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ANNUAL PERFORMANCE REPORT
1 JANUARY 2020 – 31 DECEMBER 2020

EAST MULTNOMAH COUNTY, TROUTDALE SANDSTONE AQUIFER REMEDY
ECSI 1479

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April 2021

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
BGal	billion gallons
bgs	below ground surface
Boeing	The Boeing Company
Cascade	Cascade Corporation
COPC	chemicals of potential concern
CU1	Confining Unit 1
CSSWF	Columbia South Shore Well Field
CTS	Central Treatment System
DCE	1,2-dichloroethene
DEQ	Oregon Department of Environmental Quality
ECSI	Need definition?
EMC	East Multnomah County
EW	extraction well
ft	foot, feet
GETs	groundwater extraction treatment system
gpm	gallons per minute
LAI	Landau Associates, Inc.
lbs	pounds
MCL	maximum contaminant level
msl	mean sea level
NOAA	National Oceanic and Atmospheric Administration
OWRD	Oregon Water Resources Department
PCE	tetrachloroethene
PID	photoionization detector
PLC	programmable logistics controller
PUD	People's Utility District
PVC	polyvinyl chloride
PWB	Portland Water Bureau
ROD	Record of Decision
RWPUD	Rockwood PUD system

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

scfm	standard cubic feet per minute
SGA	Sand and Gravel Aquifer
SSPA	S.S. Papadopulos & 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 2020 – 31 December 2020

East Multnomah County Troutdale Sandstone Aquifer Remedy

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1.0 INTRODUCTION

This report, submitted on behalf of Cascade Corporation (Cascade) and The Boeing Company (Boeing), summarizes performance and monitoring data for the East Multnomah County (EMC), Troutdale Sandstone Aquifer (TSA) remedy project. Data presented in this report were collected during the period of 1 January 2020 through 31 December 2020 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.

EMC Site discovery and groundwater investigations of the TSA and underlying Sand and Gravel Aquifer (SGA) began in 1986, and initial groundwater extraction using pump and treat methods commenced in 1993. Results of early investigations indicated the presence of groundwater VOC concentrations above maximum contaminant levels (MCLs) for trichloroethene (TCE), tetrachloroethene (PCE), cis-1,2-dichloroethene (DCE), 1,1-dichloroethane, 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. Groundwater extraction and treatment systems (GETs) have been operational since 1997 (interim operation prior to 1997) and have been successful in removing VOC mass from the saturated zone and greatly decreasing the size of the dissolved VOC plume. 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 the Confining Unit 1 (CU1) between the TGA and the TSA).

Low-level TCE concentrations were discovered in areas of the SGA, underlying the TSA. The SGA dissolved mass was remediated by the GETs between 1998 and 2007 and associated post-remedy groundwater monitoring ceased in 2013. All but one SGA well [BOP-44(usg)] have been decommissioned.

1.1 Purpose of Report

The reporting period for the TSA remedy Annual Performance Report presents data through calendar year 2020. This Annual Performance Report provides an evaluation of the TSA remedy performance, including:

- A summary of the remediation system operation, maintenance, and performance monitoring data;
- The GETs and the soil vapor extraction (SVE) system (remedy technique added after the Consent Order);
- An assessment of aquifer restoration progress; and

- Recommendations and future planned activities.

The project area and Site are shown in Figure 1-1. The Lower TSA remedial zones (Remedy Zones A, B, C, and D), the TSA remedy network of extraction wells and monitoring wells, and the current TSA remedy extraction system layouts are shown in Figure 1-2.

1.2 Background

The original study area for the EMC Site was an area of approximately 3.6 square miles that is bound by the Columbia River to the north, Fairview Avenue and Campbell Road to the east, NE Halsey Street to the south, and NE 181st Avenue to the West (Figure 1-1). The EMC Site is located in Sections 19, 20, 28, and 29 in Township 1 North, Range 3 East. Surface elevation at the EMC Site is highest to the south and descends in a series of river/flood cut terraces northward to the Columbia River. The EMC Site discovery and groundwater investigations of the TSA and the SGA began in 1986. Between 1994 and 1996, remedial investigations and a feasibility study were conducted that indicated groundwater VOC concentrations above the MCLs for TCE (5 micrograms per liter [µg/L]), PCE (5 µg/L), cis-1,2-DCE (70 µg/L), 1,1-DCE (7 µg/L), and VC (2 µg/L), with an aerial extent of approximately 400 acres in the TSA.

Four TSA remedial areas were described in the ROD and subsequently assigned letters as shown in Figure 1-2. A summary of the TSA remedial zones is given below:

TSA Remedial Zone	Zone Location
Zone A	Area north of Sandy Boulevard
Zone B	Area south of Sandy Boulevard in the western portion of the Boeing facility
Zone C	Area south of Sandy Boulevard directly east of Zone B and west of N.E. 205th Avenue
Zone D	Area south of Sandy Boulevard, directly east of Zone C and area east of N.E. 205th Avenue

Between 1993 and 2000, six GETs were installed to provide hydraulic capture of the dissolved VOC plume and to remove VOC mass. The approximate locations of the five former (decommissioned) GETs and the remaining GETs are shown on Figure 3-1. Below is a brief summary of each system:

- North Treatment System: Located in Zone A and began pilot testing in 1993 with full-scale operation starting in 1997 with one Upper TSA extraction well (EW-9), five Lower TSA extraction wells (EW-6, -7, -9, -19, and RPW-2), and one SGA extraction well (EW-20). The extraction wells were shut down and decommissioned in phases, and the

treatment system was shut down in 2006 with DEQ approval (DEQ, 2006) based on TCE concentrations below the cleanup level.

