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ANNUAL PERFORMANCE REPORT

1 JANUARY 2024 – 31 DECEMBER 2024

EAST MULTNOMAH COUNTY, TROUTDALE

SANDSTONE AQUIFER REMEDY

ECSI 1479

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/m ³	micrograms per cubic meter
µg/L	micrograms per liter
1,1-DCE	1,1-dichloroethene
BLA	Blue Lake Aquifer
Boeing	The Boeing Company
Cascade	Cascade Corporation
cis-1,2-DCE	cis-1,2-dichloroethene
cNFA	Conditional No Further Action
CU1	Confining Unit 1
CSSWF	Columbia Slough South Shore Well Field
CTS	Central Treatment System
DCE	1,2-dichloroethene
DEQ	Oregon Department of Environmental Quality
EMC	East Multnomah County
EPA	U.S. Environmental Protection Agency
EW	extraction well
ft	foot, feet
ft bgs	feet below ground surface
GETs	groundwater extraction treatment systems
gpm	gallons per minute
LAI	Landau Associates, Inc.
lbs	pounds
MCL	maximum contaminant level
Mgal	millions of gallons
NFA	No Further Action
NOAA	National Oceanic and Atmospheric Administration
PCE	tetrachloroethene
PID	photoionization detector
PLC	programmable logistics controller
PVC	polyvinyl chloride
PWB	Portland Water Bureau

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

ROD	Record of Decision
scfm	standard cubic feet per minute
SGA	Sand and Gravel Aquifer
SSPA	S.S. Papadopoulos & Associates, Inc.
SU	standard units
SVE	soil vapor extraction
TCE	trichloroethene
TGA	Troutdale Gravel Aquifer
TSA	Troutdale Sandstone Aquifer
VC	vinyl chloride
VOC	volatile organic compound

**Annual Performance Report
1 January 2024 – 31 December 2024**

East Multnomah County Troutdale Sandstone Aquifer Remedy

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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 (EMC) Troutdale Sandstone Aquifer (TSA) Remedy project (Site). Data presented in this report were collected during the period of 1 January 2024 through 31 December 2024 as part of the joint remedy being implemented under the Oregon Department of Environmental Quality (DEQ) Consent Order No. WMCSR-NWR-96-08 (DEQ 1997) and conditions in the Record of Decision (ROD) (DEQ 1996) to remediate dissolved volatile organic compound (VOC) comingled plumes in the direct vicinity of the Boeing and Cascade properties. The ROD and the Consent Order specify the following remedial action objectives:

- Restore the TSA to protective concentrations in a reasonable time, if feasible. If not feasible, minimize the extent of the TSA containing VOCs above maximum containment levels (MCLs), or 1×10^{-6} excess cancer risk levels, whichever is more stringent and provide long-term containment of areas where concentrations are above the MCLs;
- Prevent ingestion of TSA groundwater that contains trichloroethene (TCE), tetrachloroethene (PCE), cis-1,2-dichloroethene (cis-1,2-DCE), and 1,1-dichloroethene (1,1-DCE) at concentrations above their respective MCLs;
- Protect environmental receptors by preventing surface water discharge of TSA groundwater with VOC concentrations that exceed surface water ambient water-quality criteria;
- Prevent the further spread of contamination in the TSA to the extent practicable;
- Protect groundwater quality in the Sand and Gravel Aquifer (SGA) and the Blue Lake Aquifer (BLA); and
- Allow existing uses of groundwater resources in eastern Multnomah County, or if not feasible, minimize the type and duration of groundwater use restrictions.

EMC Site discovery and groundwater investigations of the TSA (also referred as the Upper and Lower TSA for the vitric sandstone and conglomerate portions, respectively) and underlying SGA began in 1986, and initial groundwater extraction using pump and treat methods commenced in 1993. The results of early investigations indicated the presence of VOCs in groundwater at concentrations above United States Environmental Protection Agency (EPA) MCLs for TCE, PCE, 1,1-DCE, and vinyl chloride (VC). However, TCE was determined to be the predominant contaminant and continues to be utilized to evaluate the progress of the remedy.

The ROD defined the primary source of contamination to the TSA as contaminated groundwater from the overlying Troutdale Gravel Aquifer (TGA), along with other secondary sources (i.e., natural springs and former supply wells screened across Confining Unit 1 (CU1) between the TGA and the TSA). Groundwater extraction and treatment systems (GETs) have been operational

since 1997 (interim operation commenced in 1993), which have been successful in removing VOC mass from the saturated zone of the TSA and decreasing the size of the dissolved VOC plume. In addition to the GETs, a soil vapor extraction (SVE) system has been operational since 2015 (voluntary remedy technique added after the Consent Order) with the goal of removing VOC mass from the unsaturated zone within the mound area, located in the central portion of the Site. The EMC TSA remedy background and historical remedial actions are summarized in the following Section 1.2.

During the early phase investigations in the 1980s, VOC contamination was also discovered in the SGA, underlying the TSA. The SGA VOC concentration levels were much lower than the TSA, and the SGA was successfully remediated by 2007. Rebound monitoring continued until 2013, and when VOC concentrations consistently remained below the MCLs, post-remedy groundwater monitoring ceased in 2013. In 2022, DEQ approved No Further Action (NFA) for the SGA (DEQ 2022a). The last remaining SGA well (BOP-44(usg), located north of Sandy Boulevard, will be retained for potential future sampling per a request from DEQ (DEQ 2024b).

1.1 Purpose of Report

The reporting period for the EMC TSA remedy Annual Performance Report presents data through calendar year 2024. This Annual Performance Report provides an evaluation of the EMC TSA remedy performance, including:

- A summary of the remediation systems (GETs and SVE) operation, maintenance, and performance monitoring data;
- An assessment of the aquifer restoration progress; and
- Recommendations and future planned activities.

1.2 Background

The original study area for the Site was approximately 2,300 acres with a dissolved VOC plume impacting approximately 400 acres. The study area is bound by the Columbia River to the north, Northeast Fairview Avenue and Northeast 223rd Avenue to the east, Northeast Halsey Street to the south, and Northeast 181st Avenue to the West (Figure 1-1). The EMC TSA remedy project is located in Sections 19, 20, 28, and 29 in Township 1 North, Range 3 East. The ground surface elevation at the EMC TSA remedy project is highest to the south and descends in a series of river/flood cut terraces and localized folding and faulting northward to the Columbia River.

Four TSA remedial areas, referred to as zones, were described in the ROD and subsequently assigned letters (Zones A, B, C, and D) (DEQ 1996). The TSA remedial zones, the remedy network of extraction wells and monitoring wells, and the current remedy extraction system layouts are shown in Figure 1-2.

The Site discovery and groundwater investigations of the TSA and SGA began in 1986. Between 1994 and 1996, remedial investigations and a feasibility study were conducted that indicated groundwater VOC concentrations above the EPA MCLs for TCE (5 micrograms per liter [$\mu\text{g/L}$]), PCE (5 $\mu\text{g/L}$), cis-1,2-DCE (70 $\mu\text{g/L}$), 1,1-DCE (7 $\mu\text{g/L}$), and VC (2 $\mu\text{g/L}$). TCE is the predominant contaminant and is utilized to evaluate remedy progress.

Initial groundwater extraction, using pump and treat methods, commenced in 1993. Between 1993 and 2000, six GETs were installed to provide long-term containment of the dissolved VOC plume and remove VOC mass. The GETs have been successful at reducing VOC concentrations and shrinking the size of the dissolved plume from 400 acres to about 13 acres, consisting of overlapping Upper TSA and Lower TSA plumes. Individual GETs were sequentially shut down in areas of the Site once cleanup levels were achieved. With DEQ approval, the systems were decommissioned, except for the Central Treatment System (CTS),¹ which captures groundwater in the TSA mound area in Zone C, which started operation in 1997. The approximate locations of the five former (decommissioned) GETs and the remaining CTS are shown in Figure 3-1. A total of 12 Lower TSA extraction wells (EW-1, -2, -4, -5, -8, -11, -12, -14, -15, -16, -18, and -23) routed groundwater to the CTS at system startup. Currently, EW-2 and EW-14 are actively operated, and the CTS continues to operate to provide long-term containment of the dissolved VOC plume in Zone C. Extraction wells EW-1 and EW-23 are in pilot shutdown mode, and the remaining wells are utilized for monitoring purposes only (EW-3, EW-5 [now CMW-24(dg)], EW-11, EW-12, EW-13, and EW-16). Extraction wells EW-4, EW-8, EW-15, and EW-18 were decommissioned with DEQ approval.

In 2014, an SVE pilot study commenced in the TSA mound area (Zone C) to evaluate enhanced removal of VOCs in the vadose zone. The pilot test was successful in removing VOC mass, and full-scale operation of the system was implemented in 2015 as an additional voluntary corrective measure. The system was expanded in 2016, 2019, and 2022. Eight SVE wells (VW-17D-42.5, VW-17D-75, VMW-A, through VMW-D, VMW-F, and VMW-H) were shut down after VOC concentrations reached asymptotic levels. Five SVE wells are currently operating for vapor extraction, and the remaining wells are utilized for monitoring. The SVE wells are shown in Figure 3-2.

The TSA remedy has successfully met the ROD objectives in large portions of the Site and has reduced the plume size to an isolated area in remedy Zone C. As remedy zones met the ROD objectives, requests for conditional No Further Action (cNFAs) were submitted for DEQ approval. A summary of the TSA remedial zones and current status are given below:

¹ The GETs located in Zone B historically treated both Upper TSA and Lower TSA; however, in 2013, TSA extraction operation was no longer required to meet cleanup levels, and the system currently operates for remediation of the TGA for Boeing.

TSA Remedial Zone	Zone Location	Zone Status
Zone A	Area north of Sandy Boulevard	cNFA closure certification received from DEQ in 2022 (DEQ 2022a).
Zone B	Area south of Sandy Boulevard in the western portion of the Boeing facility	cNFA approved by DEQ. Next step includes DEQ Staff Letter and public comment period before issuance of closure certificate.
Zone C	Area south of Sandy Boulevard, directly east of Zone B and west of N.E. 205 th Avenue	Ongoing remedy
Zone D	Area south of Sandy Boulevard, directly east of Zone C and area east of N.E. 205 th Avenue	cNFA approved by DEQ. Next step includes DEQ Staff Letter and public comment period before issuance of the closure certificate.

2.0 SIGNIFICANT ISSUES, EVENTS, AND ACTIONS

This section summarizes significant issues, events, and actions taken during the reporting period. The EMC TSA remedy criteria for well and system decommissioning, monitoring well modifications, and general criteria for proposing changes in sampling frequency are summarized in Table 2-1. The current groundwater monitoring schedule, along with recommended modifications (see Section 6.0), is summarized in Table 2-2. A summary of significant documents exchanged with DEQ during the period is presented in Table 2-3.

2.1 Monitoring Program and Schedule Modifications

Monitoring schedule modifications implemented during the reporting period were presented in the *Annual Performance Report 1 January 2023 – 31 December 2023 East Multnomah County, Troutdale Sandstone Aquifer Remedy ECSI 1479* (Geosyntec Consultants, Inc. [Geosyntec], Landau Associates, Inc. [LAI], and S.S. Papadopoulos & Associates, Inc. [SSPA], 2024). DEQ approved the modifications listed below on 12 November 2024 (DEQ 2024b):

- Continue shutdown of EW-1 (since August 2018) and EW-23 (since April 2021);
- Decrease monitoring frequency from quarterly to semiannually for groundwater elevation and groundwater quality monitoring for Zone C well CMW-10(ds);
- Discontinue groundwater elevation and groundwater quality monitoring at Zone B and Zone D wells (BOP-20(ds), BOP-20(dg), and BOP-23(dg), with the exception of sentinel wells identified for sampling as part of the Portland Water Bureau (PWB) Contingency Plan (BOP-20(ds) and BOP-23(dg)); and
- Shut off three SVE wells (VMW-H, VMW-C, and VMW-F).

DEQ has previously provided approvals for the decommissioning of ten existing wells. However, in November 2024, DEQ requested that the ten wells remain in usable condition for future sampling (DEQ 2024b). The following ten wells will be retained in useable condition:

- Zone A: Upper TSA well BOP-44(ds), Lower TSA wells BOP-44(dg) and EMC-2(dg), and SGA well BOP-44(usg);
- Zone B: Upper TSA wells BOP-21(ds) and BOP-42(ds) and Lower TSA wells BOP-42(dg) and BOP-60(dg); and
- Zone C: Lower TSA wells CMW-8(dg) and CMW-10(dg).

These wells remain in place, but have been removed from the monitoring plan, and no samples were collected in 2024.

2.2 Municipal Well Field Operations

The City of Portland utilizes the Bull Run Reservoir as a primary drinking water source. Periodically, the City of Portland augments the drinking water supply with groundwater from municipal production wells in the Columbia Slough South Well Field (CSSWF) (shown in Figure 1-1). The CSSWF is operated by the PWB.

During 2024, the CSSWF operated for the two pumping events, as listed in the table below (PWB, 2025).

Inset Table 2.2: Summary of CSSWF 2024 Pumping.

Reason for CSSWF Pumping	Pumping Start Date	Pumping End Date	Total Volume Pumped (MGal)	Aquifer	Percent of Total Volume Pumped	Aquifer-Specific Pumping (MGal)
Bull Run water supply augmentation	08/01/2025	08/20/2025	239	TSA	6.8	1,625
				SGA	62.9	15,033
				BLA	30.3	7,242
	10/10/2025	11/06/2025	830.1	TSA	7.6	6,309
				SGA	53.2	44,161
				BLA	39.2	32,540

Notes:

MGal: Millions of gallons

Due to the close vicinity of the CSSWF to the Site, PWB pumping events are closely monitored, and additional contingency monitoring has been established pursuant to the PWB Contingency Monitoring Plan (LAI 2019) that was approved by DEQ (DEQ 2020). Pressure transducers are installed at the PWB sentinel wells to allow for continuous water level measurements throughout the entire year to capture data in the event of a PWB pumping event.

In 2024, both CSSWF pumping events lasted less than 30 days and thus, did not trigger short-term EMC contingency monitoring requirements. However, since the timeline for the August pumping event overlapped the EMC quarterly sampling event, sentinel well CMW-36dg was sampled on 5 August 2024. Water levels and water quality data are discussed in Section 4.0.

3.0 EXTRACTION AND TREATMENT SYSTEMS

The CTS operates to remove VOC mass and maintain long-term containment of the remaining TSA dissolved VOC plume in groundwater, which consists of two overlapping plumes: 1) the Upper TSA (approximately 6 acres); and 2) the Lower TSA (approximately 9 acres), based on August 2024 data. The locations of the current and former GETs, treated water lines, and extraction and monitoring wells are shown in Figure 3-1. This section also summarizes the mound area SVE system. The SVE piping and well network is shown in Figure 3-2. Well construction and location details for current remedy wells are summarized in Table 3-1.

3.1 CTS Operational Summary

In 2024, two Lower TSA extraction wells (EW-2 and EW-14) were operated as part of the CTS in Zone C. Daily flow data from each well were recorded by the automated programmable logistics controller (PLC) system. Data from the PLC were downloaded, and manual inspections and system field checks were conducted weekly. Routine system inspections included manual collection of total flowmeter readings, filter pressure monitoring, system inspection and maintenance, and collection of temperature and pH data.

The CTS and the extraction wells were operated during the 12-month reporting period, except as discussed below. Planned shutdowns for system maintenance occurred as follows:

- 8 May 2024: EW-2 was shut down to complete sonar cleaning. The pump and motor were not replaced at this time since they were observed to be functional.

Unplanned extraction well shutdowns occurred during the reporting period, as follows:

- 22 January 2024 through 29 January 2024: An ice storm and sustained freezing temperatures resulted in the intake valves cracking. The valves were not fully broken but the system was taken offline on 16 January 2024 to observe potential damage. The valves were replaced, and the system was brought online 29 January 2024.
- 15 August 2024: EW-14 shut down for approximately 2 hours due to a power outage.
- 15 July 2024 through 9 October 2024: Extraction well EW-2 was shut down (86 days). The pump in EW-2 and the flow totalizer failed. Silica sand and sediment were observed in the well. The well was sonar-cleaned and sediment air-lifted from the base of the well, but the pump was not operable. A new pump was ordered and could not be sourced until October 2024. A new pump (Berkley 50 gallons per minute [gpm] 13ST) and motor (460-volt, 3-horsepower) were installed on 9 October 2024. Due to the presence of sand and silt in the base of the well, the pump intake was raised 2 feet (from an intake depth of 162 feet to 160 feet below the top of the well casing monitoring point). Review of a well inspection video taken during the May 2024 sonar cleaning indicated that a crack had developed in the well casing immediately above the well screen. This crack, along with a small amount of silica sand and bentonite observed in the well during the pump

changeout, indicated that well construction materials (silica sand and bentonite) are entering the well. Although raising the pump 2 feet mitigated flow issues, a liner may need to be added in the future to prevent further well damage and mitigate well construction materials entering the well. The well will be video inspected annually.

3.2 Groundwater Extraction Rates

Target flow rates for the extraction wells have been established to maintain long-term hydraulic containment of the dissolved VOC plume. The minimum target extraction rate for EW-2 is 25 gpm and for EW-14 is 20 gpm.

Flow rates at EW-2 and EW-14 averaged 25.6 and 23.1 gpm, respectively² in 2024. Between January 2023 and May 2024, the flow rate from EW-2 declined steadily (from approximately 35 to 20 gpm) but remained above the target pumping level (Figure A-1). Sonar cleaning was performed in May 2024, resulting in a smaller than usual increase in the flow rate (from 19.8 gpm to 24.7 gpm). The limited improvement in flow rate after sonar cleaning is attributed to the pump failure from silica sand and/or silt in the pump. The EW-2 pump failed and shut down completely on 15 July 2024, and EW-2 resumed operation on 9 October 2024 once the pump and motor were replaced. After completing repairs and raising the pump intake inlet by 2 feet in the well screen, flow rates at EW-2 increased to an average 33.4 gpm. Flow from EW-14 has remained above the target flow rate (between 20 and 25 gpm) since it was last sonar-cleaned in May of 2023 (Figure A-2).

The 2024 flow rates were sufficient to maintain long-term containment of the dissolved VOC plume in the mound area, as demonstrated by groundwater elevations and gradients (discussed in Section 4.2), with the exception of the shutdown period of EW-2 from 15 July 2024 through 9 October 2024.

Flow rate and depth to groundwater data for the extraction wells are provided in Appendix A, with average monthly extraction well flow rates over the previous five-year period for EW-2 and EW-14 provided in Figures A-1 and A-2, respectively, and combined average monthly flow for extraction wells in Figure A-3. Between January and June 2024, the combined flow varied between 45 and 48 gpm (Figure A-3). The flow dropped to 23 to 30 gpm during July through September as a result of EW-2 being offline. After the new pump and motor were installed in EW-2, the total flow rebounded to 52 to 55 gpm. Average flow data for the 12-month reporting -period for individual wells and the total combined system are summarized in Appendix A, Table A-1.

3.3 Treatment System Effluent Compliance

CTS performance data consist of weekly flow, pH, and temperature measurements and quarterly influent and effluent analytical testing. The discharge permit for treated groundwater effluent to the Columbia Slough from the CTS is presented in Attachment C to the EMC TSA Remedy

² Monthly average flows are generated from flow rates during the operation period and exclude shutdown periods.

Consent Order (DEQ 1997). The discharge permit limits were not exceeded in 2024, as discussed below and summarized in Appendix A (Table A-2):

The total average flow during the 12-month period was 49 gpm³ (Appendix A, Table A-1). There is no minimum flow rate criterion in the discharge permit.

- Effluent pH ranged from 7.54 to 7.94 standard units (SU) and remained within the discharge permit effluent limits of 6 to 9 SU.
- Effluent temperatures ranged from 60 to 66 degrees Fahrenheit. There is no temperature operating limit in the discharge permit.

VOCs were not detected at concentrations above the respective laboratory reporting limits in 2024. Discharge permit limits for VOC concentrations are set at the MCLs.

3.4 Well Decommissioning

No well decommissioning was completed in 2024. This section and Appendix B are included in this report to maintain consistency with prior and future reports when decommissioning will be completed.

3.4.1 SVE System Operation

The SVE system consists of a 15-horsepower TurboTron™ regenerative blower, and a knock-out tank situated in a shed within the chain-link fence that surrounds the CTS. The system is connected to VW-17D-95.5 by aboveground polyvinyl chloride (PVC) piping and 11 SVE wells via belowground PVC piping, five of which were active as of the end of 2024. Extracted vapors are sampled quarterly and discharged into the atmosphere through a PVC exhaust stack at a height of approximately 8 feet. The SVE system maintained an average flow rate of around 359 standard cubic feet per minute (scfm) in 2024, and average weekly flow rates are shown in Table C-1 and Figure C-2 (Appendix C).

3.4.2 SVE System Monitoring

Over the last nine years, vapor monitoring wells have been removed from the system and either decommissioned or used for groundwater monitoring. Individual vapor extraction wells that were shut down were tested for rebound after VOC concentrations neared asymptotic levels. The rebound test results did not indicate a vapor rebound, and the SVE wells remained shut down. In 2018 and 2019, five wells (VW-17D-42.5 and VW-17D-75 (both decommissioned in 2018), and VMW-A, VMW-B, and VMW-D) were shut down.

Through May 2024, routine SVE system monitoring was conducted in eight of the 11 SVE wells (VMW-C, VMW-E through VMW-K, and VW-17D-95.5). Beginning in June 2024, wells

³ This total average flow excludes the shutdown periods.

VMW-C, VMW-F, VMW-H were removed from the SVE system with agreement by DEQ (DEQ 2024a; Geosyntec 2024), leaving five remaining SVE wells operational.

SVE monitoring includes measuring VOC vapor results at the outlet with a photoionization detector (PID) and laboratory testing of vapor sampled from the outlet and wells. The monitoring frequency for the system effluent was decreased from monthly to quarterly after September 2024. The 2024 SVE monitoring schedule is summarized in the table below.

Inset Table 3.5.2: SVE Vapor Monitoring Schedule

Well Name	Vapor Sampling (Summa) ⁴	Temperature, Pressure, Flow Rate
VMW-17D-95.5 (soil vapor only)	Quarterly	Weekly
VMW-A	NM	NM
VMW-B	NM	NM
VMW-C	Quarterly to shutdown after May 2024 sampling event	Weekly
VMW-D	NM	NM
VMW-E	Quarterly	Weekly
VMW-F	Quarterly to shut down after May 2024 sampling event	Weekly
VMW-G	Quarterly	Weekly
VMW-H	Quarterly to shutdown after May 2024 sampling event	Weekly
VMW-J2	Quarterly	Weekly
VMW-K	Quarterly	Weekly
Effluent	Monthly to Quarterly starting after September 2024 sampling event	Weekly

VOC vapor monitoring results are summarized in Tables C-1 and C-2, and the analytical results are shown in Figure C-1.

3.4.3 SVE System Monitoring Results

The 2024 quarterly analytical results for the actively operated SVE wells are shown in Figure 3-2 and summarized below.

- VMW-K had the highest average TCE vapor concentration over the operating year and ranged from 320 to 1,300 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$).

⁴ Summa cannister samples sent to the analytical laboratory for analysis.

- For 2024, the majority of the SVE mass was removed from 5 wells (VMW-E, VMW-G, VMW-J2, VMW-K, and VW-17d-95.5). VOC mass removal declined at three wells (VMW-C, VMW-F, and VMW-H) to asymptotic levels, and these wells were shut down in spring 2024 following the scheduled May 2024 sampling event.
- The average TCE vapor concentration for the SVE system effluent was 443 $\mu\text{g}/\text{m}^3$, which is a 95 $\mu\text{g}/\text{m}^3$ decrease relative to the 2023 average (538 $\mu\text{g}/\text{m}^3$). This decrease is due to the continuous vapor removal that has reduced the available mass in the vadose zone and the reduced number of operating wells.

3.4.4 SVE System Mass Removal

Based on the analytical data results, the SVE system removed approximately 5.6 pounds (lbs) of total VOC mass (4.9 lbs of TCE) in 2024. Since the system startup in 2014, a total of approximately 106.3 lbs of VOC mass (91.8 lbs of TCE) has been removed by the SVE system in the TSA mound area (Table C-3).

The current VOC mass removal rate (5.6 lbs/year) has decreased relative to the previous four operational years (7.3 lbs/year in 2023, 9.2 lbs/year in 2022, 8.2 lbs/year in 2021, and 7.6 lbs/year in 2020), which is due to reduced VOC mass in the vadose zone near operating SVE wells. Flow rates, vapor concentrations (field and laboratory), and estimated mass extracted are summarized in Appendix C, Tables C-1 through C-3, and in Figures C-1 through C-3. Based on declining mass removal rates and VOC concentrations at and nearing asymptotic levels, a work plan for evaluating SVE system shut down and rebound testing will be submitted to DEQ in 2025.

4.0 REMEDY PERFORMANCE SUMMARY

This section summarizes remedy performance data obtained during this reporting period, including groundwater elevation data and groundwater quality data. Groundwater monitoring is conducted in accordance with the Performance Monitoring Schedule (Table 2-2). Groundwater elevation data are summarized in Appendix D, and groundwater quality data are summarized in Appendix E. Laboratory reports, along with data validation memoranda, are presented in Appendix F.

4.1 Groundwater Elevations

Groundwater elevations were manually measured either monthly, quarterly, semiannually, annually, or biennially based on the Performance Monitoring Schedule (Table 2-2). Depth to groundwater is measured using a portable electric tape meter. PWB contingency sentinel wells have pressure transducers installed to allow for continuous depth to groundwater measurements throughout the year.

Groundwater depths and groundwater elevations are summarized in Appendix D, Table D-1. Groundwater elevation hydrographs for the wells with pressure transducers, along with precipitation data, are included in Appendix D in Figures D-1 and D-2 (National Oceanic and Atmospheric Administration [NOAA] 2025a). Precipitation during the 2024, 12-month reporting period was 39.67 inches; slightly above the 21-year average annual precipitation (1991 through 2020) at the Portland Airport (NOAA 2025b).

Since the CSSWF was not operated for 30 or more consecutive days in 2024, the short-term response monitoring was not triggered. However, groundwater elevations were measured continuously at the sentinel wells and are presented in Appendix D, Figures D-1 and D-2.

4.2 Groundwater Flow and Long-Term Containment

As defined in the ROD, the objectives of the TSA dissolved VOC plume remedy are to restore groundwater quality to the MCLs, if feasible, and if not, maintain long-term containment of the dissolved VOC plume and prevent further vertical and horizontal spread of VOC contaminants to allow existing uses of groundwater resources in eastern Multnomah County (DEQ 1996). Groundwater elevations near the TSA mound area, located within remedy Zone C, indicate that inward horizontal gradients towards the operating extraction wells continued for most of 2024 due to ongoing remedy pumping. Groundwater contours for the semi-annual water level measurement event (February 2024) and the annual event (August 2024) for the Upper TSA and the Lower TSA are provided in Figures 4-1a, 4-1b, 4-2a, and 4-2b.

Groundwater flow in the Upper TSA is towards the north-northeast with the exception of the area near the mound area, which exhibits a radial flow pattern towards the south, southeast, and southwest. Lower TSA groundwater flow is towards the north, with the exception of the area near the mound area, which is influenced by the inward hydraulic gradients towards the operating

extraction wells. The inward gradient towards the operating extraction wells is indicative of containment and demonstrates the effectiveness of Lower TSA extraction wells EW-2 and EW-14 in achieving and maintaining capture of the dissolved VOC plume. The water level measured at EW-14 in February 2024 (Figure 4-1b) reflects the time period when the cone of depression was re-establishing after the temporary shutdown in January (due to frozen valves). During the shutdown of EW-2 (15 July 2024 through 9 October 2024) the inward gradient towards this well was not observed along the eastern portion of the mound area although the gradient toward EW-14 persisted. Groundwater flow directions in the mound area do not vary significantly from the wet to dry seasons and are strongly influenced by the operating extraction wells. These extraction wells capture groundwater from areas with current VOC concentrations above cleanup levels. Containment of the dissolved VOC plume is also exhibited by spatial VOC concentration trends, as discussed in the following subsections.

4.3 Groundwater Quality

Groundwater samples are collected for analytical testing on a quarterly, semi-annual, annual, or biennial frequency, based on the DEQ-approved Performance Monitoring Schedule (Table 2-2). Sampling events occur in February, May, August, and November of each year, with August (Annual/Biennial event) being the most inclusive sampling event. Biennial monitoring events are conducted in August of odd number calendar years (e.g., 2023 and 2025); therefore, biennial sampling was not conducted in 2024. The Performance Monitoring Schedule is reviewed annually to ensure compliance with the ROD and develop recommendations for the monitoring program for DEQ approval.

Analytical results for groundwater samples collected during this reporting period are summarized in Appendix E, Table E-1. Plots of TCE profiles for select mound area wells (monitoring wells and extraction wells) are presented in Appendix E, Figures E-1 through E-7. TCE concentration contours for the routine remedy semiannual sampling events (February and August) are shown in Figures 5-1a, 5-1b, 5-2a, and 5-2b for the Upper and Lower TSA wells, respectively.

4.3.1 Upper TSA

The current area of the Upper TSA TCE plume with concentrations over the MCL (5 µg/L) in August 2024 is estimated at 6 acres, a 99% reduction in size from the initial 400-acre plume. TCE concentrations in the Upper TSA wells located outside of the mound area were either not detected above the laboratory reporting limits or at low levels and below the MCL. TCE concentrations in the western portions of the Site (remedy Zone B) have consistently been below the MCL since 2019 and were not detected above the laboratory reporting limit in 2024.

TCE concentrations for mound area (Zone C) wells continue to have the highest TCE concentrations, which are discussed below. TCE profiles for mound area wells are depicted in Figures E-1 through E-6.

- CMW-17(ds): TCE concentrations fluctuated but generally decreased in 2024 from a maximum of 21.8 µg/L in May to 0.848 µg/L in November. The TCE concentrations decreased during the shutdown of extraction well EW-2 (August 2024 sampling event) and remained below the MCL in the November 2024 sampling event. TCE concentrations have fluctuated over time, as shown in Figure E-1.
- CMW-10(ds): TCE concentrations decreased to below the MCL in 2024 with concentrations ranging from 4.23 and 4.55 µg/L. TCE concentrations over time are stable and decreasing since resaturation of the well screen in 2009 (Figure E-2).
- CMW-18(ds): TCE concentrations ranged from 23.4 µg/L in February to 63.8 µg/L in August during the shutdown of extraction well EW-2. TCE concentrations continue to fluctuate with a large TCE concentration range at this well since resaturation in 2009 (Figure E-3).
- VMW-B: TCE concentrations in 2024 quarterly samples ranged from 9.21 µg/L in November to 12.1 µg/L in May.
- VMW-E: TCE concentrations in 2024 quarterly samples ranged from 12.1 µg/L in November to 18.9 µg/L in May.
- VMW-I: TCE concentrations ranged from 5.24 µg/L in August to 45.4 µg/L in February.
- VMW-J2: TCE concentrations decreased from 6.79 µg/L in February to below the MCL in May, August, and November (Figure E-4).
- VMW-K: TCE concentrations in 2024 quarterly samples ranged from a maximum of 10.3 µg/L in May to a minimum of 3.5 µg/L in August (Figure E-5).
- VMW-N: TCE concentrations in 2024 quarterly samples ranged from a maximum of 7.10 µg/L in February to below the MCL in May, August, and November.
- Groundwater TCE concentrations in the other VMW wells (VMW-A, VMW-C, VMW-D, VMW-F, VMW-G, VMW-H, VMW-L, and VMW-M) were below the MCL.

4.3.2 Lower TSA

In 2024, TCE concentrations remained above the MCL in the mound area wells, while TCE concentrations for wells located outside the mound area were either below the laboratory reporting limits or below the MCL. TCE concentrations for the Lower TSA wells sampled in 2024 are shown in Figures 5-1b and 5-2b. The approximate area of the Lower TSA TCE plume with concentrations over the MCL (5 µg/L), as shown in the August 2024 figures, is about 9 acres, a 98% decrease from the initial 400-acre plume area.

In the mound area, Remedy Zone C, TCE concentrations in well D-17(ds) were the highest in the Lower TSA, ranging from non-detect at the laboratory reporting limit (February) to 27.9 µg/L in November to a maximum of 52.2 µg/L (in May). However, concentrations continue to fluctuate at D-17(ds), as shown in Figure E-6. TCE concentrations at D-17(ds) were generally stable to

decreasing after aquifer resaturation in 2009 but steadily increased starting in May 2017 and reached a maximum concentration of 61.2 µg/L in May 2019. After reaching that maximum level, TCE concentrations decreased to 13.7 µg/L in August 2022, and since then, TCE concentrations have again trended up to a concentration of 52.2 µg/L in May 2024. Well D-17(ds) is screened at the top of the Lower TSA across the water table (110 to 120 feet below ground surface [ft bgs]), while adjacent well D-17(dg) is screened in the lower portion of the Lower TSA (152 to 172 ft bgs). TCE concentrations at D-17(dg) have been consistently below the MCL since August 2016 except for the August 2022 sampling event when the concentration was 18.2 J µg/L. In February 2024, the TCE concentration in D-17(dg) was not detected above the laboratory reporting limit; however, the reporting limit was 25 µg/L (above the MCL) due to continuing calibration verification outside of the acceptance criteria (data validation reports are provided in Appendix F).

In 2024, TCE concentrations at EW-1, EW-12, and EW-23 remain below the MCL. TCE concentrations at operating extraction wells EW-2 (4.79 µg/L to 7.82 µg/L) and EW-14 (4.11 to 6.03 J µg/L) decreased slightly compared to 2023, as shown in Figure E-7.

4.4 Remedy Zone A Groundwater Quality

As part of the cNFA received from DEQ for Remedy Zone A (DEQ, 2022a), five additional years of groundwater quality monitoring were required at wells owned by the PWB (PWB-1uts and PWB-1lts), which are screened in the Upper TSA and the Lower TSA, respectively. The wells were sampled in March 2024 for the second time as part of the cNFA agreement. The TCE concentration for well PWB-1uts was 1.62 µg/L and for well PWB-1lts was 2.32 µg/L (Table E-1). TCE concentrations at the two wells remain below the MCL; however, concentrations are slightly increasing at PWB-1lts. The PWB has provided feedback and indicated that they will continue to monitor and evaluate the TCE trends in the two wells (PWB, 2024). The EMC team is also evaluating the results, and a letter transmitting these data is pending (LAI, 2024)

4.5 TCE Mass Removal in Saturated TSA

TCE mass removal estimates are based on groundwater concentrations and groundwater extraction flow rates. In 2024, approximately 0.88 lbs of TCE were removed through the GETs with the two operating extraction wells in the mound area. Since the startup of the first system in 1993, the EMC pump and treat remedies (6 GETs with 23 extraction wells at maximum extent) have removed an estimated total of 506 lbs of TCE mass from the saturated zone. Mass removal rates declined markedly after the initial operational peak during the first decade following startup and have continued to decline, although gradually, year after year (Figures E-8 and E-9). The tailing-off of mass removal was expected and is due to declining VOC concentrations in the groundwater, and the systematic shutdown of extraction pumping due to compliance with MCLs and Consent Order restoration goals.

TCE annual mass removal estimates for the EMC TSA remedy are summarized in Appendix E (Table E-2 and Figure E-8), and TCE mass removal estimates for each extraction well are summarized in Appendix E (Table E-3 and Figure E-9).

5.0 PERFORMANCE SUMMARY

The EMC TSA remedy has been effective at reducing VOC plume size and TCE concentration magnitude since full-scale implementation in 1994. The VOC plume in the TSA has reduced in size from approximately 400 acres in the mid-1990s to approximately 9 acres in the Lower TSA and 6 acres in the Upper TSA in August 2024. The remaining VOC plume that exceeds the MCL is located in the groundwater mound area in Remedy Zone C.

In the Upper TSA wells in 2024, TCE concentrations were above the groundwater MCL (only in the mound area) at:

- Three out of 22 total groundwater monitoring wells: CMW-17(ds) (except November), CMW-18(ds), and D-17(ds), and
- Six out of 14 total vapor/groundwater monitoring wells: VMW-B, VMW-E, VMW-I, VMW-J2 (only February), VMW-K (February and May), and VMW-N (only February).

In the Lower TSA, TCE concentrations were above the groundwater MCL at:

- Monitoring well D-17(ds), and
- The two extraction wells EW-2 (February and May) and EW-14 (only February).

Significant remedy performance findings are summarized below.

- ROD remedy objectives for long-term containment were achieved in 2024 based on groundwater flow directions in the Upper and Lower TSA that indicate ongoing inward and downward flow towards the operating extraction wells (Figures 4-1a, 4-1b, 4-2a, and 4-2b). The mechanical shutdown of extraction well EW-2 between 15 July 2024 and 9 October 2024 resulted in a localized increase in groundwater elevation. Generally, TCE concentrations continue to decline or are below laboratory reporting limits in wells outside of the mound area.
- Average flow rates at operational extraction wells continue to be at or above target levels as follows: EW-2 (26 gpm versus target of 25 gpm) and EW-14 (23 gpm versus target of 20 gpm), with the exception of the mechanical downtime for EW-2.

The EMC TSA groundwater and SVE systems removed 0.88 lbs and 4.9 lbs of TCE, respectively, in 2024. Since full-scale remedy startup, TCE mass removal is estimated at 506 lbs from the saturated zone (1997 through 2024) and 92 lbs from the unsaturated zone (2015 through 2024). Current mass removal rates in the saturated zone are slow (less than 2 lbs/yr since 2021 and less than 1 lb/yr in 2024), and the GETS is operated primarily for hydraulic containment of the dissolved VOC plume in the mound area.

6.0 RECOMMENDATIONS AND FUTURE PLANNED ACTIVITIES

6.1 Recommended Changes for Treatment Systems

The CTS continues to operate and maintain long-term containment of the dissolved VOC plume and provide mass removal of the dissolved VOC plume. Continued operation of wells EW-2 and EW-14 is recommended at this time. It is recommended that extraction wells currently in shutdown mode remain in shutdown mode in 2025, since VOC concentrations are compliant with MCL goals in these areas of the remedy.

The SVE system continues to remove VOC mass from the Upper TSA, and continued operation will be voluntary. Based on declining mass removal rates at the remaining five operating vapor extraction wells, shutdown and rebound testing are being evaluated. A separate work plan will be submitted to DEQ regarding changes to the SVE system operation.

