shutdown status to monitoring well per DEQ approval in 15 April 2013 email.

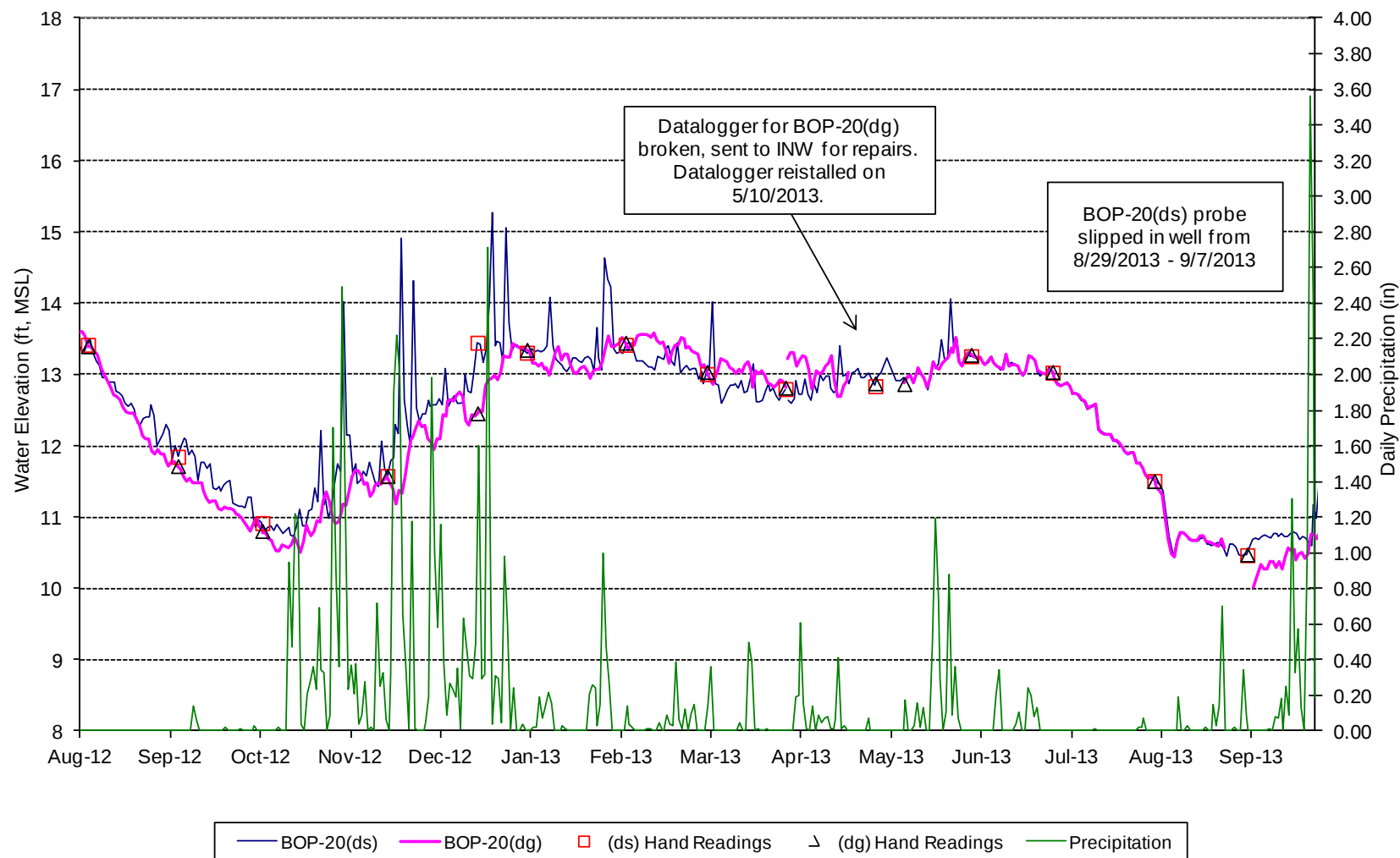


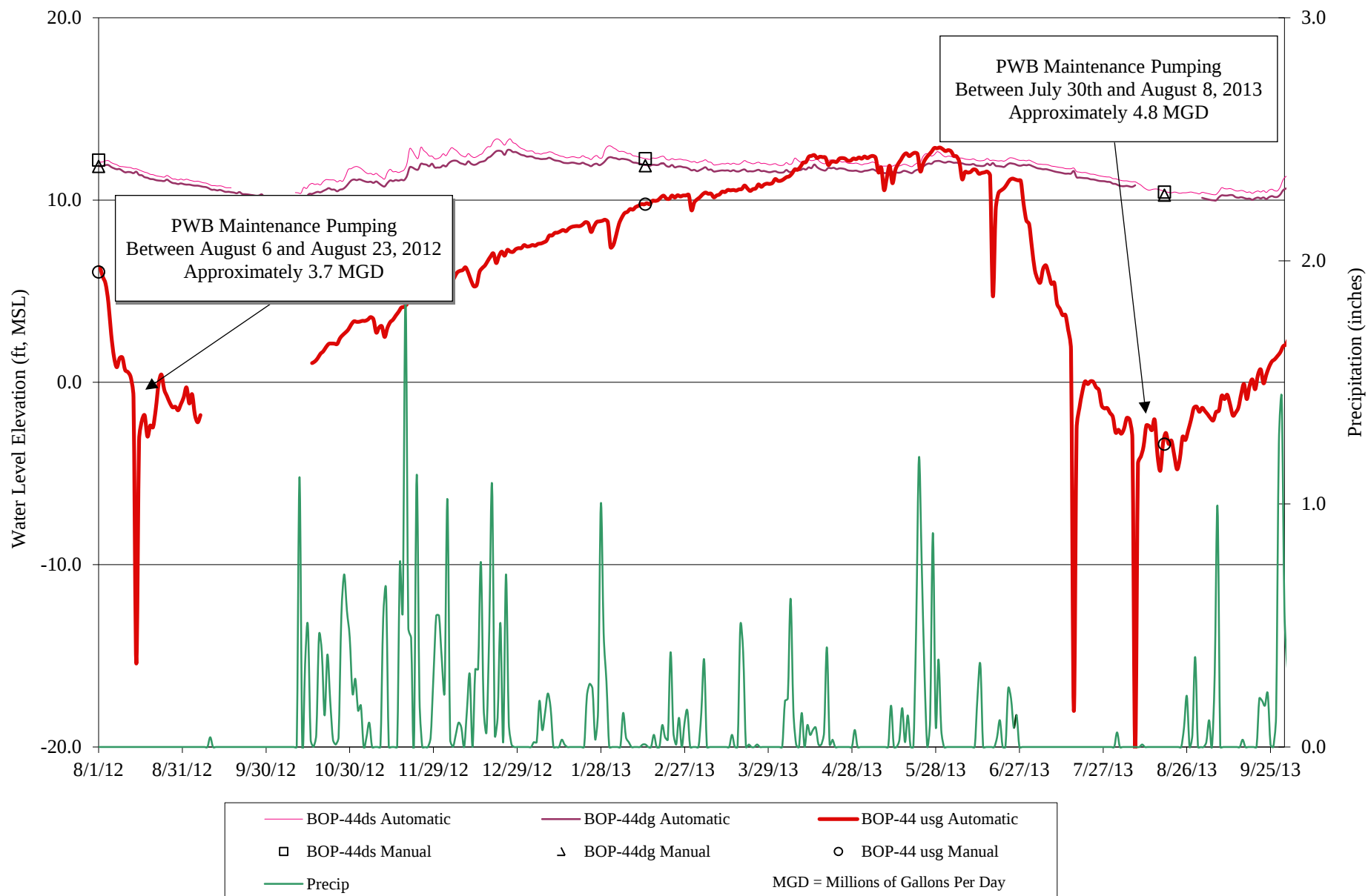
NOTE: Data from NOAA (WS Form F-6); readings taken at Portland International Airport.