- SGA Treatment System: Cleanup of the SGA was implemented at one groundwater extraction well (EW-20) mentioned above, located in Zone A, as part of the North Treatment System. Except at three wells (EW-20 and two nearby monitoring wells) where TCE concentrations were between 9.9 and 59 µg/L. TCE concentrations were consistently below the respective reporting limits for SGA monitoring wells. Groundwater extraction in the Lower TSA and the SGA successfully restored SGA groundwater by the year 2000 as cleanup goals were met, and the system was shut down in 2007.
- Far North Treatment System: Located in Zone A and installed as a stand-alone system with one Lower TSA extraction well EW-17. The system operated from 1998 to 2003 and was decommissioned with DEQ approval in 2007 because TCE concentrations were consistently below the cleanup level for the prior two years.
- West Treatment System: Located in Zone B and began operation in 1989. The system remains in operation for the Boeing TGA project (ECSI #13); however, operation of the system for TSA groundwater was discontinued in 2009. Historically, the system consisted of two Upper TSA extraction wells (EW-3 and EW-22) and one Lower TSA extraction well (EW-13). Extraction well EW-22 was decommissioned in 2010, and operation of EW-3 and EW-13 was discontinued in 2009, with DEQ's approval, based on TCE concentrations meeting cleanup levels. Wells EW-3 and EW-13 are currently utilized as groundwater monitoring wells.
- Central Treatment System (CTS): The system is installed in the TSA mound area in Zone C and started operation in 1997. The CTS continues to operate to provide hydraulic capture of the dissolved VOC plume. A total of 11 Lower TSA extraction wells (EW-1, -2, -4, -5, -8, -11, -12, -14, -15, -16, -18, and -23) have routed groundwater to the system since system startup. Currently, EW-1 (temporary shutdown mode), EW-2, EW-14, and EW-23 are in active operation. Wells EW-4, EW-16, and EW-18 have been decommissioned with DEQ approval based on TCE concentrations meeting cleanup levels, and the remaining wells were converted into groundwater monitoring wells.
- East Treatment System: Installed as a stand-alone system with one Upper TSA extraction well (EW-10). The system started operation in 1998 and was discontinued in 2001 due to groundwater VOC concentrations being below the MCLs; however, the well was subsequently operated for the property owner's beneficial use until 2005.

Currently, only the CTS remains in operation with three operating extraction wells, EW-2, EW-14, and EW-23, and EW-1 which is in temporary shutdown mode.

2.0 SIGNIFICANT ISSUES, EVENTS, AND ACTIONS

This section summarizes significant issues, events, and actions taken during the reporting period. The 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 7.0), 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 2019 – 31 December 2019 East Multnomah County, Troutdale Sandstone Aquifer Remedy ECSI 1479* (Geosyntec Consultants, Inc. [Geosyntec], Landau Associates, Inc [LAI], and S.S. Papadopulos & Associates, Inc. [SSPA], 2020). DEQ approved the modifications listed below on September 11, 2020 (DEQ, 2020a):

- Proceed with temporary shutdown of EW-23. The extraction well operated throughout 2020 but will be placed in pilot shutdown mode in April 2021.
- Continue temporary shutdown of EW-1 to allow for increased flushing in the TSA mound area at EW-2 and EW-14.
- Decommission Upper TSA wells BOP-21(ds) and BOP-42(ds) along with Lower TSA wells BOP-42(dg) and BOP-60(dg). These four wells have met remedy decommissioning criteria, as the locations are redundant to several other wells located closer to the leading edge of the dissolved VOC plume. The decommissioning of these four wells remains pending; however, the wells have been removed from the monitoring network and therefore, no samples were collected from these wells in 2020.
- Discontinue East Multnomah County project water quality monitoring at two wells owned by the Portland Water Bureau [PWB-1(uts) and PWB-1(lts)].

Additional modifications recommended previously in the 2018 Annual Report (Geosyntec, Landau, and SSPA, 2019), which DEQ approved (DEQ, 2019a), that are still pending in 2020 include the decommissioning of CMW-8(dg) and CMW-10(dg). Decommissioning of these wells has been delayed due to a lack of an access agreement with the landowner, and samples were not collected from these wells in 2020.

Additional modifications recommended previously in the 2017 Annual Report (Geosyntec, Landau, and SSPA, 2018), which DEQ approved (DEQ, 2018), that are still pending in 2020 include the decommissioning of SGA well BOP-44(usg), and TSA wells BOP-44(dg), BOP-44(ds), and EMC-2(dg), which are all located in Remedy Zone A. Although DEQ approved decommissioning these wells, the schedule for decommissioning has been delayed pending DEQ

approval for partial closure of Remedy Zone A. Samples were not collected from these wells in 2020.

2.2 Municipal Well Field Operations

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

During 2020, the CSSWF was operated for one pumping event that began on 4 August and ended on 26 August. The CSSWF operated for a total of 22 days and pumped an estimated 0.41 billion gallons (BGal) of groundwater (PWB, 2021). Below are the estimated pumped volumes per aquifer during the summer shutdown:

- Sand and Gravel Aquifer: 0.21 BGal or approximately 51% of total production;
- Blue Lake Aquifer: 0.05 BGal or approximately 13% of total production; and
- Troutdale Sandstone Aquifer: 0.15 BGal or approximately 36% of total production.

Due to the close vicinity of the CSSWF to the EMC Site, PWB pumping events are closely monitored and additional contingency monitoring is established pursuant to the PWB Contingency Monitoring Plan (LAI, 2019) and approved by DEQ (DEQ, 2020b). Water levels were collected continuously using pressure transducers with weekly manual checks to confirm data. Per the PWB contingency plan for short-term PWB pumping events, no additional groundwater samples were collected by the EMC related to the PWB pumping event.

3.0 EXTRACTION AND TREATMENT SYSTEMS

This section summarizes the operation and performance of the GETs, as well as the SVE system implemented in 2015. The groundwater CTS consists of the one GETs remaining in operation for the TSA remedy in 2020. Six GETs were operated for the EMC site historically. Individual GETs were closed down with DEQ's approval and decommissioned when no longer needed for hydraulic capture of the dissolved VOC plume. The locations of the current and former GETs, treated water lines, and extraction and monitoring wells are shown in Figure 3-1. Currently, the CTS operates to remove VOC mass and maintain hydraulic control of the TSA plume by the operation of three Lower TSA extraction wells (Figure 1-2). Current operating extraction wells are EW-2 and EW-14, located in the mound area near the CTS, and EW-23 located on the Boeing property in Zone C.