6.2 Recommend Changes to Monitoring Program and Schedule Modifications

The following monitoring program and sampling schedule modifications are recommended for DEQ approval. The recommendations are for wells that meet TSA Remedy Criteria (Table 2-1). The monitoring and schedule modifications are summarized in Table 2-2 and include:

- Decreased monitoring frequency for groundwater elevation and groundwater quality monitoring for Remedy Zone C wells VMW-G, VMW-H, and VMW-L (from quarterly to semiannually). TCE concentrations in VMW-G have been below the MCL since May 2020 and have been steadily declining to concentrations less than half of the MCL. TCE concentrations at VMW-H are either detected just above the method report limit or not detected since 2021. TCE has not been detected above the method report limit at VMW-L since it was installed in 2020. These three wells are located in an area with numerous monitoring wells, and the semiannual sampling and monitoring frequency would be sufficient to monitor low-level VOC concentrations and water levels.

7.0 REFERENCES

- Geosyntec, LAI, and S.S. Papadopoulos & Associates, Inc., 2024. Annual Performance Report: 1 January 2023 through 31 December 2023, Troutdale Sandstone Aquifer Remedy. 31 July.
- Geosyntec, 2024. Email. EMC TSA - Plan for shutoff of SVE Wells WMV-H, VMW-C, and VMW-F. 25 April.
- LAI, 2019. 2019 Monitoring and Contingency Plan for PWB Pumping Events, East Multnomah County Troutdale Sandstone Aquifer Remedy, Gresham, Oregon, ECSI # 1479. 7 July 2019.
- LAI, 2024. Response to ODEQ Meeting and Comment Letter—VOCs Troutdale Sandstone Aquifer East Multnomah County, Oregon Landau Project No. 0025116.624. 12 December.
- National Oceanic and Atmospheric Administration (NOAA), 2025a. NOAA Centers for Environmental Information. <https://www.ncei.noaa.gov/cdo-web/>, website accessed February 2025.
- NOAA, 2025b. National Oceanic and Atmospheric Administration, <https://www.weather.gov/pqr/ClimateBookPortland>, website accessed March 2025.
- Oregon Department of Environmental Quality (DEQ), 1996. Remedial Action Record of Decision for the East Multnomah County Groundwater Contamination Site, Troutdale Sandstone Aquifer. 31 December.
- DEQ, 1997. TSA Remedy Order on Consent, WMCSR-NWR-96-08, 14 February.
- DEQ, 2020. Email from K. Thiessen, DEQ: DEQ approval of: EMC TSA Remedy, 2019 PWB Contingency Plan (ECSI #1479).
- DEQ, 2022a. Letter from K. Thiessen, Re: East Multnomah County, Troutdale Sandstone Aquifer (TSA) Remedy Conditional No Further Action Determination for Zone A of the TSA and a No Further Action Declaration for the Site-Related Sand and Gravel Aquifer (SGA). ECSI #1479. 10 November.
- DEQ, 2024a. Email from K. Thiessen. Re: MC TSA - Plan for shutoff of SVE Wells WMV-H, VMW-C, and VMW-F. 25 April.
- DEQ, 2024b. Letter from K. Thiessen. Re: Annual Performance Report 1 Jan. – 31 Dec. 2023 and Five-Year Remedy Performance Evaluation, East Multnomah County, Troutdale Sandstone Aquifer Remedy, Gresham, Oregon. ECSI #1479. 12 November.
- PWB, 2024. Technical Memorandum. Summary of 2023 Groundwater Quality Impacts at Portland Water Bureau Wells Due to Contaminant Releases by the Boeing Company and Cascade Corporation at the East Multnomah County Site. 01 October.
- PWB, 2025. Email from Jack Dahl, Portland Water Bureau, RE: PWB SSWF 2024 Pumping Dates and Volumes (email provided pumping information for the CSSWF). 7 April.

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:

- *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.*
- *If TCE remains below the MCL cleanup level for 2 years, DEQ will evaluate potential decommissioning of these wells.*

2. MONITORING WELL NETWORK MODIFICATION

Wells may be removed from the monitoring program if a well meets one or more of the following criteria:

- *TCE concentrations have been consistently below detection limits for 2 or more years.*
- *The well is located outside the limits of the plume and is no longer needed to monitor hydraulic plume control or restoration progress.*
- *The location of a well duplicates another well better suited to evaluate hydraulic control and restoration progress.*

3. SAMPLING FREQUENCY MODIFICATIONS

The following criteria serve to standardize current and future monitoring adjustments as restoration progresses over the coming years:

Criteria for Increasing Sampling Frequency:

- *The sampling frequency will be increased at a well if TCE concentrations increase to detected levels for two consecutive sampling events where they have been below detection limits for 2 or more years.*
- *The sampling frequency will be increased at a well if TCE concentrations increase above the MCL for two consecutive sampling events where they have been below the MCL for 2 or more years.*

Criteria for Reducing Sampling Frequency:

- *If TCE has been consistently below detection limits for the prior 2 years, the sampling frequency may be reduced.*
- *If TCE has been stable to declining for the prior 2 years, the sampling frequency may be reduced.*

4. CRITERIA FOR WELL DECOMMISSIONINGS

Extraction and monitoring well decommissionings will be proposed to DEQ if the following criteria are met:

- *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.*
- *Monitoring well decommissioning will be proposed to DEQ if TCE concentrations remain below the MCL for 2 consecutive years.*

¹Landau Associates, Prowell Environmental, Pegasus Geoscience, 2006. Troutdale Sandstone Aquifer Remedial Action Annual Performance Evaluation, 04/01/05 through 03/31/06. 30 June 2006.

Table 2-2
Performance Monitoring Schedule - 1 January 2024 through 31 December 2024
TSA Remedy - East Multnomah County

Well	Aquifer	Water Level Measurements	Water Quality Sampling	Responsibility
Groundwater Systems				
CTS Influent	--	--	Quarterly	Cascade
CTS Effluent	--	--	Quarterly	Cascade
TSA Extraction Wells				
EW-1 (pilot shutdown)	Lower TSA	Monthly	Quarterly	Cascade
EW-2 (on)	Lower TSA	Monthly	Quarterly	Cascade
EW-14 (on)	Lower TSA	Monthly	Quarterly	Cascade
EW-23 (pilot shutdown)	Lower TSA	Monthly	Semiannually	Cascade
TSA Monitoring Wells				
BOP-13(ds)	Upper TSA	Annually	Annually	Boeing
BOP-13(dg)	Lower TSA	Annually	Annually	Boeing
BOP-20(ds)	Upper TSA	PWB Monitoring	PWB Monitoring	Boeing
BOP-20(dg)	Lower TSA	Biennial to NLM	Biennial to NLM	Boeing
BOP-23(dg)	Lower TSA	PWB Monitoring	PWB Monitoring	Boeing
BOP-31(ds)	Upper TSA	Annually	Annually	Boeing
BOP-31(dg)	Lower TSA	Annually	Annually	Boeing
BOP-62(ds)	Upper TSA	PWB Monitoring	PWB Monitoring	Boeing
BOP-65(ds)	Upper TSA	PWB Monitoring	PWB Monitoring	Boeing
D-17(ds)	Lower TSA	Quarterly	Quarterly	Cascade
D-17(dg)	Lower TSA	Quarterly	Quarterly	Cascade
EW-11 (monitoring only)	Lower TSA	Annually	Biennial	Cascade
EW-12 (monitoring only)	Lower TSA	Semiannually	Semiannually	Cascade
EW-13 (monitoring only)	Lower TSA	PWB Monitoring	PWB Monitoring	Boeing
CMW-10(ds)	Upper TSA	Semiannually	Semiannually	Cascade
CMW-14R(ds)	Lower TSA	Semiannually	Semiannually	Cascade
CMW-17(ds)	Upper TSA	Quarterly	Quarterly	Cascade
CMW-18(ds)	Upper TSA	Quarterly	Quarterly	Cascade
CMW-19(ds)	Upper TSA	Quarterly	Quarterly	Cascade
CMW-20(ds)	Upper TSA	Semiannually	Annually	Cascade
CMW-22(dg)	Lower TSA	Semiannually PWB Monitoring	Biennial PWB Monitoring	Cascade
CMW-24(dg)/EW-5	Lower TSA	Semiannually	Semiannually	Cascade
CMW-25(dg)	Lower TSA	Semiannually	Semiannually	Cascade
CMW-36(dg)	Lower TSA	PWB Monitoring	PWB Monitoring	Cascade
Soil Vapor and Groundwater Monitoring Wells				
VMW-17d-95.5 (soil vapor only)	Upper TSA	Quarterly	Quarterly	Cascade
VMW-A	Upper TSA	Quarterly	Quarterly	Cascade
VMW-B	Upper TSA	Quarterly	Quarterly	Cascade
VMW-C	Upper TSA	Quarterly	Quarterly	Cascade
VMW-D	Upper TSA	Quarterly	Quarterly	Cascade
VMW-E	Upper TSA	Quarterly	Quarterly	Cascade
VMW-F	Upper TSA	Quarterly	Quarterly	Cascade
VMW-G	Upper TSA	Quarterly to Semiannually	Quarterly to Semiannually	Cascade
VMW-H	Upper TSA	Quarterly to Semiannually	Quarterly to Semiannually	Cascade
VMW-I	Upper TSA	Quarterly	Quarterly	Cascade
VMW-J2	Upper TSA	Quarterly	Quarterly	Cascade
VMW-K	Upper TSA	Quarterly	Quarterly	Cascade
VMW-L	Upper TSA	Quarterly to Semiannually	Quarterly to Semiannually	Cascade
VMW-M	Upper TSA	Quarterly	Quarterly	Cascade
VMW-N	Upper TSA	Quarterly	Quarterly	Cascade
Portland Water Bureau				
PWB-01Its	Lower TSA	Annually - Feb	Annually - Feb	Cascade
PWB-01uts	Upper TSA	Annually - Feb	Annually - Feb	Cascade

NOTES:

1. Annual monitoring performed in August; semiannual in February and August; quarterly in February, May, August, and November. Next biennial sampling event planned for August 2025.
2. Recommendations for modifications to the Monitoring Schedules are indicated in red text.
3. Blue text indicates additional monitoring requirements. PWB wells will be sampled until 2028 with 2024 as Year 1.
4. PWB Monitoring indicates the selected well is used for PWB Contingency Monitoring during times of PWB pumping.
NLM = No longer monitored

Table 2-3
Significant Remedy Documents – 1 January 2024 through 31 December 2024
TSA Remedy – East Multnomah County Oregon

Date	Document Type	Author	Title	Comments
04/25/2024	Emails	Geosyntec and DEQ	EMC TSA - Plan for shutoff of SVE Wells WMV-H, VMW-C, and VMW-F	EMC TSA request and DEQ approval to shut down SVE at three wells: VMW-H, VMW-C, and VMW-F.
10/01/2024	Technical Memorandum	PWB (Attached to DEQ 10/16/24 email)	Summary of 2023 Groundwater Quality Impacts at Portland Water Bureau Wells Due to Contaminant Releases by the Boeing Company and Cascade Corporation at the East Multnomah County Site	PWB request to DEQ to require increased monitoring of TCE in Zone A of the EMC TSA. PWB performed a trend analysis on TCE data in wells PWB-1(UTS) and PWB-1(LTS) and determined there is a statistically significant increasing concentration that is projected to exceed the TCE MCL of 5 µg/L by 2047. PWB states that further mitigation such as hydraulic control should be considered and might be required per the ROD.
10/16/2024	Email	DEQ	Agenda for Boeing/Cascade meeting 10/16/24	DEQ agenda to discuss the 10/01/2024 PWB memo and five other items.
11/12/2024	Memo	DEQ	Annual Performance Report 1 Jan. – 31 Dec. 2023 and Five-Year Remedy Performance Evaluation, East Multnomah County, Troutdale Sandstone Aquifer Remedy, Gresham, Oregon. ECSI #1479	<p>DEQ approves the document and the Section 7.0 <i>Recommendations and Future Planned Activities</i>.</p> <p>In summary, decrease monitoring frequency at CMW-10(ds); discontinue monitoring groundwater elevation and quality in Zones B and D except for the PWB Contingency Wells (BOP-20(dg) and BOP-23(dg)); shutdown SVE wells VMW-H, VMW-C, and VMW-F.</p> <p>DEQ requests the following wells be retained for possible future sampling: BOP-44(ds), BOP-44(dg), EMC-2(dg), BOP-44(usg), BOP-21(ds), BOP-42(ds), BOP-42(dg), BOP-60(dg), CMW-8(dg), and CMW-10(dg).</p>

Table 2-3
Significant Remedy Documents – 1 January 2024 through 31 December 2024
TSA Remedy – East Multnomah County Oregon

Date	Document Type	Author	Title	Comments
12/12/2024	Memo	Cascade	Cascade’s Response to DEQ PFAS Inquiry in its November 12, 2024, Letter and the October 16, 2024, Meeting	Cascade’s response to the 11/12/2024 DEQ Memo and a meeting with DEQ on 10/16/2024. In summary, Cascade requests that PFAS related requests are separated from the EMC TSA Remedy because PFAS is not addressed in the remedy. Cascade also requests that Boeing and Cascade remain as separate entities concerning future PFAS related inquiries. Cascade requested a 60-day extension to the PFAS related inquiries due to the holiday season.
12/12/2024	Memo	Landau	Response to ODEQ Meeting and Comment Letter—VOCs Troutdale Sandstone Aquifer East Multnomah County, Oregon Landau Project No. 0025116.624	Landau’s response to the 11/12/2024 DEQ Memo and a meeting with DEQ on 10/16/2024 on behalf of both Cascade and Boeing (EMC Members). In summary, the EMC members are requesting TCE data from PWB to independently evaluate the TCE trend analysis findings by PWB presented in their October Memo. The EMC members also request the following from PWB: historical and current pumping data in the CSSWF, groundwater elevation and analytical results from CSSWF wells, and VOC data associated with an outfall on the Columbia Slough. The EMC members agree to retain the monitoring wells listed in the November Memo in the event of future monitoring.

Table 3-1
Well Construction Data - 1 January 2024 through 31 December 2024
TSA Remedy - East Multnomah County

Well	Aquifer Screened	NAD 1983 State Plane Oregon (ft)		Elevations (ft NGVD29)				Depth of Boring (ft bgs)
		X Coordinate	Y Coordinate	Ground Surface	Top of Casing	Top of Screen	Bottom of Screen	
Extraction Wells								
EW-2	Lower TSA	7700692.2	689205.9	126.2	126.01	-6.8	-46.8	178
EW-14	Lower TSA	7699952.7	689329.7	128.4	127.63	-21.9	-51.9	230
Monitoring Wells & Former Extraction Wells Approved for Monitoring Use								
BOP-13(ds)	Upper TSA	7699461.3	689388.4	126.7	128.94	8.7	-1.3	128
BOP-13(dg)	Lower TSA	7699465.9	689375.4	127.5	128.71	-41.0	-61.0	193
BOP-20(ds)	Upper TSA	7698395.4	691041.6	78.2	77.45	9.2	-10.8	97
BOP-20(dg)	Lower TSA	7698381.4	691042.6	78.1	77.32	-104.9	-124.9	209
BOP-21(ds)	Upper TSA	7697591.5	691105.0	77.1	78.02	-87.9	-107.9	192
BOP-23(dg)	Lower TSA	7699526.6	690832.2	75.2	76.96	-25.8	-45.8	125
BOP-31(ds)	Upper TSA	7699322.2	690090.6	97.1	99.04	17.1	7.1	91
BOP-31(dg)	Lower TSA	7699323.6	690105.1	96.5	98.51	-33.5	-53.5	154
BOP-42(ds)	Upper TSA	7698251.0	689588.3	129.3	130.74	-8.7	-28.7	158.5
BOP-42(dg)	Lower TSA	7698236.8	689588.9	129.5	130.71	-92.5	-112.5	243.2
BOP-44(ds)	Upper TSA	7698995.4	691938.6	32.5	35.24	-23.4	-43.4	76
BOP-44(dg)	Lower TSA	7699014.1	691938.6	32.6	35.15	-103.9	-123.9	166
BOP-60(dg)	Lower TSA	7697704.8	690369.9	93.8	93.59	-165.2	-185.2	280
BOP-61(ds)	Upper TSA	7698640.8	690240.7	96.3	94.64	7.7	-2.7	100
BOP-61(dg)	Lower TSA	7698632.5	690246.1	96.2	94.43	-59.8	-69.8	171
BOP-62(ds)	Upper TSA	7697855.5	689987.2	112.1	112.29	-41.9	-51.9	166
BOP-65(ds)	Upper TSA	7698234.0	690115.0	104.4	104.22	1.9	-8.1	113
BOP-66(ds)	Upper TSA	7698670.7	690111.4	103.3	102.97	12.8	2.8	102
D-17(ds)	Lower TSA	7699886.2	689530.7	121.9	123.28	11.9	1.9	121
D-17(dg)	Lower TSA	7699869.5	689532.2	121.8	124.61	-30.2	-50.2	178
EMC-2(dg)	Lower TSA	7701014.5	692008.0	44.8	43.51	-75.2	-85.2	140
EW-1	Lower TSA	7699560.1	689504.6	124.1	124.04	-27.8	-57.8	184
EW-3	Upper TSA	7697737.4	690313.3	97.1	94.26	-77.9	-102.9	205
EW-11	Lower TSA	7702091.6	689192.5	115.4	114.73	-22.8	-62.8	235
EW-12	Lower TSA	7699532.9	689992.8	94.4	94.14	-16.1	-46.1	197
EW-13	Lower TSA	7698486.3	690082.6	104.5	103.59	-33.5	-73.5	232
EW-23	Lower TSA	7698806.9	690524.7	83.8	83.93	-26.2	-66.2	157
CMW-8(dg)	Lower TSA	7700075.7	689028.3	137.0	136.21	-41.0	-56.0	199
CMW-10(ds)	Upper TSA	7700599.9	688922.1	135.2	134.54	21.2	6.2	135
CMW-10(dg)	Lower TSA	7700589.4	688923.9	135.3	135.05	-53.7	-68.7	210
CMW-14R(ds)	Lower TSA	7700852.9	689866.6	81.0	82.23	28.0	13.0	78
CMW-17(ds)	Upper TSA	7700547.4	689425.5	120.0	121.89	23.5	13.5	110
CMW-18(ds)	Upper TSA	7700889.2	689267.3	118.2	117.66	16.2	6.2	118
CMW-19(ds)	Upper TSA	7700297.2	688642.8	144.3	144.08	9.8	-0.2	170
CMW-20(ds)	Upper TSA	7699683.6	688990.1	150.5	152.72	6.3	-3.7	158
CMW-22(dg)	Lower TSA	7701545.4	689850.7	82.1	81.65	-41.9	-51.9	141
CMW-24(dg)/EW-5	Lower TSA	7700192.8	689918.9	80.5	77.74	8.0	-42.1	127
CMW-25(dg)	Lower TSA	7699797.3	690022.8	75.7	75.28	-31.5	-41.5	121
CMW-26(dg)	Lower TSA	7703189.8	689303.5	106.3	108.98	-58.8	-68.8	238
CMW-36(dg)	Lower TSA	7701389.7	690792.4	79.1	78.84	-31.2	-40.9	162
BOP-44(ug)	SGA	7698996.3	691888.8	24.6	34.25	-181.0	-191.0	219

Table 3-1
Well Construction Data - 1 January 2024 through 31 December 2024
TSA Remedy - East Multnomah County

Well	Aquifer Screened	NAD 1983 State Plane Oregon (ft)		Elevations (ft NGVD29)				Depth of Boring (ft bgs)
		X Coordinate	Y Coordinate	Ground Surface	Top of Casing	Top of Screen	Bottom of Screen	
Soil Vapor and Groundwater Monitoring Wells								
VW-75d-95.5	Upper TSA-Vapor only	7700536.9	689410.4	120.0	123.00	44.5	24.5	130
VMW-A	Upper TSA + Vapor	7700436.7	689423.9	121.0	123.34 (TOC)	34.5	14.5	114
VMW-B	Upper TSA + Vapor	7700630.8	689380.7	120.7	123.25 (TOC)	36.2	16.2	111
VMW-C	Upper TSA + Vapor	7700339.8	689398.9	122.0	124.17 (TOC)	34.5	14.5	110
VMW-D	Upper TSA + Vapor	7700693.2	689302.0	120.6	122.67 (TOC)	33.1	13.1	110
VMW-E*	Upper TSA + Vapor	7700720.3	689167.7	126.8	129.14	-13.207	-43.207	---
VMW-F*	Upper TSA + Vapor	7700742.7	689252.3	118.3	119.89	-11.698	-41.698	---
VMW-G*	Upper TSA + Vapor	7700722.3	689335.1	118.3	119.89	-11.698	-41.698	---
VMW-H	Upper TSA + Vapor	7700240.9	689484.6	120.1	123.63	34.067	14.067	---
VMW-I	Upper TSA + Vapor	7700614.9	689242.7	125.8	128.73	15.77	-24.24	160
VMW-J2	Upper TSA + Vapor	7700421.0	689306.9	123.8	126.87	33.283	3.283	121
VMW-K	Upper TSA + Vapor	7700281.1	689359.2	123.5	126.55	32.767	2.767	121
VMW-L	Upper TSA + Vapor	7700260.4	689588.3	110.1	111.98	28.141	-1.859	115
VMW-M	Upper TSA + Vapor	7700507.6	689556.8	108.6	111.47	28.618	-1.382	110
VMW-N	Upper TSA + Vapor	7700730.3	689494.5	109.5	112.52	29.039	-0.961	111
Soil Vapor and Groundwater Monitoring Wells								
PWB-01lts	Lower TSA	7700352.3	692604.8	14.0	16.48	-98.0	-118.0	134
PWB-01uts	Upper TSA	7700344.1	692612.1	13.9	15.98	-51.1	-71.1	86

NOTES:

1. Monitoring wells indicated in red text were recommended for sampling frequency modifications (Table 2-2). Wells indicated in red text and green shading are recommended for decommissioning. Wells indicated in black text and green shading were previously approved for decommissioning but have not yet been decommissioned. Wells indicated in black text and blue shading were previously approved for decommissioning but DEQ requested they be retained for possible future sampling.

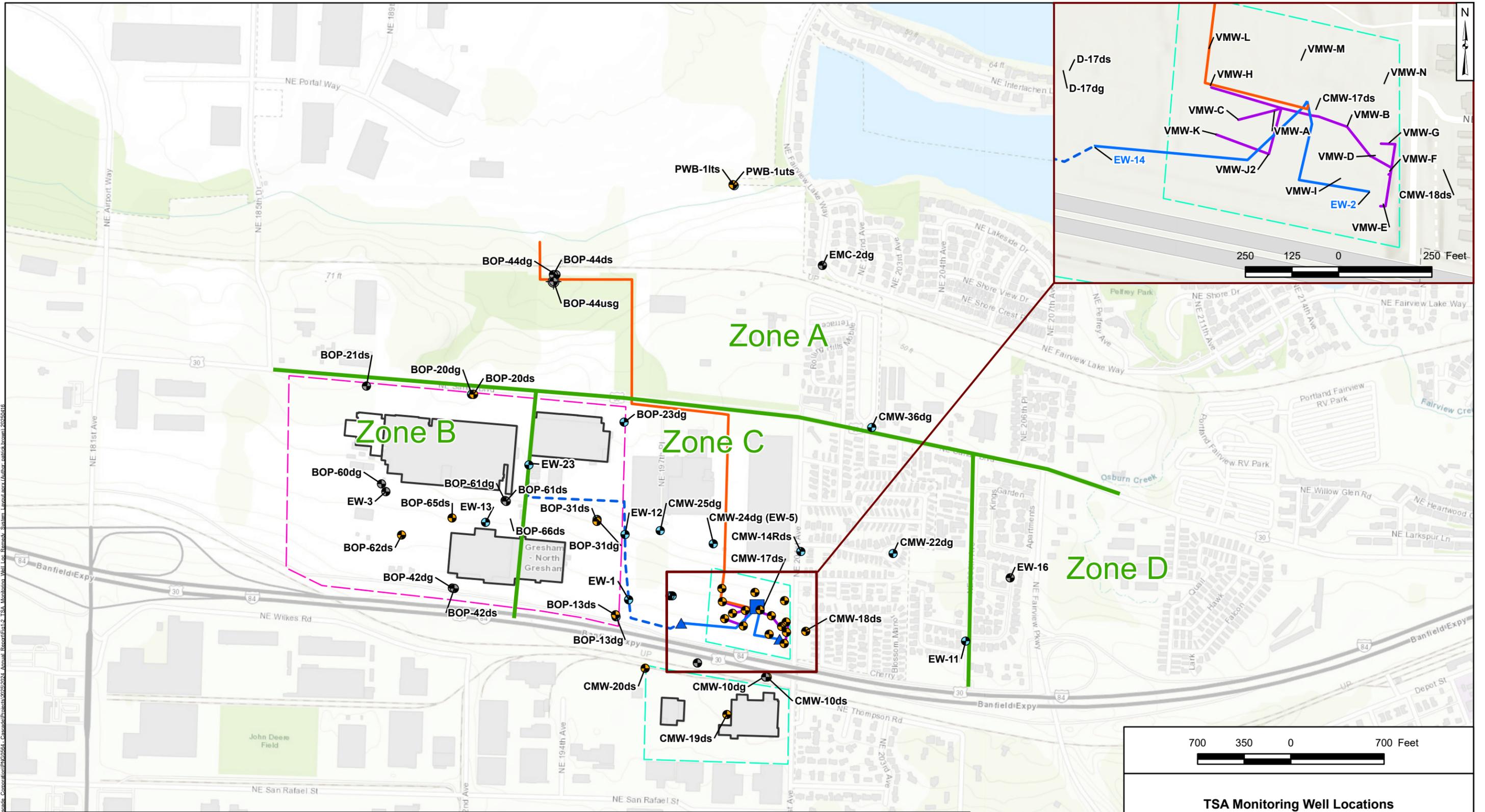
ft = feet

MSL = mean sea level

bgs = below ground surface

*Angled well

FIGURES



Legend

Upper TSA Monitoring Well	Groundwater Treatment System	Approximate Extracted Groundwater Conveyance Pipeline, Active
Lower TSA Monitoring Well	Structure	Approximate Treated Groundwater Discharge Pipeline, Active
SGA Monitoring Well	Boeing Property Boundary	Approximate Extracted Groundwater Conveyance Pipeline, No Longer In Use
Decommissioned or No Longer Monitored Monitoring Well	Cascade Corporation Property Boundary	Zone Boundary
Lower TSA Extraction Well	Soil Vapor Extraction Trench, Active	

Note
 Blue labels show currently operating extraction wells. Monitoring of wells PWB-1Its and PWB-1uts resumed in the first quarter of 2024. Wells EW-23 and EW-1 are transitioned from extraction wells to lower TSA monitoring wells.

700 350 0 700 Feet

TSA Monitoring Well Locations and Remediation System Layout

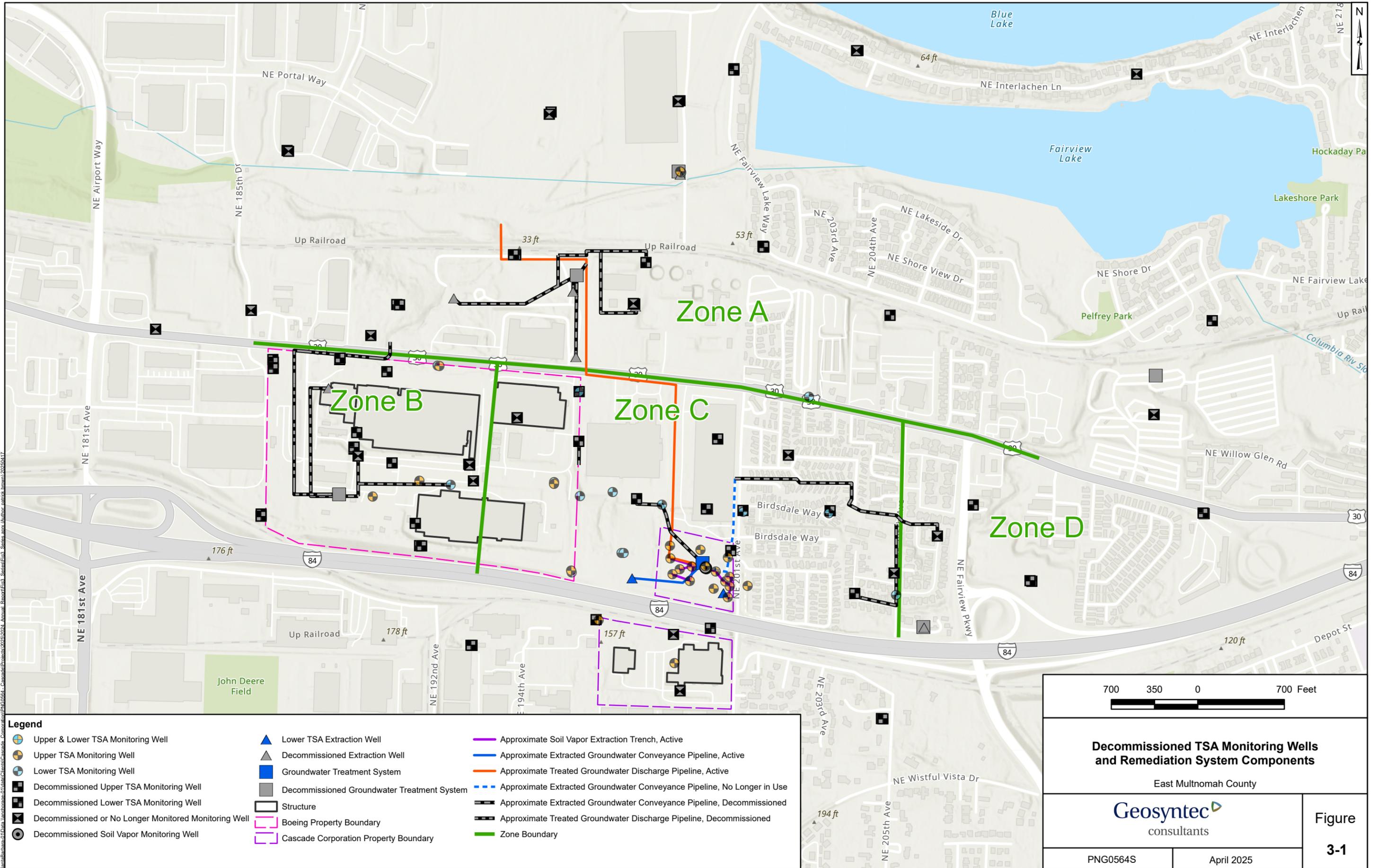
East Multnomah County

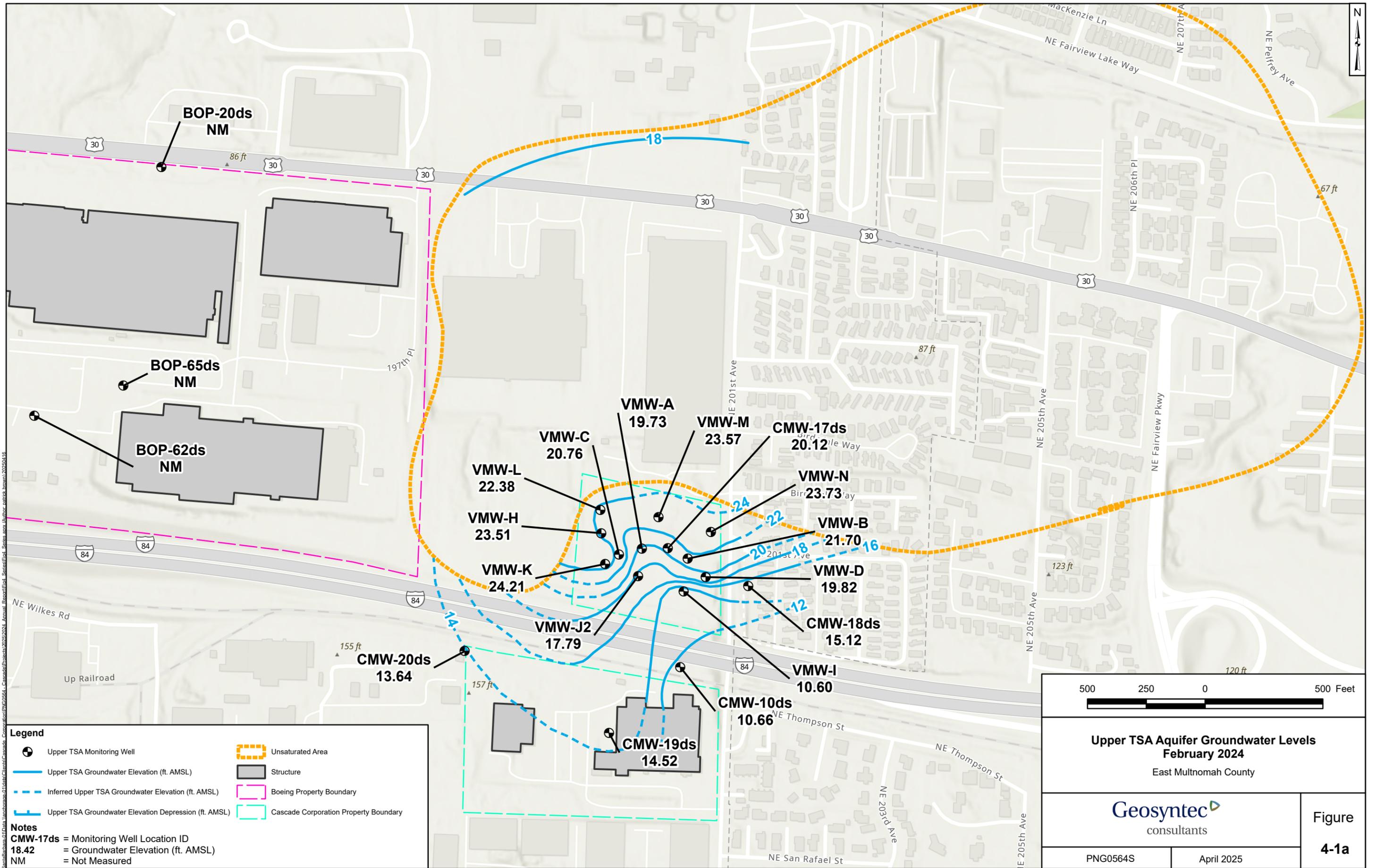
Geosyntec
consultants

PNG0564S April 2025

Figure 1-2

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500 250 0 500 Feet

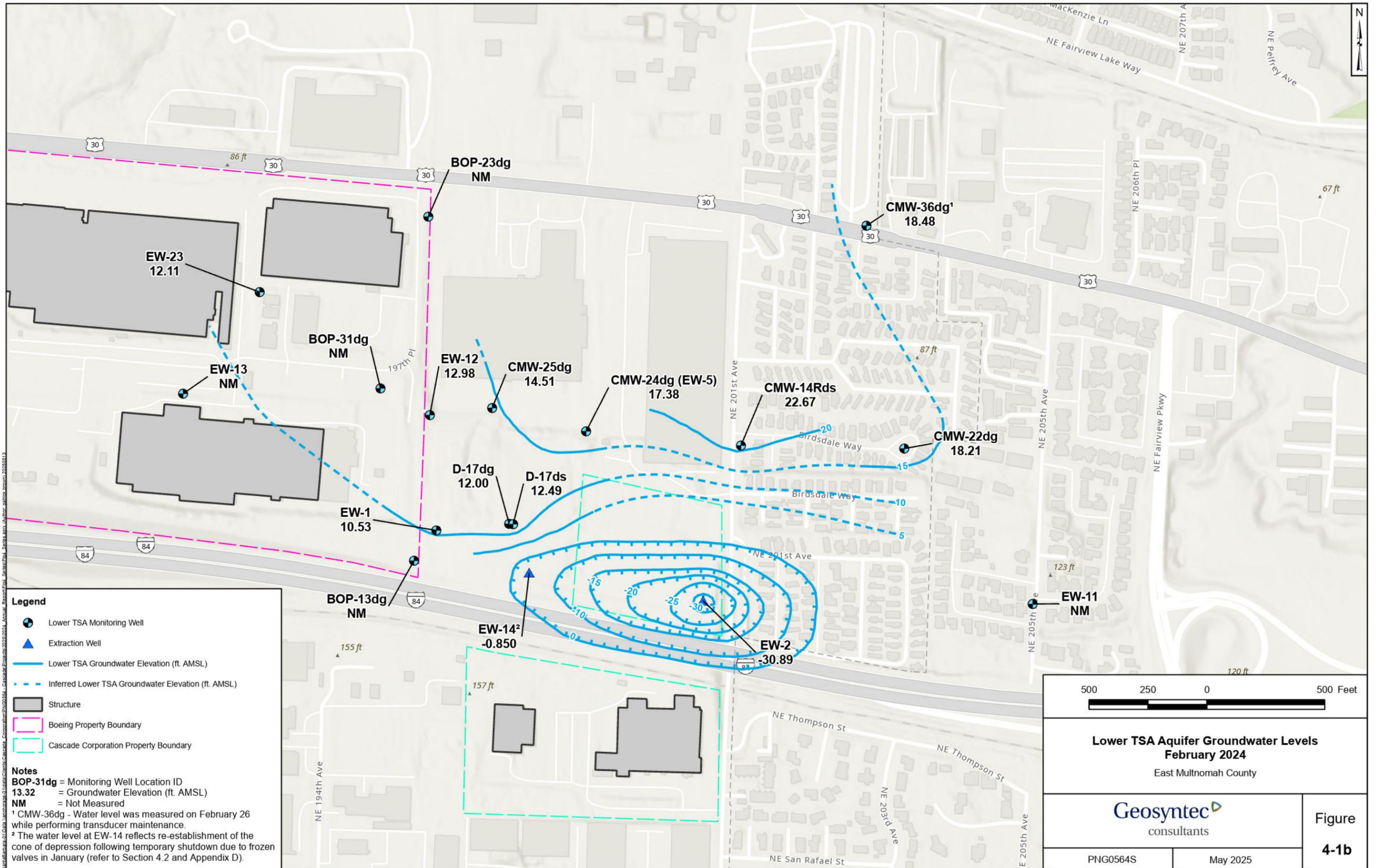
Upper TSA Aquifer Groundwater Levels
February 2024
 East Multnomah County