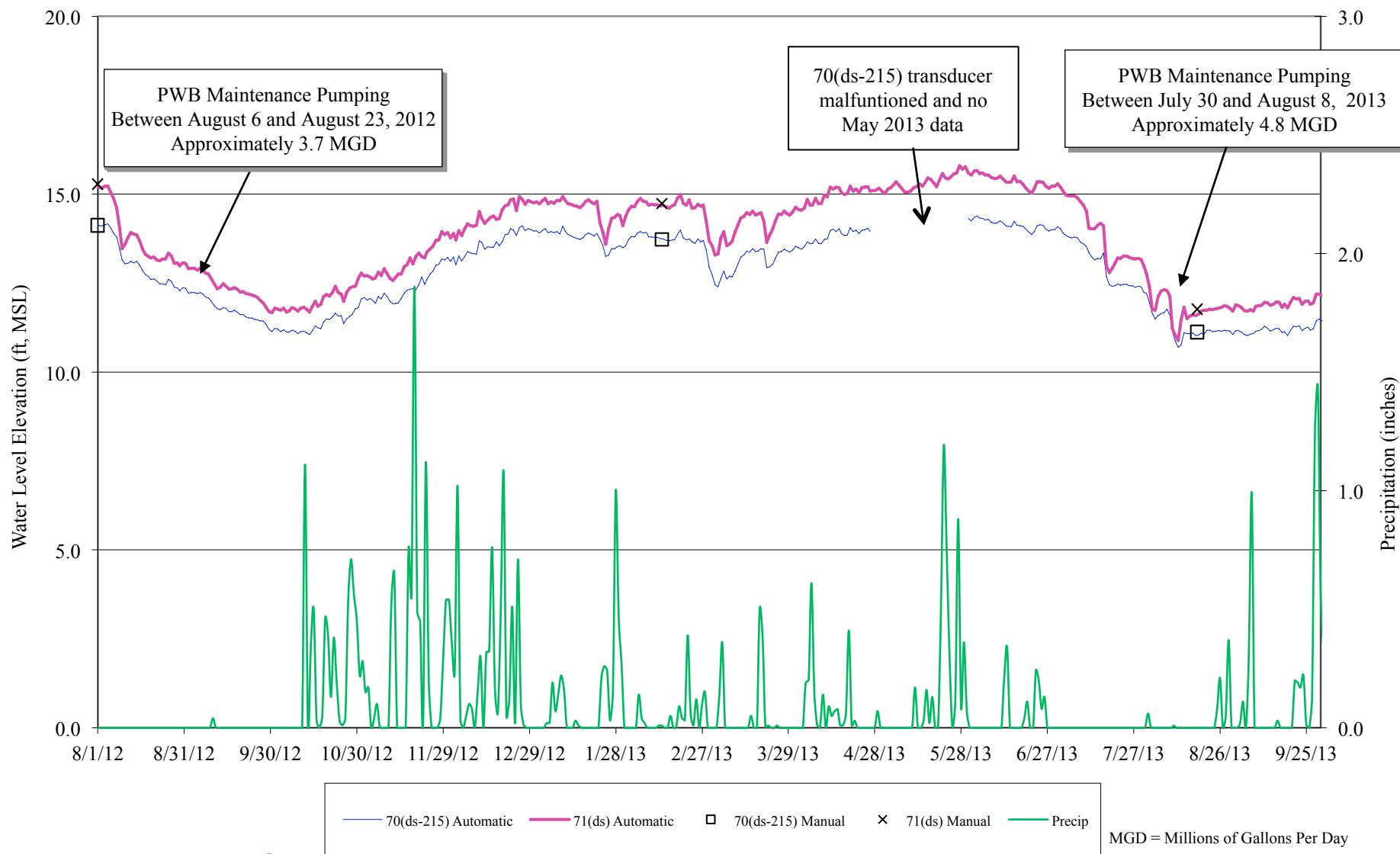


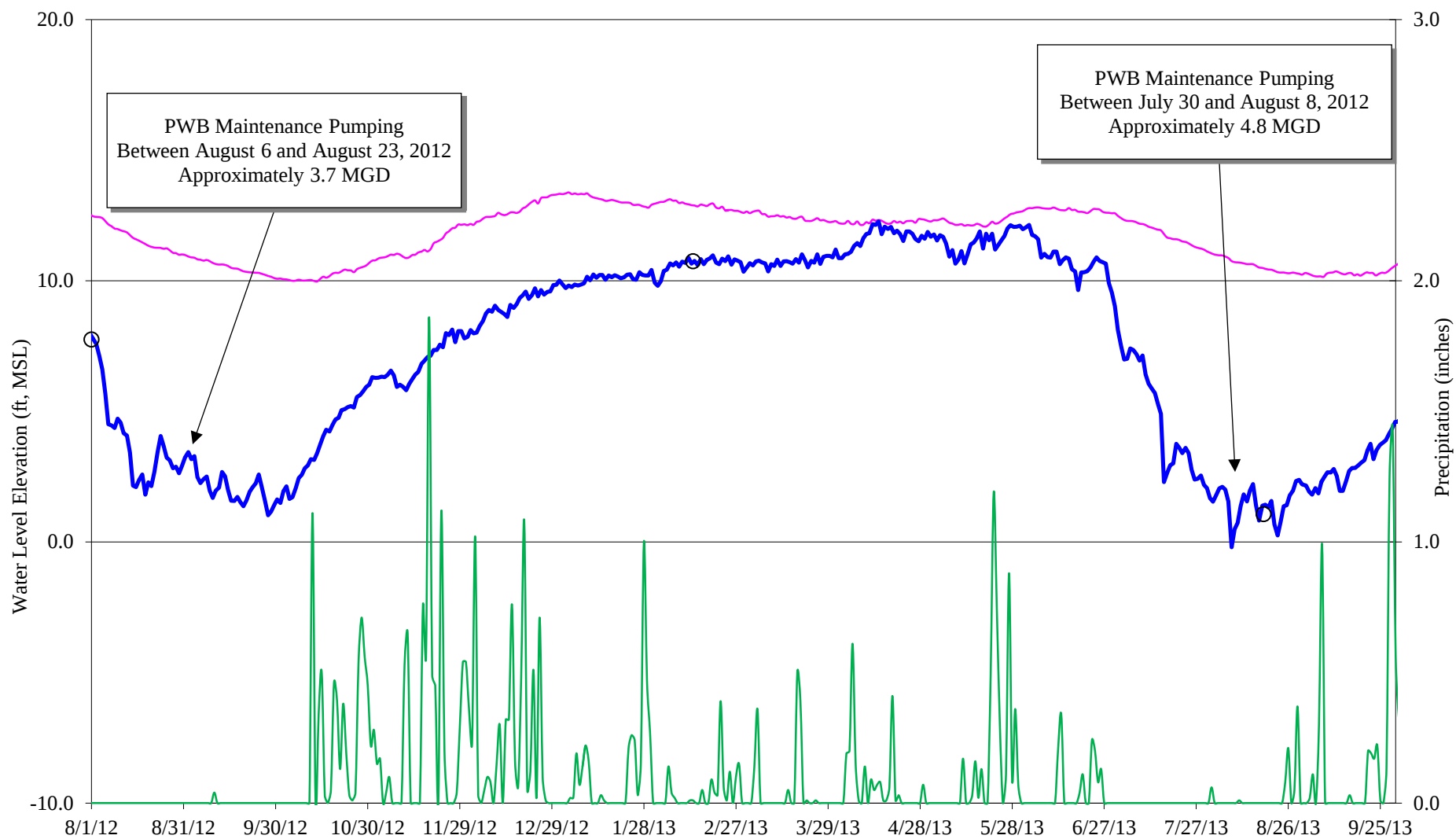






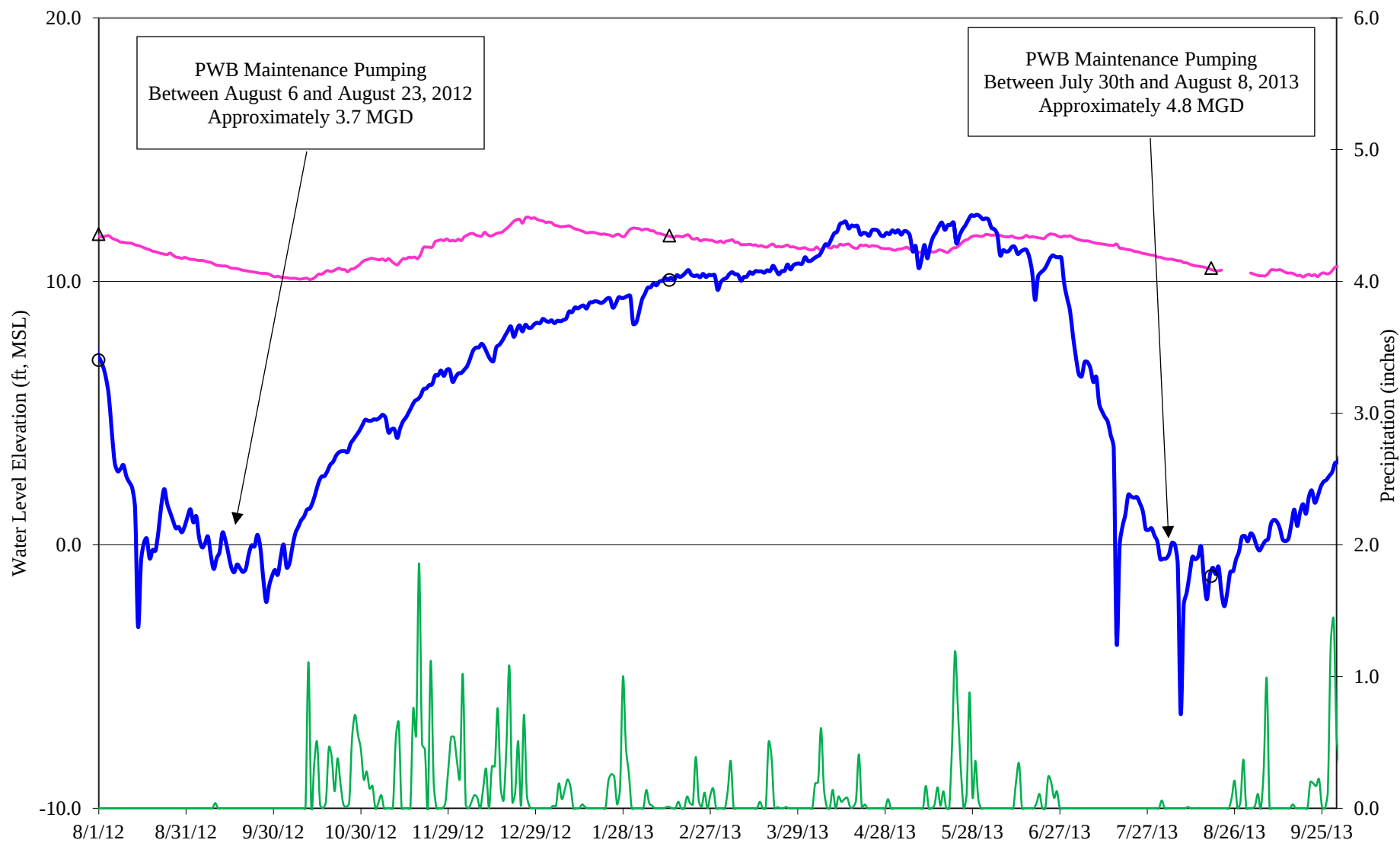




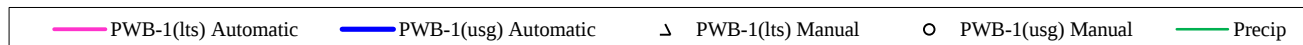


MGD = Millions of Gallons Per Day

— (dg) Automatic
 — EMC-2 usg Automatic
 ○ (usg) Manual
 — Precip



MGD = Millions of Gallons Per Day



APPENDIX C

Groundwater Quality Data

Table C-1
Groundwater Analytical Results (µg/L)
1 April 2013 through 30 September 2013
TSA Remedy- East Multnomah County

TSA Zone	Monitoring Well ID	Sample ID	Sample Date	Trichloro-ethene (TCE)	cis-1,2-Dichloro-ethene	Tetrachloro-ethene (PCE)	1,1-Dichloro-ethene	Vinyl Chloride
System Influent/effluent								
Lower	TS-C-Eff	EFF-050813	5/8/2013	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Lower	TS-C-Eff	EFF-050813-D	5/8/2013	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Lower	TS-C-Inf	INF-050813	5/8/2013	8.2	1.1	< 0.50	< 0.50	< 0.50
Lower	TS-C-Eff	CS-EFF-082013	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	TS-C-Eff	CS-EFF-082013-D	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	TS-C-Inf	CS-INF-082013	8/20/2013	5.0	< 1.0	< 1.0	< 1.0	< 1.0
Extraction wells								
Lower	EW-1	EW1-050813	5/8/2013	6.2	1.3	< 0.50	< 0.50	< 0.50
Lower	EW-1	EW1-081913	8/19/2013	2.8	< 1.0	< 1.0	< 1.0	< 1.0
Lower	EW-2	EW2-050813	5/8/2013	21	2.0	1.2	< 0.50	< 0.50
Lower	EW-2	EW2-081913	8/19/2013	12	< 1.0		< 1.0	< 1.0
Lower	EW-2	EW2-081913-D	8/19/2013	12	< 1.0	1.0 J	< 1.0	< 1.0
Lower	EW-14	EW14-050813	5/8/2013	15	1.9	0.70	< 0.50	< 0.50
Lower	EW-14	EW14-081913	8/19/2013	6.7	< 1.0	< 1.0	< 1.0	< 1.0
Lower	EW-16	EW16-050813	5/8/2013	0.70	< 0.50	< 0.50	< 0.50	< 0.50
Lower	EW-16	EW16-050813-D	5/8/2013	0.81	< 0.50	< 0.50	< 0.50	< 0.50
Lower	EW-16	EW16-082013	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	EW-23	EW23-081913	8/19/2013	2.2	< 1.0	< 1.0	< 1.0	< 1.0
Monitoring Wells								
Lower	BOP-13dg	BOP-13dg	8/5/2013	1.2	< 0.20	< 0.20	< 0.20	< 0.20
Upper	BOP-13ds	BOP-13ds	5/9/2013	3.8	0.5	0.2	< 0.20	< 0.20
Upper	BOP-13ds	BOP-13ds	8/5/2013	4.6	0.70	0.20	< 0.20	< 0.20
Lower	BOP-20dg	BOP-20dg	8/5/2013	0.90	< 0.20	< 0.20	< 0.20	< 0.20
Upper	BOP-20ds	BOP-20ds	8/5/2013	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Upper	BOP-20ds	BOP-20ds	8/5/2013	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Upper	BOP-21ds	BOP-21ds	8/5/2013	0.30	< 0.20	< 0.20	< 0.20	< 0.20
Upper	BOP-22Rds	BOP-22Rds	8/5/2013	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Lower	BOP-23dg	BOP-23dg	8/5/2013	0.80	< 0.20	< 0.20	< 0.20	< 0.20
Lower	BOP-31dg	BOP31dg	8/5/2013	4.9	0.60	0.50	< 0.20	< 0.20
Upper	BOP-31ds	BOP-31ds	5/9/2013	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Upper	BOP-31ds	BOP-31ds	8/5/2013	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Lower	BOP-41DG	BOP41DG-082013	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Upper	BOP-41DS	BOP41DS-082013	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	BOP-42dg	BOP-42dg	8/5/2013	1.1	< 0.20	< 0.20	< 0.20	< 0.20
Upper	BOP-42ds	BOP-42ds	8/5/2013	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
lower	MW-44dg	MW44dg-091613	9/16/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Upper	BOP-44DS	BOP44DS-082013	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	BOP-60dg	BOP-60dg	8/5/2013	2.6	0.40	< 0.20	< 0.20	< 0.20
Lower	BOP-60dg	BOP-60dg	8/5/2013	2.5	0.40	< 0.20	< 0.20	< 0.20
Upper	BOP-60Rds	BOP-60Rds	8/5/2013	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Lower	BOP-61dg	BOP-61dg	8/5/2013	6.9	0.80	0.20	< 0.20	< 0.20
Upper	BOP-61ds	BOP-61ds	8/5/2013	5.6	0.50	0.30	< 0.20	< 0.20
Upper	BOP-62ds	BOP-62ds	8/5/2013	0.30	< 0.20	< 0.20	< 0.20	< 0.20
Upper	BOP-65ds	BOP-65ds	8/20/2013	3.5	0.90	< 0.20	< 0.20	< 0.20
Upper	BOP-66ds	BOP-66ds	8/20/2013	2.8	< 0.20	< 0.20	< 0.20	< 0.20
Upper	BOP-70ds (215)	BOP70-DS215-08202013	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Table C-1
Groundwater Analytical Results (µg/L)
1 April 2013 through 30 September 2013
TSA Remedy- East Multnomah County

TSA Zone	Monitoring Well ID	Sample ID	Sample Date	Trichloro-ethene (TCE)	cis-1,2-Dichloro-ethene	Tetrachloro-ethene (PCE)	1,1-Dichloro-ethene	Vinyl Chloride
Upper	BOP-71ds	BOP71ds-08202013	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	CMW-8dg	MW8DG-082013	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	CMW-10dg	MW10DG-082013	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Upper	CMW-10ds	MW10ds-050813	5/8/2013	23	0.58	0.92	< 0.50	< 0.50
Upper	CMW-10ds	MW10DS-082013	8/20/2013	15	< 1.0	< 1.0	< 1.0	< 1.0
Lower	CMW-14Rds	MW14Rds-050813	5/8/2013	0.89	< 0.50	< 0.50	< 0.50	< 0.50
Lower	CMW-14Rds	MW14RDS-081913	8/19/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Upper	CMW-17ds	MW17ds-050813	5/8/2013	69	10	3.0	< 0.50	< 0.50
Upper	CMW-17ds	MW17DS-082013	8/20/2013	36	6.4	1.7	< 1.0	< 1.0
Upper	CMW-18ds	MW18ds-050813	5/8/2013	91 =, D	15	4.2	< 0.50	< 0.50
Upper	CMW-18ds	MW18DS-082013	8/20/2013	83	12	3.0	< 1.0	< 1.0
Upper	CMW-18ds	MW18DS-082013-D	8/20/2013	66	11	2.5	< 1.0	< 1.0
Upper	CMW-19ds	MW19ds-050813	5/8/2013	1.0	< 0.50	< 0.50	< 0.50	< 0.50
Upper	CMW-19ds	MW19DS-081913	8/19/2013	2.3	< 1.0	< 1.0	< 1.0	< 1.0
Upper	CMW-20ds	MW20DS-082113	8/21/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	CMW-22dg	MW22-082113	8/21/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	CMW-24dg (EW-5)	MW24DG-081913-L	8/19/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	CMW-24dg (EW-5)	MW24DG-081913-U	8/19/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	CMW-25dg	MW25DG-081913	8/19/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	CMW-26dg	MW26dg-050813	5/8/2013	6.5	< 0.50	< 0.50	< 0.50	< 0.50
Lower	CMW-26dg	MW26dg-050813-D	5/8/2013	6.4	< 0.50	< 0.50	< 0.50	< 0.50
Lower	CMW-26dg	M26DG-081913	8/19/2013	3.1	< 1.0	< 1.0	< 1.0	< 1.0
Lower	CMW-36dg	MW36DG-081913	8/19/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Upper	D-16DS	D16DS-082013	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Upper	D-16DS	D16DS-082013-D	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	D-17DG	D17DG-081913	8/19/2013	6.9	1.4	< 1.0	< 1.0	< 1.0
Lower	D-17ds	D17ds-050813	5/8/2013	73	18	2.1	< 0.50	< 0.50
Lower	D-17DS	D17DS-082013	8/20/2013	45	13	1.1	< 1.0	< 1.0
Upper	D-18DS	D18DS-082013	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Upper	EW-3	EW-3	8/6/2013	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Lower	EW-8	EW8-081913-L	8/19/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	EW-8	EW8-081913-U	8/19/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	EW-11	EW11-L-082113	8/21/2013	1.3	< 1.0	< 1.0	< 1.0	< 1.0
Lower	EW-11	EW11-082113-U	8/21/2013	1.2	< 1.0	< 1.0	< 1.0	< 1.0
Lower	EW-12	EW12-050813-L	5/8/2013	6.6	0.70	< 0.50	< 0.50	< 0.50
Lower	EW-12	EW12-050813-U	5/8/2013	6.9	0.72	0.51	< 0.50	< 0.50
Lower	EW-12	EW12-081913-L	8/19/2013	4.1	< 1.0	< 1.0	< 1.0	< 1.0
Lower	EW-12	EW12-081913-U	8/19/2013	4.4	< 1.0	< 1.0	< 1.0	< 1.0
Lower	EW-13	EW-13	8/6/2013	2.3	0.50	< 0.20	< 0.20	< 0.20
Lower	EW-15	EW15-082113-L	8/21/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	EW-15	EW15-082113-U	8/21/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	EW-18	EW18-050813-L	5/8/2013	3.1	< 0.50	< 0.50	< 0.50	< 0.50
Lower	EW-18	EW18-050813-U	5/8/2013	3.2	< 0.50	< 0.50	< 0.50	< 0.50
Lower	EW-18	EW18-081913-L	8/19/2013	2.3	< 1.0	< 1.0	< 1.0	< 1.0
Lower	EW-18	EW18-081913-U	8/19/2013	2.4	< 1.0	< 1.0	< 1.0	< 1.0

Table C-1
Groundwater Analytical Results (µg/L)
1 April 2013 through 30 September 2013
TSA Remedy- East Multnomah County

TSA Zone	Monitoring Well ID	Sample ID	Sample Date	Trichloro-ethene (TCE)	cis-1,2-Dichloro-ethene	Tetrachloro-ethene (PCE)	1,1-Dichloro-ethene	Vinyl Chloride
Lower	PMX-196	PMX196-081913	8/19/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	PMX-198	PMX198-081913	8/19/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lower	PWB-1lts	PWB1LTS-082113	8/21/2013	1.4	< 1.0	< 1.0	< 1.0	< 1.0
Upper	PWB-1uts	PWB1UTS-082013	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
SGA wells								
N/A	PWB-1usg	PWB1USG-082113	8/21/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
N/A	EMC-2USG	EMC2USG-082013	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
N/A	EMC-2USG	EMC2USG-082013-D	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
N/A	BOP-44USG	BOP44USG-082013	8/20/2013	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

NOTES:

BOP = wells installed by and/or on Boeing Corporation property.