Historically, extraction wells have been shut down once TCE concentrations are consistently below the MCL. After shutdown, the extraction wells are typically utilized as groundwater monitoring locations or decommissioned based on DEQ approval. Upper TSA extraction well EW-3 and Lower TSA extraction wells EW-1, EW-5, EW-8, EW-11, EW-12, EW-13, EW-15, and EW-16 remain in use as monitoring wells.

Well construction and location details for current monitoring and extraction wells are summarized in Table 3-1.

3.1 CTS Operational Summary

In 2020, the CTS was operated to treat and capture groundwater through the operation of three Lower TSA extraction wells (EW-2, EW-14, and EW-23). Daily flow data from each well are recorded by the automated programmable logistics controller (PLC) system. Data from the PLC, manual inspections, and system field checks are conducted weekly. Routine system inspections include manual collection of total flow meter 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:

- January 15, 2020: EW-14 transducer replaced.
- February 25, 2020: EW-14 pump and motor replaced.
- May 14, 2020: Sonic cleaning of EW-2; pump and motor replaced.

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

- January 28 - February 4, 2020: EW-23 vault flooded causing the pump to shut down.
- April 13, 2020: EW-2 Y-trap cleaned, found to be filled with silica sand. A follow-up inspection on April 20, 2020 found no issues.

- September 14, 2020: Boeing facility access restricted due to ambient air quality, O&M readings not collected for EW-23.
- December 21, 2020: EW-23 off upon arrival, no alarm triggered. Issue likely due to power shutoff for building work.
- December 28, 2020: EW-23 off upon arrival, no alarm triggered. Issue likely due to power shutoff for building work. EW-23 had been observed to be operating on December 26, 2020.

Significant repair and cleaning events for the operating TSA extraction wells in 2020 are noted in Figures A-1 through A-3 of Appendix A. Upgrades to the CTS and PLC in recent years have included significant updates to the computer programs (2017 and 2019), power supply protection for stability during power surges from lightning and power grid fluctuations (2018 and 2019), and water level controls (new transducers and a barometer in 2019 and 2020).

3.2 Groundwater Extraction Rates

Target flow rates for the extraction wells have been established to maintain hydraulic capture of the dissolved VOC plume. The 2020 target extraction rates were: EW-2 at 25 gallons per minute (gpm); EW-14 at 20 gpm; and EW-23 at 30 gpm.

Flows at EW-2, EW-14, and EW-23 averaged 30, 24, and 31 gpm, respectively, and were above the target flow rates for each well. As discussed in the 2019 Annual Report, transducer issues in November 2019 resulted in the reduction of flow rate in EW-2 and EW-14 pending replacement of transducers in these wells (January 2020). The marked increase in flowrate and resulting decrease in groundwater elevations for EW-2 and EW-14 in the spring of both 2019 and 2020 are due to sonic cleaning of the wells as part of the routine extraction well maintenance program (Figures A-1 and A-2). Flow rates were sufficient to maintain hydraulic capture in the mound area of the site, as demonstrated by groundwater elevations and gradients (discussed in Section 4.2) and TCE concentrations in nearby wells (discussed in Section 4.3).

Flow rate and water level data for the extraction wells are provided in Appendix A, with average monthly extraction well flow rates over the most recent five-year period in Figures A-1 through A-3 and combined average monthly flow for all wells in Figure A-4. 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. In addition, influent and effluent samples are collected from the CTS quarterly. Permits to discharge treated groundwater effluent from the CTS are presented in Attachment C to the TSA Remedy Consent

Order (DEQ 1997). Flow, pH, temperature, and influent and effluent VOC data for the reporting period, including compliance (or discharge) limits, are presented in Appendix A (Table A-2).

CTS data for the reporting period are as follows:

- The total average flow during the 12-month period, January through December 2020, was 85 gpm (Appendix A, Table A-1).
- Effluent pH ranged from 7.11 to 8.04 standard units (SU) and remained within the effluent limits of 6 to 9 SU.
- Effluent temperature ranged from 52 to 68 degrees Fahrenheit (F).
- VOCs were not detected at the respective laboratory reporting limits in quarterly effluent samples.

2020 performance data were in compliance with permit limits.

3.4 Well Decommissioning

Decommissioning of the Upper TSA wells BOP-21(ds) and BOP-42(ds) along with the Lower TSA wells (BOP-42[dg] and BOP-60[dg]) was proposed in the *2019 TSA Annual Report* (Geosyntec et al., 2020) and approved by DEQ (DEQ, 2020a). The decommissioning of these four wells is pending; however, these wells have not been removed from the monitoring well network.

Decommissioning of CMW-26dg was proposed via email on June 26, 2020 (Geosyntec, 2020a) and approved by DEQ on August 11, 2020 (DEQ, 2020c). CMW-26dg was damaged during property development construction sometime during December 2019 or January 2020. Attempts were made to rehabilitate the well, including repairing the monument, high pressure jetting, use of drilling mud to remove larger diameter solids, and in-well video recordings. Ultimately, there was bentonite grout and gravel obstructing the well at 40 feet below ground surface (ft bgs). The contracted driller along with the Oregon Water Resources Department (OWRD) determined the well was not salvageable (Geosyntec, 2020a). CMW-26dg was decommissioned on October 21, 2020 by over-drilling using a truck-mounted sonic drilling rig (OWRD Start Card 1049397). Aboveground features (concrete pad and steel vault) along with the belowground well material (polyvinyl chloride [PVC] pipe casing, screen, filter pack, and bentonite) were removed down to the total depth of the well (60 ft bgs). The borehole was backfilled to 5 ft bgs with hydrated bentonite slurry (1,300 pounds [lbs] of bentonite grout) that met the requirements of OAR 690-240-0475. The top 5 ft was filled with hydrated bentonite chips (300 lbs of bentonite). The ground surface was restored to match surrounding terrain, the drill rig and equipment were decontaminated, and the drill cuttings and wastewater were transported to the vicinity of the CTS.

Wastewater generated from both the rehabilitation and decommissioning activities was discharged to the CTS system. Drums containing solids generated during the rehabilitation activities were

disposed of at Hillsboro Landfill (Waste Tracking Number 1330140R-1). The drums containing drill cuttings from the CMW-26dg decommissioning activities are pending disposal.