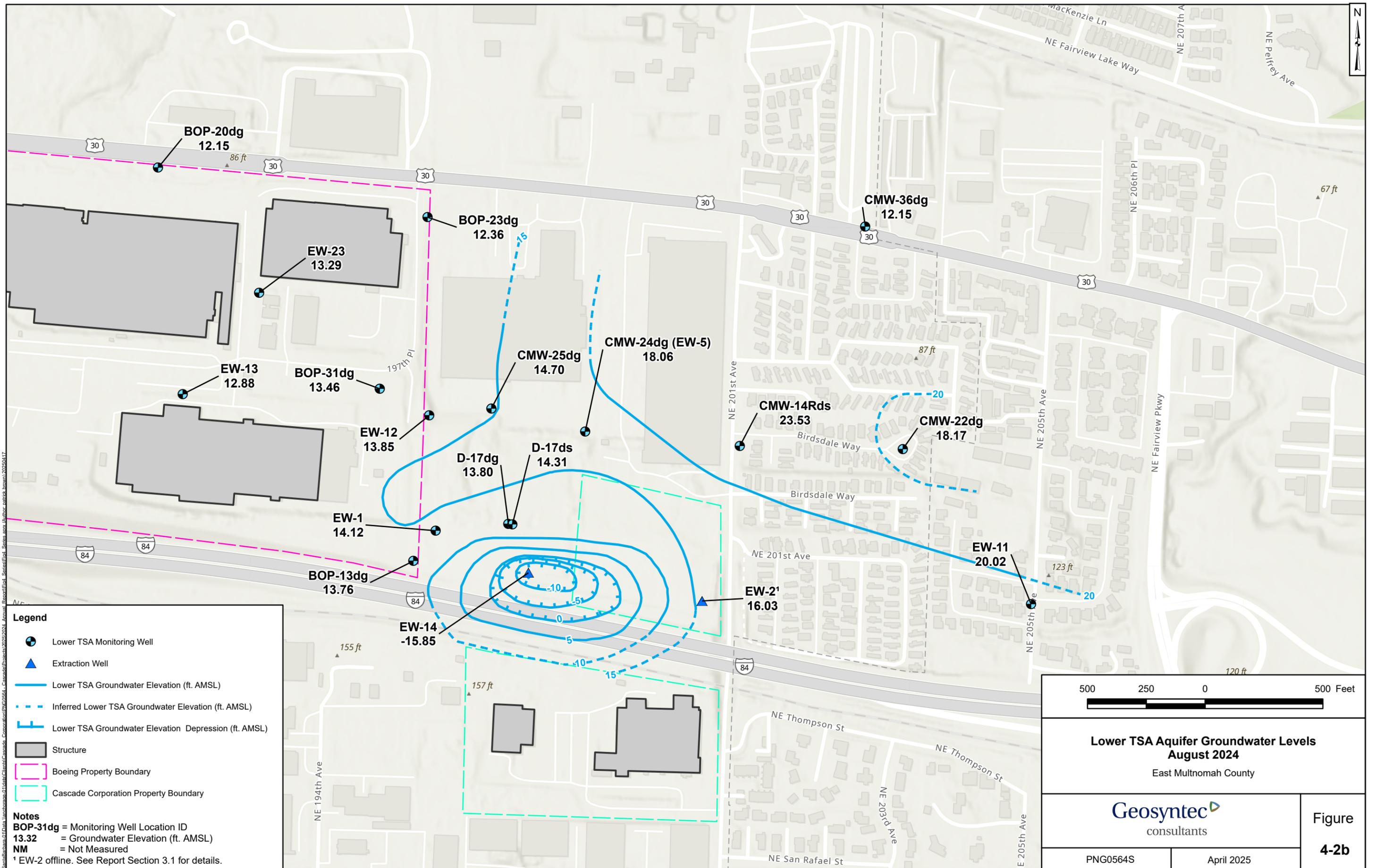
Geosyntec
 consultants

Figure
4-1a

PNG0564S

April 2025





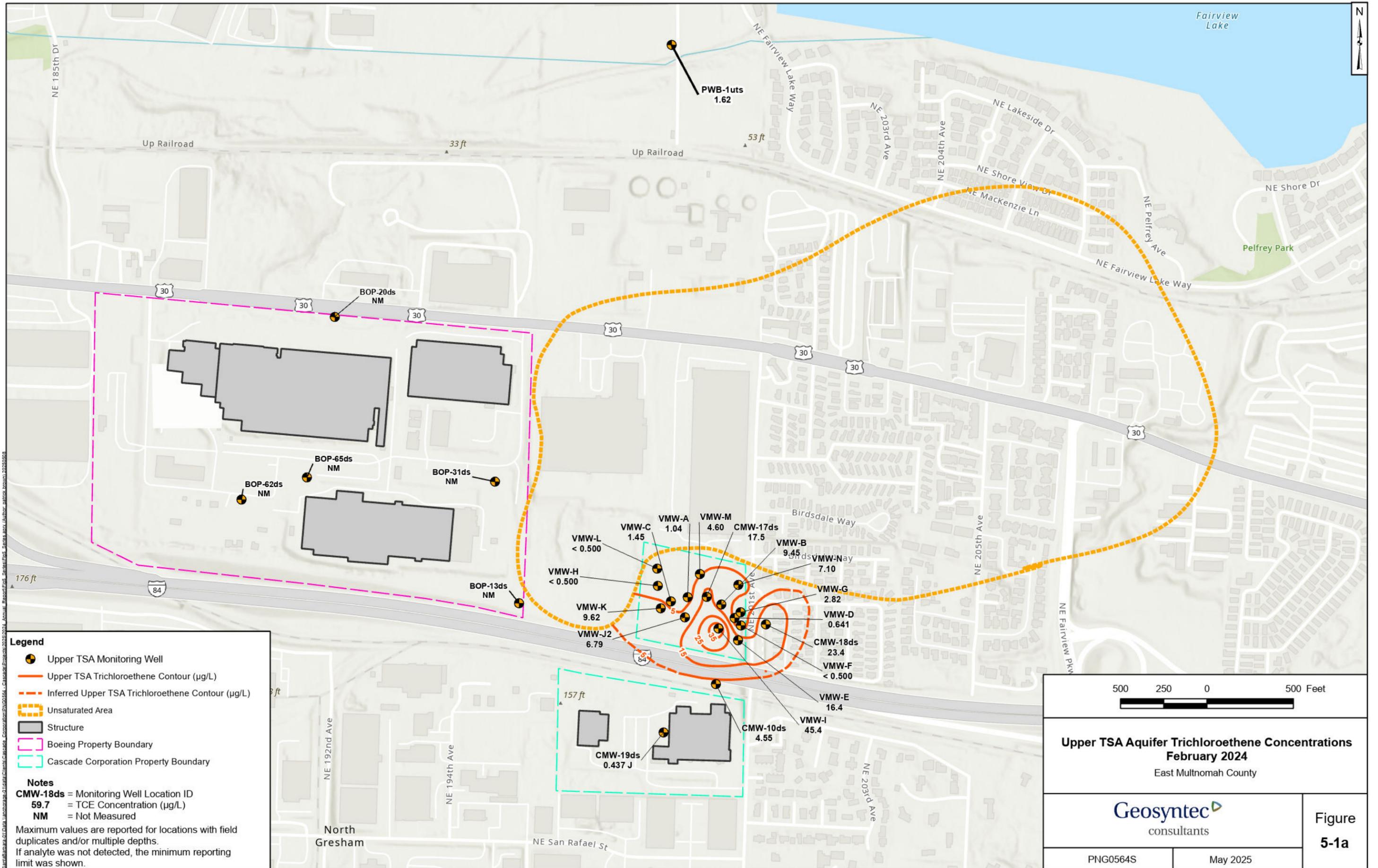
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Lower TSA Aquifer Groundwater Levels
August 2024
 East Multnomah County

Geosyntec
 consultants

Figure
4-2b

PNG0564S April 2025



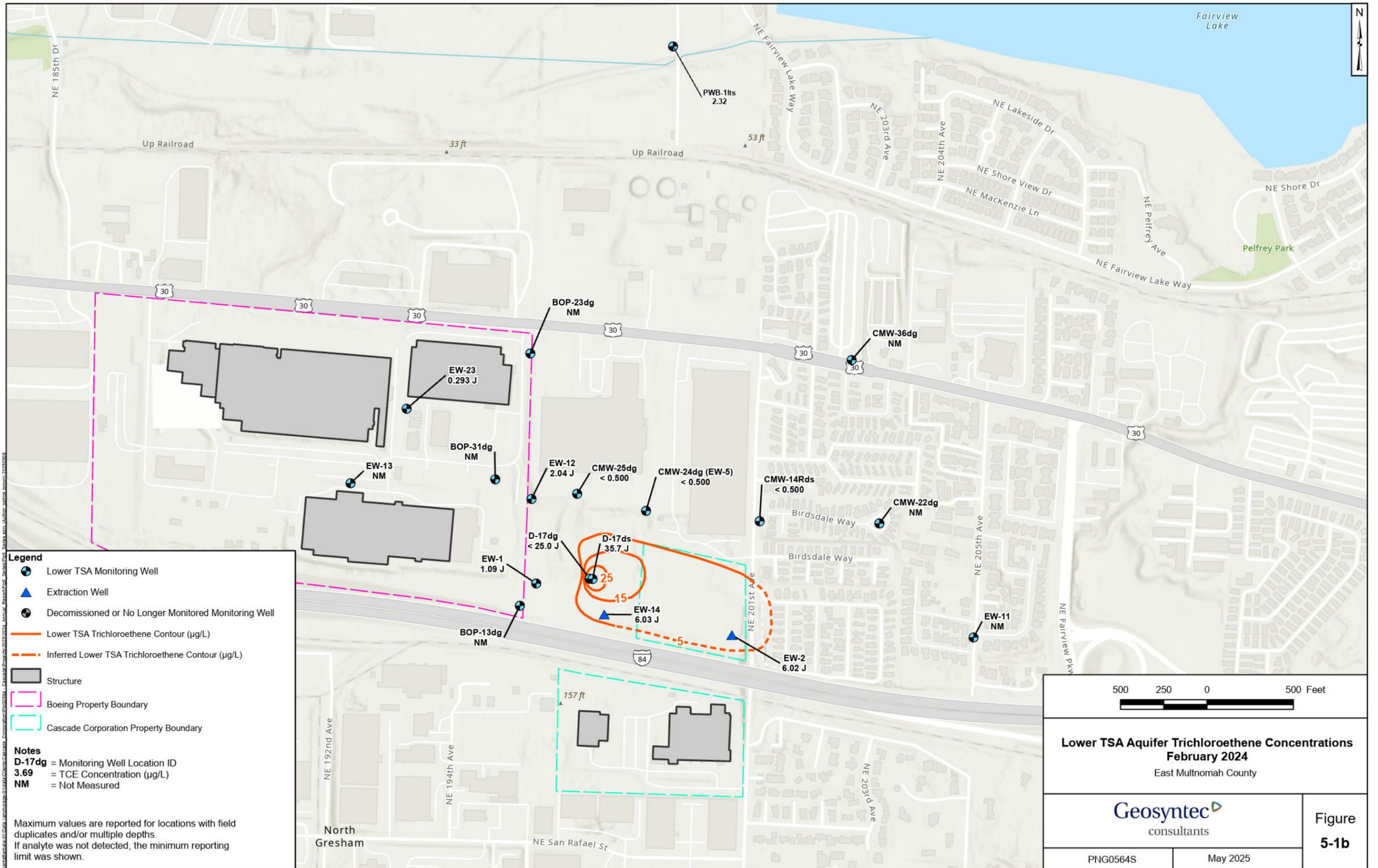
500 250 0 500 Feet

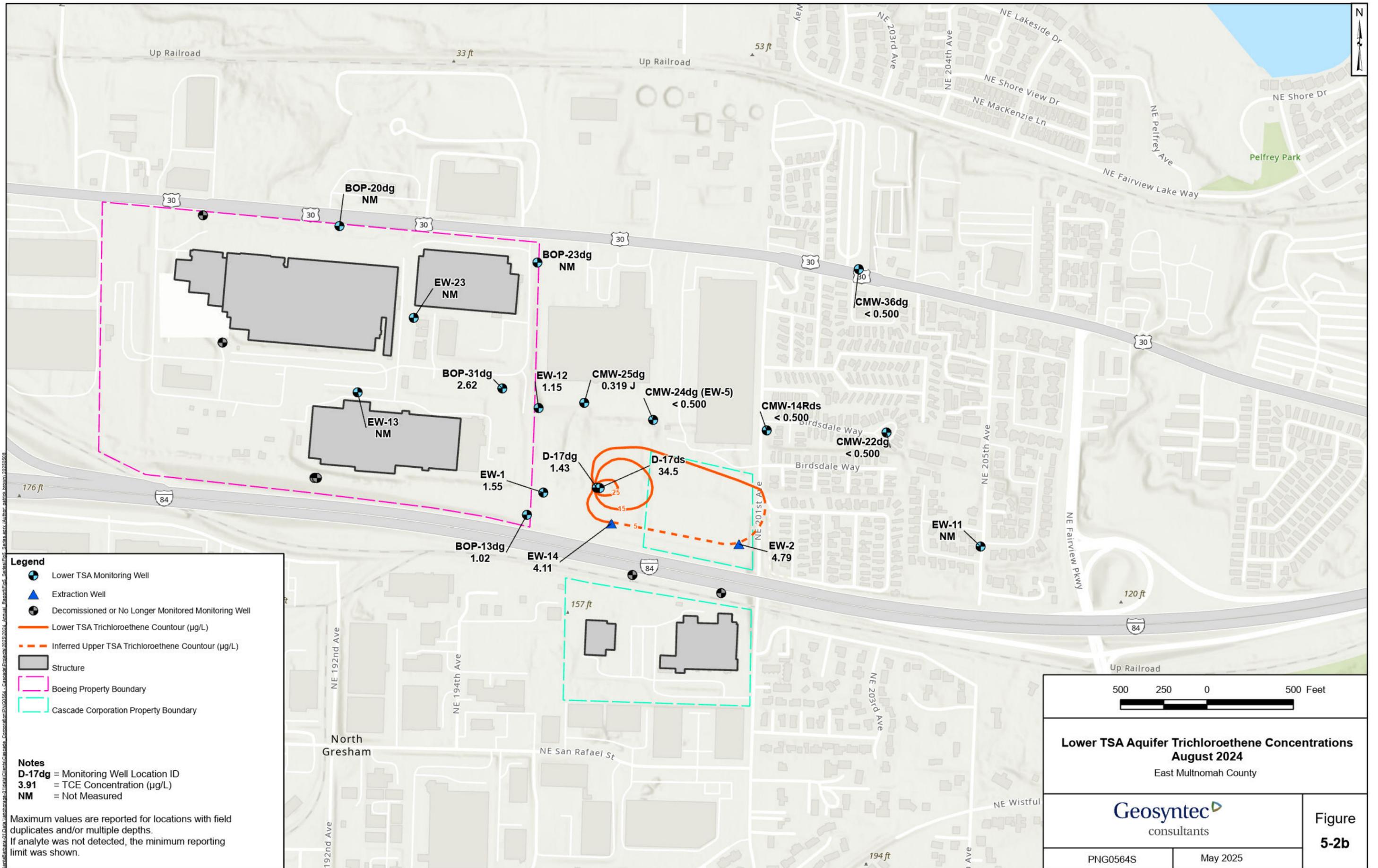
**Upper TSA Aquifer Trichloroethene Concentrations
February 2024**
East Multnomah County

Geosyntec
consultants

Figure
5-1a

PNG0564S May 2025





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 20240506 10:00:00
 Author: jacob.brown

APPENDIX A

Extraction Rates

Table A-1
TSA Extraction Rates 1 January 2024 through 31 December 2024 and
12-Month Averages through 31 December 2024
East Multnomah County TSA Remedy

Zone	12-Mo. Avg.	01/2024	02/2024	03/2024	04/2024	05/2024	06/2024	07/2024	08/2024	09/2024	10/2024	11/2024	12/2024
<i>EW-2</i> ²	25.6	24.3	27.6	22.9	20.2	19.8	24.7	8.6	0.0	0.0	28.1	32.9	31.8
<i>EW-14</i>	23.1	23.3	20.2	25.3	25.6	24.9	23.2	21.1	22.7	23.4	23.6	22.4	21.7
<i>Total Avg Flow TSA</i>	48.7	47.6	47.7	48.1	45.8	44.7	48.0	29.8	22.7	23.4	51.7	55.3	53.5

NOTES:

1. Monthly average flow rates are shown in gallons per minute for each well.
2. The pump in EW-2 failed on July 15 due to the presence of sand was offline until a new pump could be sourced and installed on October 9. The 12-month average flowrate for EW-2 is biased high as the average is reported only for operational period and neglects the shutdown period. Figures A-1 and A-2 present monthly flowrates including the period that extraction wells were offline.

Table A-2
Discharge Monitoring Summary - Cental Treatment System
1 January 2024 through 31 December 2024
East Multnomah County TSA Remedy

Parameter	Discharge Limitations ¹	Unit	Sample Date	System Discharge			Number of Exceedances	Sample Frequency
				Min	Avg	Max		
Jan-24								
pH	6.0 – 9.0	su	—	7.86	7.87	7.88	0	Weekly
Temperature	—	°F	—	60	60	60	—	Weekly
Flow	—	gpm	—	--	48	--	—	Daily
Feb-24								
Trichloroethene	5.0	µg/L	2/6/2024	--	< 0.500 J	--	0	Quarterly
1,1-Dichloroethene	7.0	µg/L	2/6/2024	--	< 0.500	--	0	Quarterly
cis-1,2-Dichloroethene	70	µg/L	2/6/2024	--	< 0.500	--	0	Quarterly
Tetrachloroethene	5.0	µg/L	2/6/2024	--	< 0.500 J	--	0	Quarterly
Vinyl Chloride	2.0	µg/L	2/6/2024	--	< 0.500	--	0	Quarterly
pH	6.0 – 9.0	su	—	7.86	7.88	7.89	0	Weekly
Temperature	—	°F	—	60	60	60	—	Weekly
Flow	—	gpm	—	--	48	--	—	Daily
Mar-24								
pH	6.0 – 9.0	su	—	7.84	7.86	7.88	0	Weekly
Temperature	—	°F	—	60	60	60	—	Weekly
Flow	—	gpm	—	--	48	--	—	Daily
Apr-24								
pH	6.0 – 9.0	su	—	7.54	7.79	7.87	0	Weekly
Temperature	—	°F	—	60	60	60	—	Weekly
Flow	—	gpm	—	--	46	--	—	Daily
May-24								
Trichloroethene	5.0	µg/L	5/2/2024	--	< 0.500	--	0	Quarterly
1,1-Dichloroethene	7.0	µg/L	5/2/2024	--	< 0.500	--	0	Quarterly
cis-1,2-Dichloroethene	70	µg/L	5/2/2024	--	< 0.500	--	0	Quarterly
Tetrachloroethene	5.0	µg/L	5/2/2024	--	< 0.500	--	0	Quarterly
Vinyl Chloride	2.0	µg/L	5/2/2024	--	< 0.500	--	0	Quarterly
pH	6.0 – 9.0	su	—	7.63	7.78	7.94	0	Weekly
Temperature	—	°F	—	60	60	61	—	Weekly
Flow	—	gpm	—	--	45	--	—	Daily
Jun-24								
pH	6.0 – 9.0	su	—	7.69	7.85	7.91	0	Weekly
Temperature	—	°F	—	60	60	61	—	Weekly
Flow	—	gpm	—	--	48	--	—	Daily
Jul-24								
pH	6.0 – 9.0	su	—	7.89	7.91	7.94	0	Weekly
Temperature	—	°F	—	60	62	66	—	Weekly
Flow	—	gpm	—	--	30	--	—	Daily
Aug-24								
Trichloroethene	5.0	µg/L	8/6/2024	--	< 0.500	--	0	Quarterly
1,1-Dichloroethene	7.0	µg/L	8/6/2024	--	< 0.500 J	--	0	Quarterly
cis-1,2-Dichloroethene	70	µg/L	8/6/2024	--	< 0.500	--	0	Quarterly
Tetrachloroethene	5.0	µg/L	8/6/2024	--	< 0.500	--	0	Quarterly
Vinyl Chloride	2.0	µg/L	8/6/2024	--	< 0.500	--	0	Quarterly
pH	6.0 – 9.0	su	—	7.88	7.90	7.91	0	Weekly
Temperature	—	°F	—	60	60	60	—	Weekly
Flow	—	gpm	—	--	23	--	—	Daily

Table A-2
Discharge Monitoring Summary - Cental Treatment System
1 January 2024 through 31 December 2024
East Multnomah County TSA Remedy

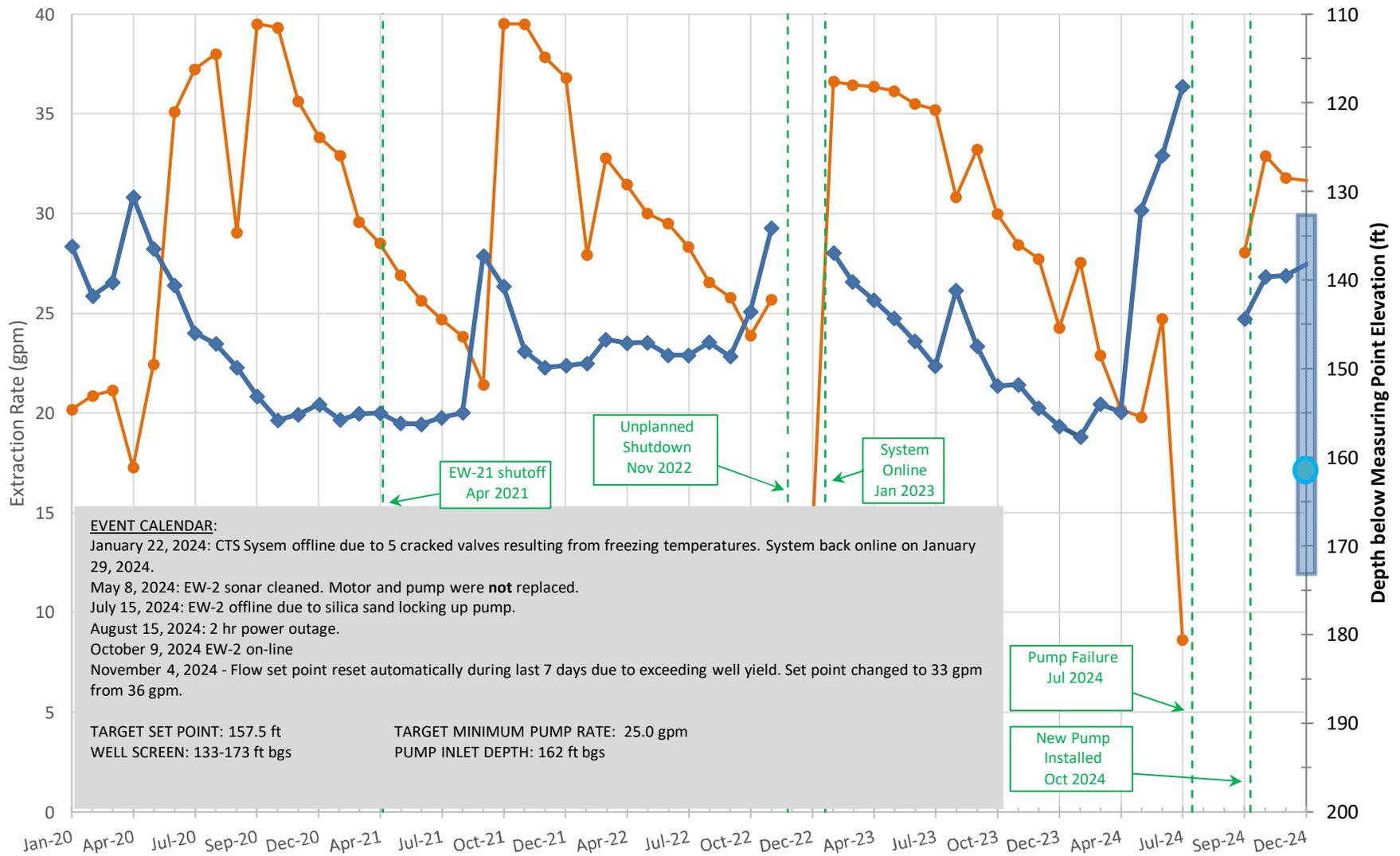
Parameter	Discharge Limitations ¹	Unit	Sample Date	System Discharge			Number of Exceedances	Sample Frequency
				Min	Avg	Max		
Sep-24								
pH	6.0 – 9.0	su	—	7.84	7.88	7.90	0	Weekly
Temperature	—	°F	—	60	60	60	—	Weekly
Flow	—	gpm	—	--	23	--	—	Daily
Oct-24								
pH	6.0 – 9.0	su	—	7.90	7.91	7.92	0	Weekly
Temperature	—	°F	—	60	60	60	—	Weekly
Flow	—	gpm	—	--	52	--	—	Daily
Nov-24								
Trichloroethene	5.0	µg/L	11/6/2024	--	< 0.500	--	0	Quarterly
1,1-Dichloroethene	7.0	µg/L	11/6/2024	--	< 0.500	--	0	Quarterly
cis-1,2-Dichloroethene	70	µg/L	11/6/2024	--	< 0.500	--	0	Quarterly
Tetrachloroethene	5.0	µg/L	11/6/2024	--	< 0.500	--	0	Quarterly
Vinyl Chloride	2.0	µg/L	11/6/2024	--	< 0.500	--	0	Quarterly
pH	6.0 – 9.0	su	—	7.88	7.91	7.94	0	Weekly
Temperature	—	°F	—	60	60	60	—	Weekly
Flow	—	gpm	—	--	55	--	—	Daily
Dec-24								
pH	6.0 – 9.0	su	—	7.89	7.90	7.91	—	Weekly
Temperature	—	°F	—	60	60	60	—	Weekly
Flow	—	gpm	—	--	53	--	—	Daily

NOTES:

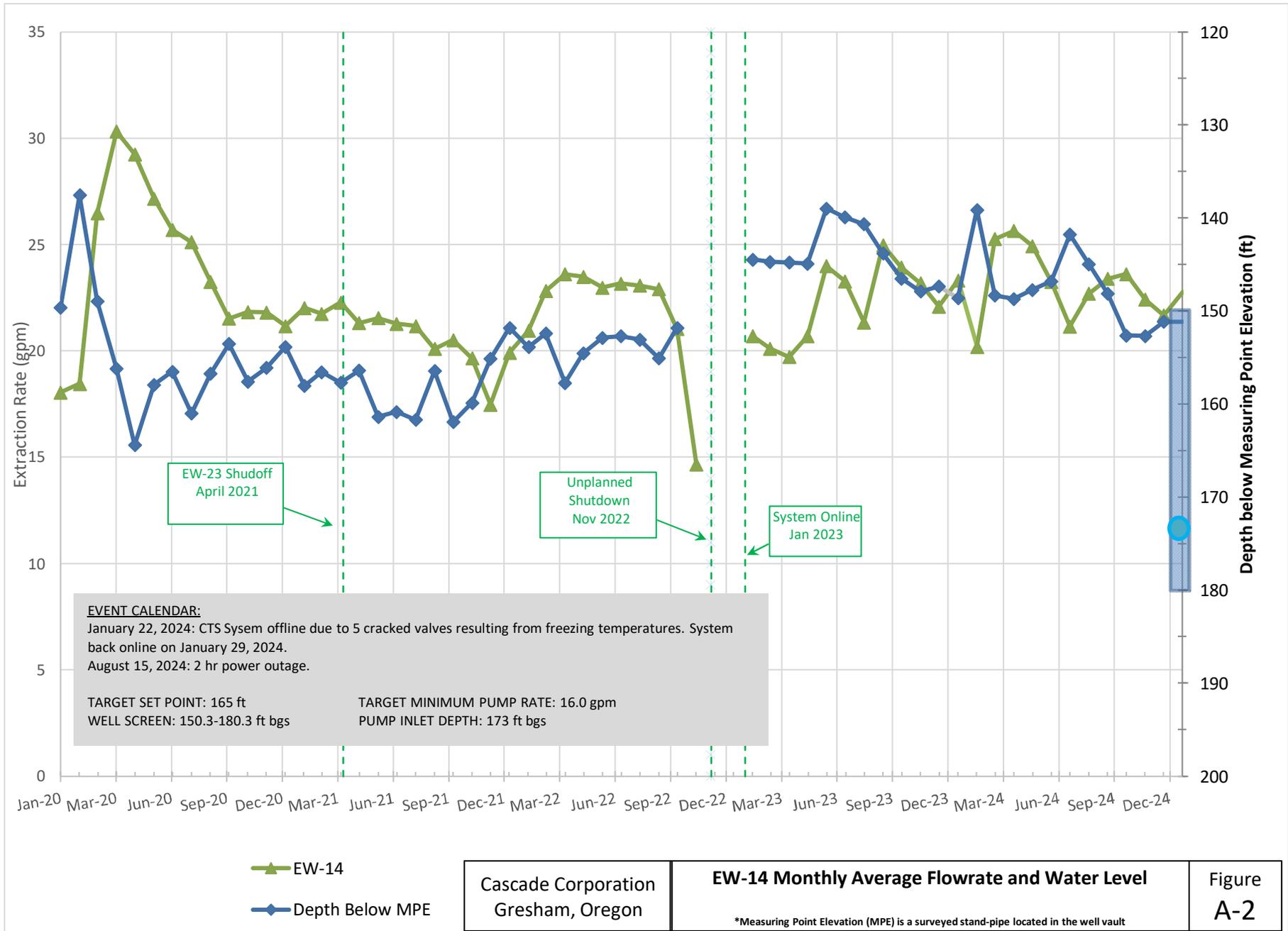
1. Discharge limitations for the CTS are per Attachment C to DEQ Consent Order No. WMCSR-NWR-96-08 dated 2/14/97.
2. Flow includes EW-2 and EW-14. EW-2 was shutdown on From July 15 to October 9 due to a damaged pump and issues sourcing a replacement.

ACRONYMS:

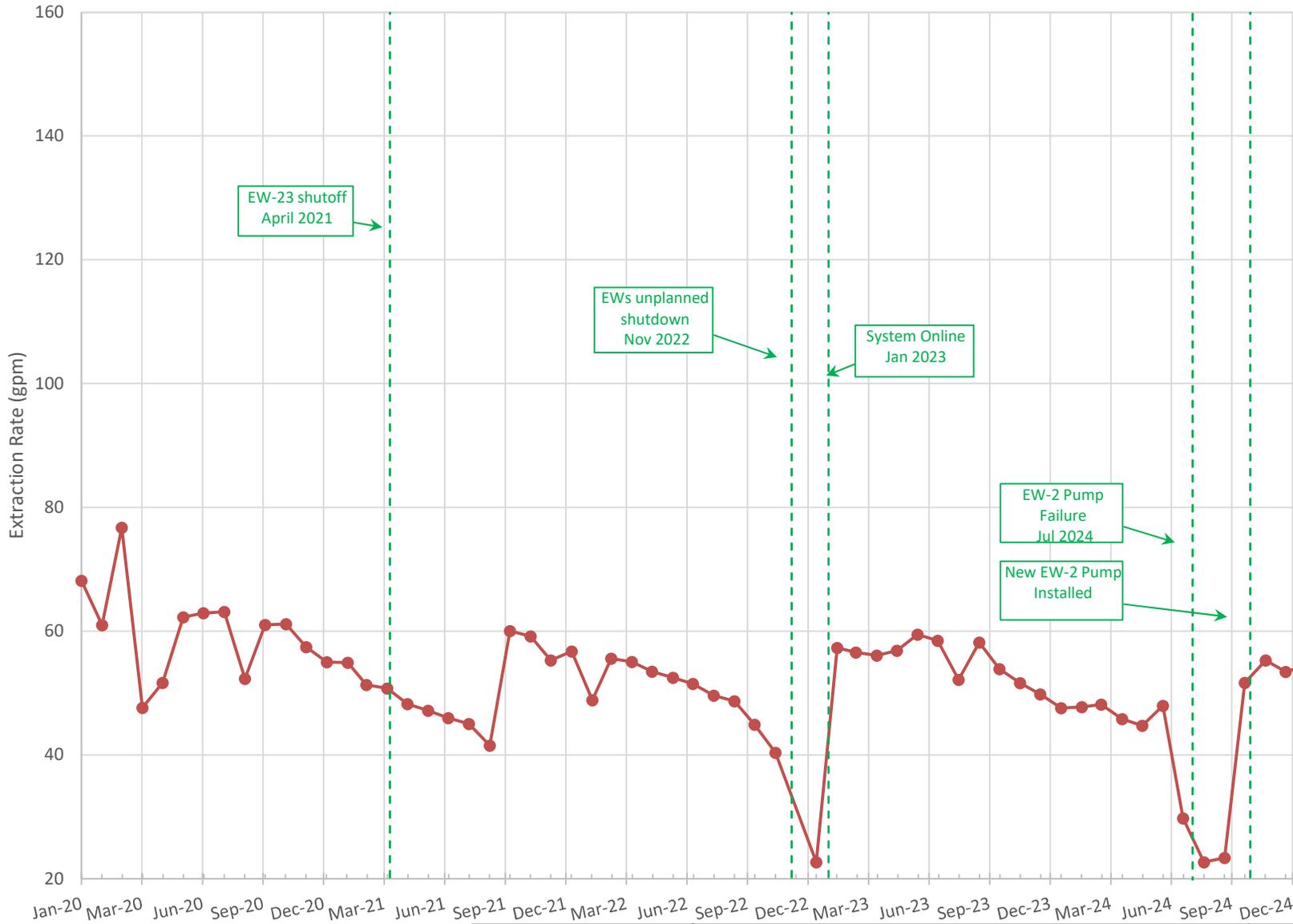
µg/L = micrograms/liter; °F = degrees Fahrenheit; gpm = gallons per minute; su = standard units.



Cascade Corporation Gresham, Oregon	EW-2 Monthly Average Flowrate and Water Level	Figure A-1
	*Measuring Point Elevation (MPE) is a surveyed stand-pipe located in the well vault	



Cascade Corporation Gresham, Oregon	EW-14 Monthly Average Flowrate and Water Level <small>*Measuring Point Elevation (MPE) is a surveyed stand-pipe located in the well vault</small>	Figure A-2
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● Total from All EWs

Cascade Corporation
Gresham, Oregon

**Total Extraction Rate for Remedy All Wells
TSA Remedy**

Figure
A-3

APPENDIX B

Well Decommissioning (2024 - Placeholder)

APPENDIX C

SVE Data

Table C-1
Soil Vapor Extraction 1 January 2024 through 31 December 2024
East Multnomah County TSA Remedy

Well ID	Date	Time (hrs)	Temperature ¹ (degrees F)	Flow Rate ² (scfm)	PID Measurement ³ (ppm)	Calculated VOC Concentrations (µg/m ³)
Soil Vapor Extraction Outlet						
SVE System Outlet	1/3/2024	11:20	85	370.3	0.1	580
SVE System Outlet	1/9/2024	13:10	85	356.3	0.1	580
SVE System Outlet	1/16/2024	10:10	60	361.4	0.1	580
SVE System Outlet	1/30/2024	13:10	90	343.1	0.1	580
SVE System Outlet	2/5/2024	15:15	90	358.6	0.1	580
SVE System Outlet	2/13/2024	8:40	80	348.6	0.1	580
SVE System Outlet	2/20/2024	9:05	90	336.8	0.1	580
SVE System Outlet	2/27/2024	15:00	90	356.8	0.1	580
SVE System Outlet	3/5/2024	12:40	95	334.6	0.1	580
SVE System Outlet	3/12/2024	14:30	90	334.9	0.1	580
SVE System Outlet	3/19/2024	13:30	85	346.1	0.1	580
SVE System Outlet	3/26/2024	15:30	95	352.6	0.1	580
SVE System Outlet	4/2/2024	14:30	100	346.1	0.1	580
SVE System Outlet	4/9/2024	10:00	95	351.3	0.1	580
SVE System Outlet	4/16/2024	11:40	90	371.2	0.1	580
SVE System Outlet	4/22/2024	11:00	90	356.1	0.1	580
SVE System Outlet	4/30/2024	12:10	85	343.5	0.1	580
SVE System Outlet	5/7/2024	14:00	85	364.2	0.1	580
SVE System Outlet	5/14/2024	13:15	100	340.1	0.1	580
SVE System Outlet	5/21/2024	10:30	85	328.1	0.2	1170
SVE System Outlet	5/28/2024	13:30	85	336.4	0.3	1750
SVE System Outlet	6/4/2024	11:00	85	358.3	0.4	2340
SVE System Outlet	6/11/2024	10:00	85	341.3	0.3	1750
SVE System Outlet	6/18/2024	10:20	90	357.8	0.3	1750
SVE System Outlet	6/25/2024	6:40	85	364.3	0.3	1750
SVE System Outlet	7/2/2024	12:30	100	356.1	0.1	580
SVE System Outlet	7/8/2024	11:30	115	346.8	0.2	1170
SVE System Outlet	7/16/2024	14:30	110	328.1	0.2	1170
SVE System Outlet	7/23/2024	16:15	110	361.4	0.2	1170
SVE System Outlet	7/30/2024	12:40	95	364.3	0.1	580
SVE System Outlet	8/6/2024	13:00	100	366.3	0.1	580
SVE System Outlet	8/13/2024	13:00	100	388.6	0.2	1170
SVE System Outlet	8/20/2024	13:10	110	381.6	0.1	580
SVE System Outlet	8/27/2024	15:10	100	334.6	0.1	580
SVE System Outlet	9/3/2024	14:00	100	346.9	0.1	580
SVE System Outlet	9/10/2024	14:40	110	368.4	0.1	580
SVE System Outlet	9/17/2024	13:00	95	374.6	0.1	580
SVE System Outlet	9/24/2024	11:00	100	364.7	0.1	580
SVE System Outlet	10/1/2024	13:40	100	348.6	0.1	580
SVE System Outlet	10/8/2024	10:50	90	388.9	0.1	580
SVE System Outlet	10/15/2024	10:30	95	391.4	0.1	580

Table C-1
Soil Vapor Extraction 1 January 2024 through 31 December 2024
East Multnomah County TSA Remedy

Well ID	Date	Time (hrs)	Temperature ¹ (degrees F)	Flow Rate ² (scfm)	PID Measurement ³ (ppm)	Calculated VOC Concentrations (µg/m ³)
Soil Vapor Extraction Outlet						
SVE System Outlet	10/22/2024	11:15	95	391.6	0.1	580
SVE System Outlet	10/29/2024	13:30	90	356.4	0.1	580
SVE System Outlet	11/5/2024	9:40	90	374.6	0.1	580
SVE System Outlet	11/12/2024	11:00	90	381.3	0.1	580
SVE System Outlet	11/19/2024	11:30	90	345.1	0.1	580
SVE System Outlet	11/26/2024	15:40	90	381.8	0.1	580
SVE System Outlet	12/3/2024	10:40	95	364.3	0.1	580
SVE System Outlet	12/10/2024	13:00	-	336.4	0.1	580
SVE System Outlet	12/17/2024	15:30	95	377.6	0.2	1170
SVE System Outlet	12/24/2024	13:50	90	363.4	0.2	1170
SVE System Outlet	12/30/2024	10:00	90	354.8	0.3	1750

Notes:

ID = identification
hrs = hours
F = Fahrenheit
ppm = parts per million

µg/m³ = micrograms per cubic meter
VOC = volatile organic compounds
--- = Measurement not available
scfm = standard cubic feet per minute

1. Flow measurements taken using a hot-wire anemometer. SVE system inlet flow measurements are presented as a result of high SVE system outlet temperatures interfering with the effluent measurement.