CMW = monitoring wells installed by and/or on Cascade Corporation property.

< = compound was not detected above the reporting limit shown.

J = estimated value

"=D" diluted sample.

Sample ID with "-D" indicates duplicate sample.

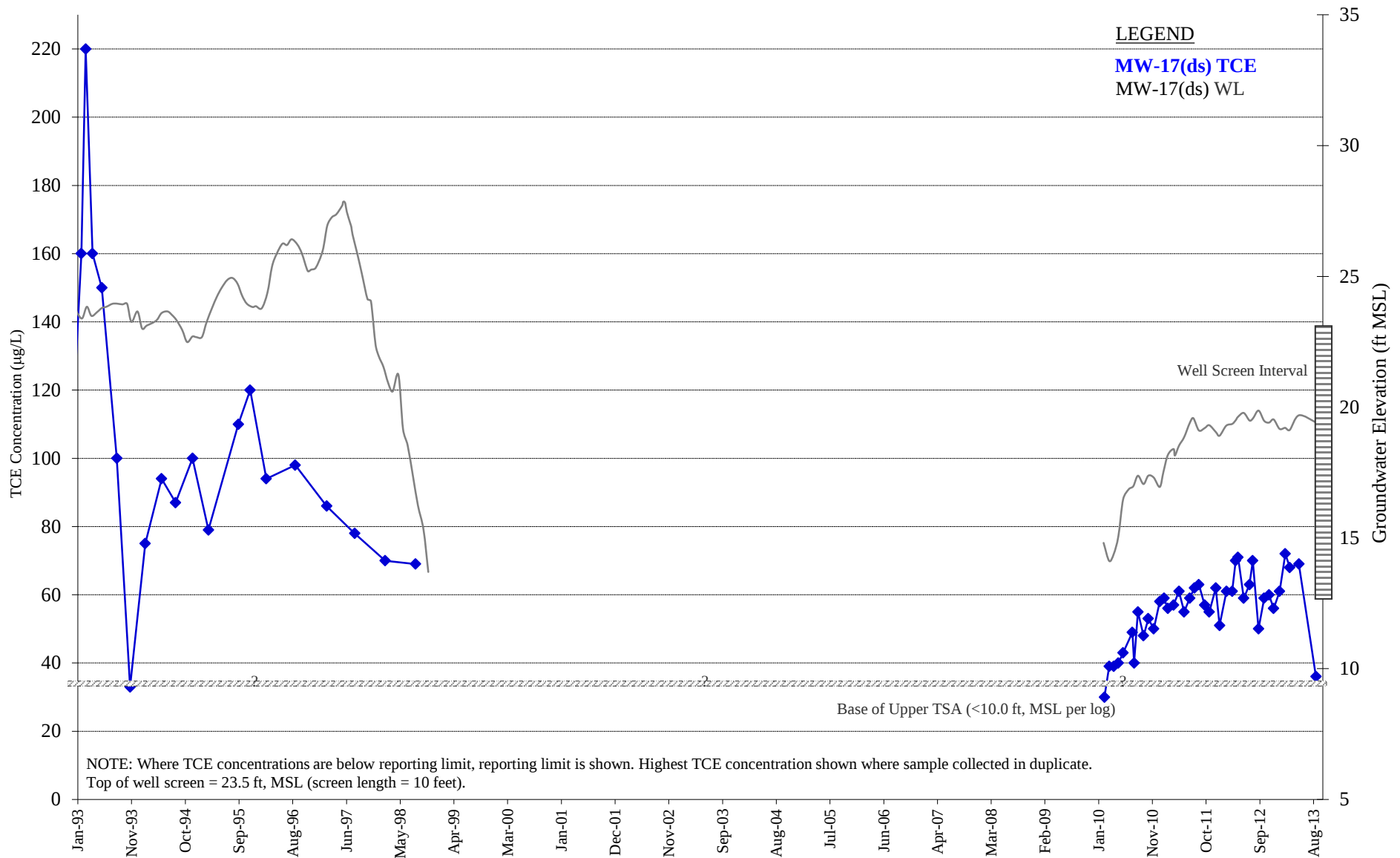
Sample ID with "-U" indicates sample collected from the upper portion of the screened interval.

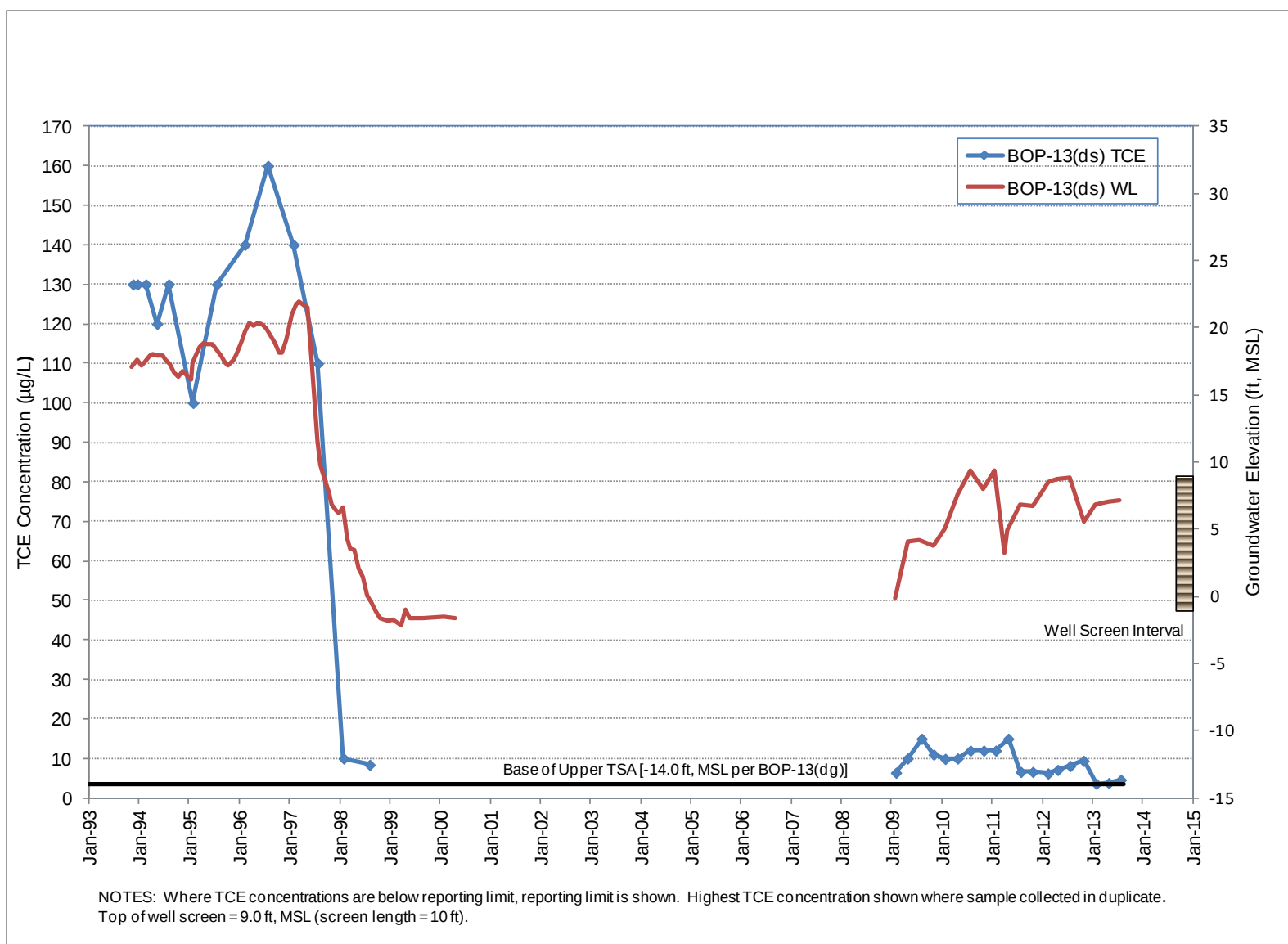
Sample ID with "-L" indicates sample collected from the lower portion of the screened interval.

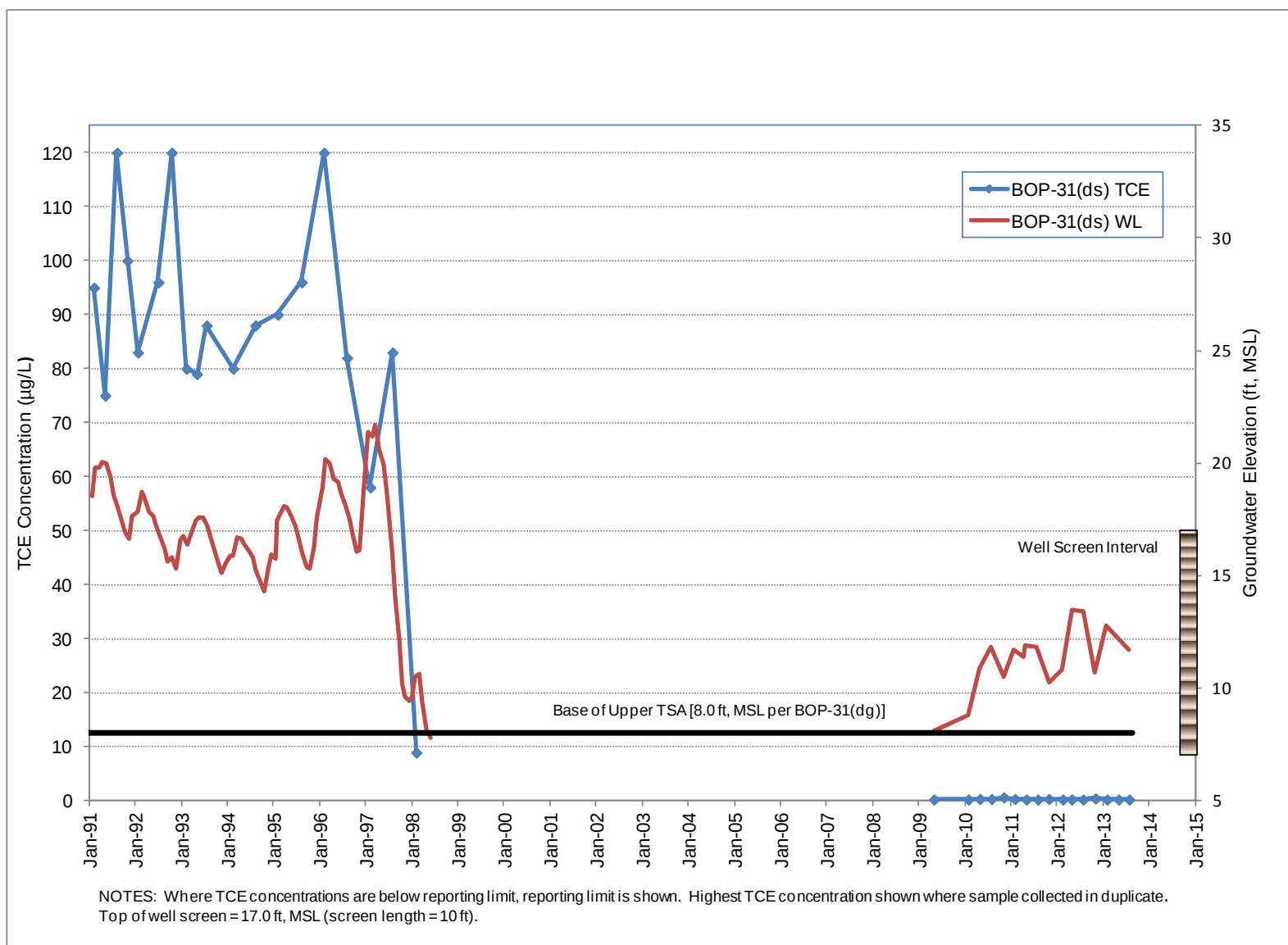
All units in micrograms per Liter (µg/L).