3.5 Soil Vapor Extraction

The SVE system is an additional corrective measure that has been implemented in the TSA mound area where VOC concentrations in the groundwater have responded slowly to the pump and treat remedy. Beginning in 2014, SVE was pilot tested at three vapor monitoring wells (VW-17D-42.5, VW-17D-75, and VW-17D-95.5) and following favorable results, full-scale SVE commenced at these vapor wells in 2015. The SVE system was expanded in 2016 with four vapor extraction wells (VMW-A through VMW-D) and again in Spring 2019 with installation of three wells (VMW-E, VMW-F, and VMW-G) that are angled towards groundwater monitoring well CMW-18(ds) and one vertical well VMW-H to the west of VMW-C. The 2019 Annual Report also described additional SVE wells to be installed to further expand the SVE system to the west (near well D-17ds) onto the adjacent property. However, these wells have been placed on hold pending property owner development plans and access agreements. In the summer of 2020, six vapor/groundwater monitoring wells were installed in the mound area that were designed such that they can be incorporated into the existing SVE system, as needed.

SVE has been discontinued at specific wells after mass removal reached asymptotic levels. Vapor extraction at the two shallow wells VW-17D-42.5 and VW-17D-75 was discontinued in 2016, and these wells were subsequently decommissioned in 2018. Shutdown and rebound testing for SVE wells VMW-A, VMW-B, and VMW-D was conducted in 2019. Based on the results, the wells have not been utilized for SVE since October 2019; however, the wells have not been decommissioned and can be utilized as either vapor or groundwater monitoring wells, if needed.

The SVE system wells and underground piping are shown in Figure 3-2.

3.5.1 Vapor/Groundwater Well Installation

Six vapor/groundwater monitoring wells (VMW-I, -J2, -K, -L, -M, and -N) were installed in June and July of 2020. In summary, the objectives of the investigation were to:

- Obtain subsurface soil data to better understand soil types and lithology in areas between existing boreholes/wells and to use the data to evaluate the stratigraphy/lithology and identify any potential preferred pathways.
- Obtain groundwater samples at a higher resolution/closer spacing than existed in the mound area. These wells may also be utilized in the future, if appropriate, as part of the remediation system, such as SVE, groundwater extraction, and/or other alternatives.
- Provide data to refine the conceptual site model in order to target remediation more accurately.

The purpose of these wells is described in detail in the memorandum titled *Data Gaps Investigation Work Plan – East Multnomah County Troutdale Sandstone Aquifer Remedy (ECSI 1479) Geosyntec Project Number: PNG0564S19* (Geosyntec, 2020b), which was approved by DEQ in March 2020 (DEQ, 2020d). The construction of these wells and preliminary data will be reported in a separate technical memorandum.

3.5.2 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 PVC piping and eight vapor extraction wells (VMW-A though VMW-H) via belowground PVC piping. A PVC exhaust stack directly discharges into the atmosphere at a height of approximately 8 ft. The SVE system maintained an average flow rate of around 380 standard cubic feet per minute (scfm) in 2020 (Appendix C; Table C-1; Figure C-2).

3.5.3 SVE System Monitoring

Routine SVE system monitoring was conducted in six of the nine SVE wells (VMW-C, VMW-E, VMW-F, VMW-G, VMW-H, and VW-17D-95.5). The 2020 monitoring schedule is summarized in the table below:

Well Name	Vapor Monitoring (PID)	Vapor Sampling (Summa)
VMW-17D-95.5 (soil vapor only)	Quarterly	Quarterly
VMW-A	NM[1]	NM[1]
VMW-B	NM[1]	NM[1]
VMW-C	Quarterly	Quarterly
VMW-D	NM[1]	NM[1]
VMW-E	Quarterly	Quarterly
VMW-F	Quarterly	Quarterly
VMW-G	Quarterly	Quarterly
VMW-H	Quarterly	Quarterly
Effluent	Monthly	Monthly

The monitoring for the six actively operated SVE wells and the system outlet consisted of the following:

- Weekly Monitoring: collect field measurements of temperature, pressure, and flow rates from the system and individual operating SVE wells, as well as effluent field vapor sampling readings;
- Monthly Sampling: collect VOC vapor samples from system effluent; and

[1]NM = not monitored for vapor. Vapor extraction at well is currently shutdown. Well is utilized for groundwater monitoring.

- Quarterly Sampling: collect VOC samples (vapor and groundwater) from the individual operating SVE wells.

VOC vapor results from photoionization detector (PID) measurements in ppm (outlet only) and laboratory testing in ug/m^3 (outlet and wells) are summarized in Tables C-1 and C-2, and the analytical results are shown in Figure C-1. Analytical laboratory reports and data validation memoranda are provided in Appendix F.

3.5.4 SVE System Monitoring Results

The 2020 quarterly analytical results for the actively operated SVE wells indicate that the highest TCE vapor concentration was measured during May in VMW-E (1,300 µg/m³) (Figure 3-3). However, VMW-C had the highest average TCE vapor concentration and ranged from 590 to 920 µg/m³. The average TCE vapor concentration for the SVE system outlet was 499 µg/m³. Groundwater samples collected from the SVE wells indicate that the highest TCE concentrations were detected at angled well VMW-E and ranged from 30.1 to 42.5 µg/L. The vapor analytical results are summarized in Tables C-1 (outlet) and C-2 (outlet and wells), and groundwater analytical results are summarized in Table E-1.

3.5.5 SVE System Mass Removal

The SVE system removed approximately 7.6 lbs of VOCs (6.4 lbs of TCE) in 2020 (based on laboratory analyses) and a total of approximately 76 lbs of VOC mass from the TSA mound area since the startup of the SVE Pilot Study in 2014 (Table C-3). Mass removal in 2020 decreased from the 2019 mass removal rate (9 lbs/year) by 15%. This mass removal rate decrease is typical of SVE system operation and an expected result of continued mass removal from the subsurface. Operational data for the SVE system and mass removal data are provided in Appendix C. Flow rates, vapor concentrations (field and laboratory), and estimated mass extracted are summarized in Appendix C, Tables C-1, C-2, C-3, and in Figures C-1 through C-3.