4. Bold text indicates sample for lab analysis was taken on that day or within several days. Those results are shown on Table C-2.

Table C-2
Soil Vapor Extraction - Laboratory VOC Results
East Multnomah County TSA Remedy

Well ID	Date	cis-1,2-dichloroethene (µg/m ³)	Trichloroethene (µg/m ³)	Tetrachloroethene (µg/m ³)	Total VOCs (µg/m ³)	Flow Rate (scfm) ¹
System Outlet	1/3/24	31	400	32	463	370.3
	2/13/24	34	490	28	552	348.6
	3/7/24	22	250	20	292	334.6
	4/9/24	32	380	29	441	351.3
	5/14/24	38	390	32	460	364.2
	6/11/24	53	640	41	734	341.3
	7/16/24	42	660	42	744	328.1
	8/6/24	31	420	34	485	366.3
	9/10/24	45	420	32	497	334.6
	11/5/24	38	380	33	451	374.6
VMW-C	2/13/24	2.8	50	8.1	60.9	50.3
	5/14/24	2.4	37	8.3	47.7	45.8
VMW-E	2/13/24	50	970	59	1079	69.8
	5/14/24	61	930	66	1057	66.8
	8/6/24	33	530	44	607	72.1
	11/5/24	33	390	40	463	73.9
VMW-F	2/13/24	4.4	32	14	50.4	70.1
	5/14/24	5.9	48	16	69.9	66.9
VMW-G	2/13/24	29	260	23	312	69.9
	5/14/24	< 0.84	< 1.1	3.0	4.94	65.8
	8/6/24	8.7	52	11	71.7	72.6
	11/5/24	10	62	16	88	74.2
VMW-H	2/13/24	9.6	41	1.8	52.4	61.4
	5/14/24	8.8	31	2.1	41.9	58.6
VMW-J2	2/13/24	26	450	25	501	69.8
	5/14/24	25	280	23	328	68.9
	8/6/24	9.4	130	13	152.4	71.1
	11/5/24	19	220	25	264	73.6
VMW-K	2/13/24	100	1300	59	1459	70.4
	5/14/24	90	1000	55	1145	68.1
	8/6/24	29	320	20	369	71.3
	11/5/24	78	800	50	928	73.4
VW-17d-95.5	2/13/24	< 0.76	< 1.0	< 1.3	3.06	55.6
	5/14/24	< 0.82	5.0	1.8	7.62	53.9
	8/6/24	< 1.0	< 1.4	< 1.7	4.1	60.8
	11/5/24	25	230	27	282	60.9

Notes:

ID = identification

scfm = standard cubic feet per minute

µg/m³ = micrograms per cubic meter

VOC = volatile organic compounds

Total VOCs are the calculated sum of the three VOCs shown

¹ Flow rates associated with the analytical data on 7 March 2024 were measured on 5 March 2024; on 14 May 2024, flows were measured 7 May 2024; on 10 September, flows were measured 28 August 2024.

² Blue colored analytical results indicate that the results were below the detection limit.

Table C-3
Soil Vapor Extraction VOC Mass Removal - April 2015 through December 2023
East Multnomah County TSA Remedy

Date	Pounds of TCE Removed Per Sampling Period	Cumulative Pounds of TCE Removed	Pounds of VOCs Removed Per Sampling Period	Cumulative Pounds of VOCs Removed	TCE Percentage of Mass Removal per Sampling Period
04/16/15	0.00	0.00	0.00	0.00	0%
04/28/15	1.13	1.13	1.30	1.30	87%
05/26/15	2.57	3.71	2.95	4.25	87%
06/30/15	2.46	6.17	2.80	7.05	88%
07/28/15	1.44	7.60	1.64	8.69	88%
09/10/15	1.68	9.29	1.93	10.62	87%
09/29/15	0.79	10.08	0.90	11.52	88%
10/27/15	0.95	11.03	1.09	12.61	87%
11/30/15	1.31	12.33	1.50	14.11	87%
12/28/15	0.84	13.17	0.96	15.07	87%
01/26/16	0.84	14.01	0.98	16.04	86%
02/23/16	1.07	15.08	1.24	17.28	86%
03/15/16	0.73	15.81	0.85	18.13	86%
04/27/16	1.51	17.32	1.74	19.88	87%
05/24/16	1.05	18.37	1.21	21.09	86%
06/21/16	0.98	19.35	1.14	22.23	86%
07/26/16	0.91	20.27	1.05	23.28	87%
08/24/16	0.59	20.86	0.69	23.97	86%
09/27/16	0.84	21.70	1.00	24.96	85%
10/27/16	0.85	22.55	1.00	25.96	85%
12/14/16	1.84	24.40	2.11	28.07	87%
01/10/17	1.51	25.91	1.73	29.80	87%
02/07/17	1.95	27.86	2.25	32.05	86%
03/07/17	1.66	29.52	1.95	34.00	85%
04/11/17	1.85	31.37	2.20	36.20	84%
05/09/17	1.48	32.85	1.75	37.95	85%
06/06/17	1.51	34.35	1.77	39.72	85%
07/11/17	1.63	35.99	1.92	41.64	85%
08/08/17	1.16	37.15	1.36	43.00	85%
09/12/17	1.24	38.39	1.46	44.46	85%
10/10/17	0.92	39.31	1.08	45.54	85%
11/07/17	0.98	40.29	1.14	46.68	86%
12/12/17	1.31	41.60	1.52	48.20	86%
01/09/18	0.74	42.34	0.87	49.07	85%
02/06/18	0.78	43.12	0.90	49.97	87%
03/06/18	0.89	44.00	1.01	50.98	88%
04/10/18	1.00	45.01	1.15	52.13	87%
05/10/18	0.79	45.80	0.91	53.04	87%
06/12/18	1.05	46.85	1.20	54.25	87%
07/10/18	0.85	47.70	0.97	55.22	87%
08/07/18	0.76	48.46	0.87	56.09	87%
09/10/18	0.75	49.21	0.86	56.95	87%
10/09/18	0.62	49.83	0.72	57.67	87%
11/06/18	0.69	50.52	0.79	58.46	87%
12/12/18	0.84	51.36	0.98	59.44	86%

Table C-3
 Soil Vapor Extraction VOC Mass Removal - April 2015 through December 2023
 East Multnomah County TSA Remedy

Date	Pounds of TCE Removed Per Sampling Period	Cumulative Pounds of TCE Removed	Pounds of VOCs Removed Per Sampling Period	Cumulative Pounds of VOCs Removed	TCE Percentage of Mass Removal per Sampling Period
01/08/19	0.58	51.94	0.66	60.10	87%
02/12/19	0.83	52.77	0.96	61.06	86%
03/26/19	1.07	53.83	1.24	62.29	86%
04/09/19	0.31	54.14	0.36	62.66	85%
05/07/19	0.56	54.70	0.67	63.33	84%
06/11/19	0.78	55.48	0.91	64.24	85%
07/09/19	0.63	56.11	0.75	65.00	84%
08/05/19	0.56	56.67	0.67	65.67	83%
09/10/19	0.70	57.37	0.83	66.50	84%
10/03/19	0.36	57.73	0.42	66.92	84%
11/05/19	0.70	58.43	0.81	67.73	86%
12/03/19	0.56	58.99	0.66	68.39	85%
01/07/20	0.64	59.63	0.77	69.16	83%
02/04/20	0.51	60.14	0.60	69.77	85%
03/03/20	0.50	60.64	0.59	70.35	85%
04/07/20	0.64	61.28	0.77	71.13	83%
05/11/20	0.61	61.89	0.73	71.86	83%
06/02/20	0.39	62.28	0.46	72.32	84%
07/07/20	0.60	62.88	0.71	73.03	85%
08/05/20	0.49	63.37	0.57	73.61	86%
09/01/20	0.53	63.90	0.62	74.22	85%
10/06/20	0.71	64.61	0.84	75.06	84%
11/03/20	0.53	65.14	0.63	75.69	84%
12/01/20	0.25	65.39	0.31	76.00	82%
01/05/21	0.32	65.71	0.38	76.38	84%
02/02/21	0.44	66.15	0.53	76.91	84%
03/02/21	0.48	66.64	0.58	77.49	83%
04/06/21	0.66	67.29	0.79	78.28	83%
05/04/21	0.56	67.85	0.66	78.94	85%
07/06/21	0.63	68.48	0.72	79.66	87%
08/03/21	0.81	69.29	0.90	80.56	89%
09/08/21	0.98	70.27	1.09	81.66	89%
10/05/21	0.71	70.98	0.82	82.47	87%
11/02/21	0.70	71.67	0.79	83.27	88%
12/08/21	0.81	72.49	0.93	84.20	88%
01/06/22	0.61	73.09	0.70	84.90	87%
02/14/22	0.95	74.04	1.08	85.98	88%
03/21/22	0.93	74.97	1.06	87.03	88%
04/05/22	0.42	75.39	0.48	87.52	88%
05/05/22	0.78	76.17	0.88	88.39	89%
06/07/22	0.93	77.10	1.05	89.44	89%
07/06/22	0.64	77.74	0.73	90.17	88%
08/09/22	0.75	78.49	0.85	91.02	88%
09/06/22	0.60	79.08	0.68	91.70	87%
10/03/22	0.49	79.58	0.57	92.27	87%
11/03/22	0.56	80.14	0.64	92.91	87%
12/07/22	0.40	80.54	0.46	93.38	87%

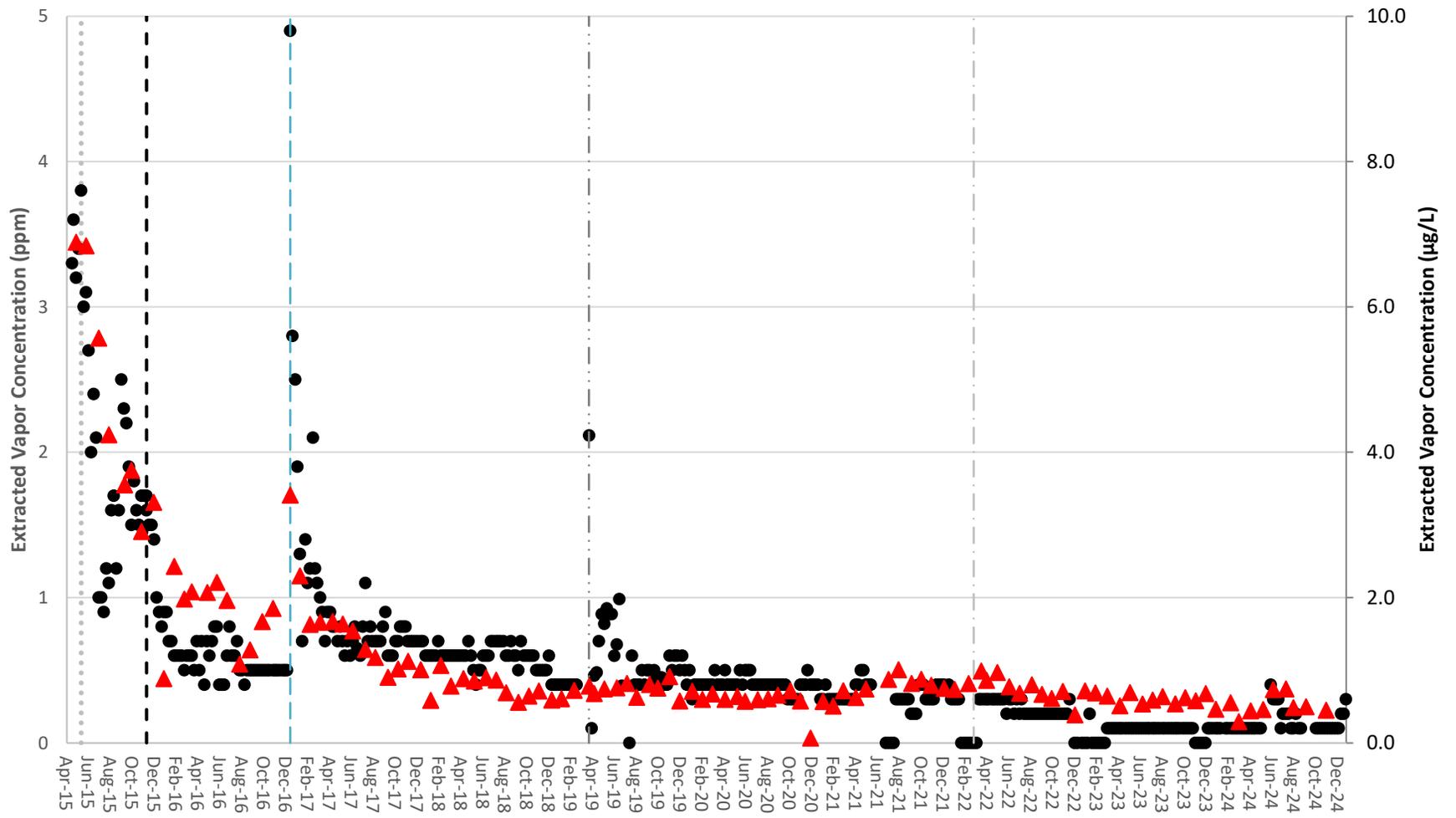
Table C-3
 Soil Vapor Extraction VOC Mass Removal - April 2015 through December 2023
 East Multnomah County TSA Remedy

Date	Pounds of TCE Removed Per Sampling Period	Cumulative Pounds of TCE Removed	Pounds of VOCs Removed Per Sampling Period	Cumulative Pounds of VOCs Removed	TCE Percentage of Mass Removal per Sampling Period
01/04/23	0.44	80.98	0.51	93.89	87%
02/02/23	0.56	81.55	0.64	94.53	88%
03/07/23	0.65	82.20	0.75	95.28	87%
04/11/23	0.57	82.77	0.67	95.95	86%
05/09/23	0.50	83.28	0.58	96.53	87%
06/13/23	0.65	83.93	0.74	97.27	88%
07/11/23	0.47	84.40	0.54	97.81	87%
08/08/23	0.51	84.91	0.58	98.39	87%
09/12/23	0.52	85.43	0.62	99.01	84%
10/10/23	0.47	85.90	0.55	99.57	85%
11/08/23	0.50	86.40	0.57	100.14	87%
12/06/23	0.51	86.91	0.59	100.73	87%
01/03/24	0.46	87.37	0.53	101.25	88%
02/13/24	0.58	87.95	0.66	101.91	88%
03/07/24	0.26	88.21	0.30	102.21	88%
04/09/24	0.33	88.54	0.38	102.60	86%
05/14/24	0.43	88.97	0.51	103.10	85%
06/11/24	0.46	89.44	0.54	103.64	86%
07/16/24	0.72	90.16	0.82	104.46	88%
08/06/24	0.37	90.53	0.42	104.88	88%
09/10/24	0.50	91.02	0.58	105.46	86%
11/05/24	0.74	91.77	0.88	106.34	84%

Notes

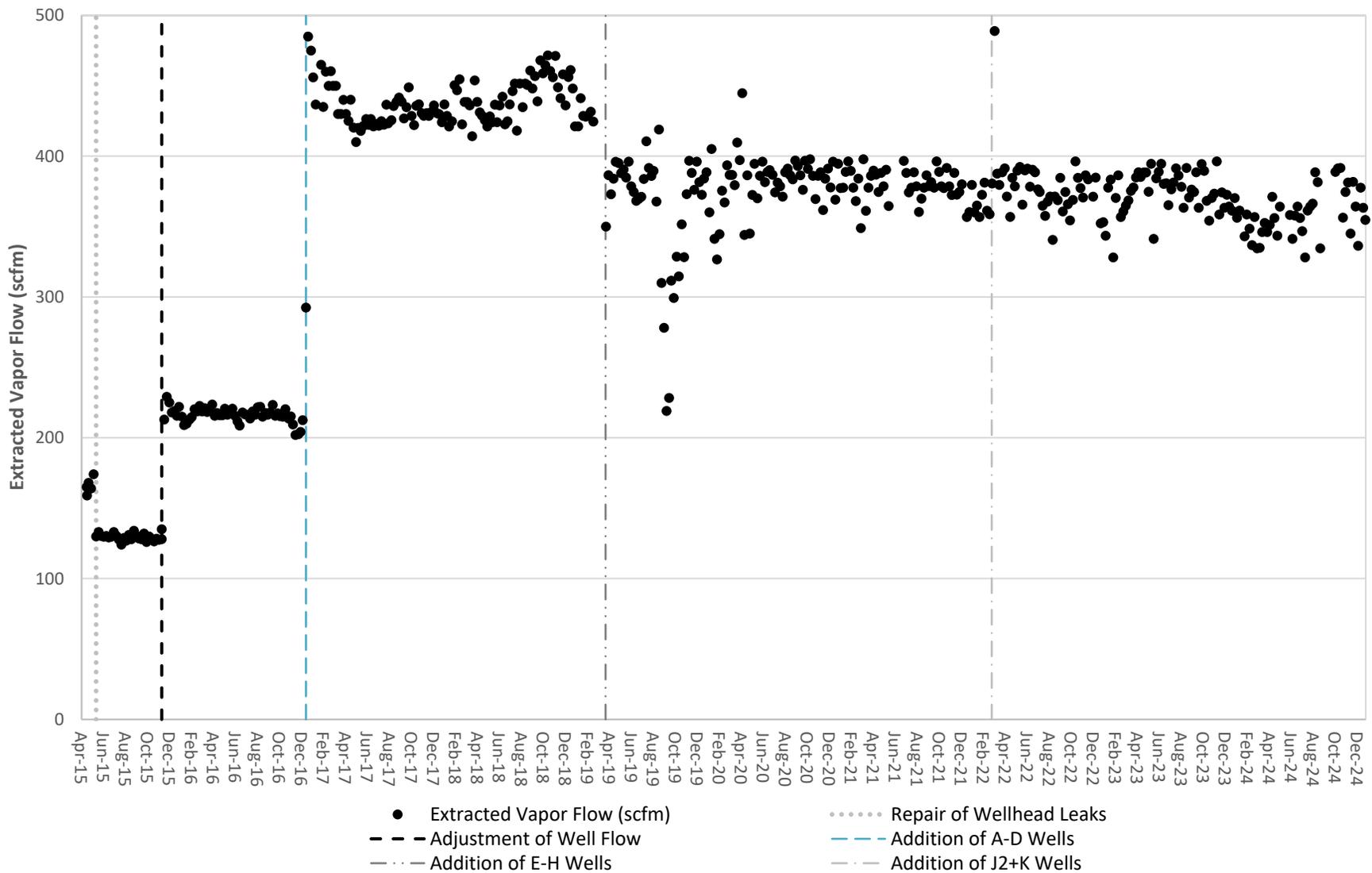
VOC = Volatile Organic Compound

TCE = Trichloroethene



- Vapor Conc. (ppm) - PID Reading
- Repair of Wellhead Leaks
- Adjustment of Well Flow
- ▲ Vapor Conc. (µg/L) - Lab Data
- Addition of A-D Wells
- Addition of E-H Wells
- Addition of J2+K Wells

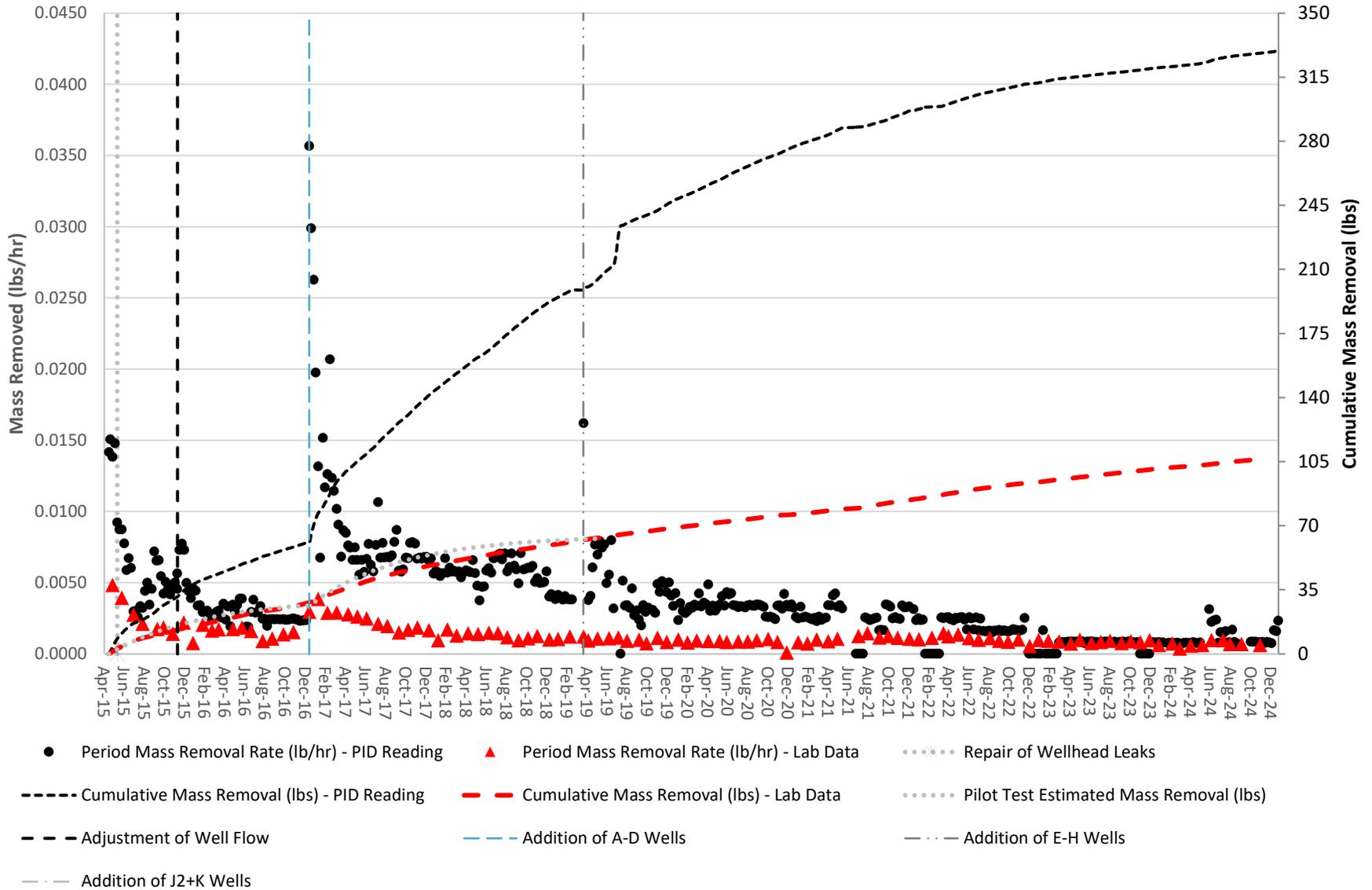
Cascade Corporation Gresham, Oregon	SVE Effluent VOC Vapor Concentration TSA Remedy	Figure C-1
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Cascade Corporation
Gresham, Oregon

SVE Extracted Vapor Flow (Weekly Average)
TSA Remedy

Figure
C-2



Cascade Corporation
Gresham, Oregon

SVE System Mass Removal
TSA Remedy

Figure
C-3

APPENDIX D

Groundwater Elevation Data

Table D-1
Groundwater Elevations - 1 January 2024 through 31 December 2024
East Multnomah County TSA Remedy

TSA Zone	Well ID	Date	Time	Top of Casing Elevation (ft MSL)	Depth to Water (ft below TOC)	Groundwater Elevation (ft MSL)
Extraction Wells						
Lower	EW-14	2/5/2024	9:40	127.63	128.48	-0.85
Lower	EW-14	5/1/2024	13:45	127.63	149.88	-22.25
Lower	EW-14	8/5/2024	8:48	127.63	143.48	-15.85
Lower	EW-14	11/5/2024	12:43	127.63	154.15	-26.52
Lower	EW-2	2/5/2024	9:32	126.01	156.90	-30.89
Lower	EW-2	5/1/2024	12:45	126.01	148.08	-22.07
Lower	EW-2	8/5/2024	8:04	126.01	109.98	16.03
Lower	EW-2	11/5/2024	12:36	126.01	139.14	-13.13
Monitoring Wells						
Upper	CMW-10ds	2/5/2024	14:32	134.54	123.88	10.66
Upper	CMW-10ds	8/5/2024	13:40	134.54	120.79	13.75
Upper	CMW-17ds	2/5/2024	11:10	121.89	101.77	20.12
Upper	CMW-17ds	2/15/2024	9:25	121.89	102.23	19.66
Upper	CMW-17ds	5/1/2024	11:46	121.89	101.21	20.68
Upper	CMW-17ds	8/5/2024	7:45	121.89	100.03	21.86
Upper	CMW-17ds	11/5/2024	10:50	121.89	101.08	20.81
Upper	CMW-18ds	2/5/2024	13:04	117.66	102.54	15.12
Upper	CMW-18ds	2/15/2024	12:18	117.66	102.79	14.87
Upper	CMW-18ds	5/1/2024	13:45	117.66	101.83	15.83
Upper	CMW-18ds	8/5/2024	12:04	117.66	100.73	16.93
Upper	CMW-18ds	11/5/2024	13:00	117.66	101.59	16.07
Upper	CMW-19ds	2/5/2024	14:17	144.08	129.56	14.52
Upper	CMW-19ds	5/1/2024	14:00	144.08	128.93	15.15
Upper	CMW-19ds	8/5/2024	13:26	144.08	128.21	15.87
Upper	CMW-19ds	11/5/2024	13:14	144.08	129.81	14.27
Upper	CMW-20ds	2/5/2024	14:02	152.72	139.08	13.64
Upper	CMW-20ds	8/5/2024	14:00	152.72	137.53	15.19
Lower	CMW-14Rds	2/5/2024	13:11	83.48	60.81	22.67
Lower	CMW-14Rds	8/5/2024	12:18	83.48	59.35	24.13
Lower	CMW-22dg	2/5/2024	13:14	81.65	63.44	18.21
Lower	CMW-22dg	2/26/2024	13:36	81.65	62.88	18.77
Lower	CMW-22dg	8/5/2024	12:32	81.65	63.48	18.17
Lower	CMW-24dg (EW-5)	2/5/2024	12:09	77.74	60.36	17.38
Lower	CMW-24dg (EW-5)	8/5/2024	14:46	77.74	59.68	18.06
Lower	CMW-25dg	2/5/2024	13:25	75.28	60.77	14.51
Lower	CMW-25dg	8/5/2024	13:04	75.28	60.58	14.70
Lower	CMW-36dg	2/26/2024	13:51	78.84	60.36	18.48
Lower	CMW-36dg	8/5/2024	12:52	78.84	66.69	12.15
Lower	D-17dg	2/5/2024	11:58	124.61	112.61	12.00
Lower	D-17dg	5/1/2024	13:30	124.61	111.79	12.82
Lower	D-17dg	8/5/2024	10:52	124.61	110.81	13.80
Lower	D-17dg	11/5/2024	11:35	124.61	113.91	10.70
Lower	D-17ds	2/5/2024	12:02	123.28	110.79	12.49
Lower	D-17ds	2/15/2024	10:30	123.28	111.26	12.02
Lower	D-17ds	5/1/2024	13:23	123.28	109.98	13.30
Lower	D-17ds	8/5/2024	10:50	123.28	108.97	14.31
Lower	D-17ds	11/5/2024	11:28	123.28	111.47	11.81
Lower	EW-1	2/5/2024	9:44	124.04	113.51	10.53

Table D-1
Groundwater Elevations - 1 January 2024 through 31 December 2024
East Multnomah County TSA Remedy

TSA Zone	Well ID	Date	Time	Top of Casing Elevation (ft MSL)	Depth to Water (ft below TOC)	Groundwater Elevation (ft MSL)
Lower	EW-1	5/1/2024	13:38	124.04	109.61	14.43
Lower	EW-1	8/5/2024	11:15	124.04	109.92	14.12
Lower	EW-1	11/5/2024	11:39	124.04	111.18	12.86
Lower	EW-11	8/5/2024	12:46	114.73	94.71	20.02
Lower	EW-12	2/5/2024	12:37	94.14	81.16	12.98
Lower	EW-12	8/5/2024	11:20	94.14	80.29	13.85
Lower	EW-23	2/5/2024	13:43	83.93	71.82	12.11
Lower	EW-23	8/5/2024	8:25	83.93	70.64	13.29
Lower	PWB-1lts	2/6/2024	11:36	16.48	4.15	12.33
Lower	PWB-1lts	3/7/2024	11:50	16.48	4.06	12.42
Upper	PWB-1uts	2/6/2024	11:40	15.98	4.12	11.86
Upper	PWB-1uts	3/7/2024	11:52	15.98	4.16	11.82
Vapor Monitoring Wells						
Upper	VMW-A	2/5/2024	12:18	123.34	103.61	19.73
Upper	VMW-A	2/15/2024	9:57	123.34	102.91	20.43
Upper	VMW-A	5/1/2024	12:02	123.34	103.29	20.05
Upper	VMW-A	8/5/2024	9:36	123.34	102.13	21.21
Upper	VMW-A	11/5/2024	10:57	123.34	102.78	20.56
Upper	VMW-B	2/5/2024	11:22	123.25	101.55	21.70
Upper	VMW-B	2/15/2024	12:03	123.25	100.81	22.44
Upper	VMW-B	5/1/2024	13:00	123.25	101.81	21.44
Upper	VMW-B	8/5/2024	15:34	123.25	101.96	21.29
Upper	VMW-B	11/5/2024	12:41	123.25	101.44	21.81
Upper	VMW-C	2/5/2024	11:50	124.17	103.41	20.76
Upper	VMW-C	2/15/2024	10:52	124.17	103.11	21.06
Upper	VMW-C	5/1/2024	12:14	124.17	103	21.17
Upper	VMW-C	8/5/2024	9:56	124.17	102.81	21.36
Upper	VMW-C	11/5/2024	11:03	124.17	103.28	20.89
Upper	VMW-D	2/5/2024	11:30	126.78	106.96	19.82
Upper	VMW-D	2/15/2024	11:44	126.78	106.45	20.33
Upper	VMW-D	5/1/2024	12:47	126.78	106.51	20.27
Upper	VMW-D	8/5/2024	11:53	126.78	105.23	21.55
Upper	VMW-D	11/5/2024	12:22	126.78	105.53	21.25
Upper	VMW-H	2/5/2024	12:12	126.88	103.37	23.51
Upper	VMW-H	2/15/2024	10:22	126.88	103.13	23.75
Upper	VMW-H	5/1/2024	13:06	126.88	101.83	25.05
Upper	VMW-H	8/5/2024	10:22	126.88	101.63	25.25
Upper	VMW-H	11/5/2024	11:06	126.88	102.96	23.92
Upper	VMW-I	2/5/2024	11:37	131.98	121.38	10.60
Upper	VMW-I	2/15/2024	11:16	131.98	121.39	10.59
Upper	VMW-I	5/1/2024	12:41	131.98	117.88	14.10
Upper	VMW-I	8/5/2024	11:48	131.98	113.08	18.90
Upper	VMW-I	11/5/2024	12:10	131.98	122.75	9.23
Upper	VMW-J2	2/5/2024	11:44	130.12	112.33	17.79
Upper	VMW-J2	2/15/2024	11:02	130.12	112.62	17.5
Upper	VMW-J2	5/1/2024	12:36	130.12	111.74	18.38
Upper	VMW-J2	8/5/2024	11:40	130.12	110.58	19.54

Table D-1
Groundwater Elevations - 1 January 2024 through 31 December 2024
East Multnomah County TSA Remedy

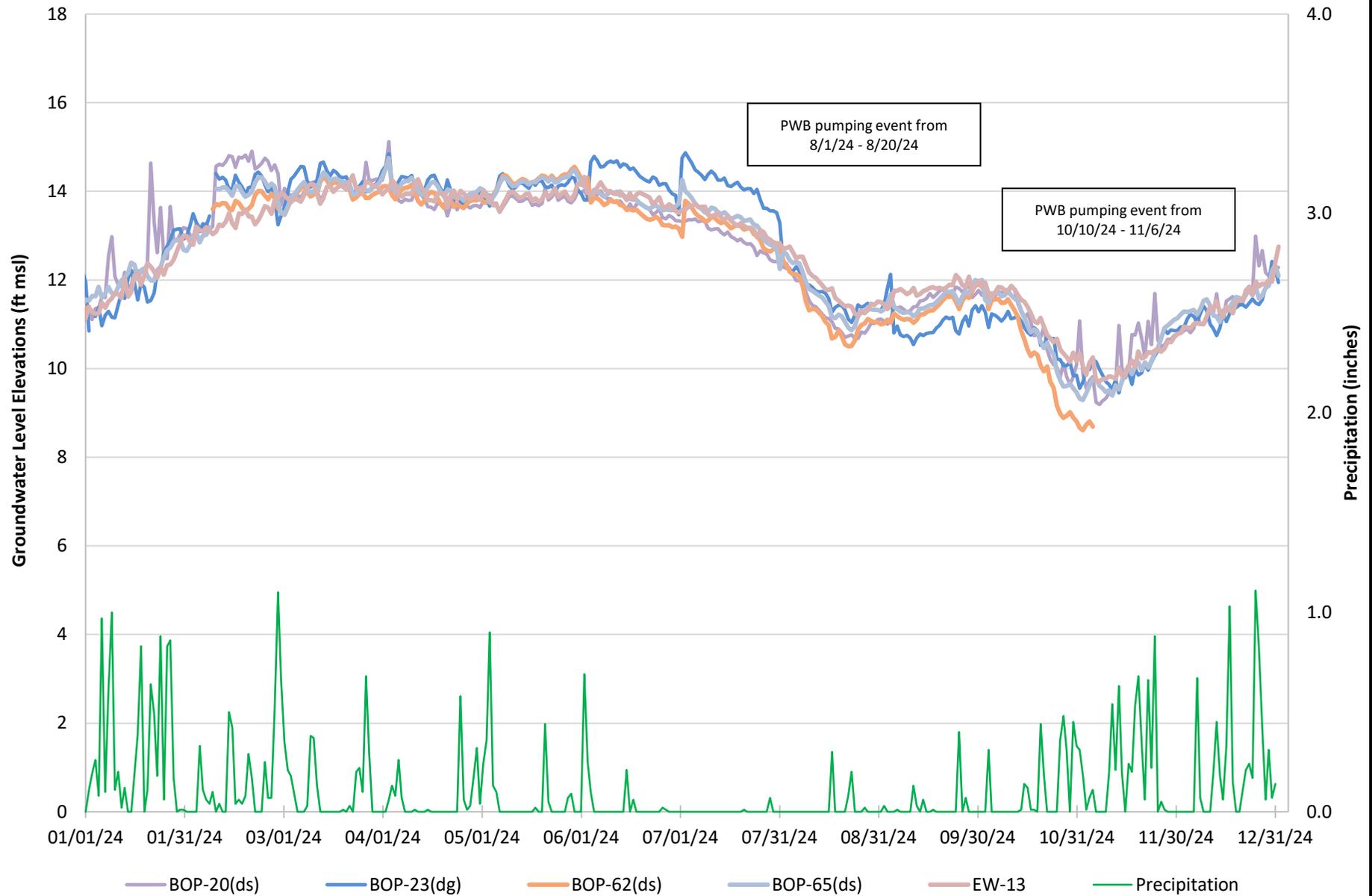
TSA Zone	Well ID	Date	Time	Top of Casing Elevation (ft MSL)	Depth to Water (ft below TOC)	Groundwater Elevation (ft MSL)
Upper	VMW-J2	11/5/2024	12:03	130.12	111.08	19.04
Upper	VMW-K	2/5/2024	11:54	129.80	105.59	24.21
Upper	VMW-K	2/15/2024	10:43	129.80	107.45	22.35
Upper	VMW-K	5/1/2024	12:24	129.80	106.32	23.48
Upper	VMW-K	8/5/2024	10:05	129.80	104.82	24.98
Upper	VMW-K	11/5/2024	11:55	129.80	105.33	24.47
Upper	VMW-L	2/5/2024	12:15	115.23	92.85	22.38
Upper	VMW-L	5/1/2024	13:11	115.23	92.04	23.19
Upper	VMW-L	8/5/2024	10:36	115.23	91.9	23.33
Upper	VMW-L	11/5/2024	11:13	115.23	91.21	24.02
Upper	VMW-M	2/5/2024	12:23	114.72	91.15	23.57
Upper	VMW-M	2/15/2024	10:10	114.72	91.18	23.54
Upper	VMW-M	5/1/2024	12:10	114.72	89.31	25.41
Upper	VMW-M	8/5/2024	9:42	114.72	88.49	26.23
Upper	VMW-M	11/5/2024	12:30	114.72	90.24	24.48
Upper	VMW-N	2/5/2024	12:45	115.77	92.04	23.73
Upper	VMW-N	2/15/2024	11:53	115.77	91.99	23.78
Upper	VMW-N	5/1/2024	12:56	115.77	90.6	25.17
Upper	VMW-N	8/5/2024	11:59	115.77	89.72	26.05
Upper	VMW-N	11/5/2024	12:54	115.77	91.41	24.36

Notes:

ft MSL = feet above mean sea level

TOC = top of casing

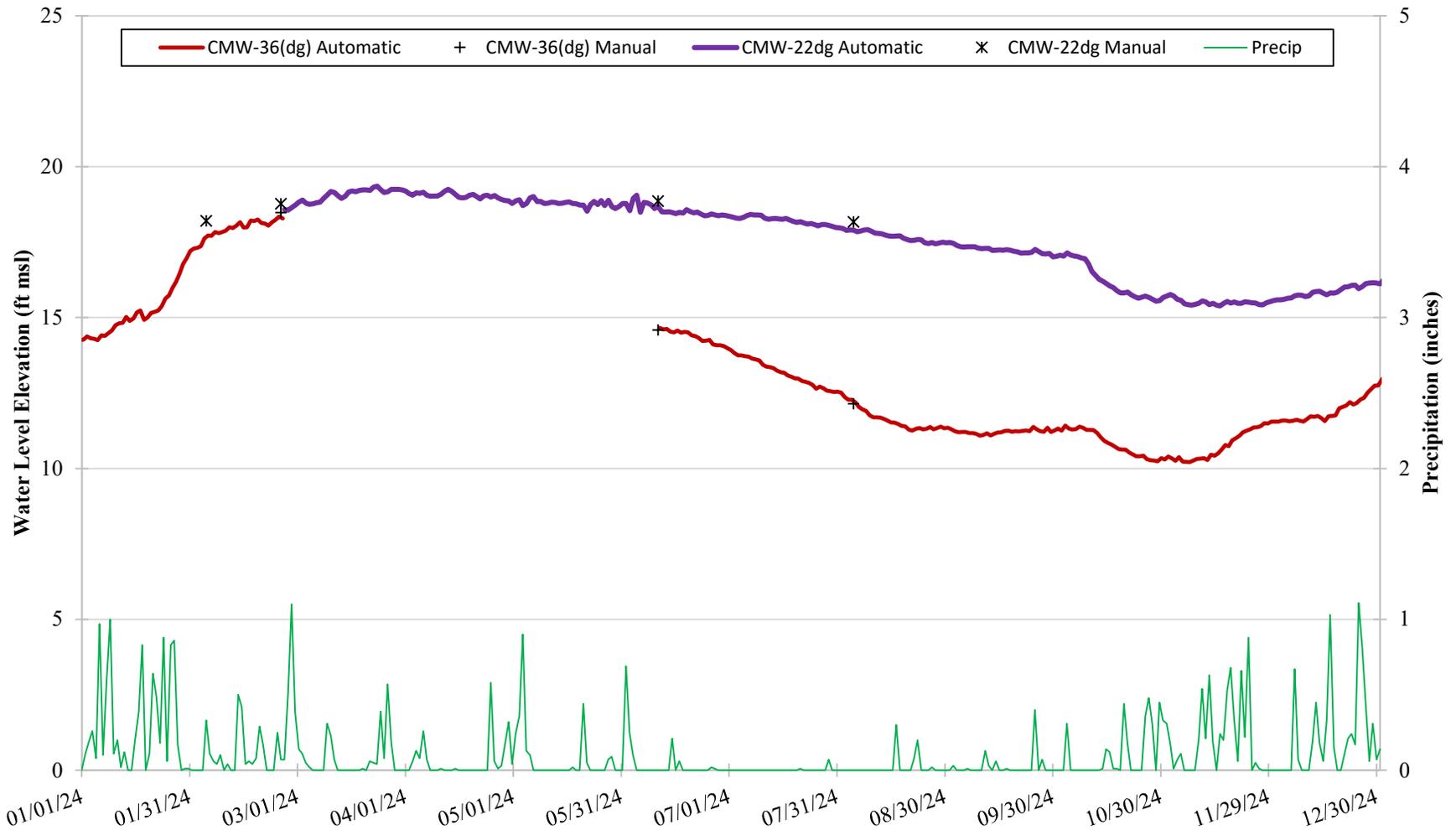
A - Wells VMW-E, VMW-F, and VMW-G are angled wells and depth to water cannot be measured manually.