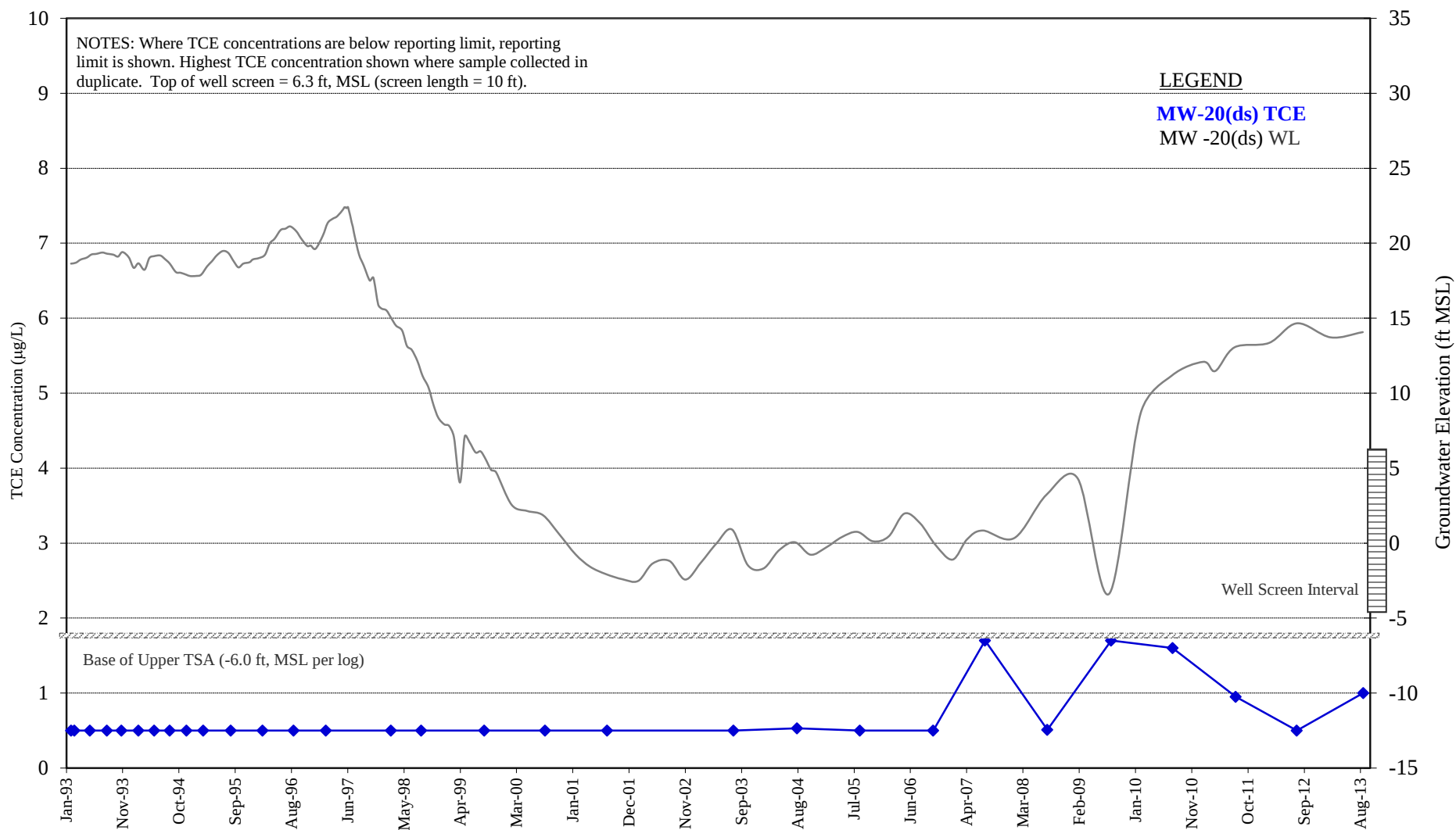
Samples analyzed using EPA Method 8260 and results shown above have been validated,
with applicable qualifiers shown.

Laboratory and validation reports for above listed samples are presented on a disc in Appendix D.