3.5.6 SVE Discussion

In addition to the quarterly samples collected at the SVE wells, groundwater samples were also collected quarterly at nearby well CMW-17(ds), which is located adjacent to the vapor wells. CMW-17(ds) is screened near the top of the Upper TSA between elevations 14 and 24 ft mean sea level (msl), at depths of 98 to 108 ft bgs. The elevation of the CMW-17(ds) screen is deeper than the screen interval for the deepest SVE well (VW-17D-95.5) which is screened from elevation 44.5 to 24.5 ft msl). Groundwater TCE concentrations at CMW-17(ds) decreased from 42.9 to 7.13 µg/L between February 2017 and November 2018, which correlates to the time of the active SVE operation in nearby wells. However, after the minimum concentration was reached, concentrations increased to a maximum of 61.2 µg/L in August 2019. Since reaching the maximum, TCE concentrations have steadily decreased to 40.9 µg/L, as measured in November 2020.

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 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 measured either monthly, quarterly, semi-annually, or annually based on the Performance Monitoring Schedule (Table 2-2). Depth to groundwater is measured using a portable electric tape meter in the monitoring wells and with pressure transducers located in 11 wells (four Upper TSA wells, six Lower TSA wells, and one SGA well). Pressure transducers are utilized in wells selected as part of the PWB contingency monitoring plan. Water level data are downloaded monthly from the pressure transducers.

During operation of municipal well fields PWB and Rockwood People's Utility District (PUD) in 2020, drawdown was approximately 8.5 ft in the upper TSA well BOP-65(ds), 6.5 ft in the Lower TSA well EW-13, and over 37 ft in the SGA well BOP-44usg. These wells are located along the western and northern portions of the remedy area.

Groundwater depths and groundwater elevations are summarized in Table D-1 of Appendix D. Groundwater elevation hydrographs and precipitation data for the wells with pressure transducers along with precipitation data are included in Appendix D in Figures D-1 and D-2. Precipitation during the 2020 12-month reporting period was approximately 32.4 inches, which is approximately 3.6 inches below the normal 36.0 inches of annual precipitation at the Portland Airport (National Oceanic and Atmospheric Administration [NOAA], 2020).

4.2 Groundwater Flow and Hydraulic Capture

As defined in the ROD, the objectives of the TSA-dissolved VOC plume remedy are to: 1) maintain hydraulic capture; 2) prevent further vertical and horizontal spread of VOC contaminants; and 3) allow existing uses of groundwater resources in the 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 in 2020 due to ongoing remedy pumping. Groundwater contours for the semiannual water level measurement event (February 2020) and the annual event (August 2020) are provided in Figures 4-1a,b and 4-2a,b.

Groundwater flow in the Upper TSA exhibits a radial or mounded flow pattern in the vicinity of the TSA mound area with localized flow to the south. Lower TSA inward hydraulic gradients toward the extraction wells are indicative of hydraulic capture and demonstrate the effectiveness of Lower TSA extraction wells EW-2, EW-14, and EW-23 in achieving and maintaining capture.

Groundwater flow directions in the Lower TSA in the mound area do not vary significantly from wet to dry season and are strongly influenced by the operating extraction wells. These extraction wells capture groundwater within areas of the site with VOC concentrations above the respective cleanup level. Hydraulic capture of the dissolved VOC plume is also exhibited by spatial VOC concentration trends, as discussed below.

4.3 Groundwater Quality

Groundwater quality is evaluated against the MCL for the site chemicals of concern. TCE, the predominant chemical by mass, is used to evaluate remedy progress, and has an MCL of 5 µg/L.

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 event) being the most inclusive well sampling event. Biennial analytical monitoring is conducted in August of odd number calendar years (e.g., 2021 and 2023); therefore, no biennial sampling was conducted in 2020. The Performance Monitoring Schedule is reviewed annually to optimize the monitoring program to maintain compliance with the ROD.

Analytical results for groundwater samples collected during this reporting period are summarized in Appendix E, Table E-1. Plots of time versus TCE concentrations for select monitoring wells in or near the mound area and the three operating extraction wells are presented in Appendix E, Figures E-1 through E-7. TCE concentration contours for the February and August sampling events are shown in Figures 5-1a,b and 5-2a,b for the Upper and Lower TSA wells, respectively.

4.3.1 Upper TSA

TCE concentrations in the Upper TSA mound area (located in Remedy Zone C) during the monitoring period (January through December 2020) were as follows:

- CMW-17(ds): 37.9 to 51.8 µg/L (Figure E-1);
- BOP-13(ds): 2.0 to 2.6 µg/L;
- CMW-10(ds): 9.5 to 14.2 µg/L (Figure E-3);
- CMW-18(ds): 80.6 to 96.6 µg/L (Figure E-4);
- Vapor monitoring wells (VMW-A through VMW-H) ranged from non-detect at the laboratory reporting limit (VMW-H and VMW-F) to 42.5 µg/L (VMW-E); and
- New vapor monitoring wells (VMW-I through VMW-N): ranged from non-detect at the laboratory reporting limit (VMW-L), below the MCL (VMW-K), and up to 85.4 µg/L at VMW-J2. (Data from the six new wells will be evaluated and discussed further in a separate upcoming report.)

TCE concentrations in remaining Upper TSA wells, located outside of the mound area, were all below the MCL and some were below the laboratory reporting limits. TCE concentrations for the Upper TSA are highest at CMW-18(ds), which ranged from 80.6 to 96.6 µg/L in 2020, while adjacent vapor/groundwater monitoring wells VMW-E, VMW-F, and VMW-G ranged from non-detect at the laboratory reporting limits to 42.5 µg/L. TCE concentrations in exceedance of the MCL are localized to the mound area. TCE concentration contours for February and August 2020 are shown in Figures 5-1a and 5-2a. The approximate area of the Upper TSA TCE plume is approximately 14 acres.

4.3.2 Lower TSA

In the western portion of the remedy area, Remedy Zone B, TCE concentrations in the Lower TSA were below the MCL in wells sampled in 2020. At well BOP-31(dg), located along the western portion of the TSA mound area, TCE concentrations ranged from 2.71 to 3.0 µg/L (Figure E-5). TCE concentrations were also below the MCL at EW-23 and ranged from 1.64 to 1.74 µg/L (Figure E-7).