East Multnomah
County Cleanup

**Hydrograph for Boeing TSA Wells
January - December 2024**

Figure
D-1



Notes:

The transducer in CMW-22dg broke during data collection on 27 November 2023. The transducer was repaired and replaced into the well in February 2024.
 The CMW-36(dg) transducer data between 2 February 2024 and 11 June 2024 was anomalous and is not presented in this figure



Cascade Corporation Gresham, Oregon	Hydrographs for Troutdale Sandstone Aquifer (TSA) Zone C Wells 1 January 2024 through December 2024	Figure D-2
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APPENDIX E

Groundwater Quality Data

Table E-1
Groundwater Analytical Results
1 January 2024 through 31 December 2024
East Multnomah County Troutdale Sandstone Aquifer (TSA) Remedy

TSA Zone	Monitoring Well ID	Sample ID	Sample Date	Trichloroethene (TCE)	Tetrachloroethene (PCE)	cis-1,2-Dichloroethene	1,1-Dichloroethene	Vinyl Chloride	Duplicate sample
System Influent/Effluent									
Lower	TS-C-Eff	TS-C-EFF-020624	2024-02-06	< 0.500 J	< 0.500 J	< 0.500	< 0.500	< 0.500	
Lower	TS-C-Eff	TS-C-EFF-020624-DUP	2024-02-06	< 0.500 J	< 0.500 J	< 0.500	< 0.500	< 0.500	Yes
Lower	TS-C-Eff	TS-C-EFF-050224	2024-05-02	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	TS-C-Eff	TS-C-EFF-050224-DUP	2024-05-02	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	Yes
Lower	TS-C-Eff	TS-C-EFF-080624	2024-08-06	< 0.500	< 0.500	< 0.500	< 0.500 J	< 0.500	
Lower	TS-C-Eff	TS-C-EFF-080624-DUP	2024-08-06	< 0.500	< 0.500	< 0.500	< 0.500 J	< 0.500	Yes
Lower	TS-C-Eff	TS-C-EFF-110624	2024-11-06	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	TS-C-Eff	TS-C-EFF-110624-DUP	2024-11-06	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	Yes
Lower	TS-C-Inf	TS-C-INF-020624	2024-02-06	5.97 J	0.501 J	0.572	< 0.500	< 0.500	
Lower	TS-C-Inf	TS-C-INF-050224	2024-05-02	5.88	0.460 J	0.636	< 0.500	< 0.500	
Lower	TS-C-Inf	TS-C-INF-080624	2024-08-06	3.65	0.303 J	0.495 J	< 0.500 J	< 0.500	
Lower	TS-C-Inf	TS-C-INF-100624	2024-11-06	5.53	0.381 J	0.533	< 0.500	< 0.500	
Extraction Wells									
Lower	EW-14	EW14-020624	2024-02-06	6.03 J	0.428 J	0.605	< 0.500	< 0.500	
Lower	EW-14	EW14-050224	2024-05-02	4.88	< 0.500	0.526	< 0.500	< 0.500	
Lower	EW-14	EW14-080624	2024-08-06	4.11	0.325 J	0.568	< 0.500 J	< 0.500	
Lower	EW-14	EW14-110624	2024-11-06	4.80	< 0.500	0.491 J	< 0.500	< 0.500	
Lower	EW-2	EW2-020624	2024-02-06	6.02 J	0.557 J	0.536	< 0.500	< 0.500	
Lower	EW-2	EW2-050224	2024-05-02	7.82	< 0.500	0.730	< 0.500	< 0.500	
Lower	EW-2	EW2-080624	2024-08-06	4.79	0.574	< 0.500	< 0.500 J	< 0.500	
Lower	EW-2	EW2-110624	2024-11-06	5.88	0.460 J	0.524	< 0.500	< 0.500	
Monitoring Wells									
Upper	BOP-13ds	BOP-13DS;BOP-13DS-0824;20240805	2024-08-05	3.0 J	< 0.50 J	0.50 J	< 0.50 J	< 0.50 J	
Upper	BOP-31ds	BOP-31DS;BOP-31DS-0824;20240805	2024-08-05	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	
Upper	BOP-66ds	BOP-66DS;BOP-66DS-0824;20240805	2024-08-05	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	
Upper	CMW-10ds	CMW10DS-020824	2024-02-08	4.55	0.326 J	< 0.500	< 0.500	< 0.500	
Upper	CMW-10ds	CMW10DS-080524	2024-08-05	4.23	< 0.500	< 0.500	< 0.500 J	< 0.500	
Upper	CMW-17ds	CMW17DS-020824	2024-02-08	16.8	0.909	2.22	< 0.500	< 0.500	
Upper	CMW-17ds	CMW17DS-020824-DUP	2024-02-08	17.5	0.984	2.52	< 0.500	< 0.500	Yes
Upper	CMW-17ds	CMW17DS-050224	2024-05-02	21.8	1.23	2.84	< 0.500	< 0.500	
Upper	CMW-17ds	CMW17DS-050224-DUP	2024-05-02	20.6	1.15	2.60	< 0.500	< 0.500	Yes
Upper	CMW-17ds	CMW17DS-080524	2024-08-05	10	0.679	1.24	< 0.500 J	< 0.500	
Upper	CMW-17ds	CMW17DS-110624	2024-11-06	0.848 J	< 2.50	< 2.50	< 2.50	< 2.50	
Upper	CMW-17ds	CMW17DS-110624-DUP	2024-11-06	0.795	< 0.500	< 0.500	< 0.500	< 0.500	Yes
Upper	CMW-18ds	CMW18DS-020824	2024-02-08	23	0.792	3.84	< 0.500	< 0.500	
Upper	CMW-18ds	CMW18DS-020824-DUP	2024-02-08	23.4	0.784	3.54	< 0.500	< 0.500	Yes
Upper	CMW-18ds	CMW18DS-050224	2024-05-02	62.5	1.93	9.59	< 0.500	< 0.500	
Upper	CMW-18ds	CMW18DS-050224-DUP	2024-05-02	62.2	2.12	9.66	< 0.500	< 0.500	Yes
Upper	CMW-18ds	CMW18DS-080524	2024-08-05	63.1	3.13	10.7	< 0.500 J	< 0.500	
Upper	CMW-18ds	CMW18DS-080524-DUP	2024-08-05	63.8	2.98	10.6	< 0.500 J	< 0.500	Yes
Upper	CMW-18ds	CMW18DS-110624	2024-11-06	45	2.22 J	7.10	< 2.50	< 2.50	
Upper	CMW-18ds	CMW18DS-110624-DUP	2024-11-06	50.4	2.57	8.03	< 0.500	< 0.500	Yes
Upper	CMW-19ds	CMW19DS-020824	2024-02-08	0.437 J	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	CMW-19ds	CMW19DS-050224	2024-05-02	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	CMW-19ds	CMW19DS-080524	2024-08-05	< 0.500	< 0.500	< 0.500	< 0.500 J	< 0.500	
Upper	CMW-19ds	CMW19DS-110624	2024-11-06	0.218 J	< 2.50	< 2.50	< 2.50	< 2.50	

Table E-1
Groundwater Analytical Results
1 January 2024 through 31 December 2024
East Multnomah County Troutdale Sandstone Aquifer (TSA) Remedy

TSA Zone	Monitoring Well ID	Sample ID	Sample Date	Trichloroethene (TCE)	Tetrachloroethene (PCE)	cis-1,2-Dichloroethene	1,1-Dichloroethene	Vinyl Chloride	Duplicate sample
Upper	CMW-20ds	CMW20DS-080524	2024-08-05	0.217 J	< 0.500	< 0.500	< 0.500 J	< 0.500	
Upper	PWB-1uts	PWB-1(UTS)-030724	2024-03-07	1.62	< 0.500	0.222 J	< 0.500 J	< 0.500 J	
Lower	BOP-13dg	BOP-13DG;BOP-13DG-0824;2024080	2024-08-05	1.0	< 0.50	< 0.50	< 0.50	< 0.50	
Lower	BOP-13dg	BOP-13DG;BOP-Z-0824;20240805	2024-08-05	0.92	< 0.50	< 0.50	< 0.50	< 0.50	Yes
Lower	BOP-31dg	BOP-31DG;BOP-31DG-0824;2024080	2024-08-05	2.6	< 0.50	< 0.50	< 0.50	< 0.50	
Lower	CMW-14Rds	CMW14RDS-020824	2024-02-08	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	CMW-14Rds	CMW14RDS-080524	2024-08-05	< 0.500	< 0.500	< 0.500	< 0.500 J	< 0.500	
Lower	CMW-22dg	CMW22DG-080524	2024-08-05	< 0.500	< 0.500	< 0.500	< 0.500 J	< 0.500	
Lower	CMW-24dg (EW-5)	CMW24DG-020824	2024-02-08	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	CMW-24dg (EW-5)	CMW24DG-080524	2024-08-05	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	CMW-25dg	CMW25DG-020824	2024-02-08	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	CMW-25dg	CMW25DG-080524	2024-08-05	0.319 J	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	CMW-36dg	CMW36DG-080524	2024-08-05	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	D-17dg	D17DG-020624	2024-02-06	< 25.0 J	< 25.0 J	< 25.0	< 25.0	< 25.0	
Lower	D-17dg	D17DG-050224	2024-05-02	1.90	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	D-17dg	D17DG-080524	2024-08-05	1.43	< 0.500	< 0.500	< 0.500 J	< 0.500	
Lower	D-17dg	D17DG-110624	2024-11-06	1.40	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	D-17ds	D17DS-020624	2024-02-06	35.7 J	< 10.0 J	7.04 J	< 10.0	< 10.0	
Lower	D-17ds	D17DS-050224	2024-05-02	52.2	1.13	11.9	< 0.500	< 0.500	
Lower	D-17ds	D17DS-080524	2024-08-05	34.5	1.15	9.39	< 0.500 J	< 0.500	
Lower	D-17ds	D17DS-110624	2024-11-06	27.9	0.869	6.78	< 0.500	< 0.500	
Lower	EW-1	EW1-020624	2024-02-06	1.09 J	< 0.500 J	< 0.500	< 0.500	< 0.500	
Lower	EW-1	EW1-050224	2024-05-02	1.20	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	EW-1	EW1-080624	2024-08-06	1.55	< 0.500	< 0.500	< 0.500 J	< 0.500	
Lower	EW-1	EW1-110624	2024-11-06	1.05	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	EW-12	EW12-020624	2024-02-06	2.04 J	0.361 J	< 0.500	< 0.500	< 0.500	
Lower	EW-12	EW12-080524	2024-08-05	1.15	< 0.500	< 0.500	< 0.500 J	< 0.500	
Lower	EW-23	EW23-020624	2024-02-06	0.293 J	< 0.500 J	< 0.500	< 0.500	< 0.500	
Lower	PWB-1lts	PWB-1(LTS)-030724	2024-03-07	2.32	< 0.500	0.328 J	< 0.500 J	< 0.500 J	
Vapor Monitoring Wells									
Upper	VMW-A	VMWA-020824	2024-02-08	1.04	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-A	VMWA-050224	2024-05-02	1.22	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-A	VMWA-080624	2024-08-06	1.01	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-A	VMWA-110724	2024-11-07	0.664	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-B	VMWB-020824	2024-02-08	9.45	0.504	1.79	< 0.500	< 0.500	
Upper	VMW-B	VMWB-050224	2024-05-02	12.1	0.583	1.88	< 0.500	< 0.500	
Upper	VMW-B	VMWB-080624	2024-08-06	11.5	0.541	1.75	< 0.500	< 0.500	
Upper	VMW-B	VMWB-110624	2024-11-06	9.21	0.378 J	1.58	< 0.500	< 0.500	
Upper	VMW-C	VMWC-020824	2024-02-08	1.45	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-C	VMWC-050224	2024-05-02	1.56	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-C	VMWC-080524	2024-08-05	1.07	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-C	VMWC-110724	2024-11-07	1.26	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-D	VMWD-020824	2024-02-08	0.641	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-D	VMWD-050224	2024-05-02	1.06	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-D	VMWD-080624	2024-08-06	0.455 J	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-D	VMWD-110624	2024-11-06	0.699	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-E	VMWE-020824	2024-02-08	16.4	1.09	2.42	< 0.500	< 0.500	

Table E-1
Groundwater Analytical Results
1 January 2024 through 31 December 2024
East Multnomah County Troutdale Sandstone Aquifer (TSA) Remedy

TSA Zone	Monitoring Well ID	Sample ID	Sample Date	Trichloroethene (TCE)	Tetrachloroethene (PCE)	cis-1,2-Dichloroethene	1,1-Dichloroethene	Vinyl Chloride	Duplicate sample
Upper	VMW-E	VMWE-050224	2024-05-02	18.9	1.38	2.45	< 0.500	< 0.500	
Upper	VMW-E	VMWE-080624	2024-08-06	15	1.24	1.96	< 0.500	< 0.500	
Upper	VMW-E	VMWE-110624	2024-11-06	12.1	0.890	1.63	< 0.500	< 0.500	
Upper	VMW-F	VMWF-020824	2024-02-08	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-F	VMWF-050224	2024-05-02	0.988	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-F	VMWF-080624	2024-08-06	1.30	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-F	VMWF-110624	2024-11-06	1.76	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-G	VMWG-020824	2024-02-08	2.82	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-G	VMWG-050224	2024-05-02	0.931	< 0.500	0.173 J	< 0.500	< 0.500	
Upper	VMW-G	VMWG-080624	2024-08-06	0.775	< 0.500	0.334 J	< 0.500	< 0.500	
Upper	VMW-G	VMWG-110624	2024-11-06	1.35	< 0.500	0.132 J	< 0.500	< 0.500	
Upper	VMW-H	VMWH-020824	2024-02-08	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-H	VMWH-050224	2024-05-02	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-H	VMWH-080524	2024-08-05	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-H	VMWH-110724	2024-11-07	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-I	VMWI-020824	2024-02-08	45.4	2.05	3.56	< 0.500	< 0.500	
Upper	VMW-I	VMWI-050224	2024-05-02	43	1.83	3.12	< 0.500	< 0.500	
Upper	VMW-I	VMWI-080624	2024-08-06	5.33	0.443 J	0.373 J	< 0.500	< 0.500	
Upper	VMW-I	VMWI-080624-DUP	2024-08-06	5.24	0.459 J	0.350 J	< 0.500	< 0.500	Yes
Upper	VMW-I	VMWI-110724-143.7	2024-11-07	45	2.01	3.39	< 0.500	< 0.500	
Upper	VMW-J2	VMWJ2-020824	2024-02-08	6.79	< 0.500	0.580	< 0.500	< 0.500	
Upper	VMW-J2	VMWJ2-050224	2024-05-02	3.32	< 0.500	0.369 J	< 0.500	< 0.500	
Upper	VMW-J2	VMWJ2-080624	2024-08-06	2.8	< 0.500	0.348 J	< 0.500	< 0.500	
Upper	VMW-J2	VMWJ2-110724-120.25	2024-11-07	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	
Upper	VMW-K	VMWK-020824	2024-02-08	9.38	0.415 J	2.35	< 0.500	< 0.500	
Upper	VMW-K	VMWK-020824-DUP	2024-02-08	9.62	0.385 J	2.21	< 0.500	< 0.500	Yes
Upper	VMW-K	VMWK-050224	2024-05-02	10	0.359 J	2.35	< 0.500	< 0.500	
Upper	VMW-K	VMWK-050224-DUP	2024-05-02	10.3	< 0.500 J	2.34	< 0.500	< 0.500	Yes
Upper	VMW-K	VMWK-080524	2024-08-05	3.64	< 0.500	0.680	< 0.500	< 0.500	
Upper	VMW-K	VMWK-080524-DUP	2024-08-05	3.5	< 0.500	0.648	< 0.500	< 0.500	Yes
Upper	VMW-K	VMWK-110724-114.25	2024-11-07	3.58	< 0.500	0.617	< 0.500	< 0.500	
Upper	VMW-K	VMWK-110724-114.25-DUP	2024-11-07	3.58	< 0.500	0.604	< 0.500	< 0.500	Yes
Upper	VMW-L	VMWL-020824	2024-02-08	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-L	VMWL-050224	2024-05-02	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-L	VMWL-080524	2024-08-05	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-L	VMWL-110724-103.25	2024-11-07	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-M	VMWM-020824	2024-02-08	4.6	< 0.500	0.690	< 0.500	< 0.500	
Upper	VMW-M	VMWM-050224	2024-05-02	4.66	< 0.500	0.688	< 0.500	< 0.500	
Upper	VMW-M	VMWM-080524	2024-08-05	2.88	< 0.500	0.409 J	< 0.500	< 0.500	
Upper	VMW-M	VMWM-110724-94	2024-11-07	2.52	< 0.500	0.396 J	< 0.500	< 0.500	
Upper	VMW-N	VMWN-020824	2024-02-08	7.1	0.562	0.962	< 0.500	< 0.500	
Upper	VMW-N	VMWN-050224	2024-05-02	0.698	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-N	VMWN-080624	2024-08-06	0.616	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-N	VMWN-110729-110.8	2024-11-07	2.4	< 0.500	0.342 J	< 0.500	< 0.500	

Table E-1
Groundwater Analytical Results
1 January 2024 through 31 December 2024
East Multnomah County Troutdale Sandstone Aquifer (TSA) Remedy

TSA Zone	Monitoring Well ID	Sample ID	Sample Date	Trichloroethene (TCE)	Tetrachloroethene (PCE)	cis-1,2-Dichloroethene	1,1-Dichloroethene	Vinyl Chloride	Duplicate sample
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Notes:

Results are presented in micrograms per liter (µg/L)

BOP = wells installed by and /or on Boeing Corporation Property

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

J=estimated concentration

< = compound not detected above the reporting limit shown.

Bold value indicates detection above method detection limit.

Sample ID with "DUP" 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.

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

Data validation reports are provided in Appendix F, and laboratory reports are presented on a disc in Appendix F.

N/A = not applicable

ID = Identification

Table E-2
Trichloroethylene (TCE) Mass Removal - January 1998 through December 2024
Troutdale Sandstone Aquifer (TSA) Remedy - East Multnomah County

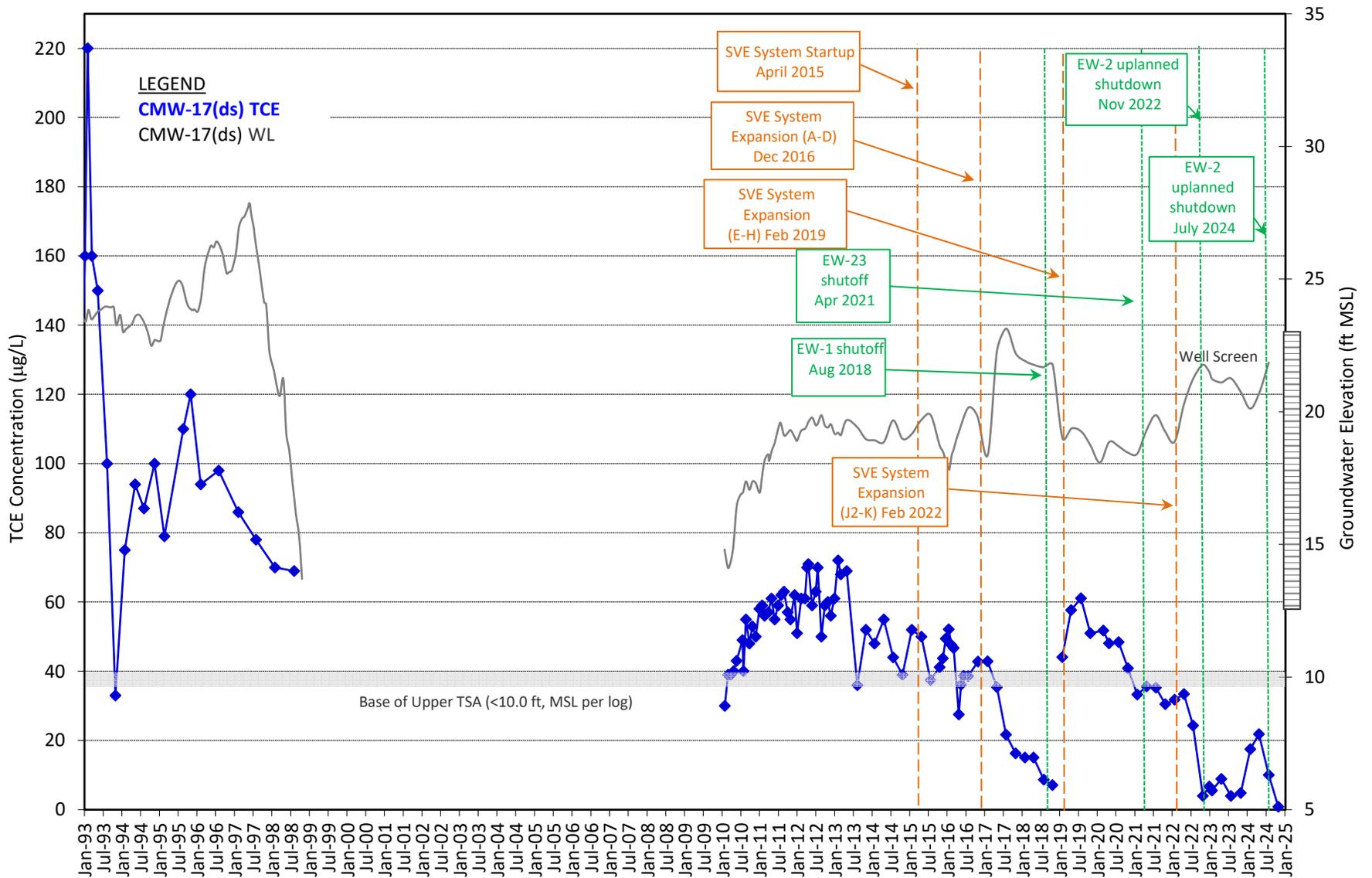
Date	Pounds of TCE Removed Per Year	Cumulative Pounds of TCE Removed
Jan-98	0.00	0.00
Aug-98	116.00	116.00
Feb-00	110.00	226.00
Feb-01	55.00	281.00
Feb-02	51.20	332.20
Feb-03	32.30	364.50
Feb-08	81.00	445.50
Feb-09	8.10	453.60
Feb-10	6.11	459.71
Feb-11	4.59	464.30
Feb-12	5.48	469.79
Feb-13	7.17	476.96
Dec-13	3.39	480.35
Dec-14	3.46	483.81
Dec-15	2.98	486.80
Dec-16	3.25	490.04
Dec-17	2.53	492.58
Dec-18	2.65	495.23
Dec-19	2.43	497.66
Dec-20	2.52	500.18
Dec-21	1.70	501.88
Dec-22	1.43	503.31
Dec-23	1.36	504.67
Dec-24	0.88	505.55

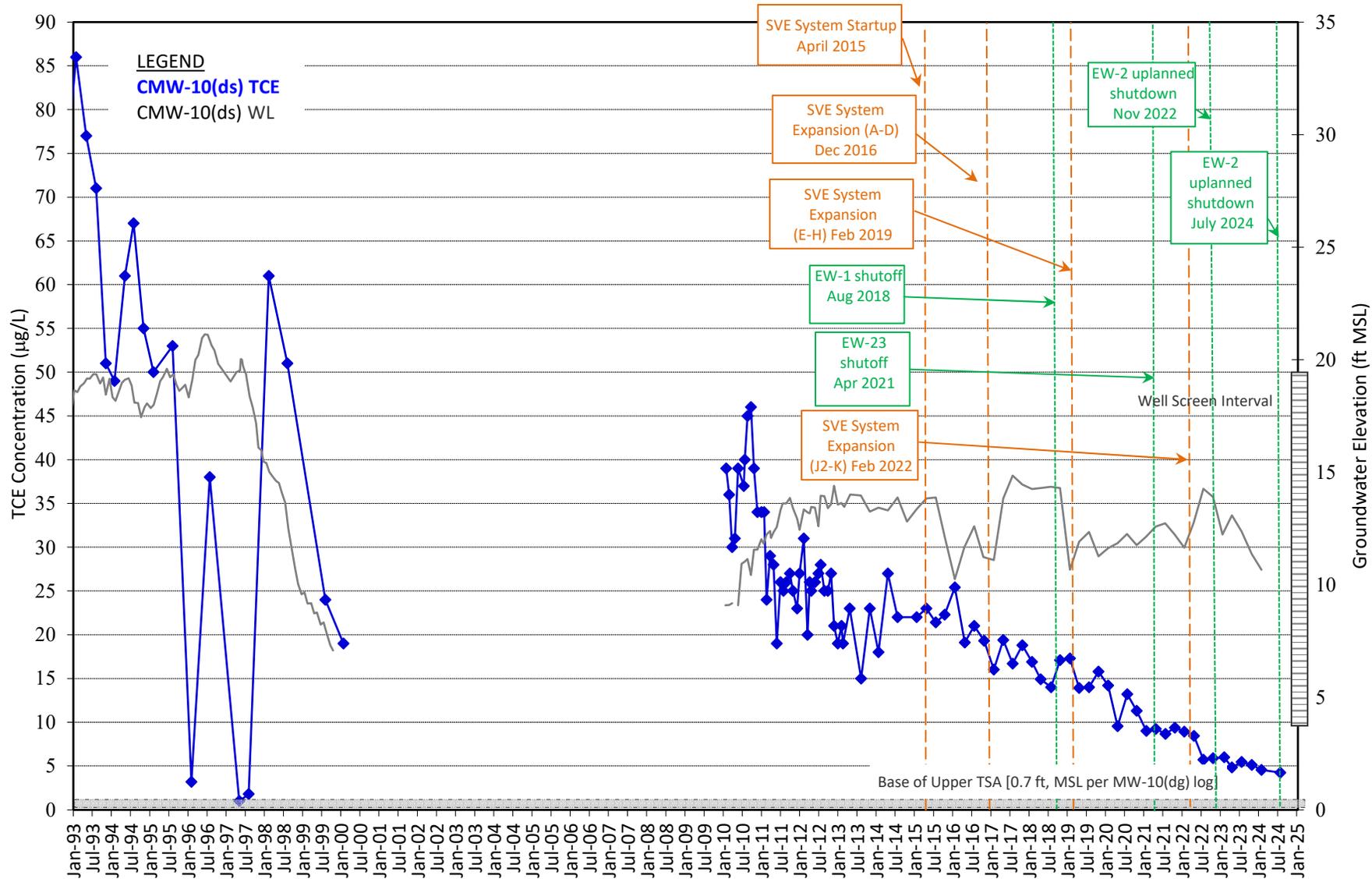
Table E-3
Trichloroethylene (TCE) Mass Removal Per Extraction Well
Troutdale Sandstone Aquifer (TSA) Remedy - East Multnomah County

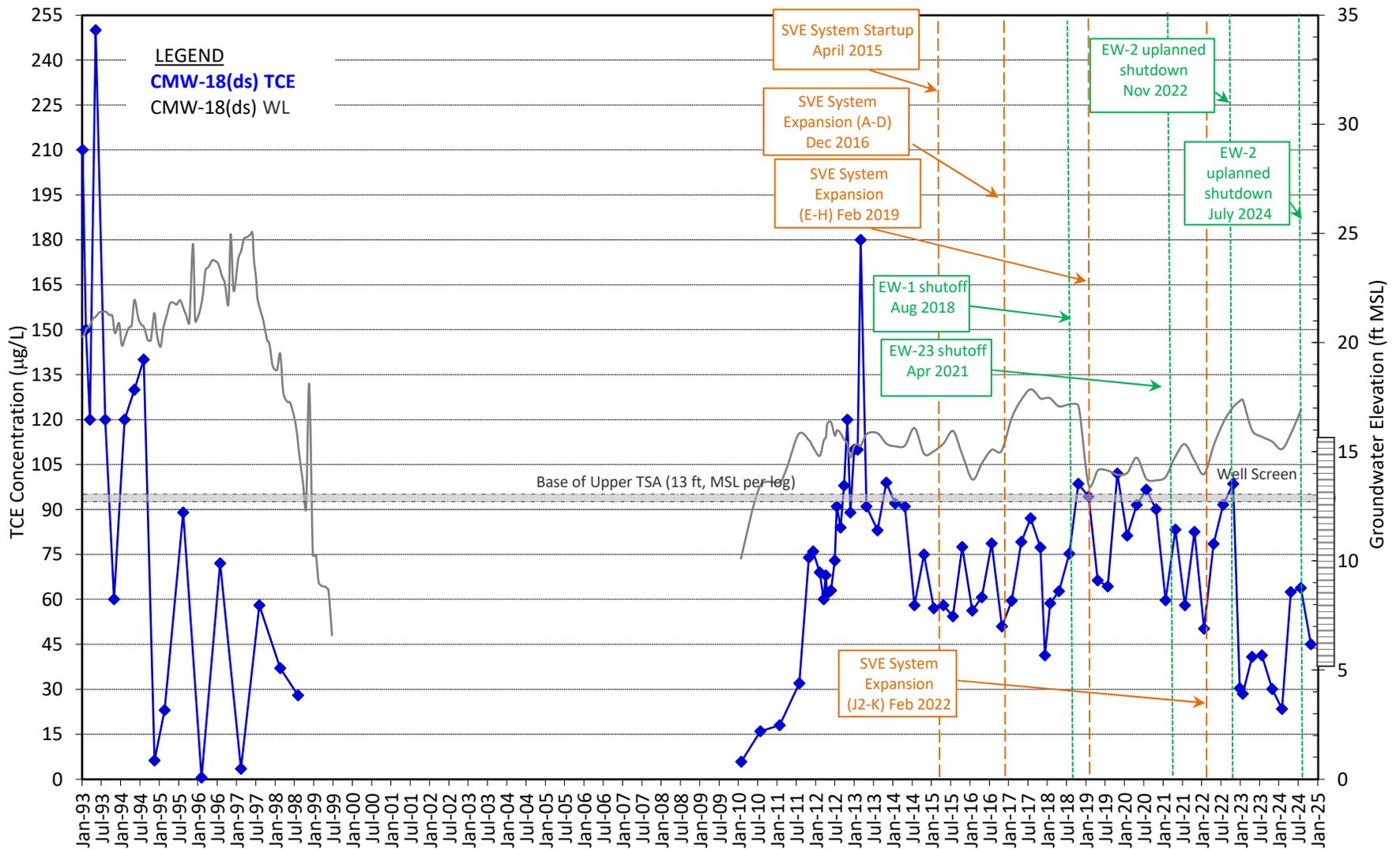
Date	Pounds of TCE Removed Per Well										
	EW-1	EW-2	EW-3	EW-13	EW-14	EW-15	EW-16	EW-18	EW-22	EW-23	Total
Mar 2008-Feb 2009	1.02	2.03	1.54	0.47	1.69	0.60	0.08	0.13	0.12	0.43	8.10
Mar 2009-Feb 2010	0.68	1.93	1.07	0.20	1.52	0.21	0.04	0.08	0.00	0.38	6.11
Mar 2010-Feb 2011	0.79	1.70			1.41	0.03	0.05			0.61	4.59
Mar 2011-Feb 2012	1.86	1.60			1.58		0.00			0.46	5.48
Mar 2012-Feb 2013	1.72	3.10			1.36		0.22			0.77	7.17
Mar 2013-Dec 2013	0.80	1.34			0.83		0.05			0.37	3.39
2014	0.68	1.41			0.82		0.10			0.44	3.46
2015	0.60	1.22			0.74					0.43	2.98
2016	0.87	1.42			0.70					0.26	3.25
2017	0.67	0.98			0.60					0.28	2.53
2018	0.32	1.45			0.64					0.24	2.65
2019		1.52			0.67					0.24	2.43
2020		1.57			0.72					0.24	2.52
2021		1.15			0.51					0.04	1.70
2022		0.95			0.48						1.43
2023		0.93			0.43						1.36
2024		0.45			0.43						0.88
Total (5 years)	0.00	5.04	0.00	0.00	2.56	0.00	0.00	0.00	0.00	0.28	7.89
Total (10 years)	2.45	11.64	0.00	0.00	5.91	0.00	0.00	0.00	0.00	1.72	21.73

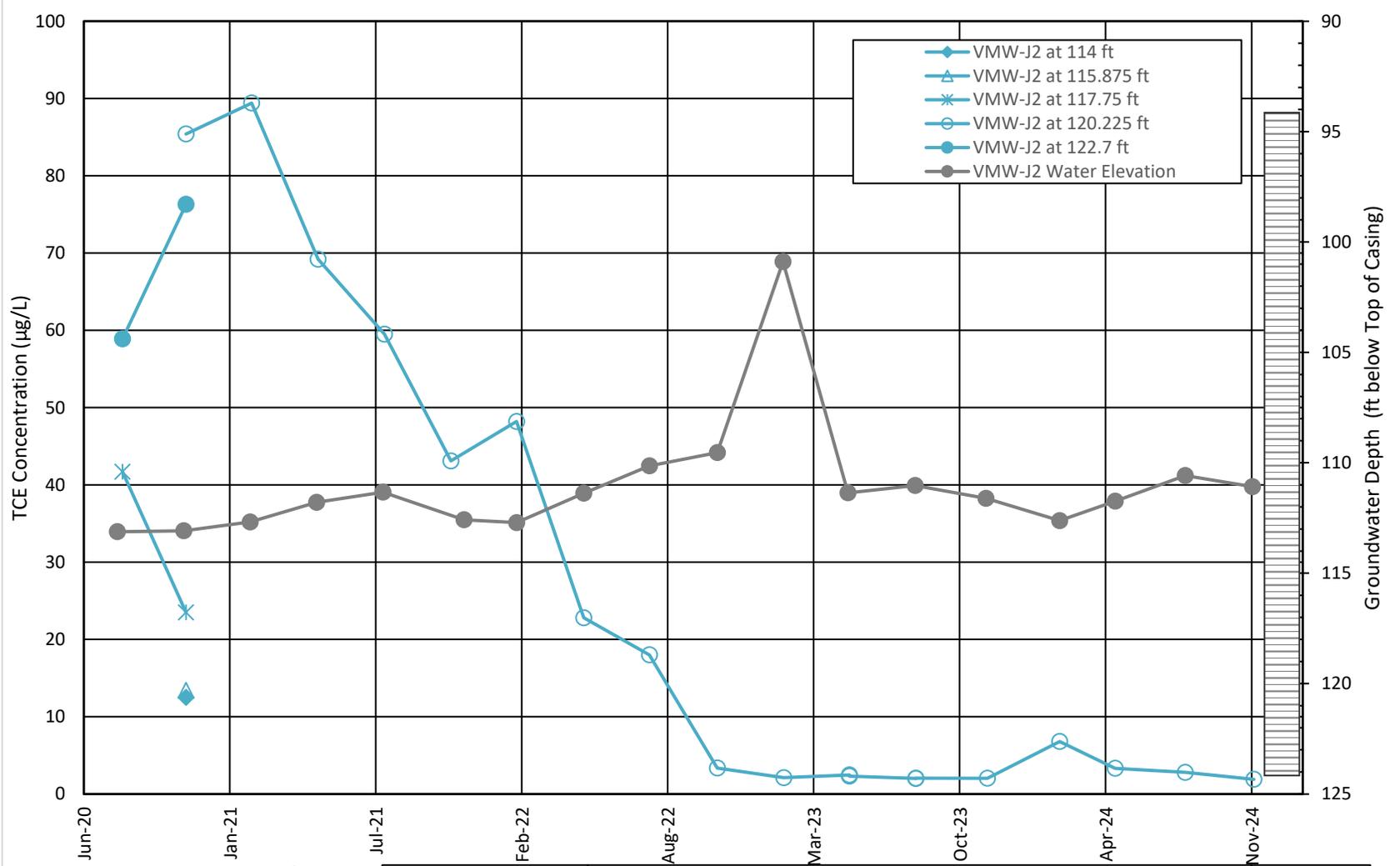
Notes

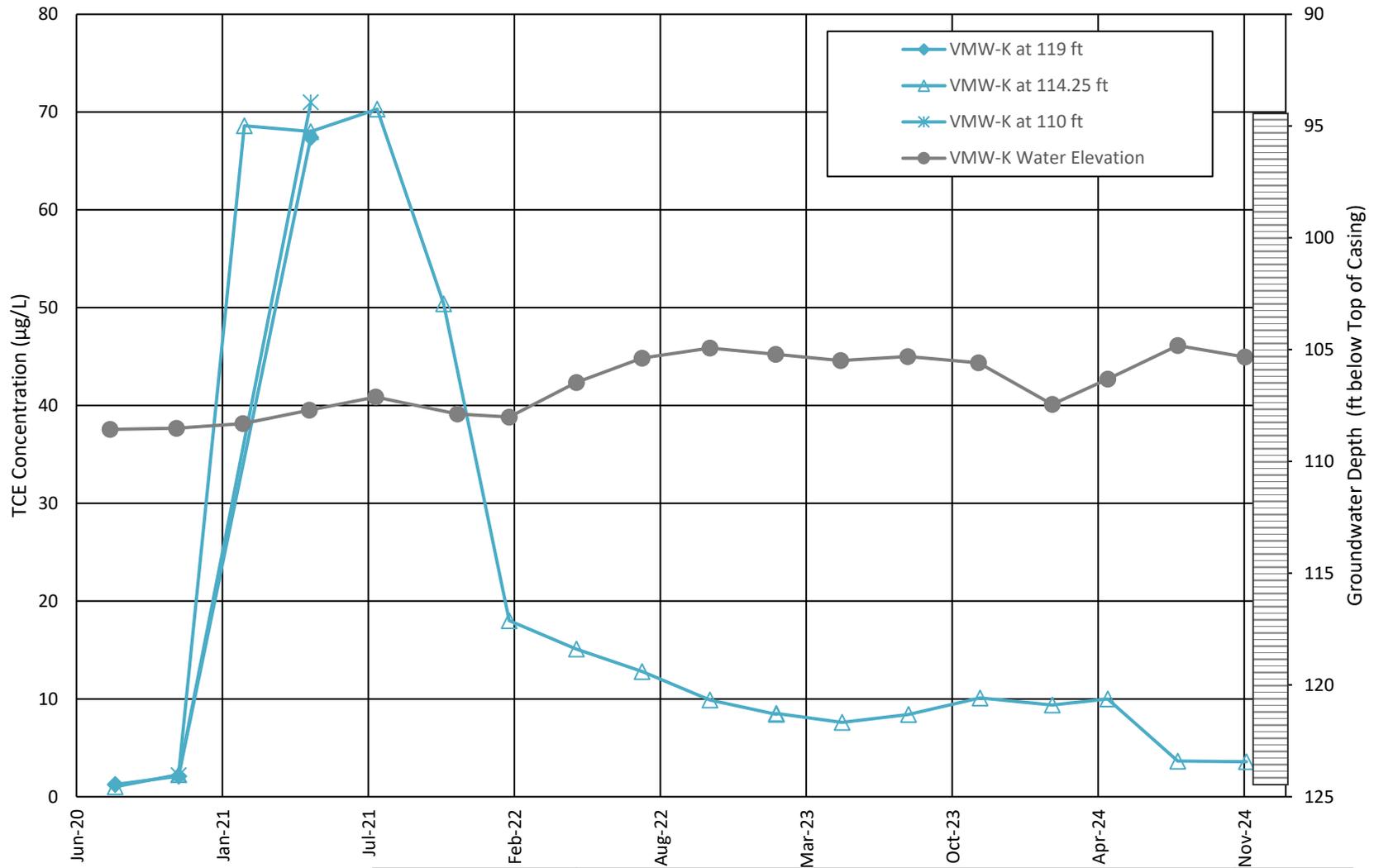
The amount of TCE removed by the extraction wells in the remedial systems was calculated using the average quarterly flow rates at each extraction well and the TCE concentration from samples collected on a quarterly basis. Note that the mass removal for 2018 was incorrectly reported as 1.28 pounds (lbs) in the 2018 TSA Annual Report and has been corrected here to 2.65 lbs.