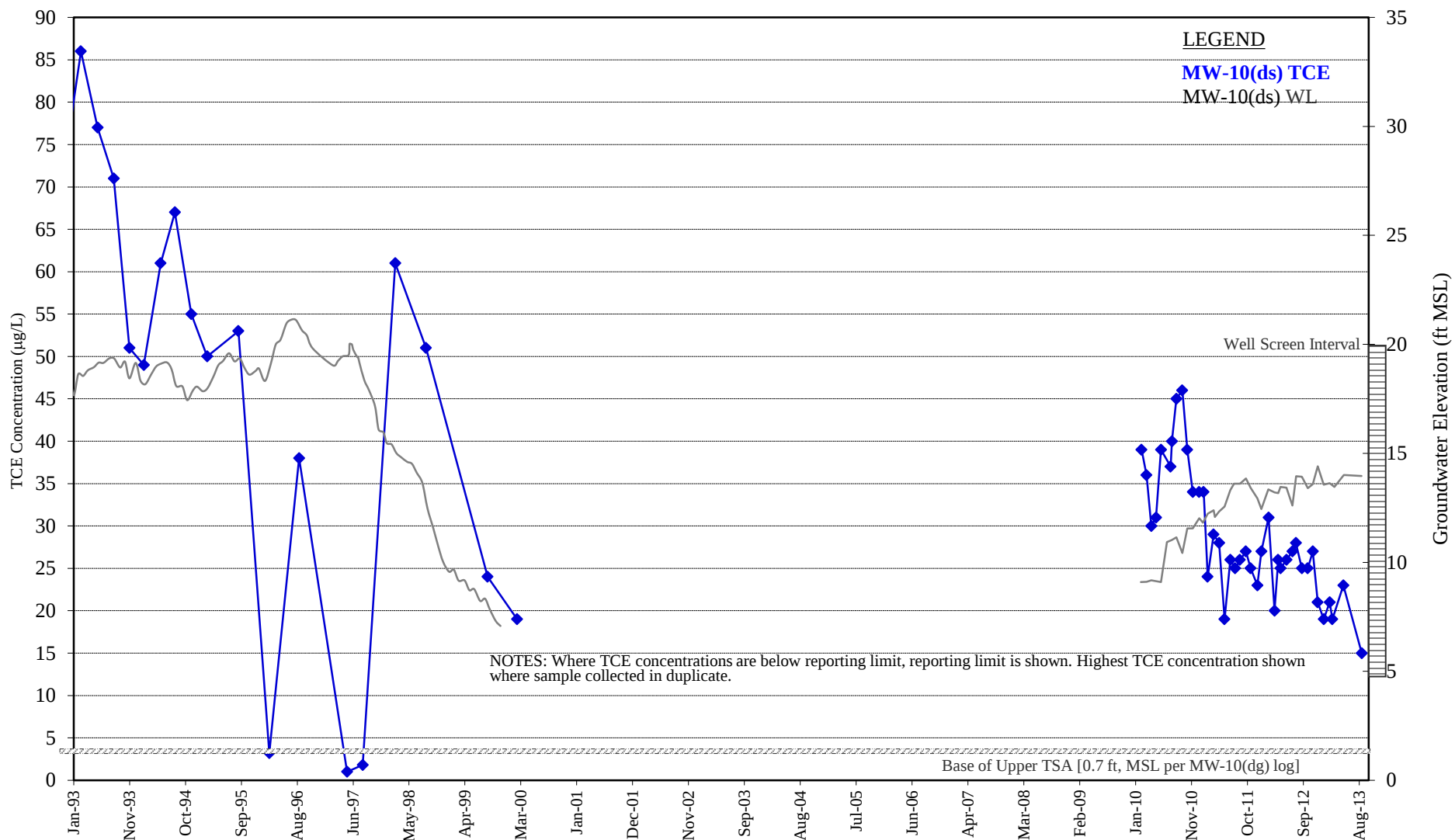


Geosyntec
consultants

Cascade Corporation
Gresham, Oregon

**TCE Concentration Profile MW-20(ds)
TSA Remedy**

Figure
C-4

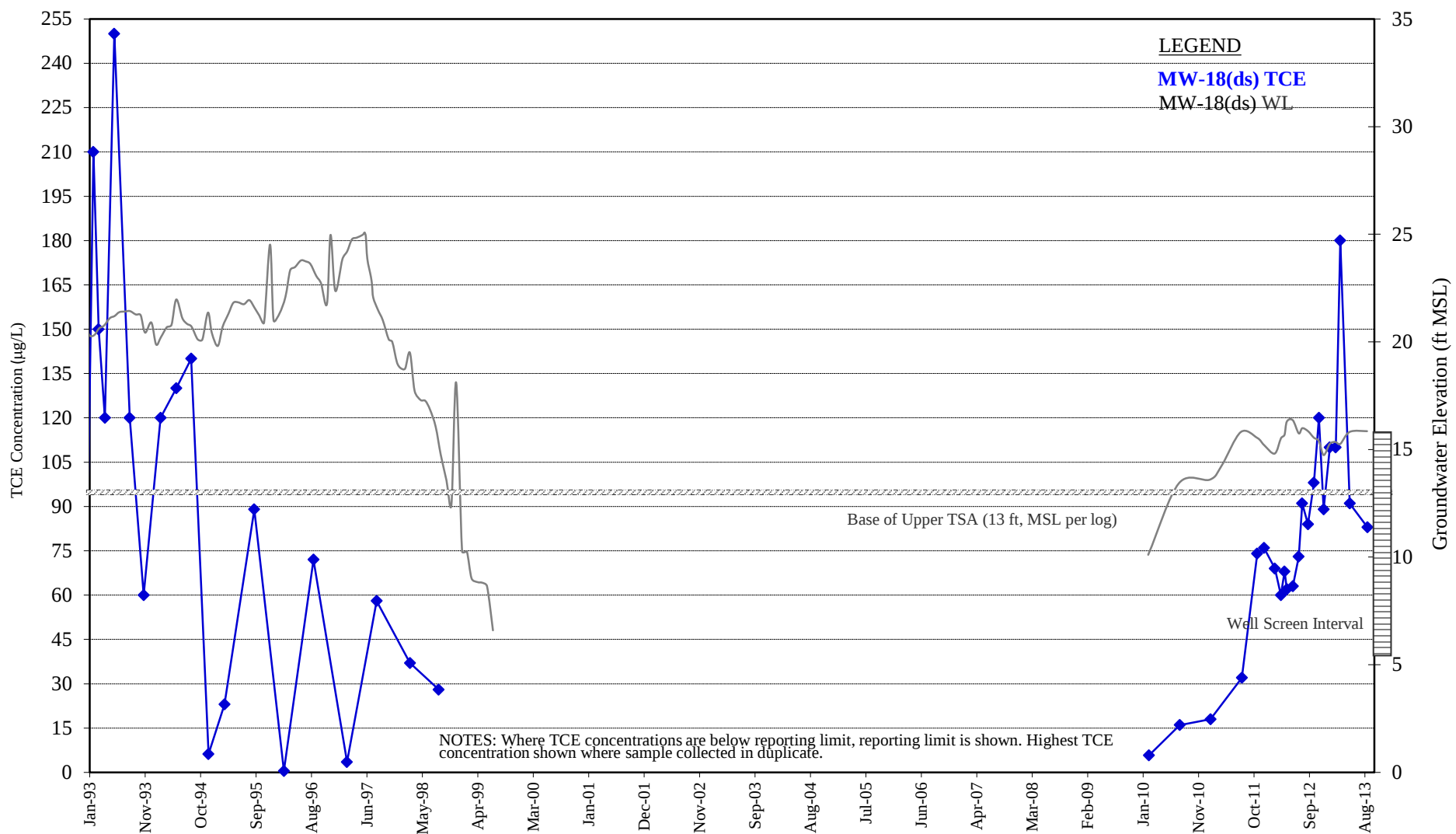


Geosyntec
consultants

Cascade Corporation
Gresham, Oregon

**TCE Concentration Profile MW-10(ds)
TSA Remedy**

Figure
C-5

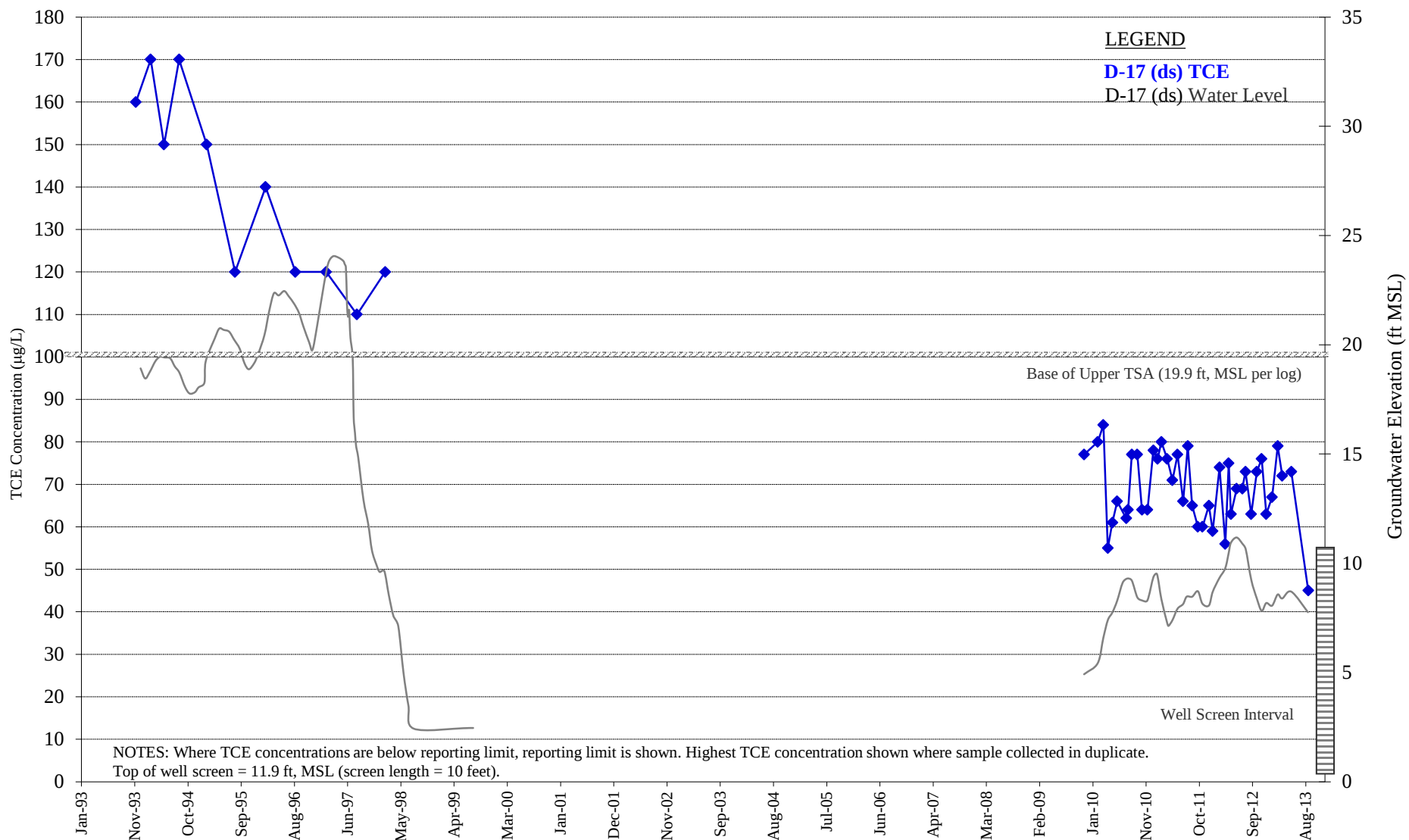


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Gresham, Oregon

TCE Concentration Profile MW-18(ds)
TSA Remedy

Figure
C-6

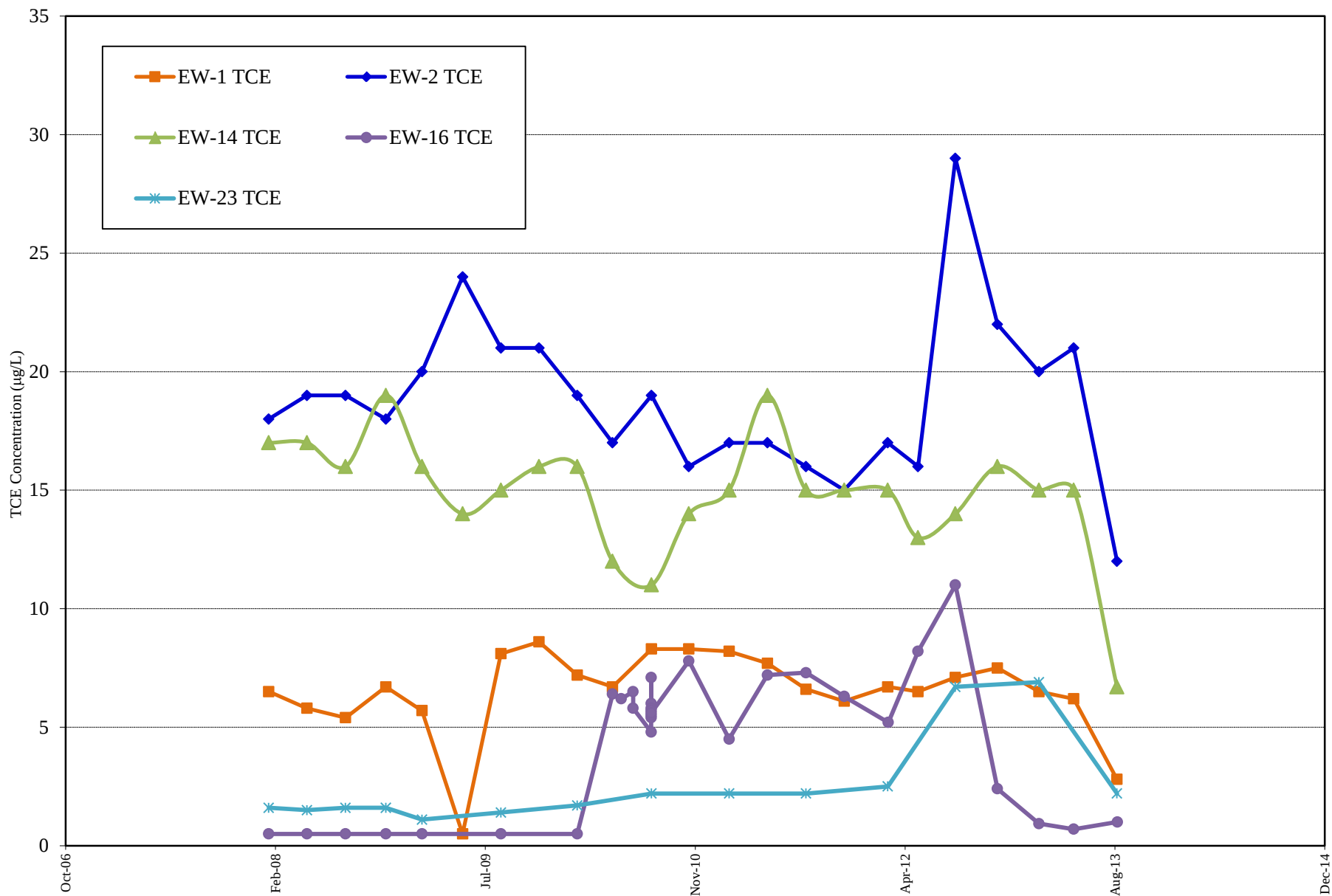


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Gresham, Oregon

TCE Concentration Profile D-17(ds)
TSA Remedy

Figure
C-7



APPENDIX D

Laboratory Reports (CD) and Data Validation Memoranda Semi-Annual Reporting Period

TECHNICAL MEMORANDUM

TO: Chris Kimmel, Project Manager

FROM: Terry McGourty and Anne Halvorsen

DATE: June 23, 2013

RE: **BOEING PORTLAND (TSA)
SECOND QUARTER 2013 GROUNDWATER QUALITY SAMPLING
LABORATORY DATA QUALITY EVALUATION**

This technical memorandum provides the results of a focused data validation associated with 2 groundwater samples and 1 trip blank collected during the second quarter 2013 TSA water quality sampling event at Boeing Portland. Samples were analyzed by Eurofins Lancaster Laboratories (LLI), located in Lancaster, Pennsylvania. This data quality evaluation covers LLI data package 1389086. Samples submitted to LLI were analyzed for volatile organic compounds [(VOCs) U.S. Environmental Protection Agency (EPA) Method SW8260C]. Sample data were evaluated in accordance with the *Boeing Portland Quality Assurance Project Plan (QAPP)* (EMCON and Landau Associates 1997) and applicable portions of the *National Functional Guidelines for Organic Data Review* (EPA 1999). The following parameters were evaluated:

- Chain-of-custody records
- Holding times
- Blank results (laboratory method and field trip)
- Surrogate recoveries
- Matrix spike/matrix spike duplicate (MS/MSD) and laboratory replicate results
- Laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) results
- Blind field duplicate results
- Quantitation limits
- Audit/corrective action records
- Completeness and overall data quality.

Data validation qualifiers are added to samples based on the evaluation of data quality. The absence of a data qualifier indicates that the reported result is acceptable without qualification. The data quality evaluation is summarized below. All data are acceptable without qualification.

CHAIN-OF-CUSTODY RECORDS

A signed chain-of-custody (COC) record was attached to this data package. The laboratory received all samples in good condition. All analyses were performed as requested. No special cleanups or handling methods were requested. No qualification of the data is necessary.

Upon receipt by LLI, the sample container information was compared to the associated chain-of-custody and the cooler temperature was recorded. The cooler associated with this data package was received with a temperature below the EPA-recommended limit of $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ (1.8°C). Data were not qualified based upon the cooler temperatures.

HOLDING TIMES

For all analyses and all samples, the time between sample collection, extraction (if applicable), and analysis was determined to be within EPA- and project-specified holding times. No qualification of the data is necessary.

BLANK RESULTS

Laboratory Method Blanks

At least one method blank was analyzed with this batch of samples for VOCs analysis. No contamination was detected in the method blanks. No qualification of the data is necessary.

Field Trip Blanks and Field Equipment Blanks

One trip blank was analyzed with this batch of samples for VOCs analysis. No contamination was detected in the trip blank. No qualification of the data is necessary.

No field equipment blanks were submitted for analysis with this batch of samples.

SURROGATE RECOVERIES

Appropriate compounds were used as surrogate spikes for the VOCs analysis. Recovery values for the surrogate spikes were within the current laboratory-specified control limits. No qualification of the data is necessary.

MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD) AND LABORATORY REPLICATE RESULTS

No matrix spike or laboratory duplicate samples were analyzed with this data package.

LABORATORY CONTROL SAMPLE AND LABORATORY CONTROL SAMPLE DUPLICATE (LCS/LCSD) RESULTS

At least one laboratory control sample and/or laboratory control sample duplicate (LCS/LCSD) was analyzed with this batch of samples for VOC analysis. Recoveries and relative percent differences (RPDs) for the laboratory control samples and associated duplicates were within the current laboratory-specified control limits with the following exception:

- The percent recovery values for the LCS associated with the VOC analyses for 1,2-dichloroethane in this data package were slightly above the laboratory-specified control limits. Since the associated samples are not detected, no qualification of the data is necessary.

BLIND FIELD DUPLICATE RESULTS

No blind field duplicates were submitted for analysis with this batch of samples.

QUANTITATION LIMITS

Project-specified quantitation limits were met for all samples except for instances where high concentrations required dilution of the sample extracts.

AUDIT/CORRECTIVE ACTION RECORDS

No audits were performed or required. No corrective action records were generated for this sample batch.

Continuing calibration (CCV) recovery results are provided with this data package. All project samples results associated with the high CCAL recovery of 1,2-dichloroethane in this data package are not detected and, therefore, no qualification of the data is necessary.

COMPLETENESS AND OVERALL DATA QUALITY

The completeness for this data set is 100 percent, which meets the project-specified goal of 90 percent minimum.

Data precision was evaluated through laboratory control sample duplicates. Data accuracy was evaluated through laboratory control samples and surrogate spikes. No data were rejected.

REFERENCES

EMCON and Landau Associates. 1997. *Appendix D, Quality Assurance Project Plan, Troutdale Sandstone Aquifer Remedy, Remedial Design and Remedial Action Work Plan, Troutdale Sandstone Aquifer, East Multnomah County, Oregon*. Prepared for Cascade Corporation and The Boeing Company. June 19.

EPA. 1999. *Contract Laboratory Program National Functional Guidelines for Organic Data Review*. U.S. Environmental Protection Agency. October.

Memorandum

Date: 03 October 2013
To: Cindy Bartlett, RG, LG, Geosyntec Consultants, Portland, Oregon
From: Geosyntec Quality Assurance Group, Knoxville, Tennessee
Subject: **Stage 2A Data Validation - Level II Data Deliverables – ESC Lab Sciences (ESC) Work Orders: L652830, L653204, L653217, and L653415**

SITE: Cascade Corporation in Fairview, Oregon; Job No: PNG0564S-05

INTRODUCTION

This report summarizes the findings of the Stage 2A data validation of Fifty (50) water samples, five field duplicate samples, and four trip blanks, collected on August 19-21, 2013, as part of the site investigation activities for the Cascade Corporation in Fairview, Oregon. ESC, Mt. Juliet, Tennessee, analyzed the samples. The samples were analyzed for the following test:

- EPA Method 8260B - Volatile Organic Compounds (VOCs)
- EPA Method 9056 - Chloride and Fluoride
- Standard Method 9223B-2004 – E. Coli and Coliform

EXECUTIVE SUMMARY

The samples were handled, prepared, and measured in the same manner under similar prescribed conditions.

Overall, based on this Stage 2A data validation covering the quality control (QC) parameters listed below, the data as qualified are usable for meeting project objectives, with the following exceptions.

The undetected values for 2-chloroethyl vinyl ether were rejected in the samples due to matrix spike/matrix spike duplicate (MS/MSD) recoveries less than 20%.

The undetected concentrations of the compounds associated with internal standards 2-bromo-1-chloropropane and 1,4-dichlorobenzene-D4 in samples EW2-081913 and EW2-081913-D were R qualified as rejected due to low internal standard recoveries.

The organic data were reviewed based on USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, June 2008 (USEPA-540-R-08-01), as well as by the pertinent methods referenced by the data package and professional judgment.

The inorganic data were reviewed based on USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, January 2010 (USEA-540-R-10-011), as well as by the pertinent methods referenced by the data package and professional judgment.

The sample results were reported in four ESC reports. The samples reported in each ESC report are listed in the table below.

ESC Report No.	Date of Report	Samples	Equip. Blank	Trip Blank
L652830	08/27/2013	D17DG-081913, EW12-081913-U, EW12-081913-L, EW18-081913-U, EW18-081913-L, MW24DG-081913-U, MW24DG-081913-L, MW14RDS-081913, MW36DG-081913, PMX196-081913, M26DG-081913, EW1-081913, EW2-081913, EW2-081913-D, EW14-081913, EW23-081913, EW8-081913-U, EW8-081913-L, MW25DG-081913, PMX198-081913, TRIP BLANK, MW19DS-081913	No	Yes
L653204	08/29/2013	BOP41DG-082013, BOP44DS-082013, BOP70 DS-215, BOP71-082013, D16DS-082013, D16DS-082013-D, D18DS-082013, MW8DG-082013, MW10DG-082013, MW18DS-082013, MW18DS-082013-D, PWB1UTS-082013, EMC2USG-082013, EMC2USG-082013-D, BOP44USG-082013, EW16-082013, D17DS-082013, MW10DS-082013, MW17DS-082013, TRIPBLANK, BOP41DS-082013	No	Yes
L653217	08/29/2013	CS-INF-082013, CS-EFF-082013, CS-EFF-082013-D, TRIPBLANK	No	Yes
L653415	08/29/2013	MW20DS-082113, EW11-082113-L, EW11-082113, EW15-082113-U, EW15-082113-L, EW15-082113, EW11-082113-U, MW22-082113 (1225), MW22-082113 (1255), PWB1LTS-082113, PWB1USG-082113, TRIPBLANK	No	Yes

The samples were received at the laboratory within the criteria $<6^{\circ}\text{C}$, but not frozen. The cooler temperatures were documented at 2.4°C , 3.1°C , 3.1°C , and 3.7°C . No sample preservation issues were noted by the laboratory.

For ESC report L652830 sample MW19DS-081913 was included with the shipment but not listed on the chain of custody (COC). Also, for ESC report L653204 sample MW10DS-082013 was listed twice on the COC and BOP41DS-082013 was not listed. Both samples were logged in as labeled. This did not affect the quality of the data.

The four E. coli and coliform samples were received and analyzed by the laboratory past the 6 hour holding time. The results for the E. coli and total coliform are usable for a “present” or “not present” approach only.

Incorrect error corrections were observed on the COC forms instead of the proper procedure of a single line through, initial and date. This did not affect the quality of the data.

1.0 VOCs

Forty-seven (47) water samples, five field duplicate samples, and four trip blanks were analyzed for VOCs per EPA Method 8260B.

The areas of data review are listed below. A leading check mark (✓) indicates an area of review in which the data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ⊗ Overall Assessment
- ✓ Holding Time
- ✓ Method Blank
- ⊗ Matrix Spike/Matrix Spike Duplicate
- ⊗ Laboratory Control Sample
- ✓ Surrogates
- ⊗ Field Duplicate
- ✓ Trip Blank
- ✓ Sensitivity
- ✓ Electronic Data Deliverables Review

1.1 Overall Assessment

The VOC data reported in this package are considered to be usable for meeting project objectives, with the following exception. The analytical completeness, defined as the ratio of the number of valid analytical results (valid analytical results include values qualified as estimated) to the total number of analytical results requested on samples submitted for analysis, for the project is 96.7%.

The undetected values for 2-chloroethyl vinyl ether were R qualified as rejected in the samples due to MS/MSD recoveries less than 20% (see Section 1.4 below).

The laboratory noted in the report L652830 that the internal standard recoveries were not met for samples EW2-081913 and EW2-081913-D. The raw data showed that internal standards 2-bromo-1-chloropropane and 1,4-dichlorobenzene-D4 had recoveries less than 50%. Therefore, the undetected values of the associated compounds in EW2-081913 and EW2-081913-D were R qualified as rejected and the detected values were J qualified as estimated.