In the central portion of the remedy area, Remedy Zone C, the highest TCE concentration in the Lower TSA continued to occur in the mound area well D-17(ds), where concentrations ranged from 34.6 to 59.9 µg/L (Appendix E, Figure E-6). TCE concentrations at D-17(ds) generally decreased after aquifer resaturation in 2009 through 2016. However, TCE concentrations steadily increased starting in May 2017 and reached a maximum concentration of 61.2 µg/L in May 2019. Since reaching the maximum, TCE concentrations have steadily decreased to 35 µg/L in November 2020. Monitoring well D-17(ds) is screened at the top of the Lower TSA across the water table, while well D-17(dg) is screened in the lower portion of the Lower TSA. TCE concentrations at D-17(dg) ranged from 0.748 to 4.38 µg/L in 2020 (Table E-1), indicating that groundwater impacts in this area are localized to the upper portion of the Lower TSA.

In 2019 and 2020, TCE concentrations were below the MCL at non-pumping extraction wells used for monitoring (EW-1, EW-8, and EW-12), with the exception of the November 2019 sampling event at EW-1 (7.14 µg/L). In 2020, TCE concentrations at EW-1 were below the laboratory reporting limit (0.5 ug/L) in each of the 2020 quarterly sampling events. TCE concentrations at extraction wells EW-2 (9.13 to 13.3 µg/L) and EW-14 (5.95 to 7.74 µg/L) exceeded the TCE MCL (Figure E-7).

In the eastern portion of the Site, TCE concentrations in the Lower TSA former extraction wells (now used for monitoring) have been below the MCL at EW-11 (since 2009) and EW-16 (since 2013), and below laboratory reporting limits EW-15 (since 2010).

TCE concentrations for the Lower TSA wells sampled in 2020 are shown in Figures 5-1b and 5-2b. The approximate area of the Lower TSA TCE plume is approximately 14 acres, a 97% decrease from the initial 400 acres.

4.4 TCE Mass Removal in Saturated TSA

TCE mass removal estimates are based on groundwater VOC concentrations and average quarterly groundwater extraction flow. In 2020, approximately 2.5 lbs of TCE was removed through the GETs, which is essentially the same amount removed in 2019 (2.4 lbs). Since startup of the GETs in 1996, an estimated total of 500 lbs of VOCs have been removed from the TSA and SGA. Mass removal rates declined markedly during the first decade following startup but have been relatively constant for the past four years (Figure E-9). TCE annual mass removal estimates for the 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

In summary, the EMC TSA GETs has been effective at reducing TCE concentrations since implementation in 1993. The TCE plume in the TSA has contracted from an original approximate 400 acres in the mid-1990s to approximately 14 acres in 2020. EMC TSA groundwater extraction and soil vapor extraction systems were operational in 2020 and resulted in TCE mass removals of 2.5 lbs and 6.4 lbs, respectively. The total remedy TCE mass removal is 500 lbs from the saturated zone and 76 lbs from the unsaturated zone. The overall TCE plume footprint has contracted to such an extent that it only persists in the localized mound area (Remedy Zone C). Additional wells installed in the mound area in 2020 as part of a data gap investigation are being utilized to refine the focused remedial approach in the mound area.

TCE concentrations were above the MCL at 4 of 31 groundwater monitoring and two extraction wells, and 10 of the 14 vapor/groundwater monitoring wells sampled (14 total wells). Wells exceeding the TCE MCL are located in Remedy Zone C.

Significant remedy performance findings are summarized below.

- ROD remedy objectives for hydraulic capture were achieved in 2020. Groundwater flow directions in the Upper and Lower TSA indicate ongoing inward and downward flow towards the operating extraction wells (Figures 4-1a,b and 4-2a,b).
- The 12-month average flow rate from the operating extraction wells was 85 gpm, which was more than the rate during the previous reporting period (80 gpm). The slight increase is due to routine sonic cleaning of extraction wells, EW-2 and EW-14, replacement of EW-2 pump and motor, and the shutdown of EW-1, which increased the flushing of porewater towards EW-2 and EW-14. Average flow rates at extraction wells EW-2 (30 gpm), EW-14 (24 gpm), and EW-23 (31 gpm) are above the design target flow rates. Upgrades to the CTS and PLC in recent years have strengthened the GETs against outages related to power surges and aging infrastructure.
- In the Upper TSA, TCE concentrations continue to be above the MCL in the mound area (Remedy Zone C) at groundwater wells CMW-17(ds), CMW-10(ds), and CMW-18(ds), and VMW-A, -B, -C, -D, -E, and -G in 2020. TCE concentrations in wells located outside of the mound area are all below the MCL and some were also below the laboratory reporting limit, as shown in Figures 5-1a and 5-2a.
- In the Lower TSA, the highest TCE concentrations remain in the mound area at well D-17(ds), as shown in Figures 5-1b and 5-2b. Outside the mound area, TCE concentrations at monitoring wells were all below the MCL and some were also below the laboratory reporting limit.
- TCE concentrations for Lower TSA extraction wells EW-2, EW-14, and EW-23 remained generally stable and consistent with previous years. The highest TCE

concentrations measured in the extraction wells during this reporting period were at EW-2; TCE concentrations were below the MCL at extraction well EW-23.

- The GETs in 2020 removed approximately 2.5 lbs of TCE, which is comparable to the removal of 2.4 lbs in 2019. The system has removed a total of 500 lbs from the saturated zone.
- The SVE system removed approximately 7.6 lbs of VOC vapor compared to 9 lbs removed in 2019. The SVE system has removed a total of approximately 76 lbs of VOCs from the unsaturated zone near the mound area since pilot test startup in 2014.

6.0 RECOMMENDATIONS AND FUTURE PLANNED ACTIVITIES

Significant remedy performance findings are summarized below.