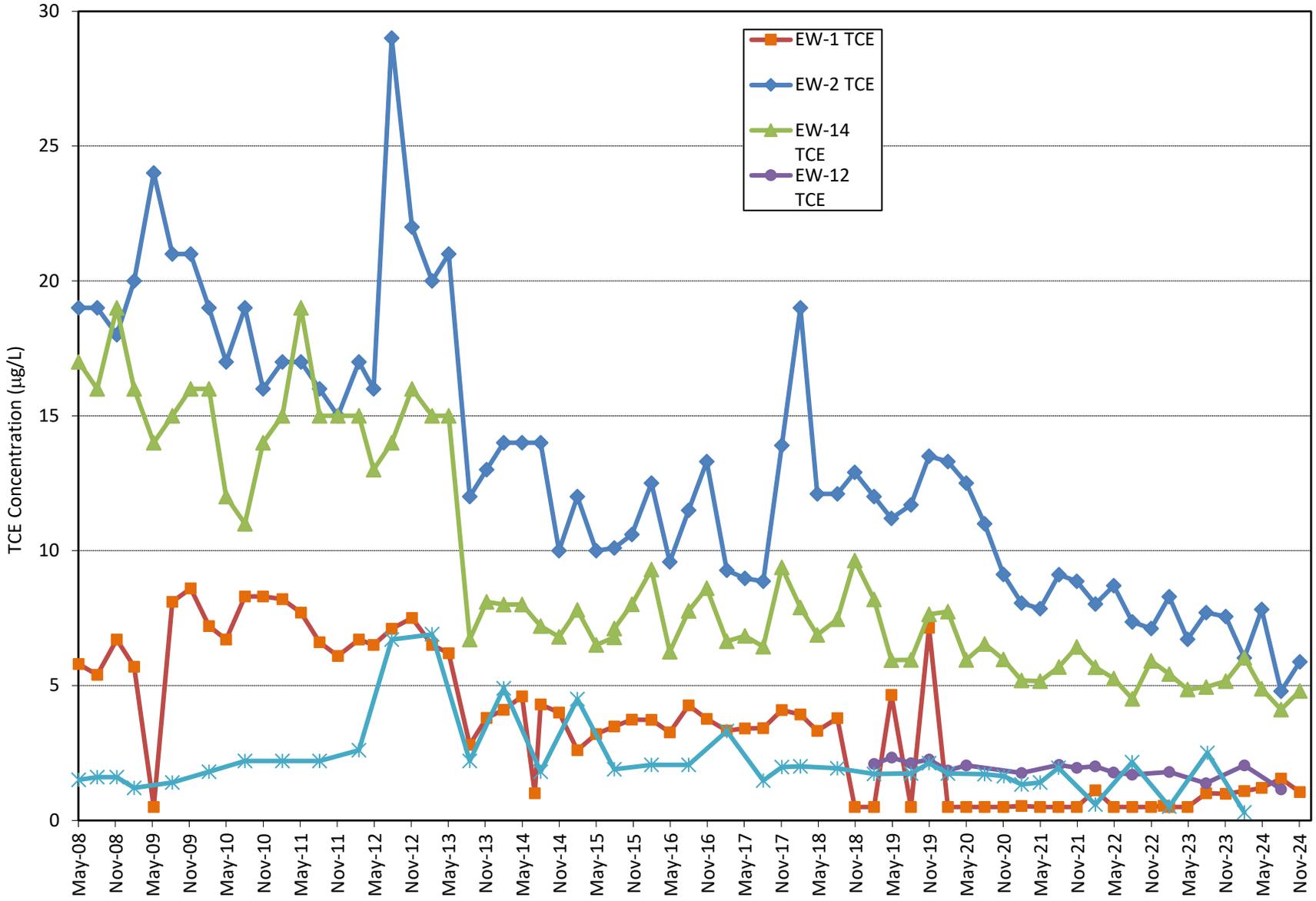


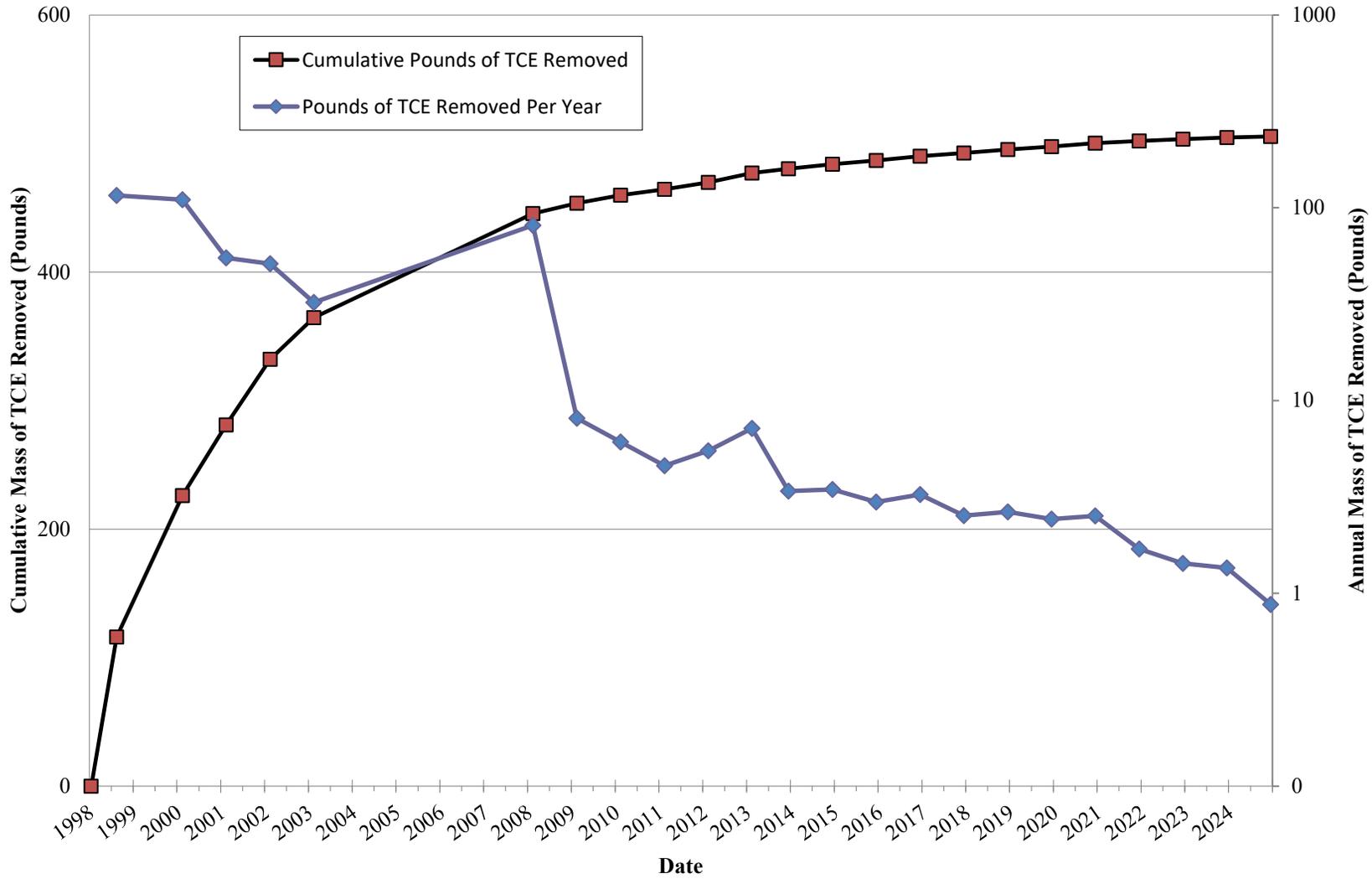


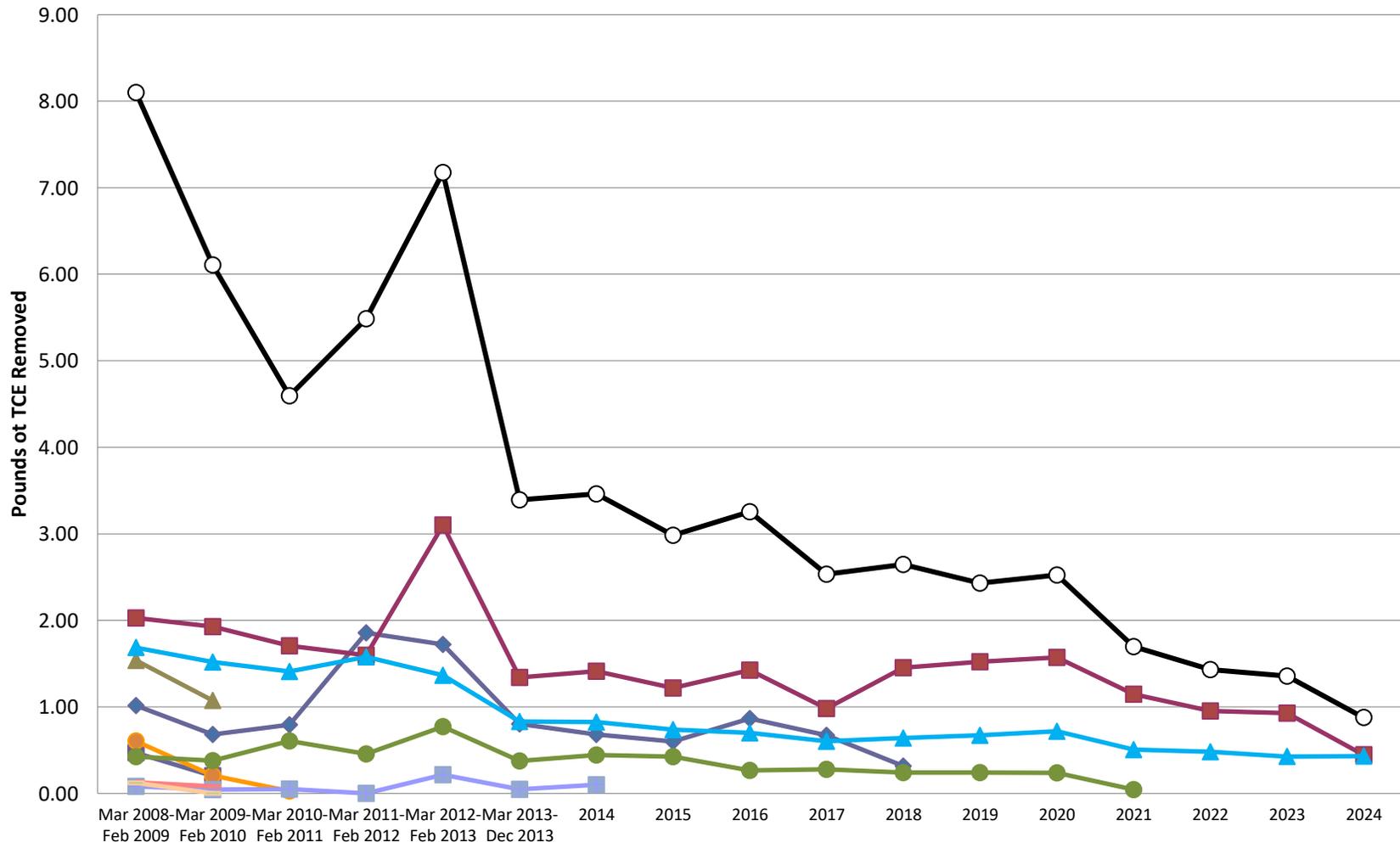












EW-1 EW-2 EW-3 EW-13 EW-14 EW-15 EW-16 EW-18 EW-22 EW-23 Total Mass Removed Per Year



Cascade Corporation Gresham, Oregon	TCE Mass Removal per Extraction Well TSA Remedy	Figure E-9
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APPENDIX F

Data Validation Memoranda,
Annual Reporting Period

Data Validation Memoranda
Laboratory Reports (CD)

Historical Data Summary Tables - VOCs and
Groundwater Elevations (CD)

TECHNICAL MEMORANDUM

TO: Chris Kimmel, Project Manager
FROM: Penny Cormier and Kristi Schultz
DATE: October 22, 2024
RE: Boeing Portland (TSA)
Third Quarter 2023 Groundwater Quality Sampling
Laboratory Data Quality Evaluation

This technical memorandum provides the results of a focused data validation associated with 6 groundwater samples and 1 trip blank collected during the third quarter 2024 TSA water quality sampling event at Boeing Portland. Samples were analyzed by Eurofins Lancaster Laboratories Environmental LLC (ELLE), located in Lancaster, Pennsylvania. This data quality evaluation covers ELLE data package 410-182876-1. Samples submitted to ELLE were analyzed for volatile organic compounds ([VOCs]; US Environmental Protection Agency [EPA] Method SW8260C).

The verification and validation check was conducted with guidance from applicable portions of EPA's *National Functional Guidelines for Organic Data Review* (EPA 2020). Landau Associates performed an EPA-equivalent Level IIa verification and validation check on each laboratory data package, which included the following:

- Verification that the laboratory data package contained all necessary documentation (including chain-of-custody records; identification of samples received by the laboratory; date and time of receipt of the samples at the laboratory; sample conditions upon receipt at the laboratory; date and time of sample analysis; explanation of any significant corrective actions taken by the laboratory during the analytical process; and, if applicable, date of extraction, definition of laboratory data qualifiers, all sample-related quality control data, and quality control acceptance criteria).
- Verification that all requested analyses, special cleanups, and special handling methods were performed.
- Evaluation of sample holding times.
- Evaluation of quality control data compared to acceptance criteria, including method blanks, surrogate recoveries, matrix spike results, laboratory duplicate and/or replicate results, and laboratory control sample results.
- Evaluation of overall data quality and completeness of analytical data.

Data validation qualifiers are added to the sample results, as appropriate, based on the verification and validation check. The absence of a data qualifier indicates that the reported result is acceptable without qualification. The data quality evaluation is summarized below. All data was found to be acceptable with no qualifications.

Chain-of-Custody Records

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

- The laboratory noted in the case narratives for data packages 410-182876-1 that the COCs were considered incomplete when received, and were missing sample preservation information for sulfate and did not indicate whether samples were grab or composite. These are specific requirements for samples collected in Pennsylvania, where the lab is located; they are not requirements for samples collected in Washington State. Revised COCs were submitted; no qualification of the data was necessary.
- The laboratory noted in the case narrative associated with data package 410-182876-1 that the sample bottle for BOP-13ds-0824 associated with the VOC analysis contained headspace. The associated sample results were qualified as estimated (J, UJ), as indicated in Table 1.

Upon receipt by ELLE, the sample container information was compared to the associated chain-of-custody and the cooler temperatures were recorded. The coolers were received with temperatures within the EPA-recommended limit of $\leq 6^{\circ}\text{C}$. No qualification of the data was necessary.

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 was necessary.

Blank Results

Laboratory Method Blanks

At least one method blank was analyzed with each batch of samples for VOCs analysis. Target analytes were not detected at concentrations greater than the reporting limits in the associated method blanks. No qualification of the data was necessary.

Field Trip Blanks and Field Equipment Blanks

One trip blank was submitted to the laboratory for VOC analysis with each sample batch. Target analytes were not detected at concentrations greater than the reporting limits in the associated trip blanks. No qualification of the data was necessary.

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

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 was necessary.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) and Laboratory Replicate Results

No matrix spikes were analyzed with this sample batch. No qualification of the data was determined necessary.

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 VOCs analysis. Recoveries and RPDs for the laboratory control samples and associated duplicates were within the current laboratory-specified control limits. No qualification of the data was 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. One pair of blind field duplicate water samples (BOP-Z-0824 / BOP-13dg-0824) was submitted for analysis with data package 410-182876-1.

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.

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. Based on the laboratory's case narratives, continuing calibration verification (CCV) recovery results were within laboratory-specified control limits. No qualification of the data was 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.

LANDAU ASSOCIATES, INC.



Penny Cormier
Data Specialist\



Kristi Schultz
Senior Data Specialist

PRC/kes
[P:\025\116\FILERM\T\TSA\DATA\DV MEMOS TSA\2023\Q3\TSA 3Q23 TM.DOCX]

References

EPA. 2020. National Functional Guidelines for Organic Superfund Methods Data Review. OLEM 9240.0-51; EPA-540-R-20-005. US Environmental Protection Agency. November.
https://www.epa.gov/sites/default/files/2021-03/documents/nfg_for_organic_superfund_methods_data_review_november_2020.pdf.

Table 1
Summary of Data Qualifiers
East Multnomah County Cleanup Project

Data Package	Sample Number	Analyte	Result	Lab Qualifier	Data Qualifier	Reason
410-182876-1	BOP-13ds-0824	All VOC Analytes	All		J,UJ	Sample vials contained headspace.

Notes:

- U = The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.
- UJ = The analyte was analyzed for but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.
- J = The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

Memorandum

Date: 13 May 2024
To: Cindy Bartlett, RG, LG
Geosyntec Consultants, Portland, Oregon
From: Molly Becia
CC: K. Henderson
Subject: **Stage 2A Data Validation - Level II Data Deliverables – Pace Analytical Sample Delivery Groups L1703219, L1703220, L1704367R, and L1713428, and Eurofins Air Toxics Work Orders # 2401092, 2402340 and 2403271**

SITE: Cascade

INTRODUCTION

This report summarizes the findings of the Stage 2A data validation of thirty-two groundwater samples, four field duplicates and two trip blanks, collected 6 and 8 February 2024 and 7 March 2024, as well as eleven soil vapor samples, collected on 3 January 2024 and 7 and 13 February 2024, as part of the site investigation activities for the Cascade Corp., Fairview Oregon sampling event.

The groundwater samples were analyzed by Pace Analytical National, Mt. Juliet, Tennessee for the following analytical test:

- United States (US) Environmental Protection Agency (EPA) Method 8260D – Volatile Organic Compounds (VOCs)

The air samples were analyzed by Eurofins Air Toxics, Folsom, California for the following analytical test:

- US EPA Modified Method TO-15 - Selected VOCs (1,1-Dichloroethene, Cis-1,2-Dichloroethene, Trichloroethene, Tetrachloroethene, and Vinyl Chloride)

EXECUTIVE SUMMARY

Overall, based on this Stage 2A data validation covering the quality control (QC) parameters listed below and based on the information provided, the data as qualified are usable for supporting project objectives. The qualified data should be used within the limitations of the qualifications. If there are results with two or more different qualifications due to multiple QC failures, the final

qualification is reconciled in the electronic data deliverable (EDD) with qualifications. The data were reviewed based on the following document, the pertinent methods referenced by the data package and professional and technical judgment:

- US EPA National Functional Guidelines for Organic Superfund Methods Data Review, November 2020 (EPA 540-R-20-005)

The following samples were analyzed in the data sets:

Laboratory IDs	Client IDs
2401092-01A	SVE-EFF-010324
2402340-01A	SVE-EFF-021324
2402340-02A	VW-17d-95.5-021324
2402340-03A	VMWE-021324
2402340-04A	VMWF-021324
2402340-05A	VMWG-021324
2402340-06A	VMWJ2-021324
2402340-07A	VMWK-021324
2402340-08A	VMWC-021324
2402340-09A	VMWH-021324
2403271-01A	SVE-EFF-020724
L1703219-01	EW1-020624
L1703219-02	EW2-020624
L1703219-03	EW14-020624
L1703219-04	EW23-020624
L1703219-05	D17DG-020624
L1703219-06	D17DS-020624
L1703219-07	EW12-020624
L1703219-08	TRIP BLANK
L1703220-01	TS-C-INF-020624
L1703220-02	TS-C-EFF-020624
L1703220-03	TS-C-EFF-020624-DUP
L1704367-01	CMW10DS-020824
L1704367-02	CMW14RDS-020824
L1704367-03	CMW17DS-020824

Laboratory IDs	Client IDs
L1704367-04	CMW17DS-020824-DUP
L1704367-05	CMW18DS-020824
L1704367-06	CMW18DS-020824-DUP
L1704367-07	CMW19DS-020824
L1704367-08	CMW24DG-020824
L1704367-09	CMW25DG-020824
L1704367-10	VMWA-020824
L1704367-11	VMWB-020824
L1704367-12	VMWC-020824
L1704367-13	VMWD-020824
L1704367-14	VMWE-020824
L1704367-15	VMWF-020824
L1704367-16	VMWG-020824
L1704367-17	VMWH-020824
L1704367-18	VMWI-020824
L1704367-19	VMWJ2-020824
L1704367-20	VMWK-020824
L1704367-21	VMWK-020824-DUP
L1704367-22	VMWL-020824
L1704367-23	VMWM-020824
L1704367-24	VMWN-020824
L1713428-01	PWB-1(LTS)-030724
L1713428-02	PWB-1(UTS)-030724
L1713428-03	TRIP BLANK

The groundwater samples were received at the laboratory within the temperature criteria of 0-6 degrees Celsius (°C).

The laboratory reported results for the analytical method(s) requested for each sample on the chain of custody (COC), with the following exception.

Sample Trip Blank-020824 was not received for analysis by the laboratory.

The initial and final pressure was not included on the COC for workorder 2403271.

Incorrect error corrections were observed on the COC, instead of the proper procedure of a single strike through, correction, and initials and date of person making the corrections.

Sample Trip Blank was submitted on both workorders L1703219 and L1703220, the trip blank was only logged in and reported for VOCs by method 8260D in workorder L1703219.

Laboratory report L1704367 was revised on 2/20/24 and 4/16/2024 to correct sample ID CMW10DS-020824 to match the COC.

The initial and final pressures for sample SVE-EFF-020724 were missing from the COC.

1.0 VOLATILE ORGANIC COMPOUNDS

The water samples were analyzed for VOCs per US EPA method 8260D.

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 Times and Preservation
- ✓ Method Blank
- ✓ Matrix Spike/Matrix Spike Duplicate
- ⊗ Laboratory Control Sample
- ✓ Surrogate
- ⊗ Trip Blank
- ✓ Field Duplicate
- ✓ Sensitivity
- ✓ Electronic Data Deliverable Review

1.1 Overall Assessment

1.1.1 Completeness

The VOC data reported in these data packages are considered usable for supporting project objectives. The results are considered valid; 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 this analysis, for the sample set is 100%.

1.1.2 Analysis Anomaly

L1703219 and L1703220: The percent differences (%Ds) for acrolein, bromomethane, and 2,2-dichloropropane in the continuing calibration verification (CCV) in batch WG2222997 were low and outside the laboratory specified acceptance criteria. Therefore, the non-detect results of acrolein, bromomethane, and 2,2-dichloropropane in the associated samples were UJ qualified as estimated less than the method detection limits (MDLs).

The %Ds for trichloroethene and tetrachloroethene in the CCV in batch WG2222997 were high and outside of laboratory specified acceptance criteria. Therefore, the concentrations of trichloroethene and tetrachloroethene in the associated samples were J qualified as estimated and the non-detect results were UJ qualified as estimated less than the MDLs.

L1704367: The %D for chloromethane in the CCV in batch WG2224300 was low and outside the laboratory specified acceptance criteria. Therefore, the non-detect results of chloromethane in the associated samples were UJ qualified as estimated less than the MDL.

The %Ds for acrylonitrile, chloromethane, and di-isopropyl ether in the CCV in batch WG2224381 were low and outside the laboratory specified acceptance criteria. Therefore, the non-detect results of acrylonitrile, chloromethane, and di-isopropyl ether in the associated samples were UJ qualified as estimated less than the MDLs.

The %D for acetone in the CCV in batch WG2224300 was high and outside of laboratory specified acceptance criteria. Therefore, the concentrations of acetone in the associated samples were J qualified as estimated and the non-detect results were UJ qualified as estimated less than the MDL.

L1713428: The %Ds for bromomethane, carbon disulfide, chloroethane, 2,2-dichloropropane, methyl tert-butyl ether, naphthalene, 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, and vinyl chloride in the CCV in batch WG2243937 were low and outside the laboratory specified acceptance criteria. Therefore, the non-detect results of bromomethane, carbon disulfide, chloroethane, 2,2-dichloropropane, methyl tert-butyl ether, naphthalene, 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, and vinyl chloride in the associated samples were UJ qualified as estimated less than the MDLs.

See Attachment 3 at the end of this report for the summary of qualifications.

1.2 Holding Time & Preservation

The holding time for the VOC analysis of a preserved groundwater sample is 14 days from collection to analysis. The holding times and preservations 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). Seven method blanks were reported (batches WG2222997, WG2226086, WG2224300, WG2224381, WG2227110, WG2227336, and WG22243937). VOCs were not detected in the method blanks at or above the MDLs.

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

MS/MSD pairs were not reported. Precision and accuracy were assessed using the laboratory control sample (LCS)/LCS duplicate (LCSD) pair for batches WG2222997, WG2226086, WG2224300, WG2227110, WG2227336, and WG22243937. Accuracy was assessed using an LCS for batch and WG2224381. 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). Six LCS/LCSD pairs and one LCS were reported. The recovery and relative percent difference (RPD) results were within the laboratory specified acceptance criteria, with the following exceptions:

L1703219 and L1703220

WG2222997

The LCSD recovery of trichloroethene in the LCS/LCSD pair in batch WG2222997 was high and outside of laboratory specified acceptance criteria. Therefore, concentrations of trichloroethene in the associated samples were J qualified as estimated.

L1704367R

WG2224300

The recovery of acrolein in the LCS/LCSD and 2,2-dichloropropane in the LCSD were high and outside of laboratory specified acceptance criteria. Since 2,2-dichloropropane was not detected in the associated samples, no qualifications were applied to the 2,2-dichloropropane data. However, the concentration of acrolein in sample CMW10DS-020824 was J qualified as estimated.

WG2224381

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

L1713428

WG2243937

The recovery of 1,1-dichloroethene in the LCSD was low and outside of the laboratory specified acceptance criteria. Therefore, the non-detect 1,1-dichloroethene results in the associated samples were UJ qualified as estimated less than the MDL, based on professional and technical judgement.

LCSs were used to assess accuracy; however, MS/MSD pairs or LCS/LCSD pairs were not reported for the assessment of batch-specific precision for batches 2224381.

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
D17DG-020624	Trichloroethene (TCE)	35.7	C5 J4	35.7	J	5
EW1-020624	Trichloroethene (TCE)	1.09	C5 J4	1.09	J	5
EW12-020624	Trichloroethene (TCE)	2.04	C5 J4	2.04	J	5
EW14-020624	Trichloroethene (TCE)	6.03	C5 J4	6.03	J	5
EW2-020624	Trichloroethene (TCE)	6.02	C5 J4	6.02	J	5
EW23-020624	Trichloroethene (TCE)	0.293	J J4	0.293	J	5
TS-C-INF-020624	Trichloroethene (TCE)	5.97	C5 J4	5.97	J	5
CMW10DS-020824	Acrolein	3.83	J J4	3.83	J	5
PWB-1(LTS)-030724	1,1-Dichloroethene	0.188	U,J4	0.188	UJ	5
PWB-1(UTS)-030724	1,1-Dichloroethene	0.188	U,J4	0.188	UJ	5
TRIP BLANK	1,1-Dichloroethene	0.188	U,J4	0.188	UJ	5

µg/l-microgram per liter

U-Not detected at the MDL.

J-The identification of the analyte is acceptable; the reported value is an estimate.

C5-The reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Method sensitivity check is acceptable.

J4-associated batch QC was outside the established quality control range for accuracy.

1.6 Surrogates

Acceptable surrogate recoveries were reported for the sample analyses.

1.7 Trip Blank

Two trip blanks, both identified as Trip Blank, were submitted with the sample sets. VOCs were not detected in the trip blanks at or above the MDLs. A trip blank was not submitted with the sample for laboratory report L1704367. This did not result in qualifications; however, the missing trip blank should be noted by the data user.

1.8 Field Duplicate

Four field duplicates (CMW17DS-020824-DUP, CMW18DS-020824-DUP, TS-C-EFF-020624-DUP, and VMWK-020824-DUP) were collected with the sample sets. Acceptable precision (RPD \leq 30%) was demonstrated between the field duplicates and the original samples CMW17DS-020824, CMW18DS-020824, TS-C-EFF-020624, and VMWK-020824, respectively, with the following exceptions.

Chloroform was detected at an estimated concentration greater than the MDL and less than the reporting detection limit (RDL) in sample CMW18DS-020824 and not detected in the field duplicate, resulting in a noncalculable RPD between the results. Therefore, based on professional and technical judgment, the concentration of chloroform was J qualified as estimated and the non-detect result was UJ qualified as estimated less than the MDL in the field duplicate pair.

Carbon disulfide was detected at an estimated concentration greater than the MDL and less than the RDL in the field duplicate and not detected in sample VMWK-020824, resulting in a noncalculable RPD between the results. Therefore, based on professional and technical judgment, the concentration of carbon disulfide was J qualified as estimated and the non-detect result was UJ qualified as estimated less than the MDL in the field duplicate pair.

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	RPD	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
CMW18DS-020824	Chloroform	0.14	J	NC	0.14	J	7
CMW18DS-020824-DUP	Chloroform	0.111	U		0.111	UJ	7
VMWK-020824	Carbon Disulfide	0.0962	U	NC	0.0962	UJ	7
VMWK-020824-DUP	Carbon Disulfide	0.135	J		0.135	J	7

µg/l-microgram per liter

U-Not detected at the MDL.

J-The identification of the analyte is acceptable; the reported value is an estimate.

* 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

1.9 Sensitivity

The sample results were reported to the MDLs. Elevated non-detect results reported due to sample dilutions analyzed.

1.10 Electronic Data Deliverable Review

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

2.0 VOLATILE ORGANIC COMPOUNDS

The samples were analyzed for selected VOCs per US EPA modified Method TO-15 using full scan mode.

The areas of data review are listed below. A leading check mark (✓) indicates an area of review in which the data were acceptable or not applicable. 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
- ✓ Laboratory Control Sample
- ✓ Surrogates
- ✓ Sensitivity
- ✓ Electronic Data Deliverable Review

2.1 Overall Assessment

The VOC data reported in these laboratory reports are considered usable for supporting project objectives. The results are considered valid; 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 this analysis, for this data set is 100%.

2.2 Holding Time

The holding time for the TO-15 analysis of an air sample collected in a canister is 30 days from collection to analysis. The holding times were met for the sample analyses.

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). Four method blanks were reported (Lab IDs: 2401092-02A, 2402340-10A, 2402340-10B, and 2403271-02A). VOCs were not detected in the method blanks at or above the reporting limits (RLs).

2.4 Laboratory Control Sample

LCSs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Four LCS/LCSD pairs were reported. The RPDs were not reported by the laboratory; therefore, the RPDs were calculated by the validator based on the reported recovery results. The recovery and RPD results were within the laboratory specified acceptance criteria.

The laboratory also reported CCV standards. The CCV recoveries were within the method specified acceptance criteria.

2.5 Surrogates

The surrogate recoveries were within the laboratory specified acceptance criteria.

2.6 Sensitivity

The samples were reported to the RLs. The laboratory noted that samples SVE-EFF-010324, SVE-EFF-021324, VMWE-021324, VMWJ2-021324, and VMWK-021324 were diluted due to the presence of high-level target species. Additionally, sample SVE-EFF-020724 was re-pressurized for TO-15 analysis, resulting in elevated RLs. Elevated non-detect results were reported due to the sample dilutions analyzed.

2.7 Electronic Data Deliverable Review

Results and sample IDs in the EDD were reviewed against the information provided by the associated level II report 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. Upon application of the U qualifier to a reported result, the definition changes to “not detected at or above the reported result.”

- 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.