Client Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier	Reason Code
EW2-081913	1,1,1,2-Tetrachloroethane	1.0	U	1.0	R	11
EW2-081913	1,1,2-Trichloroethane	1.0	U	1.0	R	11
EW2-081913	1,2,3-Trimethylbenzene	1.0	U	1.0	R	11
EW2-081913	1,2,4-Trichlorobenzene	1.0	U	1.0	R	11
EW2-081913	1,1,2,2-Tetrachloroethane	1.0	U	1.0	R	11
EW2-081913	1,2,4-Trimethylbenzene	1.0	U	1.0	R	11
EW2-081913	1,2,3-Trichloropropane	2.5	U	2.5	R	11
EW2-081913	1,2,3-Trichlorobenzene	1.0	U	1.0	R	11
EW2-081913	1,2-Dibromo-3-Chloropropane	5.0	U	5.0	R	11
EW2-081913	1,2-Dichlorobenzene	1.0	U	1.0	R	11
EW2-081913	1,2-Dibromoethane	1.0	U	1.0	R	11
EW2-081913	1,3,5-Trimethylbenzene	1.0	U	1.0	R	11
EW2-081913	1,3-Dichlorobenzene	1.0	U	1.0	R	11
EW2-081913	p-Chlorotoluene	1.0	U	1.0	R	11
EW2-081913	1,3-Dichloropropane	1.0	U	1.0	R	11
EW2-081913	1,4-Dichlorobenzene	1.0	U	1.0	R	11
EW2-081913	o-Chlorotoluene	1.0	U	1.0	R	11
EW2-081913	Bromobenzene	1.0	U	1.0	R	11
EW2-081913	Chlorobenzene	1.0	U	1.0	R	11
EW2-081913	Bromoform	1.0	U	1.0	R	11
EW2-081913	Chlorodibromomethane	1.0	U	1.0	R	11
EW2-081913	Ethylbenzene	1.0	U	1.0	R	11
EW2-081913	Hexachlorobutadiene (HCBD)	1.0	U	1.0	R	11
EW2-081913	Isopropylbenzene	1.0	U	1.0	R	11
EW2-081913	Naphthalene	5.0	U	5.0	R	11
EW2-081913	Butylbenzene	1.0	U	1.0	R	11
EW2-081913	n-Propylbenzene	1.0	U	1.0	R	11

Cascade Springs Site Validation

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Client Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier	Reason Code
EW2-081913	p-Cymene	1.0	U	1.0	R	11
EW2-081913	sec-Butylbenzene	1.0	U	1.0	R	11
EW2-081913	Styrene	1.0	U	1.0	R	11
EW2-081913	tert-Butylbenzene	1.0	U	1.0	R	11
EW2-081913	Tetrachloroethene (PCE)	1.0	U	1.0	R	11
EW2-081913	Total Xylene	3.0	U	3.0	R	11
EW2-081913-D	1,1,1,2-Tetrachloroethane	1.0	U	1.0	R	11
EW2-081913-D	1,1,2-Trichloroethane	1.0	U	1.0	R	11
EW2-081913-D	1,2,3-Trimethylbenzene	1.0	U	1.0	R	11
EW2-081913-D	1,2,4-Trichlorobenzene	1.0	U	1.0	R	11
EW2-081913-D	1,1,2,2-Tetrachloroethane	1.0	U	1.0	R	11
EW2-081913-D	1,2,4-Trimethylbenzene	1.0	U	1.0	R	11
EW2-081913-D	1,2,3-Trichloropropane	2.5	U	2.5	R	11
EW2-081913-D	1,2,3-Trichlorobenzene	1.0	U	1.0	R	11
EW2-081913-D	1,2-Dibromo-3-Chloropropane	5.0	U	5.0	R	11
EW2-081913-D	1,2-Dichlorobenzene	1.0	U	1.0	R	11
EW2-081913-D	1,2-Dibromoethane	1.0	U	1.0	R	11
EW2-081913-D	1,3,5-Trimethylbenzene	1.0	U	1.0	R	11
EW2-081913-D	1,3-Dichlorobenzene	1.0	U	1.0	R	11
EW2-081913-D	p-Chlorotoluene	1.0	U	1.0	R	11
EW2-081913-D	1,3-Dichloropropane	1.0	U	1.0	R	11
EW2-081913-D	1,4-Dichlorobenzene	1.0	U	1.0	R	11
EW2-081913-D	o-Chlorotoluene	1.0	U	1.0	R	11
EW2-081913-D	Bromobenzene	1.0	U	1.0	R	11
EW2-081913-D	Chlorobenzene	1.0	U	1.0	R	11
EW2-081913-D	Bromoform	1.0	U	1.0	R	11
EW2-081913-D	Chlorodibromomethane	1.0	U	1.0	R	11
EW2-081913-D	Ethylbenzene	1.0	U	1.0	R	11
EW2-081913-D	Hexachlorobutadiene (HCBd)	1.0	U	1.0	R	11
EW2-081913-D	Isopropylbenzene	1.0	U	1.0	R	11
EW2-081913-D	Naphthalene	5.0	U	5.0	R	11
EW2-081913-D	Butylbenzene	1.0	U	1.0	R	11
EW2-081913-D	n-Propylbenzene	1.0	U	1.0	R	11
EW2-081913-D	p-Cymene	1.0	U	1.0	R	11
EW2-081913-D	sec-Butylbenzene	1.0	U	1.0	R	11

Client Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier	Reason Code
EW2-081913-D	Styrene	1.0	U	1.0	R	11
EW2-081913-D	tert-Butylbenzene	1.0	U	1.0	R	11
EW2-081913-D	Tetrachloroethene (PCE)	1.0		1.0	J	11
EW2-081913-D	Total Xylene	3.0	U	3.0	R	11

U-not detected at or above the stated RL

1.2 Holding Time

The holding time for the VOC analysis of a preserved water sample is 14 days from collection to analysis. The holding times were met for the sample analyses.

1.3 Method Blank

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Ten method blanks were reported with the data sets. VOCs were not detected in the method blanks above the detection limits (DL).

1.4 Matrix Spike/Matrix Spike Duplicate

Four sample specific MS/MSD pairs were reported using samples MW24DG-081913-U, MW19DS-081913, BOP41DG-082013, and CS-INF-082013. The results for the sample batch MS/MSD pairs were within the laboratory specified acceptance criteria for recovery and relative percent difference (RPD), with the following exceptions.

The recoveries of 2-chloroethyl vinyl ether were low and less than 20% in the MS/MSD pairs using samples MW24DG-081913-U, MW19DS-081913, BOP41DG-082013, and CS-INF-082013. Also the RPD was high in each of the MS/MSD pairs for 2-chloroethyl vinyl ether. Based on professional judgment and because the recoveries were <20% the values for 2-chloroethyl vinyl ether in the samples were R qualified as rejected.

The recoveries of acrolein were high and above the laboratory specified acceptance criteria in the MS/MSD pairs using samples MW19DS-081913 and CS-INF-082013. However since there were no detections for acrolein in MW19DS-081913 and CS-INF-082013, no qualifications were added to the data set.

For MS/MSD pair using sample BOP41DG-082013 the RPDs were high and above the laboratory specified acceptance criteria for 1,1,1-trichloroethane, 1,1,2-trichlorotrifluoroethane, 1,1-dichloroethene, 1,1-dichloropropene, carbon tetrachloride, chloromethane, dichlorodifluoromethane, 2,2-dichloropropane, tetrachloroethene, trichloroethene, trichlorofluoromethane, and vinyl chloride. However since there were

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no detections for the compounds above the DL in sample BOP41DG-082013, no qualifications were added to the data set.

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Validation Reason Code**
D17DG-081913	2-Chloroethyl vinyl ether	50	U	50	R	4
EW12-081913-U	2-Chloroethyl vinyl ether	50	U	50	R	4
EW12-081913-L	2-Chloroethyl vinyl ether	50	U	50	R	4
EW18-081913-U	2-Chloroethyl vinyl ether	50	U	50	R	4
EW18-081913-L	2-Chloroethyl vinyl ether	50	U	50	R	4
MW24DG-081913-U	2-Chloroethyl vinyl ether	50	U	50	R	4
MW24DG-081913-L	2-Chloroethyl vinyl ether	50	U	50	R	4
MW14RDS-081913	2-Chloroethyl vinyl ether	50	U	50	R	4
MW36DG-081913	2-Chloroethyl vinyl ether	50	U	50	R	4
PMX196-081913	2-Chloroethyl vinyl ether	50	U	50	R	4
M26DG-081913	2-Chloroethyl vinyl ether	50	U	50	R	4
EW1-081913	2-Chloroethyl vinyl ether	50	U	50	R	4
EW2-081913	2-Chloroethyl vinyl ether	50	U	50	R	4
EW2-081913-D	2-Chloroethyl vinyl ether	50	U	50	R	4
EW14-081913	2-Chloroethyl vinyl ether	50	U	50	R	4
EW23-081913	2-Chloroethyl vinyl ether	50	U	50	R	4
EW8-081913-U	2-Chloroethyl vinyl ether	50	U	50	R	4
EW8-081913-L	2-Chloroethyl vinyl ether	50	U	50	R	4
MW25DG-081913	2-Chloroethyl vinyl ether	50	U	50	R	4

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Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Validation Reason Code**
PMX198-081913	2-Chloroethyl vinyl ether	50	U	50	R	4
TRIP BLANK (ESC report L652830)	2-Chloroethyl vinyl ether	50	U	50	R	4
MW19DS-081913	2-Chloroethyl vinyl ether	50	U	50	R	4
BOP41DG-082013	2-Chloroethyl vinyl ether	50	U	50	R	4
BOP44DS-082013	2-Chloroethyl vinyl ether	50	U	50	R	4
BOP70 DS-215	2-Chloroethyl vinyl ether	50	U	50	R	4
BOP71-082013	2-Chloroethyl vinyl ether	50	U	50	R	4
D16DS-082013	2-Chloroethyl vinyl ether	50	U	50	R	4
D16DS-082013-D	2-Chloroethyl vinyl ether	50	U	50	R	4
D18DS-082013	2-Chloroethyl vinyl ether	50	U	50	R	4
MW8DG-082013	2-Chloroethyl vinyl ether	50	U	50	R	4
MW10DG-082013	2-Chloroethyl vinyl ether	50	U	50	R	4
MW18DS-082013	2-Chloroethyl vinyl ether	50	U	50	R	4
MW18DS-082013-D	2-Chloroethyl vinyl ether	50	U	50	R	4
PWB1UTS-082013	2-Chloroethyl vinyl ether	50	U	50	R	4
EMC2USG-082013	2-Chloroethyl vinyl ether	50	U	50	R	4
EMC2USG-082013-D	2-Chloroethyl vinyl ether	50	U	50	R	4
BOP44USG-082013	2-Chloroethyl vinyl ether	50	U	50	R	4
EW16-082013	2-Chloroethyl vinyl ether	50	U	50	R	4

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Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Validation Reason Code**
D17DS-082013	2-Chloroethyl vinyl ether	50	U	50	R	4
MW10DS-082013	2-Chloroethyl vinyl ether	50	U	50	R	4
MW17DS-082013	2-Chloroethyl vinyl ether	50	U	50	R	4
TRIPBLANK (ESC report L653204)	2-Chloroethyl vinyl ether	50	U	50	R	4
BOP41DS-082013	2-Chloroethyl vinyl ether	50	U	50	R	4
CS-INF-082013	2-Chloroethyl vinyl ether	50	U	50	R	4
CS-EFF-082013	2-Chloroethyl vinyl ether	50	U	50	R	4
CS-EFF-082013-D	2-Chloroethyl vinyl ether	50	U	50	R	4
TRIPBLANK (ESC report L653217)	2-Chloroethyl vinyl ether	50	U	50	R	4
MW20DS-082113	2-Chloroethyl vinyl ether	50	U	50	R	4
EW11-L-082113	2-Chloroethyl vinyl ether	50	U	50	R	4
EW15-082113-U	2-Chloroethyl vinyl ether	50	U	50	R	4
EW15-082113-L	2-Chloroethyl vinyl ether	50	U	50	R	4
EW11-082113-U	2-Chloroethyl vinyl ether	50	U	50	R	4
MW22-082113	2-Chloroethyl vinyl ether	50	U	50	R	4
PWB1LTS-082113	2-Chloroethyl vinyl ether	50	U	50	R	4
PWB1USG-082113	2-Chloroethyl vinyl ether	50	U	50	R	4

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Validation Reason Code**
TRIPBLANK (ESC report L653415)	2-Chloroethyl vinyl ether	50	U	50	R	4

U-not detected at the reported DL

µg/L-microgram per liter

*Validation qualifiers are defined in Attachment 1 at the end of this report

**Reason codes are defined in Attachment 2 at the end of this report

1.5 Laboratory Control Sample (LCS)

LCSs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Ten LCS/LCS duplicate (LCSD) pairs were reported with the data sets. The results for the LCS/LCSD pairs were within the laboratory specified acceptance criteria for recovery and RPD, with the following exceptions.

The recovery of trichlorofluoromethane was low and outside the laboratory specified acceptance criteria in the LCS in batch WG677886 in laboratory report L652830. Therefore the undetected results in the associated samples are UJ qualified as estimated less than the DL.

The RPD of vinyl chloride was high and outside the laboratory specified acceptance criteria in the LCS/LCSD pair in batch WG677867 in laboratory report L652830. However since vinyl chloride was not detected in the associated samples, no qualifications were added to the data set.

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Validation Reason Code**
MW24DG-081913-U	Trichlorofluoromethane	5	U,J4	50	UJ	5
MW24DG-081913-L	Trichlorofluoromethane	5	U,J4	50	UJ	5
MW14RDS-081913	Trichlorofluoromethane	5	U,J4	50	UJ	5
MW36DG-081913	Trichlorofluoromethane	5	U,J4	50	UJ	5
PMX196-081913	Trichlorofluoromethane	5	U,J4	50	UJ	5
M26DG-081913	Trichlorofluoromethane	5	U,J4	50	UJ	5

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Validation Reason Code**
EW1-081913	Trichlorofluoromethane	5	U,J4	50	UJ	5
EW2-081913	Trichlorofluoromethane	5	U,J4	50	UJ	5
EW2-081913-D	Trichlorofluoromethane	5	U,J4	50	UJ	5
EW14-081913	Trichlorofluoromethane	5	U,J4	50	UJ	5
EW23-081913	Trichlorofluoromethane	5	U,J4	50	UJ	5
EW8-081913-U	Trichlorofluoromethane	5	U,J4	50	UJ	5
EW8-081913-L	Trichlorofluoromethane	5	U,J4	50	UJ	5
MX25DG-081913	Trichlorofluoromethane	5	U,J4	50	UJ	5
PMX198-081913	Trichlorofluoromethane	5	U,J4	50	UJ	5
TRIP BLANK (ESC lab report L652830)	Trichlorofluoromethane	5	U,J4	50	UJ	5

U-not detected at the reported DL

J4- laboratory flag defined as batch QC was outside the established quality control range for accuracy

µg/L-microgram per liter

*Validation qualifiers are defined in Attachment 1 at the end of this report

**Reason codes are defined in Attachment 2 at the end of this report

1.6 Surrogates

Acceptable surrogate recoveries were reported for the sample analyses, with the following exceptions. Dibromofluoromethane recovery was low and below the laboratory specified limit in sample EW2-081913, EW2-081913-D, EW14-081913. 4-Bromofluorobenzene recovery was low and below the laboratory specified limit in sample PMX198-081913. However, based on professional judgment and because the remaining two surrogates were acceptable, no qualifications were added to the data set.