- As reported in 2018, 2019, and 2020 (Geosyntec, et al, 2018, 2019, and 2020), water-quality restoration has been achieved in the SGA and in the Upper and Lower TSA north of Sandy Boulevard (Remedy Zone A). DEQ agreed conceptually with proceeding with a Partial Closure for these Remedy Zones (DEQ, 2018), including decommissioning of four remaining wells located in Remedy Zone A (BOP-44(ds), BOP-44(dg), BOP-44(usg), and EMC-2(dg)). The Partial No Further Action Request report was submitted to DEQ on 23 April 2020 (Landau and Geosyntec 2020). DEQ's formal approval of the partial closure request is pending.

- Decommissioning of the Upper TSA wells BOP-21(ds) and BOP-42(ds) along with the Lower TSA wells BOP-42(dg) and BOP-60(dg) was approved by DEQ (DEQ, 2020a); although they have not been scheduled for decommissioning yet.

- Decommissioning of CMW-8(dg) and CMW-10(dg) has been approved by DEQ (DEQ, 2020a). Decommissioning will be conducted once the property access agreements have been established.

- Water quality restoration has also been achieved in the western portion of the remedy (Remedy Zone B). Since 2019, VOC concentrations in Remedy Zone B wells have been below either the laboratory reporting limit or the respective MCL. Based on the Remedy Zone B VOC concentrations, the previously DEQ-approved pilot shutdown of extraction well EW-23 will commence in second quarter 2021. If TCE concentrations in EW-23 and monitoring wells remain below the MCL for 2 years (in accordance with the remedy shutdown criteria in Table 2-1), then decommissioning will be evaluated and discussed with DEQ.

- Residual TCE was detected just above the MCL during three sampling events at monitoring well CMW-26dg, prior to decommissioning after irreparable damage. TCE concentrations at this well have followed the same general trend as the remaining two Zone D wells that are now below the MCL and would likely have declined below the MCL. No replacement well for CMW-26dg is required, so closure of this Remedy Zone will be discussed with DEQ.

- Six new vapor/groundwater monitoring wells (VMW-I through VMW-N) were installed in 2020, and data from these wells collected in 2020 are included herein but will be evaluated and discussed in a separate report. These wells have been incorporated into the TSA Remedy quarterly groundwater monitoring schedule. Evaluation of these wells for potential use for soil vapor extraction or other potential remedial actions is ongoing.

6.1 Recommended Changes for Treatment Systems

The CTS continues to operate and maintain hydraulic control of the dissolved VOC plume. It is recommended to continue operation of wells EW-2 and EW-14. Pilot shutdown of EW-23 as previously approved by DEQ will begin in second quarter 2021 (DEQ, 2020a). Continued groundwater monitoring will be conducted to evaluate if resumed pumping at EW-23 is needed, per the Remedy Well Network Criteria (Table 2-1).

The SVE system has been effective at removing VOC mass from the unsaturated zone. No changes are recommended for the currently operating SVE system at this time. SVE will continue at the six wells currently operating (VW-75-95.5, VMW-C, VMW-E, VMW-F, VMW-G, and VMW-H) in 2021 or until concentrations reach asymptotic levels.

6.2 Recommend Changes to Monitoring Program and Schedule Modifications

The following monitoring program and schedule modifications are recommended for DEQ approval:

- Decommission Lower TSA well EW-15. The well is located in the far eastern portion of Remedy Zone C near the Zone D boundary. The well meets the criteria for decommissioning outlined in Table 2-1, and TCE concentrations have been below detection limits since November 2010. EW-15 is not useful for water level monitoring due to anomalous water levels.

- Decommission Lower TSA extraction well EW-8. This well is currently monitored on an annual basis and is in a redundant location for groundwater elevation and water quality monitoring. TCE concentrations at EW-8 have been less than the MCL since 2010, except one event in February 2018 when TCE concentrations were just above the MCL (5.31 ug/L). TCE concentrations in August 2018, 2019, and 2020 were well below the MCL and close to the detection limit (0.50 ug/L). The well is approximately 680 ft from the dissolved VOC plume and meets the remedy criteria for decommissioning (TCE concentrations less than the MCL for two consecutive years).

- We recommend a decrease in monitoring frequency for groundwater elevation and groundwater quality monitoring for well EW-16 (converted to monitoring status in 2017) from semi-annual to annual. EW-16 is utilized to monitor groundwater quality and groundwater elevations in Remedy Zone D. TCE concentrations at EW-16 have been below the MCL since February 2013, and this well does not provide a critical point for groundwater water elevation monitoring.

- We recommend a decrease in monitoring frequency for both groundwater elevation data and groundwater quality in Remedy Zone B wells based on VOC concentrations being consistently below the respective MCLs for two years and the distance between the specific

wells and the dissolved VOC plume. We request DEQ to approve the following, as summarized in Table 2-2:

- Reduce groundwater elevation monitoring to an annual frequency at BOP-20(ds), BOP-61(ds), BOP-61(dg), BOP-66(ds), while reducing to a biennial monitoring frequency at BOP-23(dg), BOP-62(ds), BOP-65(ds), EW-3, and EW-13.
- Reduce groundwater quality sampling to an annual frequency at BOP-61(ds, BOP-61(dg), and BOP-66(ds), while reducing to a biennial sampling frequency at wells BOP-20(ds), BOP-65(ds), and EW-13.

We request DEQ concurrence for the proposed changes to optimize the monitoring programs and remedy performance.

7.0 REFERENCES

Geosyntec, 2019b. Data Gaps Investigation Work Plan – East Multnomah County Troutdale Sandstone Aquifer Remedy (ECSI 1479) Geosyntec Project Number: PNG0564S19.

Geosyntec, 2020a. CMW-26dg Monitoring Well Rehabilitation and Decommissioning Request. 26 June 2020.

Geosyntec, 2020b. RE: Data Gaps Investigation Work Plan East Multnomah County Troutdale Sandstone Aquifer Remedy (ECSI 1479) Geosyntec Project Number: PNG0564S19. 12 March 2020.

Geosyntec, Landau Associates, and SSPA, 2018. Annual Performance Report: 1 January 2017 through 31 December 2017, Troutdale Sandstone Aquifer Remedy. 3 April 2018.

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DEQ, 2019a. Letter from K. Thiessen, DEQ Approval of Annual Performance Report for 2018 and Five-Year Remedy Performance Evaluation. East Multnomah County Troutdale Sandstone Aquifer Remedy. ECSI #1479. 3 July 2019.