**ATTACHMENT 2
DATA VALIDATION REASON CODES
Assigned by Geosyntec’s Data Validation Team**

Valid Value	Description
1	Preservation requirement not met
2	Extraction or 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
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
14	Lab flag removed or modified: no validation qualification required

LCS – Laboratory Control Sample

LCSD – Laboratory Control Sample duplicate

RPD – Relative percent difference

**ATTACHMENT 3
QUALIFICATIONS DUE TO CCV OUTSIDE OF CRITERIA**

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
D17DG-020624	Tetrachloroethene (PCE)	6	U	6	UJ	9
D17DG-020624	Trichloroethene (TCE)	35.7	C5 J4	35.7	J	9
D17DS-020624	Tetrachloroethene (PCE)	15	U	15	UJ	9
D17DS-020624	Trichloroethene (TCE)	9.5	U,J4	9.5	UJ	9
EW1-020624	Tetrachloroethene (PCE)	0.3	U	0.3	UJ	9
EW1-020624	Trichloroethene (TCE)	1.09	C5 J4	1.09	J	9
EW12-020624	Tetrachloroethene (PCE)	0.361	J	0.361	J	9
EW12-020624	Trichloroethene (TCE)	2.04	C5 J4	2.04	J	9
EW14-020624	Tetrachloroethene (PCE)	0.428	J	0.428	J	9
EW14-020624	Trichloroethene (TCE)	6.03	C5 J4	6.03	J	9
EW2-020624	Tetrachloroethene (PCE)	0.557	C5	0.557	J	9
EW2-020624	Trichloroethene (TCE)	6.02	C5 J4	6.02	J	9
EW23-020624	Tetrachloroethene (PCE)	0.3	U	0.3	UJ	9
EW23-020624	Trichloroethene (TCE)	0.293	J J4	0.293	J	9
TRIP BLANK	Tetrachloroethene (PCE)	0.3	U	0.3	UJ	9
TRIP BLANK	Trichloroethene (TCE)	0.19	U,J4	0.19	UJ	9
D17DG-020624	2,2-Dichloropropane	3.22	U,C3	3.22	UJ	9
D17DG-020624	Acrolein	50.8	U,C3	50.8	UJ	9
D17DG-020624	Methyl Bromide	12.1	U,C3	12.1	UJ	9
D17DS-020624	2,2-Dichloropropane	8.05	U,C3	8.05	UJ	9
D17DS-020624	Acrolein	127	U,C3	127	UJ	9
D17DS-020624	Methyl Bromide	30.3	U,C3	30.3	UJ	9

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
EW1-020624	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
EW1-020624	Acrolein	2.54	U,C3	2.54	UJ	9
EW1-020624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
EW12-020624	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
EW12-020624	Acrolein	2.54	U,C3	2.54	UJ	9
EW12-020624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
EW14-020624	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
EW14-020624	Acrolein	2.54	U,C3	2.54	UJ	9
EW14-020624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
EW2-020624	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
EW2-020624	Acrolein	2.54	U,C3	2.54	UJ	9
EW2-020624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
EW23-020624	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
EW23-020624	Acrolein	2.54	U,C3	2.54	UJ	9
EW23-020624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
TRIP BLANK	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
TRIP BLANK	Acrolein	2.54	U,C3	2.54	UJ	9
TRIP BLANK	Methyl Bromide	0.605	U,C3	0.605	UJ	9
TS-C-EFF-020624	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
TS-C-EFF-020624	Acrolein	2.54	U,C3	2.54	UJ	9
TS-C-EFF-020624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
TS-C-EFF-020624-DUP	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
TS-C-EFF-020624-DUP	Acrolein	2.54	U,C3	2.54	UJ	9
TS-C-EFF-020624-DUP	Methyl Bromide	0.605	U,C3	0.605	UJ	9
TS-C-INF-020624	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
TS-C-INF-020624	Acrolein	2.54	U,C3	2.54	UJ	9
TS-C-INF-020624	Methyl Bromide	0.605	U,C3	0.605	UJ	9

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
TS-C-EFF-020624	Tetrachloroethene (PCE)	0.3	U	0.3	UJ	9
TS-C-EFF-020624	Trichloroethene (TCE)	0.19	U,J4	0.19	UJ	9
TS-C-EFF-020624-DUP	Tetrachloroethene (PCE)	0.3	U	0.3	UJ	9
TS-C-EFF-020624-DUP	Trichloroethene (TCE)	0.19	U,J4	0.19	UJ	9
TS-C-INF-020624	Tetrachloroethene (PCE)	0.501	C5	0.501	J	9
TS-C-INF-020624	Trichloroethene (TCE)	5.97	C5 J4	5.97	J	9
CMW24DG-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
CMW25DG-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWA-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWB-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWC-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWD-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWE-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWF-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWG-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWH-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWI-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWJ2-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWK-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
CMW10DS-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
CMW14RDS-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
CMW17DS-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
CMW17DS-020824-DUP	Chloromethane	0.96	U,C3	0.96	UJ	9
CMW18DS-020824	Chloromethane	0.96	U,C3	0.96	UJ	9

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
CMW18DS-020824-DUP	Chloromethane	0.96	U,C3	0.96	UJ	9
CMW19DS-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWK-020824-DUP	acrylonitrile	0.671	U,C3	0.671	UJ	9
VMWK-020824-DUP	Diisopropyl Ether	0.105	U,C3	0.105	UJ	9
VMWK-020824-DUP	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWL-020824	acrylonitrile	0.671	U,C3	0.671	UJ	9
VMWL-020824	Diisopropyl Ether	0.105	U,C3	0.105	UJ	9
VMWL-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWM-020824	acrylonitrile	0.671	U,C3	0.671	UJ	9
VMWM-020824	Diisopropyl Ether	0.105	U,C3	0.105	UJ	9
VMWM-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWN-020824	acrylonitrile	0.671	U,C3	0.671	UJ	9
VMWN-020824	Diisopropyl Ether	0.105	U,C3	0.105	UJ	9
VMWN-020824	Chloromethane	0.96	U,C3	0.96	UJ	9
CMW25DG-020824	Acetone	11.3	U	11.3	UJ	9
VMWA-020824	Acetone	290	C5	290	J	9
VMWE-020824	Acetone	11.3	U	11.3	UJ	9
VMWF-020824	Acetone	11.3	U	11.3	UJ	9
VMWG-020824	Acetone	11.3	U	11.3	UJ	9
VMWH-020824	Acetone	11.3	U	11.3	UJ	9
PWB-1(LTS)-030724	1,2,4-Trichlorobenzene	0.481	U,C3	0.481	UJ	9
PWB-1(LTS)-030724	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
PWB-1(LTS)-030724	Carbon Disulfide	0.0962	U,C3	0.0962	UJ	9
PWB-1(LTS)-030724	Ethyl Chloride	0.192	U,C3	0.192	UJ	9

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
PWB-1(LTS)-030724	Methyl Bromide	0.605	U,C3	0.605	UJ	9
PWB-1(LTS)-030724	Methyl tert-Butyl Ether (MTBE)	0.101	U,C3	0.101	UJ	9
PWB-1(LTS)-030724	Naphthalene	0.174	U,C3	0.174	UJ	9
PWB-1(LTS)-030724	Vinyl Chloride	0.234	U,C3	0.234	UJ	9
PWB-1(UTS)-030724	1,2,4-Trichlorobenzene	0.481	U,C3	0.481	UJ	9
PWB-1(UTS)-030724	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
PWB-1(UTS)-030724	Carbon Disulfide	0.0962	U,C3	0.0962	UJ	9
PWB-1(UTS)-030724	Ethyl Chloride	0.192	U,C3	0.192	UJ	9
PWB-1(UTS)-030724	Methyl Bromide	0.605	U,C3	0.605	UJ	9
PWB-1(UTS)-030724	Methyl tert-Butyl Ether (MTBE)	0.101	U,C3	0.101	UJ	9
PWB-1(UTS)-030724	Naphthalene	0.174	U,C3	0.174	UJ	9
PWB-1(UTS)-030724	Vinyl Chloride	0.234	U,C3	0.234	UJ	9
TRIP BLANK	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
TRIP BLANK	Methyl Bromide	0.605	U,C3	0.605	UJ	9
TRIP BLANK	Carbon Disulfide	0.0962	U,C3	0.0962	UJ	9
TRIP BLANK	Ethyl Chloride	0.192	U,C3	0.192	UJ	9
TRIP BLANK	Methyl tert-Butyl Ether (MTBE)	0.101	U,C3	0.101	UJ	9
TRIP BLANK	Naphthalene	0.174	U,C3	0.174	UJ	9
TRIP BLANK	Vinyl Chloride	0.234	U,C3	0.234	UJ	9
TRIP BLANK	1,2,4-Trichlorobenzene	0.481	U,C3	0.481	UJ	9

µg/l-microgram per liter

U-not detected at or above the MDL

C3-The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

C5-The reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Method sensitivity check is acceptable.

J-The identification of the analyte is acceptable; the reported value is an estimate.

J4-associated batch QC was outside the established quality control range for accuracy

* 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

Memorandum

Date: 19 December 2024
To: Cindy Bartlett, RG, LG
Geosyntec Consultants, Portland, Oregon
From: Chase Harris
CC: Kris Henderson
Quyên Le
Subject: **Stage 2A Data Validation - Level II Data Deliverables – Pace Analytical Sample Delivery Groups L1732633 and L1732634, and Eurofins Air Toxics Work Orders # 2404219, 2405329 and 2406214**

SITE: Cascade

INTRODUCTION

This report summarizes the findings of the Stage 2A data validation of twenty-four groundwater samples, four field duplicates and two trip blanks, collected on 2 May 2024, as well as eleven soil vapor samples, collected on 9 April 2024, 14 May 2024 and 11 June 2024, as part of the site investigation activities for the Cascade Corp., Fairview Oregon sampling event.

The groundwater samples were analyzed by Pace Analytical National, Mount Juliet, Tennessee for the following analytical test:

- United States (US) Environmental Protection Agency (EPA) Method 8260D – Volatile Organic Compounds (VOCs)

The air samples were analyzed by Eurofins Air Toxics, Folsom, California for the following analytical test:

- US EPA Modified Method TO-15 Full Scan – Selected VOCs (1,1-Dichloroethene, cis-1,2-Dichloroethene, Trichloroethene, Tetrachloroethene and Vinyl Chloride)

EXECUTIVE SUMMARY

Overall, based on this Stage 2A data validation covering the quality control (QC) parameters listed below and based on the information provided, the data as qualified are usable for supporting project objectives. The qualified data should be used within the limitations of the qualifications. If there are results with two or more different qualifications due to multiple QC failures, the final qualification is reconciled in the electronic data deliverable (EDD) with qualifications.

The data were reviewed based on the following document, the pertinent methods referenced by the data package and professional and technical judgment:

- US EPA National Functional Guidelines for Organic Superfund Methods Data Review, November 2020 (EPA 540-R-20-005)

The following samples were analyzed in the data sets:

Lab ID	Client ID
2404219-01A	SVE-EFF-040924
2405329-01A	SVE-EFF-051424
2405329-02A	VW-17d-95.5-051424
2405329-03A	VMWJ2-051424
2405329-04A	VMWK-051424
2405329-05A	VMWC-051424
2405329-06A	VMWE-051424
2405329-07A	VMWF-051424
2405329-08A	VMWG-051424
2405329-09A	VMWH-051424
2406214-01A	SVE-EFF-061124
L1732633-01	EW1-050224
L1732633-02	EW2-050224
L1732633-03	EW14-050224
L1732633-04	D17DG-050224
L1732633-05	D17DS-050224
L1732633-06	CMW17DS-050224
L1732633-07	CMW17DS-050224-DUP
L1732633-08	CMW18DS-050224
L1732633-09	CMW18DS-050224-DUP
L1732633-10	CMW19DS-050224

Lab ID	Client ID
L1732633-11	TS-C-EFF-050224
L1732633-12	TS-C-EFF-050224-DUP
L1732633-13	TS-C-INF-050224
L1732633-14	TRIP-050224-1
L1732634-01	VMWA-050224
L1732634-02	VMWB-050224
L1732634-03	VMWC-050224
L1732634-04	VMWD-050224
L1732634-05	VMWE-050224
L1732634-06	VMWF-050224
L1732634-07	VMWG-050224
L1732634-08	VMWH-050224
L1732634-09	VMWI-050224
L1732634-10	VMWJ2-050224
L1732634-11	VMWK-050224
L1732634-12	VMWK-050224-DUP
L1732634-13	VMWL-050224
L1732634-14	VMWM-050224
L1732634-15	VMWN-050224
L1732634-16	TRIP-050224-2

The laboratory reported results for the analytical method(s) requested for each sample on the chains of custody (COCs).

The groundwater samples were received at the laboratory within the temperature criteria of 0-6 degrees Celsius (°C). No sample preservation issues were noted by the laboratory.

Incorrect error corrections were observed on the COCs, instead of the proper procedure of a single strike through, correction, and initials and date of person making the corrections.

The laboratory noted that the COC information for sample SVE-EFF-040924 did not match the information on the canister. The sample 1L4636 on the COC was labeled as 1L4686 on the canister. The client was notified of the discrepancy and the information on the canister was used to process and report the sample by the laboratory.

1.0 VOLATILE ORGANIC COMPOUNDS

The groundwater samples were analyzed for VOCs per US EPA Method 8260D.

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
- ✓ Surrogate
- ✓ Trip Blank
- ⊗ Field Duplicate
- ✓ Sensitivity
- ✓ Electronic Data Deliverable Review

1.1 Overall Assessment

1.1.1 Completeness

The VOC data reported in these data packages are considered usable for supporting project objectives. The results are considered valid; 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 this analysis, for the sample set is 100%.

1.1.2 Analysis Anomaly

The percent recoveries (%Rs) of acetone (128%) and methyl ethyl ketone (MEK) (120%) in the associated continuing calibration verification (CCV) of batch WG2281626 were outside the laboratory specified acceptance criteria and validation criteria. Therefore, the non-detect acetone and MEK results in the associated samples were UJ qualified as estimated less than the method detection limits (MDLs) and the acetone and MEK concentrations were J qualified as estimated.

The %Rs of bromomethane (65.6%), acrolein (64.6%), 1,2-dibromo-3-chloropropane (72.6%) and naphthalene (74.3%) in the associated CCV of batch WG2282098 were outside the laboratory specified acceptance criteria and validation criteria. Therefore, the non-detect bromomethane, acrolein, 1,2-dibromo-3-chloropropane and naphthalene results in the associated samples were UJ qualified as estimated less than the MDLs.

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Reason Code**
CMW17DS-050224	Acetone	284	C5	284	J	9
CMW17DS-050224	Methyl ethyl ketone	2.15	J	2.15	J	9
CMW17DS-050224-DUP	Acetone	281	C5	281	J	9
CMW17DS-050224-DUP	Methyl ethyl ketone	2.12	J	2.12	J	9
CMW18DS-050224	Acetone	544	C5	544	J	9
CMW18DS-050224	Methyl ethyl ketone	7.14	C5	7.14	J	9
CMW18DS-050224-DUP	Acetone	537	C5	537	J	9
CMW18DS-050224-DUP	Methyl ethyl ketone	6.67	C5	6.67	J	9
CMW19DS-050224	Acetone	482	C5	482	J	9
CMW19DS-050224	Methyl ethyl ketone	3.77	J	3.77	J	9
D17DG-050224	Acetone	13.5	J	13.5	J	9
D17DG-050224	Methyl ethyl ketone	1.19	U	1.19	UJ	9
D17DS-050224	Acetone	29.6	C5	29.6	J	9
D17DS-050224	Methyl ethyl ketone	1.19	U	1.19	UJ	9
EW1-050224	Acetone	11.3	U	11.3	UJ	9
EW1-050224	Methyl ethyl ketone	1.19	U	1.19	UJ	9
EW14-050224	Acetone	11.3	U	11.3	UJ	9
EW14-050224	Methyl ethyl ketone	1.19	U	1.19	UJ	9
EW2-050224	Acetone	11.3	U	11.3	UJ	9
EW2-050224	Methyl ethyl ketone	1.19	U	1.19	UJ	9
TRIP-050224-1	Methyl ethyl ketone	1.19	U	1.19	UJ	9
TRIP-050224-1	Acetone	11.3	U	11.3	UJ	9

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Reason Code**
TS-C-EFF-050224	Acetone	11.3	U	11.3	UJ	9
TS-C-EFF-050224	Methyl ethyl ketone	1.19	U	1.19	UJ	9
TS-C-EFF-050224-DUP	Acetone	11.3	U	11.3	UJ	9
TS-C-EFF-050224-DUP	Methyl ethyl ketone	1.19	U	1.19	UJ	9
TS-C-INF-050224	Acetone	11.3	U	11.3	UJ	9
TS-C-INF-050224	Methyl ethyl ketone	1.19	U	1.19	UJ	9
TRIP-050224-2	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
TRIP-050224-2	Acrolein	2.54	U,C3	2.54	UJ	9
TRIP-050224-2	Methyl Bromide	0.605	U,C3	0.605	UJ	9
TRIP-050224-2	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWG-050224	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWG-050224	Acrolein	2.54	U,C3	2.54	UJ	9
VMWG-050224	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWG-050224	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWH-050224	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWH-050224	Acrolein	2.54	U,C3	2.54	UJ	9
VMWH-050224	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWH-050224	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWI-050224	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWI-050224	Acrolein	2.54	U,C3	2.54	UJ	9
VMWI-050224	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWI-050224	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWJ2-050224	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Reason Code**
VMWJ2-050224	Acrolein	2.54	U,C3	2.54	UJ	9
VMWJ2-050224	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWJ2-050224	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWK-050224	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWK-050224	Acrolein	2.54	U,C3	2.54	UJ	9
VMWK-050224	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWK-050224	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWK-050224-DUP	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWK-050224-DUP	Acrolein	2.54	U,C3	2.54	UJ	9
VMWK-050224-DUP	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWK-050224-DUP	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWL-050224	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWL-050224	Acrolein	2.54	U,C3	2.54	UJ	9
VMWL-050224	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWL-050224	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWM-050224	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWM-050224	Acrolein	2.54	U,C3	2.54	UJ	9
VMWM-050224	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWM-050224	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWN-050224	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWN-050224	Acrolein	2.54	U,C3	2.54	UJ	9
VMWN-050224	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWN-050224	Naphthalene	0.174	U,C3	0.174	UJ	9

µg/L-microgram per liter

U-Laboratory flag denoting a non-detect concentration less than the MDL

J-Laboratory flag denoting an estimated concentration greater than or equal to the MDL and less than the reported detection limit (RDL)

C5-Laboratory flag denoting the reported concentration is an estimate. The continuing calibration standard associated with this data responded high.

C3-Laboratory flag denoting the reported concentration is an estimate. The continuing calibration standard associated with this data responded low.

*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

1.2 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). Two method blanks were reported (batches WG2281626 and WG2282098). VOCs were not detected in the method blanks at or above the MDLs.

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

MS/MSD pairs were not reported. Accuracy was assessed using the laboratory control sample (LCS) for batch WG2281626. Precision and accuracy were assessed using the LCS/LCS duplicate (LCSD) pair for batch WG2282098.

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). One LCS and one LCS/LCSD pair were reported. The recovery and relative percent difference (RPD) results were within the laboratory specified acceptance criteria, with the following exceptions.

The %RPDs of acetone and acrylonitrile in the LCS/LCSD pair of batch WG2282098 were high and outside of the laboratory specified acceptance criteria. Therefore, based on professional and technical judgment, the acetone concentrations in the associated samples were J qualified as estimated and the non-detect results for acetone and acrylonitrile in the associated samples were not qualified.

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier	Reason Code
VMWH-050224	Acetone	385	J3	385	J	5
VMWI-050224	Acetone	154	J3	154	J	5

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier	Reason Code
VMWJ2-050224	Acetone	307	J3	307	J	5
VMWK-050224	Acetone	421	J3	421	J	5
VMWK-050224-DUP	Acetone	437	J3	437	J	5
VMWL-050224	Acetone	64.9	J3	64.9	J	5
VMWM-050224	Acetone	364	J3	364	J	5

µg/L-microgram per liter

J3-laboratory flag denoting the associated batch QC was outside the established quality control range for precision

The recovery of chloromethane in the LCS of batch WG2282098 was high and outside of the laboratory specified acceptance criteria. However, since chloromethane was not detected in the associated samples and due to professional and technical judgment, no qualifications were applied to the sample data.

1.6 Surrogate

Acceptable surrogate recoveries were reported for the sample analyses.

1.7 Trip Blank

Two trip blanks, TRIP-050224-1 and TRIP-050224-2, were submitted with the sample sets. VOCs were not detected in the trip blanks at or above the MDLs.

1.8 Field Duplicate

Four field duplicates CMW17DS-050224-DUP, CMW18DS-050224-DUP, TS-C-EFF-050224-DUP and VMWK-050224-DUP were collected with the sample sets. Acceptable precisions (RPDs $\leq 30\%$) were demonstrated between the field duplicates and the original samples CMW17DS-050224, CMW18DS-050224, TS-C-EFF-050224 and VMWK-050224, respectively, with the following exceptions.

Chloroform was detected at an estimated concentration greater than or equal to the MDL and less than the RDL in sample CMW18DS-050224 and not detected in field duplicate CMW18DS-050224-DUP, resulting in a noncalculable RPD between the results. Therefore, based on professional and technical judgment, the chloroform data in the field duplicate pair CMW18DS-050224/CMW18DS-050224-DUP were J qualified as estimated and UJ qualified as estimated less than the MDL, respectively.

Tetrachloroethene was detected at an estimated concentration greater than or equal to the MDL and less than the RDL in sample VMWK-050224 and not detected in field duplicate VMWK-050224-DUP, resulting in a noncalculable RPD between the results. Therefore, based on professional and technical judgment, the tetrachloroethene data in the field duplicate pair VMWK-

050224/VMWK-050224-DUP were J qualified as estimated and UJ qualified as estimated less than the MDL, respectively.

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	RPD	Validation Result (µg/L)	Validation Qualifier	Reason Code
CMW18DS-050224	Chloroform	0.255	J	NC	0.255	J	7
CMW18DS-050224-DUP	Chloroform	0.111	U		0.111	UJ	7
VMWK-050224	Tetrachloroethene (PCE)	0.359	J	NC	0.359	J	7
VMWK-050224-DUP	Tetrachloroethene (PCE)	0.3	U		0.3	UJ	7

µg/L-microgram per liter

NC-noncalculable

U-denoting a non-detect result less than the MDL

J-denoting an estimated concentration greater than or equal to the MDL and less than the RDL

1.9 Sensitivity

The sample results were reported to the MDLs. Elevated non-detect results were not reported.

1.10 Electronic Data Deliverable Review

Results and sample IDs in the EDD 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 EDD.

2.0 VOLATILE ORGANIC COMPOUNDS

The air samples were analyzed for selected VOCs per US EPA Modified Method TO-15 Full Scan.

The areas of data review are listed below. A leading check mark (✓) indicates an area of review in which the data were acceptable or not applicable. 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
- ✓ Laboratory Control Sample
- ✓ Surrogate
- ✓ Sensitivity
- ✓ Electronic Data Deliverable Review

2.1 Overall Assessment

The VOC data reported in these laboratory reports are considered usable for supporting project objectives. The results are considered valid; 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 this analysis, for this data set is 100%.

2.2 Holding Time

The holding time for the TO-15 analysis of an air sample collected in a canister is 30 days from collection to analysis. The holding times were met for the sample analyses.

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). Four method blanks were reported (Lab IDs: 2404219-02A, 2405329-10A, 2405329-10B and 2406214-02A). VOCs were not detected in the method blanks at or above the reporting limits (RLs).

2.4 Laboratory Control Sample

LCSs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Four LCS/LCSD pairs were reported. The RPDs were not reported by the laboratory; therefore, the RPDs were calculated by the validator based on the reported recovery results. The recovery and RPD results were within the laboratory specified acceptance criteria.

The laboratory also reported CCV standards. The CCV recoveries were within the method specified acceptance criteria.

2.5 Surrogate

The surrogate recoveries were within the laboratory specified acceptance criteria.

2.6 Sensitivity

The samples were reported to the RLs. The laboratory noted that samples SVE-EFF-040924, SVE-EFF-051424, VMWJ2-051424, VMWK-051424, VMWE-051424 and SVE-EFF-061124 were diluted due to the presence of high level target species. Elevated non-detect results were reported due to the sample dilutions analyzed.

2.7 Electronic Data Deliverable Review

Results and sample IDs in the EDD 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 EDD.

* * * * *

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. Upon application of the U qualifier to a reported result, the definition changes to “not detected at or above the reported result.”

- 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.

ATTACHMENT 2
DATA VALIDATION REASON CODES
Assigned by Geosyntec’s Data Validation Team

Valid Value	Description
1	Preservation requirement not met
2	Extraction or 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 or 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	Calibration range exceeded
11	Internal standard or isotope dilution standard criteria not met
12	Lab duplicates RPD exceeded
13	Other
14	Lab flag removed

LCS – Laboratory Control Sample

LCSD – Laboratory Control Sample duplicate

RPD – Relative percent difference

Memorandum

Date: 19 December 2024
To: Cindy Bartlett, RG, LG
Geosyntec Consultants, Portland, Oregon
From: Chase Harris
CC: Kris Henderson
Quyên Le
Subject: **Stage 2A Data Validation - Level II Data Deliverables – Pace Analytical Sample Delivery Groups L1764755 and L1764757, and Eurofins Air Toxics Work Orders # 2407379, 2408153 and 2409181**

SITE: Cascade

INTRODUCTION

This report summarizes the findings of the Stage 2A data validation of thirty-two groundwater samples, four field duplicates and two trip blanks, collected 5 and 6 August 2024, as well as eight soil vapor samples, collected on 16 July 2024, 6 August 2024 and 10 September 2024, as part of the site investigation activities for the Cascade Corp., Fairview Oregon sampling event.

The groundwater samples were analyzed by Pace Analytical National, Mount Juliet, Tennessee for the following analytical test:

- United States (US) Environmental Protection Agency (EPA) Method 8260D – Volatile Organic Compounds (VOCs)

The air samples were analyzed by Eurofins Air Toxics, Folsom, California for the following analytical test:

- US EPA Modified Method TO-15 Full Scan – Selected VOCs (1,1-Dichloroethene, cis-1,2-Dichloroethene, Trichloroethene, Tetrachloroethene and Vinyl Chloride)

EXECUTIVE SUMMARY

Overall, based on this Stage 2A data validation covering the quality control (QC) parameters listed below and based on the information provided, the data as qualified are usable for supporting project objectives. The qualified data should be used within the limitations of the qualifications. If there are results with two or more different qualifications due to multiple QC failures, the final qualification is reconciled in the electronic data deliverable (EDD) with qualifications.

The data were reviewed based on the following document, the pertinent methods referenced by the data package and professional and technical judgment:

- US EPA National Functional Guidelines for Organic Superfund Methods Data Review, November 2020 (EPA 540-R-20-005)

The following samples were analyzed in the data sets:

Lab ID	Client ID
2407379-01A	SVE-EFF-071624
2408153-01A	SVE-EFF-080624
2408153-02A	VW-17d-95.5-080624
2408153-03A	VMW E-080624
2408153-04A	VMW G-080624
2408153-05A	VMW J2-080624
2408153-06A	VMW K-080624
2409181-01A	SVE-EFF-091024
L1764755-01	TS-C-INF-080624
L1764755-02	TS-C-EFF-080624
L1764755-03	TS-C-EFF-080624-DUP
L1764755-04	TRIP BLANK 1-080524
L1764757-01	EW1-080624
L1764757-02	EW2-080624
L1764757-03	EW14-080624
L1764757-04	D17DG-080524
L1764757-05	D17DS-080524
L1764757-06	EW12-080524
L1764757-07	CMW10DS-080524
L1764757-08	CMW14RDS-080524
L1764757-09	CMW17DS-080524
L1764757-10	CMW18DS-080524
L1764757-11	CMW18DS-080524-DUP

Lab ID	Client ID
L1764757-12	CMW19DS-080524
L1764757-13	CMW20DS-080524
L1764757-14	CMW22DG-080524
L1764757-15	CMW24DG-080524
L1764757-16	CMW25DG-080524
L1764757-17	CMW36DG-080524
L1764757-18	VMWA-080624
L1764757-19	VMWB-080624
L1764757-20	VMWC-080524
L1764757-21	VMWD-080624
L1764757-22	VMWE-080624
L1764757-23	VMWF-080624
L1764757-24	VMWG-080624
L1764757-25	VMWH-080524
L1764757-26	VMWI-080624
L1764757-27	VMWI-080624-DUP
L1764757-28	VMWJ2-080624
L1764757-29	VMWK-080524
L1764757-30	VMWK-080524-DUP
L1764757-31	VMWL-080524
L1764757-32	VMWM-080524
L1764757-33	VMWN-080624
L1764757-34	TRIP BLANK1-080524

The laboratory reported results for the analytical method(s) requested for each sample on the chains of custody (COCs).

The groundwater samples were received at the laboratory within the temperature criteria of 0-6 degrees Celsius (°C). No sample preservation issues were noted by the laboratory.

Incorrect error corrections were observed on the COCs, instead of the proper procedure of a single strike through, correction, and initials and date of person making the corrections.

The laboratory noted that the COC information for sample VW-17d-95.5-080624 did not match the information on the canister. The sample labeled 000003022 on the COC was labeled as 0000003022 on the canister. The client was notified of the discrepancy and the laboratory used the information on the canister to process and report the sample.

1.0 VOLATILE ORGANIC COMPOUNDS

The groundwater samples were analyzed for VOCs per US EPA Method 8260D.

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
- ✓ Surrogate
- ✓ Trip Blank
- ⊗ Field Duplicate
- ✓ Sensitivity
- ✓ Electronic Data Deliverable Review

1.1 Overall Assessment

1.1.1 Completeness

The VOC data reported in these data packages are considered usable for supporting project objectives. The results are considered valid; 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 this analysis, for the sample set is 100%.

1.1.2 Analysis Anomaly

The percent recoveries (%Rs) of trichlorofluoromethane (70.4%), 1,1-dichloroethene (1,1-DCE) (74.3%), 1,1,2-trichlorotrifluoroethane (63.4%) and 2,2-dichloropropane (77.3%) in the continuing calibration verification (CCV) of batch WG2339323 were outside the laboratory specified acceptance criteria and validation criteria. Therefore, the non-detect trichlorofluoromethane, 1,1-DCE, 1,1,2-trichlorotrifluoroethane and 2,2-dichloropropane results in the associated samples were UJ qualified as estimated less than the method detection limits (MDLs).

The %Rs of acetone (75.9%), 2-butanone(MEK) (74.4%), 1,2-dibromo-3-chloropropane(75.9%) and naphthalene(75.8%) in the CCV of batch WG2339988 were outside of the laboratory specified acceptance criteria and validation criteria. Therefore, the non-detect results of these analytes were UJ qualified as estimated less than the MDLs and the concentrations of these analytes were J qualified as estimated in the associated samples.

The %Rs of bromomethane (73.8%), chloroethane (62%), trichlorofluoromethane (65.39%), acetone (216%), 1,2-dibromo-3-chloropropane (75.2%) and naphthalene (72%) in the CCV of batch WG2343093 were outside of the laboratory specified acceptance criteria and validation criteria. Therefore, the non-detect bromomethane, chloroethane, trichlorofluoromethane, acetone, 1,2-dibromo-3-chloropropane and naphthalene results in the associated sample were UJ qualified as estimated less than the MDLs.

The %Rs of bromomethane (161%), acrolein (31.3%), acetone (221%), 1,2-dibromo-3-chloropropane (64.2%), 1,2,4-trichlorobenzene (74.4%), naphthalene (54.8%) and 1,2,3-trichlorobenzene (65.7%) in the CCV of batch WG2340142 were outside of the laboratory specified acceptance criteria and validation and/or method criteria. Therefore, the concentrations of these analytes were J qualified as estimated and the non-detect results of these analytes were UJ qualified as estimated less than the MDLs in the associated samples.

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Reason Code**
CMW10DS-080524	1,1-Dichloroethene	0.188	U,C3	0.188	UJ	9
CMW10DS-080524	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
CMW10DS-080524	Freon 11	0.16	U,C3	0.16	UJ	9
CMW10DS-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	9
CMW14RDS-080524	1,1-Dichloroethene	0.188	U,C3	0.188	UJ	9
CMW14RDS-080524	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
CMW14RDS-080524	Freon 11	0.16	U,C3	0.16	UJ	9
CMW14RDS-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	9
CMW17DS-080524	1,1-Dichloroethene	0.188	U,C3	0.188	UJ	9
CMW17DS-080524	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
CMW17DS-080524	Freon 11	0.16	U,C3	0.16	UJ	9
CMW17DS-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	9
CMW18DS-080524	1,1-Dichloroethene	0.188	U,C3	0.188	UJ	9

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Reason Code**
CMW18DS-080524	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
CMW18DS-080524	Freon 11	0.16	U,C3	0.16	UJ	9
CMW18DS-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	9
CMW18DS-080524-DUP	1,1-Dichloroethene	0.188	U,C3	0.188	UJ	9
CMW18DS-080524-DUP	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
CMW18DS-080524-DUP	Freon 11	0.16	U,C3	0.16	UJ	9
CMW18DS-080524-DUP	Freon 113	0.18	U,C3 J4	0.18	UJ	9
CMW19DS-080524	1,1-Dichloroethene	0.188	U,C3	0.188	UJ	9
CMW19DS-080524	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
CMW19DS-080524	Freon 11	0.16	U,C3	0.16	UJ	9
CMW19DS-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	9
CMW20DS-080524	1,1-Dichloroethene	0.188	U,C3	0.188	UJ	9
CMW20DS-080524	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
CMW20DS-080524	Freon 11	0.16	U,C3	0.16	UJ	9
CMW20DS-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	9
CMW22DG-080524	1,1-Dichloroethene	0.188	U,C3	0.188	UJ	9
CMW22DG-080524	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
CMW22DG-080524	Freon 11	0.16	U,C3	0.16	UJ	9
CMW22DG-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	9
D17DG-080524	1,1-Dichloroethene	0.188	U,C3	0.188	UJ	9
D17DG-080524	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
D17DG-080524	Freon 11	0.16	U,C3	0.16	UJ	9
D17DG-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	9
D17DS-080524	1,1-Dichloroethene	0.188	U,C3	0.188	UJ	9
D17DS-080524	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Reason Code**
D17DS-080524	Freon 11	0.16	U,C3	0.16	UJ	9
D17DS-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	9
EW1-080624	1,1-Dichloroethene	0.188	U,C3	0.188	UJ	9
EW1-080624	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
EW1-080624	Freon 11	0.16	U,C3	0.16	UJ	9
EW1-080624	Freon 113	0.18	U,C3 J4	0.18	UJ	9
EW12-080524	1,1-Dichloroethene	0.188	U,C3	0.188	UJ	9
EW12-080524	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
EW12-080524	Freon 11	0.16	U,C3	0.16	UJ	9
EW12-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	9
EW14-080624	1,1-Dichloroethene	0.188	U,C3	0.188	UJ	9
EW14-080624	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
EW14-080624	Freon 11	0.16	U,C3	0.16	UJ	9
EW14-080624	Freon 113	0.18	U,C3 J4	0.18	UJ	9
EW2-080624	1,1-Dichloroethene	0.188	U,C3	0.188	UJ	9
EW2-080624	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
EW2-080624	Freon 113	0.18	U,C3 J4	0.18	UJ	9
EW2-080624	Freon 11	0.16	U,C3	0.16	UJ	9
TRIP BLANK 1-080524	1,1-Dichloroethene	0.188	U,C3	0.188	UJ	9
TRIP BLANK 1-080524	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
TRIP BLANK 1-080524	Freon 11	0.16	U,C3	0.16	UJ	9
TRIP BLANK 1-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	9
TS-C-EFF-080624	1,1-Dichloroethene	0.188	U,C3	0.188	UJ	9
TS-C-EFF-080624	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
TS-C-EFF-080624	Freon 11	0.16	U,C3	0.16	UJ	9
TS-C-EFF-080624	Freon 113	0.18	U,C3 J4	0.18	UJ	9
TS-C-EFF-080624-DUP	1,1-Dichloroethene	0.188	U,C3	0.188	UJ	9

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Reason Code**
TS-C-EFF-080624-DUP	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
TS-C-EFF-080624-DUP	Freon 11	0.16	U,C3	0.16	UJ	9
TS-C-EFF-080624-DUP	Freon 113	0.18	U,C3 J4	0.18	UJ	9
TS-C-INF-080624	1,1-Dichloroethene	0.188	U,C3	0.188	UJ	9
TS-C-INF-080624	2,2-Dichloropropane	0.161	U,C3	0.161	UJ	9
TS-C-INF-080624	Freon 113	0.18	U,C3 J4	0.18	UJ	9
TS-C-INF-080624	Freon 11	0.16	U,C3	0.16	UJ	9
CMW25DG-080524	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
CMW25DG-080524	Acetone	322	C3	322	J	9
CMW25DG-080524	Methyl ethyl ketone	2.36	C3 J	2.36	J	9
CMW25DG-080524	Naphthalene	0.174	U,C3	0.174	UJ	9
CMW36DG-080524	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
CMW36DG-080524	Acetone	221	C3	221	J	9
CMW36DG-080524	Methyl ethyl ketone	5.03	C3	5.03	J	9
CMW36DG-080524	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWA-080624	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWA-080624	Acetone	115	C3	115	J	9
VMWA-080624	Methyl ethyl ketone	1.19	C3 J	1.19	J	9
VMWA-080624	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWB-080624	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWB-080624	Acetone	43.7	C3	43.7	J	9
VMWB-080624	Methyl ethyl ketone	1.19	U,C3	1.19	UJ	9
VMWB-080624	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWC-080524	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWC-080524	Acetone	140	C3	140	J	9

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Reason Code**
VMWC-080524	Methyl ethyl ketone	1.19	U,C3	1.19	UJ	9
VMWC-080524	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWD-080624	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWD-080624	Acetone	85.8	C3	85.8	J	9
VMWD-080624	Methyl ethyl ketone	2.9	C3 J	2.9	J	9
VMWD-080624	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWE-080624	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWE-080624	Acetone	11.3	U,C3	11.3	UJ	9
VMWE-080624	Methyl ethyl ketone	2.05	C3 J	2.05	J	9
VMWE-080624	Naphthalene	0.174	U,C3	0.174	UJ	9
CMW24DG-080524	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
CMW24DG-080524	Freon 11	0.16	U,C3	0.16	UJ	9
CMW24DG-080524	Ethyl Chloride	0.192	U,C3 J3	0.192	UJ	9
CMW24DG-080524	Methyl Bromide	0.605	U,C3	0.605	UJ	9
CMW24DG-080524	Naphthalene	0.174	U,C3	0.174	UJ	9
TRIP BLANK1-080524	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
TRIP BLANK1-080524	1,2,4-Trichlorobenzene	0.481	U,C3	0.481	UJ	9
TRIP BLANK1-080524	1,2-Dibromo-3-Chloropropane	0.276	U,C3 J3	0.276	UJ	9
TRIP BLANK1-080524	Acetone	11.3	U	11.3	UJ	9
TRIP BLANK1-080524	Acrolein	2.54	U,C3	2.54	UJ	9
TRIP BLANK1-080524	Methyl Bromide	0.605	U,C3	0.605	UJ	9

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Reason Code**
TRIP BLANK1- 080524	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWF- 080624	1,2,3- Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWF- 080624	1,2,4- Trichlorobenzene	0.481	U,C3	0.481	UJ	9
VMWF- 080624	1,2-Dibromo-3- Chloropropane	0.276	U,C3 J3	0.276	UJ	9
VMWF- 080624	Acetone	11.5	J	11.5	J	9
VMWF- 080624	Acrolein	2.54	U,C3	2.54	UJ	9
VMWF- 080624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWF- 080624	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWG- 080624	1,2,3- Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWG- 080624	1,2,4- Trichlorobenzene	0.481	U,C3	0.481	UJ	9
VMWG- 080624	1,2-Dibromo-3- Chloropropane	0.276	U,C3 J3	0.276	UJ	9
VMWG- 080624	Acetone	12.7	J	12.7	J	9
VMWG- 080624	Acrolein	2.54	U,C3	2.54	UJ	9
VMWG- 080624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWG- 080624	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWH- 080524	1,2,3- Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWH- 080524	1,2,4- Trichlorobenzene	0.481	U,C3	0.481	UJ	9
VMWH- 080524	1,2-Dibromo-3- Chloropropane	0.276	U,C3 J3	0.276	UJ	9
VMWH- 080524	Acetone	267	C5	267	J	9
VMWH- 080524	Acrolein	2.54	U,C3	2.54	UJ	9
VMWH- 080524	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWH- 080524	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWI- 080624	1,2,3- Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWI- 080624	1,2,4- Trichlorobenzene	0.481	U,C3	0.481	UJ	9

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Reason Code**
VMWI-080624	1,2-Dibromo-3-Chloropropane	0.276	U,C3 J3	0.276	UJ	9
VMWI-080624	Acetone	118	C5	118	J	9
VMWI-080624	Acrolein	2.54	U,C3	2.54	UJ	9
VMWI-080624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWI-080624	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWI-080624-DUP	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWI-080624-DUP	1,2,4-Trichlorobenzene	0.481	U,C3	0.481	UJ	9
VMWI-080624-DUP	1,2-Dibromo-3-Chloropropane	0.276	U,C3 J3	0.276	UJ	9
VMWI-080624-DUP	Acetone	120	C5	120	J	9
VMWI-080624-DUP	Acrolein	2.54	U,C3	2.54	UJ	9
VMWI-080624-DUP	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWI-080624-DUP	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWJ2-080624	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWJ2-080624	1,2,4-Trichlorobenzene	0.481	U,C3	0.481	UJ	9
VMWJ2-080624	1,2-Dibromo-3-Chloropropane	0.276	U,C3 J3	0.276	UJ	9
VMWJ2-080624	Acetone	287	C5	287	J	9
VMWJ2-080624	Acrolein	2.54	U,C3	2.54	UJ	9
VMWJ2-080624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWJ2-080624	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWK-080524	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWK-080524	1,2,4-Trichlorobenzene	0.481	U,C3	0.481	UJ	9
VMWK-080524	1,2-Dibromo-3-Chloropropane	0.276	U,C3 J3	0.276	UJ	9
VMWK-080524	Acetone	366	C5	366	J	9
VMWK-080524	Acrolein	2.54	U,C3	2.54	UJ	9
VMWK-080524	Methyl Bromide	0.605	U,C3	0.605	UJ	9

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Reason Code**
VMWK-080524	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWK-080524-DUP	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWK-080524-DUP	1,2,4-Trichlorobenzene	0.481	U,C3	0.481	UJ	9
VMWK-080524-DUP	1,2-Dibromo-3-Chloropropane	0.276	U,C3 J3	0.276	UJ	9
VMWK-080524-DUP	Acetone	377	C5	377	J	9
VMWK-080524-DUP	Acrolein	2.54	U,C3	2.54	UJ	9
VMWK-080524-DUP	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWK-080524-DUP	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWL-080524	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWL-080524	1,2,4-Trichlorobenzene	0.481	U,C3	0.481	UJ	9
VMWL-080524	1,2-Dibromo-3-Chloropropane	0.276	U,C3 J3	0.276	UJ	9
VMWL-080524	Acetone	414	C5	414	J	9
VMWL-080524	Acrolein	2.54	U,C3	2.54	UJ	9
VMWL-080524	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWL-080524	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWM-080524	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWM-080524	1,2,4-Trichlorobenzene	0.481	U,C3	0.481	UJ	9
VMWM-080524	1,2-Dibromo-3-Chloropropane	0.276	U,C3 J3	0.276	UJ	9
VMWM-080524	Acetone	341	C5	341	J	9
VMWM-080524	Acrolein	2.54	U,C3	2.54	UJ	9
VMWM-080524	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWM-080524	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWN-080624	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWN-080624	1,2,4-Trichlorobenzene	0.481	U,C3	0.481	UJ	9
VMWN-080624	1,2-Dibromo-3-Chloropropane	0.276	U,C3 J3	0.276	UJ	9

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier*	Reason Code**
VMWN-080624	Acetone	73.9	C5	73.9	J	9
VMWN-080624	Acrolein	2.54	U,C3	2.54	UJ	9
VMWN-080624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWN-080624	Naphthalene	0.174	U,C3	0.174	UJ	9

µg/L-microgram per liter

U-Laboratory flag denoting a non-detect concentration less than the MDL

J-Laboratory flag denoting an estimated concentration less than or equal to the MDL and less than the reported detection limit (RDL)

C3-Laboratory flag denoting the reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

C5-Laboratory flag denoting the reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Data is likely to show a high bias concerning the result.