1.7 Field Duplicate

Five field duplicate samples, EW2-081913-D, D16DS-082013-D, MW18DS-082013-D, EMCUSG-082013-D, and CS-EFF-082013-D were analyzed with the data sets. Acceptable precision (RPD $\leq 30\%$) was demonstrated between the field duplicates and the original samples, EW2-081913, D16DS-082013, MW18DS-082013, EMCUSG-082013, and CS-EFF-082013, respectively, with the following exception.

For field duplicate sample EW2-081913-D the result for tetrachloroethene was detected above the DL but not detected in the associated sample, EW2-081913. Therefore the RPD was not calculable. However since tetrachloroethene in EW2-081913-D and EW2-081913 was qualified for internal standard recovery, no additional qualifications were added to the data set.

Sample ID	Compound	Laboratory Concentration (µg/L)	Laboratory Flag	RPD (%)
EW2-081913	Tetrachloroethene	1.0	U, V3	NC
EW2-081913-D		1.0	V3	
EW2-081913	Trichloroethene	12	NA	0
EW2-081913-D		12	NA	
EW2-081913	All other VOCs	ND	U	0
EW2-081913-D		ND	U	
D16DS-082013	All VOCs	ND	U	0
D16DS-082013-D		ND	U	
MW18DS-082013	cis-1,2-Dichloroethene	12	NA	9
MW18DS-082013-D		11	NA	
MW18DS-082013	Tetrachloroethene	3.0	NA	18
MW18DS-082013-D		2.5	NA	
MW18DS-082013	Trichloroethene	83	NA	23
MW18DS-082013-D		66	NA	
MW18DS-082013	All other VOCs	ND	U	0
MW18DS-082013-D		ND	U	

Sample ID	Compound	Laboratory Concentration (µg/L)	Laboratory Flag	RPD (%)
EMC2USG-082013	All VOCs	ND	U	0
EMC2USD-082013-D		ND	U	
CS-EFF-082013	All VOCs	ND	U	0
CS-EFF-082013-D		ND	U	

V3-laboratory flag defined as internal standard exhibited poor recovery due to sample matrix interference.

µg/L-microgram per liter

NC-not calculable

ND-not detected at the MDL

NA-not applicable

1.8 Trip Blank

Four trip blanks accompanied the sample shipments. VOCs were not detected in the trip blanks above DLs.

1.9 Sensitivity

The sample results were reported to the DLs. No elevated undetected values were reported with the data sets.

1.10 Electronic Data Deliverables (EDD) Review

Results and sample IDs in the EDDs were reviewed against the information provided by the associated level II reports at a minimum of 20% as part of the data validation process. It was noted that the samples were reported to the DLs (reporting limits) in the hardcopy laboratory reports; both the DLs and the method detection limits (MDLs) were listed in the EDDs. It was also noted that the data were reported using the units parts per million (mg/L) in the EDDs, while the sample data were reported using the units parts per billion (µg/L) and the QC samples to mg/L in the level II laboratory reports. This did not affect the quality of the data. No other discrepancies were identified between the level II reports and the EDDs.

2.0 WET CHEMISTRY

Four (4) water samples were analyzed for the following.

- EPA Method 9056 - Chloride and Fluoride

- Standard Method 9223B-2004 – E. Coli and Coliform

The areas of data review are listed below. A leading check mark (✓) indicates an area of review in which the data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Overall Assessment
- ⊗ Holding Time
- ✓ Method Blank
- ✓ Matrix Spike/Matrix Spike Duplicate
- ✓ Laboratory Control Sample
- ⊗ Laboratory Duplicate
- ✓ Sensitivity
- ✓ Electronic Data Deliverables Review

2.1 Overall Assessment

The wet chemistry data reported in this package are considered to be usable for meeting project objectives. The results are considered valid; analytical completeness, defined as the ratio of the number of valid analytical results (valid analytical results include values qualified as estimated) to the total number of analytical results requested on samples submitted for analysis, for the project is 100%.

2.2 Holding Time

The holding time for the chloride and fluoride analysis for a water sample is 28 days from collection to analysis. The holding times were met for the chloride and fluoride sample analyses.

The holding time for E. coli and total coliform analysis is 6 hours. The samples were received and analyzed outside of the 6 hour hold time for E. coli and total coliform. However the data are considered usable for a “present” or “not present” approach only.

2.3 Method Blank

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Two method blanks were reported for fluoride and chloride with the data sets. Chloride and fluoride were not detected in the method blanks above the DL.

2.4 Matrix Spike/Matrix Spike Duplicate

For fluoride and chloride, one sample specific MS/MSD pair was reported using sample PMX198-081913 with the data set. The results for the sample set specific MS/MSD pair were within the laboratory specified acceptance criteria for recovery and RPD.

2.5 Laboratory Control Sample

LCSs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Two LCS/LCSD pairs were reported with the data sets. The results for the LCS/LCSD pairs were within the laboratory specified acceptance criteria for recovery and RPD.

2.6 Laboratory Duplicate

For fluoride and chloride, one sample specific laboratory duplicate sample was analyzed with the data sets using sample EW11-082113. The results of the sample specific laboratory duplicate with the laboratory specified acceptance criteria for RPD.

For E. coli and total coliform one sample specific laboratory duplicate sample was analyzed with the data set using sample EW15-082113. EW15-082113 was flagged J3 for associated batch QC outside the established quality control range for precision. Additional information from ESC indicated that the RPD for the laboratory duplicate and the original sample was 102% and above the laboratory specified acceptance criteria. Therefore the detected value for total coliform was J qualified as estimated.

Sample ID	Compound	Laboratory Result (MPN/100mL)	Laboratory Flag	Validation Result (MPN/100mL)	Validation Qualifier*	Validation Reason Code**
EW15-082113	Total Coliform	6	J3	6	J	12

J3 – associated batch QC was outside the established quality control range for precision

MPN – most probable number

mL - milliliters

*Validation qualifiers are defined in Attachment 1 at the end of this report

**Reason codes are defined in Attachment 2 at the end of this report

2.7 Sensitivity

The sample results were reported to the DLs. No elevated undetected values were reported with the data sets.

2.8 Electronic Data Deliverables Review

Results and sample IDs in the EDDs were reviewed against the information provided by the associated level II reports at a minimum of 20% as part of the data validation process. It was noted that the samples were reported to the DLs (reporting limits) in the hardcopy laboratory reports; both the DLs and the MDLs were listed in the EDDs. It was also noted that the fluoride and chloride data were reported using the units parts per million (mg/L) in the EDDs, while the sample data were reported using the units parts per billion (µg/L) and the QC samples to mg/L in

the level II laboratory reports. This did not affect the quality of the data. No other discrepancies were identified between the level II reports and the EDDs.

* * * * *

ATTACHMENT 1
DATA VALIDATION QUALIFIER DEFINITIONS
AND INTERPRETATION KEY
Assigned by Geosyntec's Data Validation Team

DATA QUALIFIER DEFINITIONS

- U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to positive bias of associated QC or calibration data or attributable to matrix interference.
- J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to negative bias of associated QC or calibration data or attributable to matrix interference.
- UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

DATA VALIDATION REASON CODES
Assigned by Geosyntec's Data Validation Team

Valid Value	Description
1	Preservation requirement not met
2	Analysis holding time exceeded
3	Blank contamination (i.e., method, trip, equipment, etc.)
4	Matrix spike/matrix spike duplicate recovery or RPD outside limits
5	LCS recovery outside limits and RPD outside limits (LCS/LCSD)
6	Surrogate recovery outside limits
7	Field Duplicate RPD exceeded
8	Serial dilution percent difference exceeded
9	Calibration criteria not met
10	Linear range exceeded
11	Internal standard criteria not met
12	Lab duplicates RPD exceeded
13	Other

RPD-relative percent difference

Memorandum

Date: 16 July 2013
To: Cindy Bartlett, RG, LG, Geosyntec Consultants, Portland, Oregon
From: Geosyntec Quality Assurance Group, Knoxville, Tennessee
Subject: **Stage 2A Data Validation - Level II Data Deliverables – ALS
Environmental Work Orders: K1301170, K1301347, K1301349,
K1301400, K1302273, K1304288, and K1304296**

SITE: Cascade Corporation in Fairview, Oregon; Job No: PNG0564S-2

INTRODUCTION

This report summarizes the findings of the Stage 2A data validation of fifty-three (53) water samples, eight field duplicate samples, and six trip blanks, collected between February and May 2013, as part of the site investigation activities for the Cascade Corporation in Fairview, Oregon. ALS (formerly Columbia Analytical Services, CAS), Kelso, Washington, analyzed the samples. The samples were analyzed for the following test:

- EPA Methods 5030B/8260C - Volatile Organic Compounds (VOCs)

EXECUTIVE SUMMARY

The samples were handled, prepared, and measured in the same manner under similar prescribed conditions.

Overall, based on this Stage 2A data validation covering the quality control (QC) parameters listed below, the data as qualified are usable for meeting project objectives.

The organic data were reviewed based on USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, June 2008 (USEPA-540-R-08-01), as well as by the pertinent methods referenced by the data package and professional judgment.

The sample results were reported in seven ALS reports. The samples reported in each ALS report are listed in the table below.

ESC Report No.	Date of Report	Samples	Equip. Blank	Trip Blank
K1301170	02/19/2013	BOP13DS-020713, BOP31DS-020713, TRIP BLANK 1	No	Yes
K1301347	02/25/2013	MW26DG-021313, MW26DG-021313-D, EW8-021313-U, EW8-021313-L, BOP70DS215-021313, BOP71DS-021313, MW25DG-021313, MW24DG-021313-U, MW24DG-021313-L, MW14RDS-021313, TRIP BLANK 4	No	Yes
K1301349	02/25/2013	CS-EFF-021313, CS-EFF-021313-D, CS-INF-021313, TRIP BLANK 2	No	Yes
K1301400	02/28/2013	EW12-021413-U, EW12-021413-L, EW15-021413-U, EW15-021413-L, EW1-021413, EW2-021413, EW14-021413, EW14-021413-D, EW16-021413, EW23-021413, MW10DS-021413, MW18DS-021413, MW19DS-021413, D17DG-021413, EW18-021413-U, EW18-021413-L, MW17DS-021413, MW17DS-021413-D, D17DS-021413, EW11-021413U, EW11-021413-L, TRIP BLANK 1,	No	Yes
K1302273	04/01/2013	MW17DS-031313, D17DS-031313, D17DS-031313-D, MW18DS-031313, MW10DS-031313, TRIP BLANK 3	No	Yes
K1304288	05/23/2013	INF-050813, EFF-050813, EFF-050813-D	No	Yes
K1304296	05/24/2013	EW1-050813, EW2-050813, EW14-050813, MW17DS-050813, EW12-050813-U, EW-050813-L, D17DS-050813, EW16-050813, EW16-050813-D, EW18-050813-U, EW18-050813-L, MW18DS-050813, MW14RDS-050813, MW26DG-050813, MW26DG-050813-D, MW19DS-050813, MW10DS-050813, TRIP BLANK	No	Yes

The samples were received at the laboratory within the criteria $<6^{\circ}\text{C}$, but not frozen. The cooler temperatures were documented at 1.7°C , 1.9°C , 1.1°C , -0.2°C , 4.0°C , 5.2°C and 5.2°C ; the temperature blank temperatures were documented at 3.3°C , 5.6°C , 2.2°C , 2.7°C , 2.3°C , 5.7°C and 5.7°C . No sample preservation issues were noted by the laboratory.

ALS laboratory reports K1301347, K1301349, K1301400, K1302273 and K1304296 were revised on July 5, 2013 to correct case narratives. ALS laboratory report K1304288 was revised on July 3, 2013 to correct sample identifications.

1.0 VOCs

Fifty-three (53) water samples, eight field duplicate samples, and six trip blanks were analyzed for VOCs per EPA Method 5030B/8260C.

The areas of data review are listed below. A leading check mark (✓) indicates an area of review in which the data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ⊗ Overall Assessment
- ✓ Holding Time
- ✓ Method Blank
- ✓ Matrix Spike/Matrix Spike Duplicate
- ✓ Laboratory Control Sample
- ✓ Surrogates
- ✓ Field Duplicate
- ✓ Trip Blank
- ✓ Sensitivity
- ✓ Electronic Data Deliverables Review

1.1 Overall Assessment

The VOC data reported in this package are considered to be usable for meeting project objectives. The results are considered valid; analytical completeness, defined as the ratio of the number of valid analytical results (valid analytical results include values qualified as estimated) to the total number of analytical results requested on samples submitted for analysis, for the project is 100%.

The report narratives indicated that the following compounds in the continuing calibration verification (CCV) standards did not meet the laboratory specified acceptance criteria. The raw data was provided by the laboratory for review of the percent difference (%D) results for each compound:

Work order K1301170, CCV file path J:\MS18\0211F008.D: Dichlorodifluoromethane (-35.5% D), chloromethane (24.1%D).

Work orders K1301347 and K1301349, CCV file path J:\MS11\0218F009.D: Bromomethane (-29.4%D).

Work order K1301400, CCV file path J:\MS13\0222F006.D: Tetrachloroethene (-20.1 %D).

Work orders K1304288 and K1304296, CCV file path J:\MS13\0516F003.D: trans-1,3-Dichloropropene (-27.6%D), bromoform (-23.1%D).

Work order K1304296, CCV file path J:\MS13\0520F007.D: trans-1,3-Dichloropropene (-24.6%D).

Since the %Ds for dichlorodifluoromethane and chloromethane in the CCV in file path J:\MS18\0211F008.D were $\leq 40\% D$ (the acceptance criteria from the USEPA National Functional Guidelines for VOCs exhibiting poor response), no qualifications were applied to the dichlorodifluoromethane and chloromethane results in the associated samples.

Since the %Ds for bromoform in the CCV in file path J:\MS13\0516F003.D, trans-1,3-dichloropropene in the CCV in file path J:\MS13\0520F007.D, and tetrachloroethene in the CCV in file path J:\MS13\0222F006.D were $\leq 25\% D$ (the acceptance criteria from the USEPA National Functional Guidelines), no qualifications were applied to the bromoform, trans-1,3-dichloropropene, and tetrachloroethene results in the associated samples.

However, the undetected values of bromomethane in the associated samples in work orders K1301347 and K1301349 and trans-1,3-dichloropropene in the associated samples in work orders K1304288 and K1304296 were UJ qualified as estimated less than the RLs due to the CCV results with low biases greater than 25%D.

Client Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Reason Code**
MW24DG-021313-U	Bromomethane	0.50	U	0.50	UJ	9
MW24DG-021313-L	Bromomethane	0.50	U	0.50	UJ	9
MW14RDS-021313	Bromomethane	0.50	U	0.50	UJ	9
TRIP BLANK 4	Bromomethane	0.50	U	0.50	UJ	9
CS-EFF-021313	Bromomethane	0.50	U	0.50	UJ	9
CS-EFF-021313-D	Bromomethane	0.50	U	0.50	UJ	9
CS-INF-021313	Bromomethane	0.50	U	0.50	UJ	9
TRIP BLANK 2	Bromomethane	0.50	U	0.50	UJ	9
INF-050813	trans-1,3-Dichloropropene	0.50	U	0.50	UJ	9
EFF-050813	trans-1,3-Dichloropropene	0.50	U	0.50	UJ	9
EFF-050813-D	trans-1,3-	0.50	U	0.50	UJ	9

Client Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Reason Code**
	Dichloropropene					
EW1-050813	trans-1,3-Dichloropropene	0.50	U	0.50	UJ	9
EW2-050813	trans-1,3-Dichloropropene	0.50	U	0.50	UJ	9
EW14-050813	trans-1,3-Dichloropropene	0.50	U	0.50	UJ	9
MW17ds-050813	trans-1,3-Dichloropropene	0.50	U	0.50	UJ	9
EW12-050813-L	trans-1,3-Dichloropropene	0.50	U	0.50	UJ	9
MW26dg-050813	trans-1,3-Dichloropropene	0.50	U	0.50	UJ	9
MW26dg-050813-D	trans-1,3-Dichloropropene	0.50	U	0.50	UJ	9
MW19ds-050813	trans-1,3-Dichloropropene	0.50	U	0.50	UJ	9
MW10ds-050813	trans-1,3-Dichloropropene	0.50	U	0.50	UJ	9
Trip Blank	trans-1,3-Dichloropropene	0.50	U	0.50	UJ	9

* Validation qualifiers are defined in Attachment 1 at the end of this report

**Reason codes are defined in Attachment 2 at the end of this report

U-not detected at or above the RL

1.2 Holding Time

The holding time for the VOC analysis of a preserved water sample is 14 days from collection to analysis. The holding times were met for the sample analyses.

1.3 Method Blank

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Eleven method blanks were reported with the data sets. VOCs were not detected in the method blanks above the method reporting limits (MRL).

1.4 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Four sample set specific MS/MSD pairs were reported, using samples EW15-021413-L in batch KWG1301511 in report K1301400, sample EW14-021413-D in batch KWG1301641 in report K1301400, sample MW10DS-021413 in batch KWG1301716 in report K1301400 and sample EW1-050813 in batch

KWG1304689 in report K1304296. The results for the sample set specific MS/MSD pairs met the laboratory specified acceptance criteria for recovery and relative percent difference (RPD).

MS/MSD pairs were not reported for batch KWG1301661 in reports K130400 and KWG1304740 and batch KWG1304782 in report K1304296. Based on professional judgment and because laboratory control samples (LCSs) were reported for each batch, no qualifications were applied to the data.

It was noted that the recoveries and RPDs for only 9 of the 30 reported compounds were included in the analytical reports for the MS/MSD pairs. Based on professional judgment and because all 30 compounds were reported in the LCSs, no qualifications were applied to the data.

1.5 Laboratory Control Sample

LCSs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Ten LCSs and one LCS/LCS duplicate (LCSD) pair were reported with the data sets. The results for the LCSs and LCS/LCSD pair were within the laboratory specified acceptance criteria for recovery and RPD, with the following exceptions.

The recovery of chloromethane was high and outside the laboratory specified acceptance criteria in the LCS in batch KWG1301270 in laboratory report K1301170. Since chloromethane was not detected in the associated samples, no qualifications were applied to the data.

The recovery of bromomethane was high and outside the laboratory specified acceptance criteria in the LCS in batch KWG1304689 in laboratory reports K1304288 and K1304296. Since bromomethane was not detected in the associated samples, no qualifications were applied to the data.

The recovery of dichlorodifluoromethane was high and outside the laboratory specified acceptance criteria in the LCS in batch KWG1304740 in laboratory report K1304296. Since dichlorodifluoromethane was not detected in the associated samples, no qualifications were applied to the data.

The recovery of bromomethane was high and outside the laboratory specified acceptance criteria in the LCS in batch KWG1304782 in laboratory report K1304296. Since bromomethane was not detected in the associated samples, no qualifications were applied to the data.

1.6 Surrogates

Acceptable surrogate recoveries were reported for the sample analyses.

1.7 Field Duplicate

Eight field duplicate samples, MW26DG-021313-D, CS-EFF-021313-D, EW14-021413-D, MW17DS-021413-D, D17DS-031313-D, EFF-050813-D, EW16-050813-D, and MW26DG-050813-D, were analyzed with the data sets. Acceptable precision (RPD $\leq 30\%$) was demonstrated between the field

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duplicates and the original samples, MW26DG-021313, CS-EFF-021313, EW14-021413, MW17DS-021413, D17DS-031313, EFF-050813, EW16-050813, and MW26DG-050813, respectively.

Sample ID	Compound	Laboratory Concentration (µg/L)	RPD (%)
MW26DG-021313	Trichloroethene	7.5	1
MW26DG-021313-D		7.6	
MW26DG-021313	The other VOCs	ND	0
MW26DG-021313-D		ND	
CS-EFF-021313	The VOCs	ND	0
CS-EFF-021313-D		ND	
EW14-021413	cis-1,2-Dichloroethene	1.8	15
EW14-021413-D		2.1	
EW14-021413	Trichloroethene	15	7
EW14-021413-D		14	
EW14-021413	Tetrachloroethene	0.84	12
EW14-021413-D		0.95	
EW14-021413	The other VOCs	ND	0
EW14-021413-D		ND	
MW17DS-021413	cis-1,2-Dichloroethene	9.7	3
MW17DS-021413-D		9.4	
MW17DS-021413	Chloroform	0.72	7
MW17DS-021413-D		0.77	
MW17DS-021413	Trichloroethene	72	1
MW17DS-021413-D		71	
MW17DS-021413	Tetrachloroethene	3.2	3
MW17DS-021413-D		3.1	
MW17DS-021413	The other VOCs	ND	0
MW17DS-021413-D		ND	
D17DS-031313	cis-1,2-Dichloroethene	18	6
D17DS-031313-D		17	
D17DS-031313	Trichloroethene	72	6
D17DS-031313-D		68	
D17DS-031313	Tetrachloroethene	1.7	6
D17DS-031313-D		1.6	
D17DS-031313	The other VOCs	ND	0
D17DS-031313-D		ND	
EFF-050813	The VOCs	ND	0
EFF-050813-D		ND	
EW16-050813	Trichloroethene	0.70	15
EW16-050813-D		0.81	
EW16-050813	The other VOCs	ND	0
EW16-050813-D		ND	
MW26DG-050813	Trichloroethene	6.5	2
MW26DG-050813-D		6.4	
MW26DG-050813	The other VOCs	ND	0
MW26DG-050813-D		ND	

µg/L-microgram per liter
ND-not detected at the MRL

1.8 Trip Blank

Six trip blanks accompanied the sample shipments. VOCs were not detected in the trip blanks above MRLs.

1.9 Sensitivity

The sample results were reported to the MRLs. No elevated non-detect values were reported with the data sets.

1.10 Electronic Data Deliverables (EDD) Review

Results and sample IDs in the EDDs were reviewed against the information provided by the associated level II reports at a minimum of 20% as part of the data validation process. No discrepancies were identified between the level II reports and the EDDs.

* * * * *

ATTACHMENT 1
DATA VALIDATION QUALIFIER DEFINITIONS
AND INTERPRETATION KEY
Assigned by Geosyntec's Data Validation Team

DATA QUALIFIER DEFINITIONS

- U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to positive bias of associated QC or calibration data or attributable to matrix interference.
- J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to negative bias of associated QC or calibration data or attributable to matrix interference.
- UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

DATA VALIDATION REASON CODES
Assigned by Geosyntec's Data Validation Team

Valid Value	Description
1	Preservation requirement not met
2	Analysis holding time exceeded
3	Blank contamination (i.e., method, trip, equipment, etc.)
4	Matrix spike/matrix spike duplicate recovery or RPD outside limits
5	LCS recovery outside limits and RPD outside limits (LCS/LCSD)
6	Surrogate recovery outside limits
7	Field Duplicate RPD exceeded
8	Serial dilution percent difference exceeded
9	Calibration criteria not met
10	Linear range exceeded
11	Internal standard criteria not met
12	Lab duplicates RPD exceeded
13	Other

RPD-relative percent difference

TECHNICAL MEMORANDUM

TO: Chris Kimmel, Project Manager

FROM: Terry McGourty and Anne Halvorsen

DATE: October 8, 2013

RE: **BOEING PORTLAND (TSA)
THIRD QUARTER 2013 GROUNDWATER QUALITY SAMPLING
LABORATORY DATA QUALITY EVALUATION**

This technical memorandum provides the results of a focused data validation associated with 22 groundwater samples and 2 trip blanks collected during the third quarter 2013 TSA water quality sampling event at Boeing Portland. Samples were analyzed by Eurofins Lancaster Laboratories Environmental LLC (LLI), located in Lancaster, Pennsylvania. This data quality evaluation covers LLI data packages 1409763 and 1413034. Samples submitted to LLI were analyzed for volatile organic compounds [(VOCs) U.S. Environmental Protection Agency (EPA) Method SW8260C]. Sample data were evaluated in accordance with the *Boeing Portland Quality Assurance Project Plan (QAPP)* (EMCON and Landau Associates 1997) and applicable portions of the *National Functional Guidelines for Organic Data Review* (EPA 1999). The following parameters were evaluated:

- Chain-of-custody records
- Holding times
- Blank results (laboratory method and field trip)
- Surrogate recoveries
- Matrix spike/matrix spike duplicate (MS/MSD) and laboratory replicate results
- Laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) results
- Blind field duplicate results
- Quantitation limits
- Audit/corrective action records
- Completeness and overall data quality.

Data validation qualifiers are added to samples based on the evaluation of data quality. The absence of a data qualifier indicates that the reported result is acceptable without qualification. The data quality evaluation is summarized below. All data are acceptable without qualification.

CHAIN-OF-CUSTODY RECORDS

A signed chain-of-custody (COC) record was attached to each data package. The laboratory received all samples in good condition. All analyses were performed as requested. No special cleanups or handling methods were requested. No qualification of the data is necessary.

Upon receipt by LLI, the sample container information was compared to the associated chain-of-custody and the cooler temperature was recorded. The coolers associated with these data packages were received with a temperature below the EPA-recommended limit of $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ (0.5°C , 1.5°C). Data were not qualified based upon the cooler temperatures.

HOLDING TIMES

For all analyses and all samples, the time between sample collection, extraction (if applicable), and analysis was determined to be within EPA- and project-specified holding times. No qualification of the data is necessary.

BLANK RESULTS

Laboratory Method Blanks

At least one method blank was analyzed with this batch of samples for VOCs analysis. No contamination was detected in the method blanks. No qualification of the data is necessary.

Field Trip Blanks and Field Equipment Blanks

Two trip blanks were analyzed with the batch of samples for VOCs analysis in data packages 1409763 and 1413034. No contamination was detected in the trip blanks. No qualification of the data is necessary.

No field equipment blanks were submitted for analysis with this batch of samples.

SURROGATE RECOVERIES

Appropriate compounds were used as surrogate spikes for the VOCs analysis. Recovery values for the surrogate spikes were within the current laboratory-specified control limits. No qualification of the data is necessary.

MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD) AND LABORATORY REPLICATE RESULTS

No matrix spike or laboratory duplicate samples were analyzed with the data packages.

LABORATORY CONTROL SAMPLE AND LABORATORY CONTROL SAMPLE DUPLICATE (LCS/LCSD) RESULTS

At least one laboratory control sample and/or laboratory control sample duplicate (LCS/LCSD) was analyzed with each batch of samples for VOC analysis. Recoveries and relative percent differences (RPDs) for the laboratory control samples and associated duplicates were within the current laboratory-specified control limits. No qualification of the data is necessary.

BLIND FIELD DUPLICATE RESULTS

As specified in the QAPP, blind field duplicate samples were collected at a rate of one blind field duplicate sample per 20 samples, but not less than one blind field duplicate per sampling round. Two pairs of blind field duplicate water samples [BOP-Y-0813/BOP-60(dg)-0813 and BOP-Z-0813/BOP-20(ds)-0813] were submitted for analysis with data package 1409763.

A project-specified control limit of 20 percent was used to evaluate the RPDs between the duplicate samples except when the sample results were within five times the reporting limit. In these cases, a project-specified control limit of plus or minus the reporting limit was used. RPDs for the duplicate sample pairs submitted for analysis were within the project-specified control limits. No qualification of the data is necessary.

QUANTITATION LIMITS

Project-specified quantitation limits were met for all samples except for instances where high concentrations required dilution of the sample extracts.

AUDIT/CORRECTIVE ACTION RECORDS

No audits were performed or required. No corrective action records were generated for this sample batch.

Continuing calibration (CCV) recovery results are provided with these data packages. All project samples results associated with the high CCAL recovery of 4-methyl-2-pentanone and 2-hexanone in data package 1413034 are not detected and, therefore, no qualification of the data is necessary.

COMPLETENESS AND OVERALL DATA QUALITY

The completeness for this data set is 100 percent, which meets the project-specified goal of 90 percent minimum.

Data precision was evaluated through laboratory control sample duplicates and one field duplicate. Data accuracy was evaluated through laboratory control samples and surrogate spikes. No data were rejected.

REFERENCES

EMCON and Landau Associates. 1997. *Appendix D, Quality Assurance Project Plan, Troutdale Sandstone Aquifer Remedy, Remedial Design and Remedial Action Work Plan, Troutdale Sandstone Aquifer, East Multnomah County, Oregon*. Prepared for Cascade Corporation and The Boeing Company. June 19.

EPA. 1999. *Contract Laboratory Program National Functional Guidelines for Organic Data Review*. U.S. Environmental Protection Agency. October.