J3-Laboratory flag denoting the associated batch QC was outside the established quality control range for precision.

J4-Laboratory flag denoting the associated batch QC was outside the established quality control range for accuracy.

*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

1.2 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). Five method blanks were reported (batches WG2339323, WG2339988, WG2340142, WG2341896 and WG2343093). VOCs were not detected in the method blanks at or above the MDLs, with the following exception.

Naphthalene was detected at an estimated concentration greater than or equal to the MDL but less than the RDL in the method blank of batch WG2343093. However, since naphthalene was not detected in the associated sample CMW24DG-080524, no qualification was applied to the data.

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

MS/MSD pairs were not reported. Accuracy was assessed using the laboratory control sample (LCS) for batches WG2339323 and WG2339988. Precision and accuracy were assessed using the LCS/LCS duplicate (LCSD) pair for batches WG2340142, WG2341896 and WG2343093.

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). Two LCSs and three LCS/LCSD pairs were reported. The recovery and relative percent difference (RPD) results were within the laboratory specified acceptance criteria, with the following exceptions.

The recoveries of bromobenzene, n-propylbenzene and 1,2,4-trimethylbenzene in the LCS of batch WG2339323 were high and outside of laboratory specified acceptance criteria. However, since these analytes were not detected in the associated samples and due to professional and technical judgment, no qualifications were applied to the data.

The recovery of freon 113 in the LCS of batch WG2339323 was low and outside of laboratory specified acceptance criteria. Therefore, based on professional and technical judgment, the non-detect freon 113 results in the associated samples were UJ qualified as estimated less than the MDLs.

The recoveries of 1,1-dichloroethene, trans-1,2-dichloroethene, di-isopropyl ether, ethylbenzene, and toluene in the LCS and/or LCSD of batch WG2340142 were high and outside of the laboratory specified acceptance criteria. The %RPD of 1,2-dibromo-3-chloropropane in the LCS/LCSD pair of batch WG2340142 was high and outside of the laboratory specified acceptance criteria. However, since these analytes were not detected in the associated samples and due to professional and technical judgment, no qualifications were applied to the data.

The %RPD of ethyl chloride in the LCS/LCSD pair of batch WG2343093 was high and outside of the laboratory specified acceptance criteria. However, since ethyl chloride was not detected in the associated samples and due to professional and technical judgment, no qualifications were applied to the data.

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier	Reason Code
CMW10DS-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	5
CMW14RDS-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	5
CMW17DS-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	5
CMW18DS-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	5
CMW18DS-080524-DUP	Freon 113	0.18	U,C3 J4	0.18	UJ	5
CMW19DS-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	5

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	Validation Result (µg/L)	Validation Qualifier	Reason Code
CMW20DS-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	5
CMW22DG-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	5
D17DG-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	5
D17DS-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	5
EW1-080624	Freon 113	0.18	U,C3 J4	0.18	UJ	5
EW12-080524	Freon 113	0.18	U,C3 J4	0.18	UJ	5
EW14-080624	Freon 113	0.18	U,C3 J4	0.18	UJ	5
EW2-080624	Freon 113	0.18	U,C3 J4	0.18	UJ	5

µg/L-microgram per liter

U-denoting a non-detect concentration less than the MDL

C3-laboratory flag denoting the reported concentration is an estimate and the continuing calibration standard responded low

J4-laboratory flag denoting the associated batch QC was outside the established quality control range for accuracy

1.6 Surrogate

Acceptable surrogate recoveries were reported for the sample analyses.

1.7 Trip Blank

Two trip blanks, TRIP BLANK 1-080524 and TRIP BLANK1-080524, were submitted with the sample sets. VOCs were not detected in the trip blanks at or above the MDLs.

1.8 Field Duplicate

Four field duplicates (CMW18DS-080524-DUP, TS-C-EFF-080624-DUP, VMWI-080624-DUP and VMWK-080524-DUP) were collected with the sample sets. Acceptable precisions (RPDs ≤ 30%) were demonstrated between the field duplicates and the original samples CMW18DS-080524, TS-C-EFF-080624, VMWI-080624 and VMWK-080524, respectively, with the following exception.

Chloroform was detected at an estimated concentration greater than or equal to the MDL and less than the RDL in sample VMWK-080524 and not detected in field duplicate VMWK-080524-DUP, resulting in a noncalculable RPD between the results. Therefore, based on professional and technical judgment, the chloroform data in the field duplicate pair VMWK-080524/VMWK-080524-DUP were J qualified as estimated and UJ qualified as estimated less than the MDL, respectively.

Sample ID	Compound	Laboratory Result (µg/L)	Laboratory Flag	RPD	Validation Result (µg/L)	Validation Qualifier	Reason Code
VMWK-080524	Chloroform	0.131	J	NC	0.131	J	7
VMWK-080524-DUP	Chloroform	0.111	U		0.111	UJ	7

µg/L-microgram per liter

NC-noncalculable

U-denoting a non-detect concentration less than the MDL

J-denoting an estimated concentration greater than or equal to the MDL and less than the RDL

1.9 Sensitivity

The sample results were reported to the MDLs. Elevated non-detect results not reported.

1.10 Electronic Data Deliverable Review

Results and sample IDs in the EDD 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 EDD.

2.0 **VOLATILE ORGANIC COMPOUNDS**

The air samples were analyzed for selected VOCs per US EPA Modified Method TO-15 Full Scan.

The areas of data review are listed below. A leading check mark (✓) indicates an area of review in which the data were acceptable or not applicable. 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
- ✓ Laboratory Control Sample
- ✓ Surrogate
- ✓ Sensitivity
- ✓ Electronic Data Deliverable Review

2.1 Overall Assessment

The VOC data reported in these laboratory reports are considered usable for supporting project objectives. The results are considered valid; 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 this analysis, for this data set is 100%.

2.2 Holding Time

The holding time for the TO-15 analysis of an air sample collected in a canister is 30 days from collection to analysis. The holding times were met for the sample analyses.

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). Four method blanks were reported (Lab IDs: 2407379-02A, 2408153-07A, 2408153-07B and 2409181-02A). VOCs were not detected in the method blanks at or above the reporting limits (RLs).

2.4 Laboratory Control Sample

LCSs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Four LCS/LCSD pairs were reported. The RPDs were not reported by the laboratory; therefore, the RPDs were calculated by the validator based on the reported recovery results. The recovery and RPD results were within the laboratory specified acceptance criteria.

The laboratory also reported CCV standards. The CCV recoveries were within the method specified acceptance criteria.

2.5 Surrogate

The surrogate recoveries were within the laboratory specified acceptance criteria.

2.6 Sensitivity

The samples were reported to the RLs. The laboratory noted that samples SVE-EFF-071624, SVE-EFF-080624, VMW E-080624, VMW J2-080624, VMW K-080624 and SVE-EFF-091024 were diluted due to the presence of high-level target species. Elevated non-detect results were reported due to the sample dilutions analyzed.

2.7 Electronic Data Deliverable Review

Results and sample IDs in the EDD 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 EDD.

* * * * *

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. Upon application of the U qualifier to a reported result, the definition changes to “not detected at or above the reported result.”
- 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.

ATTACHMENT 2
DATA VALIDATION REASON CODES
Assigned by Geosyntec’s Data Validation Team

Valid Value	Description
1	Preservation requirement not met
2	Extraction or 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 or 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	Calibration range exceeded
11	Internal standard or isotope dilution standard criteria not met
12	Lab duplicates RPD exceeded
13	Other
14	Lab flag removed

LCS – Laboratory Control Sample

LCSD – Laboratory Control Sample duplicate

RPD – Relative percent difference

Memorandum

Date: 7 January 2025
To: Cindy Bartlett, RG, LG
Geosyntec Consultants, Portland, Oregon
From: Derek Yeadon
CC: K. Henderson
Subject: **Stage 2A Data Validation - Level II Data Deliverables – Pace Analytical Sample Delivery Groups L1797246, L1797247, and L1797610 version 2, and Eurofins Air Toxics Work Orders # 2411083**

SITE: Cascade

INTRODUCTION

This report summarizes the findings of the Stage 2A data validation of twenty-four groundwater samples, four field duplicates and one trip blank, collected 5, 6 and 7 November 2024, as well as six soil vapor samples, collected on 11 November 2024, as part of the site investigation activities for the Cascade Corp., Fairview Oregon sampling event.

The groundwater samples were analyzed by Pace Analytical National, Mt. Juliet, Tennessee for the following analytical test:

- United States (US) Environmental Protection Agency (EPA) Method 8260D – Volatile Organic Compounds (VOCs)

The air samples were analyzed by Eurofins Air Toxics, Folsom, California for the following analytical test:

- US EPA Modified Method TO-15 - Selected VOCs (1,1-Dichloroethene, Cis-1,2-Dichloroethene, Trichloroethene, Tetrachloroethene, and Vinyl Chloride)

EXECUTIVE SUMMARY

Overall, based on this Stage 2A data validation covering the quality control (QC) parameters listed below and based on the information provided, the data as qualified are usable for supporting project objectives. The qualified data should be used within the limitations of the qualifications. If there are results with two or more different qualifications due to multiple QC failures, the final qualification is reconciled in the electronic data deliverable (EDD) with qualifications. The data

were reviewed based on the following document, the pertinent methods referenced by the data package and professional and technical judgment:

- US EPA National Functional Guidelines for Organic Superfund Methods Data Review, November 2020 (EPA 540-R-20-005)

The following samples were analyzed in the data sets:

Laboratory IDs	Client IDs
2411083-01A	SVE-EFF-110524
2411083-02A	VW-17d-95.5-110524
2411083-03A	VMWE-110524
2411083-04A	VMWJ2-110524
2411083-05A	VMWG-110524
2411083-06A	VMWK-110524
L1797246-01	EW1-110624
L1797246-02	EW2-110624
L1797246-03	EW14-110624
L1797246-04	D17DG-110624
L1797246-05	D17DS-110624
L1797246-06	CMW17DS-110624
L1797246-07	CMW17DS-110624-DUP
L1797246-08	CMW18DS-110624
L1797246-09	CMW18DS-110624-DUP
L1797246-10	CMW19DS-110624
L1797246-11	VMWB-110624
L1797246-12	VMWD-110624

Laboratory IDs	Client IDs
L1797246-13	VMWE-110624
L1797246-14	VMWF-110624
L1797246-15	VMWG-110624
L1797246-16	TRIP BLANK LOT #531
L1797247-01	TS-C-EFF-110624
L1797247-02	TS-C-EFF-110624-DUP
L1797247-03	TS-C-INF-100624
L1797610-01	VMWA-110724
L1797610-02	VMWC-110724
L1797610-03	VMWH-110724
L1797610-04	VMWI-110724-143.7
L1797610-05	VMWJ2-110724-120.25
L1797610-06	VMWK-110724-114.25
L1797610-07	VMWK-110724-114.25-DUP
L1797610-08	VMWL-110724-103.25
L1797610-09	VMWM-110724-94
L1797610-10	VMWN-110729-110.8

The groundwater samples were received at the laboratory within the temperature criteria of 0-6 degrees Celsius (°C).

The laboratory reported results for the analytical method(s) requested for each sample on the chain of custody (COC), with the following exception.

Incorrect error corrections were observed on the COC, instead of the proper procedure of a single strike through, correction, and initials and date of person making the corrections.

Sample TRIP BLANK LOT #531 was submitted on both workorders L1797246 and L1797247, the trip blank was only logged in and reported for VOCs by method 8260D in workorder L1797246.

An additional trip blank, listed as Trip Blank Lot# 351, was recorded on the COC for workorder L1797610. This trip blank was not logged in or analyzed by the laboratory.

The initial and final pressures for sample SVE-EFF-020724 were missing from the COC.

1.0 VOLATILE ORGANIC COMPOUNDS

The water samples were analyzed for VOCs per US EPA method 8260D.

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 Times and Preservation
- ✓ Method Blank
- ✓ Matrix Spike/Matrix Spike Duplicate
- ⊗ Laboratory Control Sample
- ✓ Surrogate
- ✓ Trip Blank
- ⊗ Field Duplicate
- ✓ Sensitivity
- ✓ Electronic Data Deliverable Review

1.1 Overall Assessment

1.1.1 Completeness

The VOC data reported in these data packages are considered usable for supporting project objectives. The results are considered valid; 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 this analysis, for the sample set is 100%.

1.1.2 Analysis Anomaly

L1797246: The percent differences (%Ds) for acrolein, bromomethane, 1,2-dibromo-3-chloropropane, naphthalene and 1,2,3-trichlorobenzene in the continuing calibration verification (CCV) in batch WG2402724 were low and outside the laboratory specified acceptance criteria. Therefore, the non-detect acrolein, bromomethane, 1,2-dibromo-3-chloropropane, naphthalene and 1,2,3-trichlorobenzene results in the associated samples were UJ qualified as estimated less than the method detection limits (MDLs).

The %Ds for acetone, bromomethane, chloromethane, dichlorodifluoromethane and vinyl acetate in the CCV in batch WG2405130 were low and outside of laboratory specified acceptance criteria. Therefore, the concentrations of acetone, bromomethane, chloromethane, dichlorodifluoromethane and vinyl acetate in the associated samples were J qualified as estimated and the non-detect results were UJ qualified as less than the estimated MDLs.

Results were reported from both batch WG2402724 and batch WG2405130 for samples CMW17DS-110624, CMW18DS-110624 and CMW19DS-110624. Since batch WG2405130 was analyzed outside of holding time, these results were not considered for validation and designated as rejected in the EDD, with the following exceptions.

Sample	Analytes
CMW17DS-110624	Chloroform
	Methyl ethyl ketone
	Trichloroethene (TCE)
CMW18DS-110624	Chloroform
	Methyl ethyl ketone
	Tetrachloroethene (PCE)
CMW19DS-110624	Methyl ethyl ketone
	Trichloroethene (TCE)

Since these analytes were detected and analyzed outside the holding time, these results from batch WG2405130 were J qualified as estimated; the results from batch WG2402724 were not considered for validation and were designated as rejected in the EDD. See section 1.2 of this report.

L1797247: The %Ds for acrolein, bromomethane, 1,2-dibromo-3-chloropropane, naphthalene and 1,2,3-trichlorobenzene in the CCV in batch WG2402724 were low and outside the laboratory specified acceptance criteria. Therefore, the non-detect acrolein, bromomethane, 1,2-dibromo-3-chloropropane, naphthalene and 1,2,3-trichlorobenzene results in the associated samples were UJ qualified as estimated less than the MDLs.

L1797610: The %Ds for acrolein, bromomethane, 1,2-dibromo-3-chloropropane, naphthalene and 1,2,3-trichlorobenzene in the CCV in batch WG2402724 were low and outside the laboratory specified acceptance criteria. Therefore, the non-detect acrolein, bromomethane, 1,2-dibromo-3-chloropropane, naphthalene and 1,2,3-trichlorobenzene results in the associated samples were UJ qualified as less than the estimated MDLs.

The %Ds for bromomethane and chloroethane in the CCV in batches WG2403050 and WG2403795 were low and outside the laboratory specified acceptance criteria. Therefore, the non-detect bromomethane and chloroethane results in the associated samples were UJ qualified as less than the estimated MDLs.

The %Ds for 1,1,1-trichloroethane, 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 1,2-dichloroethane, bromomethane, butylbenzene, chloromethane and naphthalene in the CCV in batch WG2403474 were low and outside the laboratory specified acceptance criteria. Therefore, the non-detect 1,1,1-trichloroethane, 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 1,2-dichloroethane, bromomethane, butylbenzene, chloromethane and naphthalene results in the associated samples were UJ qualified as less than the estimated MDLs.

The %D for acetone in the CCV in batch WG2403474 was high and outside the laboratory specified acceptance criteria. Therefore, the acetone concentrations in the associated samples were J qualified as estimated. Since acetone was not reported for sample VMWN-110729-110.8 from this analytical run, no qualifications were applied to the acetone result for this sample.

The %D for methyl ethyl ketone in the CCV in batch WG2403050 was high and outside the laboratory specified acceptance criteria. Therefore, the methyl ethyl ketone concentration in sample VMWI-110724-143.7 and the estimated result in sample VMWC-110724 were J qualified as estimated and the non-detect result in sample VMWH-110724 was UJ qualified as less than the estimated MDL.

See Attachment 3 at the end of this report for the summary of qualifications.

1.2 Holding Time & Preservation

The holding time for the VOC analysis of a preserved groundwater sample is 14 days from collection to analysis. The holding times and preservations were met for the sample analyses with the following exceptions.

Samples CMW17DS-110624, CMW18DS-110624 and CMW19DS-110624 were reanalyzed outside of the laboratory specified holding time. Therefore, following results were considered and J qualified as estimated: chloroform, methyl ethyl ketone and trichloroethene in samples CMW17DS-110624; chloroform, methyl ethyl ketone and tetrachloroethene in samples CMW18DS-110624; and methyl ethyl ketone and trichloroethene in samples CMW19DS-110624 were J qualified as estimated. The remaining results for samples CMW17DS-110624, CMW18DS-110624 and CMW19DS-110624 were not considered for validation and designated as R qualified as rejected in the EDD.

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
CMW17DS-110624	Chloroform	0.166	J	0.166	J	2
CMW17DS-110624	Methyl ethyl ketone	5.69	NA	5.69	J	2
CMW17DS-110624	Trichloroethene (TCE)	0.848	NA	0.848	J	2

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
CMW18DS-110624	Chloroform	0.228	J	0.228	J	2
CMW18DS-110624	Methyl ethyl ketone	3.83	J	3.83	J	2
CMW18DS-110624	Tetrachloroethene (PCE)	2.22	NA	2.22	J	2
CMW19DS-110624	Methyl ethyl ketone	5.07	NA	5.07	J	2
CMW19DS-110624	Trichloroethene (TCE)	0.218	J	0.218	J	2

µg/l-microgram per liter

J-the result is less than RL but greater than the MDL and the concentration is an approximate value

NA-not applicable

* 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

1.3 Method Blank

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Six method blanks were reported (batches WG2402724, WG2405130, WG2403050, WG2403474, WG2403795, and WG2405233). VOCs were not detected in the method blanks at or above the MDLs.

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

MS/MSD pairs were not reported. Precision and accuracy were assessed using the laboratory control sample (LCS)/LCS duplicate (LCSD) pair for batches WG2405130, WG2403474 and WG2405233. Accuracy was assessed using LCSs for batches WG2402724, WG2403050 and WG2403795. 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). Three LCS/LCSD pairs and three LCSs were reported. The recovery and relative percent difference (RPD) results were within the laboratory specified acceptance criteria, with the following exceptions:

L1797246, L1797247 and L1797610

WG2402724

The recovery of chloromethane in the LCS in batch WG2402724 was high and outside of laboratory specified acceptance criteria. Since chloromethane was not detected in the associated samples, no qualifications were applied to the data.

L1797246

WG2405130

The recovery of acrolein in the LCS/LCSD pair was high and outside of laboratory specified acceptance criteria. Since acrolein was not detected in the associated samples, no qualifications were applied to the data.

The RPD of 1,2,3-trichlorobenzene in the LCS/LCSD pair was outside of laboratory specified acceptance criteria. Since 1,2,3-trichlorobenzene was not detected in the associated samples, no qualifications were applied to the data.

L1797610

WG2403050

The recovery of 2,2-dichloropropane in the LCS was high and outside of laboratory specified acceptance criteria. Since 2,2-dichloropropane was not detected in the associated samples, no qualifications were applied to the data.

WG2403474

The recovery of cis-1,3-dichloropropene in the LCSD was low and outside of laboratory specified acceptance criteria. Therefore, the non-detect cis-1,3-dichloropropene results in the associated samples were UJ qualified as less than the estimated MDL.

WG2403795

The recoveries of 2,2-dichloropropane and 1,1,2,2-tetrachloroethane in the LCS were high and outside of laboratory specified acceptance criteria. Since 2,2-dichloropropane and 1,1,2,2-tetrachloroethane were not detected in the associated samples, no qualifications were applied to the data.

LCSs were used to assess accuracy; however, MS/MSD pairs or LCS/LCSD pairs were not reported for the assessment of batch-specific precision for batches WG2402724, WG2403050 and WG2403795.

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
VMWK-110724-114.25	cis-1,3-Dichloropropene	0.111	U,J4	0.111	UJ	5
VMWK-110724-114.25-DUP	cis-1,3-Dichloropropene	0.111	U,J4	0.111	UJ	5
VMWL-110724-103.25	cis-1,3-Dichloropropene	0.111	U,J4	0.111	UJ	5
VMWM-110724-94	cis-1,3-Dichloropropene	0.111	U,J4	0.111	UJ	5
VMWN-110729-110.8	cis-1,3-Dichloropropene	0.111	U,J4	0.111	UJ	5

µg/l-microgram per liter

U-Not detected at the MDL.

J4-associated batch QC was outside the established quality control range for accuracy.

* 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.

1.7 Trip Blank

One trip blank, identified as TRIP BLANK LOT #531, was submitted with the sample sets. VOCs were not detected in the trip blank at or above the MDLs.

1.8 Field Duplicate

Four field duplicates (CMW17DS-110624-DUP, CMW18DS-110624-DUP, TS-C-EFF-110624-DUP, and VMWK-110724-114.25-DUP) were collected with the sample sets. Acceptable precision (RPD ≤ 30%) was demonstrated between the field duplicates and the original samples CMW17DS-110624, CMW18DS-110624, TS-C-EFF-110624, and VMWK-110724-114.25, respectively, with the following exceptions.

Chloroform was detected at an estimated concentration greater than the MDL and less than the reporting detection limit (RDL) in sample CMW17DS-110624 and not detected in the field duplicate, resulting in a noncalculable RPD between the results. Therefore, based on professional and technical judgment, the concentration of chloroform was J qualified as estimated and the non-detect result was UJ qualified as less than the estimated MDL in the field duplicate pair.

Methyl ethyl ketone was detected at an estimated concentration greater than the RDL in sample CMW17DS-110624 and detected at an estimated concentration greater than the MDL and less than the RDL in the field duplicate, resulting in a noncalculable RPD between the results. Therefore,

based on professional and technical judgment, the concentration of methyl ethyl ketone was J qualified as estimated in the field duplicate pair.

Chloroform was detected at an estimated concentration greater than the MDL and less than the reporting detection limit (RDL) in sample CMW18DS-110624 and not detected in the field duplicate, resulting in a noncalculable RPD between the results. Therefore, based on professional and technical judgment, the concentration of chloroform was J qualified as estimated and the non-detect result was UJ qualified as less than the estimated MDL in the field duplicate pair.

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	RPD	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
CMW17DS-110624	Chloroform	0.166	J	NC	0.166	J	7
CMW17DS-110624-DUP	Chloroform	0.111	U		0.111	UJ	7
CMW17DS-110624	Methyl ethyl ketone	5.69	NA	NC	5.69	J	7
CMW17DS-110624-DUP	Methyl ethyl ketone	3.07	J		3.07	J	7
CMW18DS-110624	Chloroform	0.228	J	NC	0.228	J	7
CMW18DS-110624-DUP	Chloroform	0.111	U		0.111	UJ	7

µg/l-microgram per liter

U-Not detected at the MDL.

J-The identification of the analyte is acceptable; the reported value is an estimate.

NA-Not applicable

* 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

1.9 Sensitivity

The sample results were reported to the MDLs. Elevated non-detect results were reported due to the sample dilutions analyzed.

1.10 Electronic Data Deliverable Review

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

2.0 VOLATILE ORGANIC COMPOUNDS

The samples were analyzed for selected VOCs per US EPA modified Method TO-15 using full scan mode.

The areas of data review are listed below. A leading check mark (✓) indicates an area of review in which the data were acceptable or not applicable. 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
- ✓ Laboratory Control Sample
- ✓ Surrogates
- ✓ Sensitivity
- ✓ Electronic Data Deliverable Review

2.1 Overall Assessment

The VOC data reported in these laboratory reports are considered usable for supporting project objectives. The results are considered valid; 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 this analysis, for this data set is 100%.

2.2 Holding Time

The holding time for the TO-15 analysis of an air sample collected in a canister is 30 days from collection to analysis. The holding times were met for the sample analyses.

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). One method blank was reported (Lab ID: 2411083-07A). VOCs were not detected in the method blank at or above the reporting limits (RLs).

2.4 Laboratory Control Sample

LCSs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). One LCS/LCSD pair was reported. The RPD was not reported by the laboratory; therefore, the RPD was calculated by the validator based on the reported recovery results. The recovery and RPD results were within the laboratory specified acceptance criteria.

The laboratory also reported CCV standards. The CCV recoveries were within the method specified acceptance criteria.

2.5 Surrogates

The surrogate recoveries were within the laboratory specified acceptance criteria.

2.6 Sensitivity

The samples were reported to the RLs. The laboratory noted that sample VMWK-110524 was diluted due to the presence of high-level target species. Elevated non-detect results were reported due to the sample dilutions analyzed.

2.7 Electronic Data Deliverable Review

Results and sample IDs in the EDD were reviewed against the information provided by the associated level II report 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. Upon application of the U qualifier to a reported result, the definition changes to “not detected at or above the reported result.”

- 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.

ATTACHMENT 2
DATA VALIDATION REASON CODES
Assigned by Geosyntec’s Data Validation Team

Valid Value	Description
1	Preservation requirement not met
2	Extraction or 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
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
14	Lab flag removed or modified: no validation qualification required

LCS – Laboratory Control Sample

LCSD – Laboratory Control Sample duplicate

RPD – Relative percent difference

ATTACHMENT 3
QUALIFICATIONS DUE TO CCV OUTSIDE OF CRITERIA

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
CMW17DS-110624	1,2,3-Trichlorobenzene	0.82	U,C3	0.82	UJ	9
CMW17DS-110624	1,2-Dibromo-3-Chloropropane	1.38	U,C3	1.38	UJ	9
CMW17DS-110624	Acrolein	12.7	U,C3	12.7	UJ	9
CMW17DS-110624	Methyl Bromide	3.03	U,C3	3.03	UJ	9
CMW17DS-110624	Naphthalene	0.87	U,C3	0.87	UJ	9
CMW17DS-110624-DUP	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
CMW17DS-110624-DUP	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
CMW17DS-110624-DUP	Acrolein	2.54	U,C3	2.54	UJ	9
CMW17DS-110624-DUP	Methyl Bromide	0.605	U,C3	0.605	UJ	9
CMW17DS-110624-DUP	Naphthalene	0.174	U,C3	0.174	UJ	9
CMW18DS-110624	1,2,3-Trichlorobenzene	0.82	U,C3	0.82	UJ	9
CMW18DS-110624	1,2-Dibromo-3-Chloropropane	1.38	U,C3	1.38	UJ	9
CMW18DS-110624	Acrolein	12.7	U,C3	12.7	UJ	9
CMW18DS-110624	Methyl Bromide	3.03	U,C3	3.03	UJ	9
CMW18DS-110624	Naphthalene	0.87	U,C3	0.87	UJ	9
CMW18DS-110624-DUP	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
CMW18DS-110624-DUP	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
CMW18DS-110624-DUP	Acrolein	2.54	U,C3	2.54	UJ	9
CMW18DS-110624-DUP	Methyl Bromide	0.605	U,C3	0.605	UJ	9
CMW18DS-110624-DUP	Naphthalene	0.174	U,C3	0.174	UJ	9
CMW19DS-110624	1,2,3-Trichlorobenzene	0.82	U,C3	0.82	UJ	9

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
CMW19DS-110624	1,2-Dibromo-3-Chloropropane	1.38	U,C3	1.38	UJ	9
CMW19DS-110624	Acrolein	12.7	U,C3	12.7	UJ	9
CMW19DS-110624	Methyl Bromide	3.03	U,C3	3.03	UJ	9
CMW19DS-110624	Naphthalene	0.87	U,C3	0.87	UJ	9
D17DG-110624	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
D17DG-110624	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
D17DG-110624	Acrolein	2.54	U,C3	2.54	UJ	9
D17DG-110624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
D17DG-110624	Naphthalene	0.174	U,C3	0.174	UJ	9
D17DS-110624	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
D17DS-110624	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
D17DS-110624	Acrolein	2.54	U,C3	2.54	UJ	9
D17DS-110624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
D17DS-110624	Naphthalene	0.174	U,C3	0.174	UJ	9
EW1-110624	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
EW1-110624	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
EW1-110624	Acrolein	2.54	U,C3	2.54	UJ	9
EW1-110624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
EW1-110624	Naphthalene	0.174	U,C3	0.174	UJ	9
EW14-110624	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
EW14-110624	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
EW14-110624	Acrolein	2.54	U,C3	2.54	UJ	9
EW14-110624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
EW14-110624	Naphthalene	0.174	U,C3	0.174	UJ	9
EW2-110624	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
EW2-110624	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
EW2-110624	Acrolein	2.54	U,C3	2.54	UJ	9
EW2-110624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
EW2-110624	Naphthalene	0.174	U,C3	0.174	UJ	9
TRIP BLANK LOT #531	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
TRIP BLANK LOT #531	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
TRIP BLANK LOT #531	Acrolein	2.54	U,C3	2.54	UJ	9
TRIP BLANK LOT #531	Methyl Bromide	0.605	U,C3	0.605	UJ	9
TRIP BLANK LOT #531	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWB-110624	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWB-110624	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWB-110624	Acrolein	2.54	U,C3	2.54	UJ	9
VMWB-110624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWB-110624	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWD-110624	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWD-110624	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWD-110624	Acrolein	2.54	U,C3	2.54	UJ	9
VMWD-110624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWD-110624	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWE-110624	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWE-110624	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWE-110624	Acrolein	2.54	U,C3	2.54	UJ	9
VMWE-110624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWE-110624	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWF-110624	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
VMWF-110624	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWF-110624	Acrolein	2.54	U,C3	2.54	UJ	9
VMWF-110624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWF-110624	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWG-110624	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWG-110624	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWG-110624	Acrolein	2.54	U,C3	2.54	UJ	9
VMWG-110624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWG-110624	Naphthalene	0.174	U,C3	0.174	UJ	9
CMW17DS-110624	Chloromethane	0.96	U,C3	0.96	UJ	9
CMW17DS-110624	Freon 12	0.374	U,C3	0.374	UJ	9
CMW17DS-110624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
CMW17DS-110624	Vinyl Chloride	0.234	U,C3	0.234	UJ	9
CMW18DS-110624	Chloromethane	0.96	U,C3	0.96	UJ	9
CMW18DS-110624	Freon 12	0.374	U,C3	0.374	UJ	9
CMW18DS-110624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
CMW18DS-110624	Vinyl Chloride	0.234	U,C3	0.234	UJ	9
CMW19DS-110624	Acetone	120	C3	120	J	9
CMW19DS-110624	Chloromethane	0.96	U,C3	0.96	UJ	9
CMW19DS-110624	Freon 12	0.374	U,C3	0.374	UJ	9
CMW19DS-110624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
CMW19DS-110624	Vinyl Chloride	0.234	U,C3	0.234	UJ	9
TS-C-EFF-110624	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
TS-C-EFF-110624	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
TS-C-EFF-110624	Acrolein	2.54	U,C3	2.54	UJ	9
TS-C-EFF-110624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
TS-C-EFF-110624	Naphthalene	0.174	U,C3	0.174	UJ	9
TS-C-EFF-110624-DUP	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
TS-C-EFF-110624-DUP	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
TS-C-EFF-110624-DUP	Acrolein	2.54	U,C3	2.54	UJ	9
TS-C-EFF-110624-DUP	Methyl Bromide	0.605	U,C3	0.605	UJ	9
TS-C-EFF-110624-DUP	Naphthalene	0.174	U,C3	0.174	UJ	9
TS-C-INF-100624	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
TS-C-INF-100624	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
TS-C-INF-100624	Acrolein	2.54	U,C3	2.54	UJ	9
TS-C-INF-100624	Methyl Bromide	0.605	U,C3	0.605	UJ	9
TS-C-INF-100624	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWA-110724	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWA-110724	1,2-Dibromo-3-Chloropropane	0.276	U,C3	0.276	UJ	9
VMWA-110724	Acrolein	2.54	U,C3	2.54	UJ	9
VMWA-110724	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWA-110724	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWC-110724	Ethyl Chloride	0.192	U,C3	0.192	UJ	9
VMWC-110724	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWH-110724	Ethyl Chloride	0.192	U,C3	0.192	UJ	9
VMWH-110724	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWI-110724-143.7	Ethyl Chloride	0.192	U,C3	0.192	UJ	9

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
VMWI-110724-143.7	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWJ2-110724-120.25	Ethyl Chloride	1.92	U,C3	1.92	UJ	9
VMWJ2-110724-120.25	Methyl Bromide	6.05	U,C3	6.05	UJ	9
VMWK-110724-114.25	1,1,1-Trichloroethane	0.149	U,C3	0.149	UJ	9
VMWK-110724-114.25	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWK-110724-114.25	1,2,4-Trichlorobenzene	0.481	U,C3	0.481	UJ	9
VMWK-110724-114.25	1,2-Dichloroethane	0.0819	U,C3	0.0819	UJ	9
VMWK-110724-114.25	Butylbenzene	0.157	U,C3	0.157	UJ	9
VMWK-110724-114.25	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWK-110724-114.25	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWK-110724-114.25	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWK-110724-114.25-DUP	1,1,1-Trichloroethane	0.149	U,C3	0.149	UJ	9
VMWK-110724-114.25-DUP	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWK-110724-114.25-DUP	1,2,4-Trichlorobenzene	0.481	U,C3	0.481	UJ	9
VMWK-110724-114.25-DUP	1,2-Dichloroethane	0.0819	U,C3	0.0819	UJ	9
VMWK-110724-114.25-DUP	Butylbenzene	0.157	U,C3	0.157	UJ	9
VMWK-110724-114.25-DUP	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWK-110724-114.25-DUP	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWK-110724-114.25-DUP	Naphthalene	0.174	U,C3	0.174	UJ	9

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
VMWL-110724-103.25	1,1,1-Trichloroethane	0.149	U,C3	0.149	UJ	9
VMWL-110724-103.25	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWL-110724-103.25	1,2,4-Trichlorobenzene	0.481	U,C3	0.481	UJ	9
VMWL-110724-103.25	1,2-Dichloroethane	0.0819	U,C3	0.0819	UJ	9
VMWL-110724-103.25	Butylbenzene	0.157	U,C3	0.157	UJ	9
VMWL-110724-103.25	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWL-110724-103.25	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWL-110724-103.25	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWM-110724-94	1,1,1-Trichloroethane	0.149	U,C3	0.149	UJ	9
VMWM-110724-94	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWM-110724-94	1,2,4-Trichlorobenzene	0.481	U,C3	0.481	UJ	9
VMWM-110724-94	1,2-Dichloroethane	0.0819	U,C3	0.0819	UJ	9
VMWM-110724-94	Butylbenzene	0.157	U,C3	0.157	UJ	9
VMWM-110724-94	Chloromethane	0.96	U,C3	0.96	UJ	9
VMWM-110724-94	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWM-110724-94	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWN-110729-110.8	1,1,1-Trichloroethane	0.149	U,C3	0.149	UJ	9
VMWN-110729-110.8	1,2,3-Trichlorobenzene	0.164	U,C3	0.164	UJ	9
VMWN-110729-110.8	1,2,4-Trichlorobenzene	0.481	U,C3	0.481	UJ	9
VMWN-110729-110.8	1,2-Dichloroethane	0.0819	U,C3	0.0819	UJ	9
VMWN-110729-110.8	Butylbenzene	0.157	U,C3	0.157	UJ	9
VMWN-110729-110.8	Chloromethane	0.96	U,C3	0.96	UJ	9

Sample ID	Compound	Laboratory Result (µg/l)	Laboratory Flag	Validation Result (µg/l)	Validation Qualifier*	Reason Code**
VMWN-110729-110.8	Methyl Bromide	0.605	U,C3	0.605	UJ	9
VMWN-110729-110.8	Naphthalene	0.174	U,C3	0.174	UJ	9
VMWK-110724-114.25	Acetone	162	C5	162	J	9
VMWK-110724-114.25-DUP	Acetone	158	C5	158	J	9
VMWL-110724-103.25	Acetone	208	C5	208	J	9
VMWM-110724-94	Acetone	300	C5	300	J	9
VMWC-110724	Methyl ethyl ketone	4.32	J	4.32	J	9
VMWH-110724	Methyl ethyl ketone	0	U	0	UJ	9
VMWI-110724-143.7	Methyl ethyl ketone	5.93	C5	5.93	J	9

µg/l-microgram per liter

U-not detected at or above the MDL

C3-The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

C5-The reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Method sensitivity check is acceptable.

J-The identification of the analyte is acceptable; the reported value is an estimate.

* 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