DEQ, 2020a. Letter from K. Thiessen, DEQ: DEQ Approval of Annual Performance Report for 2019. East Multnomah County Troutdale Sandstone Aquifer Remedy. ECSI #1479. 11 September 2020.

DEQ, 2020b. Email from K. Thiessen, DEQ: DEQ approval of: EMC TSA Remedy, 2019 PWB Contingency Plan (ECSI #1479)

DEQ, 2020c. Letter from K. Thiessen, DEQ: DEQ Approval of CMW-26dg Monitoring Well Rehabilitation and Decommissioning Request. 11 August 2020.

DEQ, 2020d. Letter from K. Thiessen, DEQ: DEQ Approval of Data Gaps Investigation Work Plan. 3 March 2020.

Portland Water Bureau (PWB), 2021. Email from Doug Wise, PWB, to Chris Kimmel, Landau Associates, regarding SSWF operation in 2020. 03 March 2021.

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 report[1] 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.*

[1]Landau 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 2020 through 31 December 2020
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 (on)	Lower TSA	Monthly	Semiannually	Cascade
TSA Monitoring Wells				
BOP-13(ds)	Upper TSA	Quarterly	Quarterly	Boeing
BOP-13(dg)	Lower TSA	Quarterly	Quarterly	Boeing
BOP-20(ds)	Upper TSA	Semiannual to Annually PWB Monitoring	Annually to Biennial PWB Monitoring	Boeing
BOP-20(dg)	Lower TSA	Annually PWB Monitoring	Annually PWB Monitoring	Boeing
BOP-23(dg)	Lower TSA	Annually to Biennial PWB Monitoring	Biennial PWB Monitoring	Boeing
BOP-31(ds)	Upper TSA	Quarterly	Quarterly	Boeing
BOP-31(dg)	Lower TSA	Quarterly	Quarterly	Boeing
BOP-61(ds)	Upper TSA	Semiannual to Annually	Semiannual to Annually	Boeing
BOP-61(dg)	Lower TSA	Semiannual to Annually	Semiannual to Annually	Boeing
BOP-62(ds)	Upper TSA	Annually to Biennial PWB Monitoring	Biennial PWB Monitoring	Boeing
BOP-65(ds)	Upper TSA	Semiannually to Biennial PWB Monitoring	Annually to Biennial PWB Monitoring	Boeing
BOP-66(ds)	Upper TSA	Semiannual to Annually	Semiannual to Annually	Boeing
D-17(ds)	Lower TSA	Quarterly	Quarterly	Cascade
D-17(dg)	Lower TSA	Quarterly	Quarterly	Cascade
EW-3 (monitoring only)	Upper TSA	Annually to Biennial	Biennial	Boeing
EW-8 (monitoring only)	Lower TSA	Semiannually to Decommission	Annually to Decommission	Cascade
EW-11 (monitoring only)	Lower TSA	Annually	Biennial	Cascade
EW-12 (monitoring only)	Lower TSA	Semiannually	Quarterly	Cascade
EW-13 (monitoring only)	Lower TSA	Semiannual to Biennial PWB Monitoring	Annually to Biennial PWB Monitoring	Boeing
EW-15 (monitoring only)	Lower TSA	Annually to	Biennial to Deccommission	Cascade
EW-16 (monitoring only)	Lower TSA	Semiannually	Semiannually to Annually	Cascade
CMW-10(ds)	Upper TSA	Quarterly	Quarterly	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

Table 2-2
Performance Monitoring Schedule - 1 January 2020 through 31 December 2020
TSA Remedy - East Multnomah County

Well	Aquifer	Water Level Measurements	Water Quality Sampling	Responsibility
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	Quarterly	Cascade
VMW-H	Upper TSA	Quarterly	Quarterly	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	Quarterly	Cascade
VMW-M	Upper TSA	Quarterly	Quarterly	Cascade
VMW-N	Upper TSA	Quarterly	Quarterly	Cascade

NOTES:

Annual monitoring performed in August; semiannual in February and August; quarterly in February, May, August, and November. Next biennial sampling event planned for August 2021.

Recommendations for modifications to the Monitoring Schedules are indicated in red text, and wells recommended for decommissioning are also in red text and shaded green.

Pilot shutown of EW-23 was approved by DEQ in September 2020 and will commence in second quarter 2021.

Table 2-3
Significant Remedy Documents – 1 January 2020 through 31 December 2020
TSA Remedy – East Multnomah County Oregon

Date	Document Type	Author	Title	Comments
2/7/2020	Email	DEQ	DEQ approval of: EMC TSA Remedy, 2019 PWB Contingency Plan (ECSI #1479)	Approval of proposed changes to contingency groundwater monitoring during periods of active groundwater pumping by the Portland Water Bureau (PWB) at the nearby Columbia South Shore Well Field.
2/21/2020	Memorandum	Geosyntec	Data Gaps Investigation Work Plan – East Multnomah County Troutdale Sandstone Aquifer Remedy (ECSI 1479) `Geosyntec Project Number: PNG0564S19	The work plan proposes the installation of six groundwater monitoring wells that could be used in the future for SVE. The lithology/stratigraphy would be used to better understand groundwater and contaminant transport in the mound area of the Site to inform the conceptual Site model in order to target remediation. This work plan is in response to increasing TCE concentrations in the mound area.
3/12/2020	Letter	DEQ	RE: Data Gaps Investigation Work Plan East Multnomah County Troutdale Sandstone Aquifer Remedy (ECSI 1479) Geosyntec Project Number: PNG0564S19	DEQ approves the work plan for the installation of six groundwater monitoring wells that could be used in the future for SVE and the collection of geologic data.
4/23/2020	Memorandum	Landau and Geosyntec	Partial No Further Action Request East Multnomah County Troutdale Sandstone Aquifer Remedy, Zone A and SGA ECSI 1479	This document presents the basis for the Oregon DEQ's recommendation for a Partial No Further Action (NFA) determination for portions of the East Multnomah County Area Groundwater (EMC) Site. Based on successful restoration of groundwater quality in the EMC Site TSA Remedy Zone A and the underlying SGA, a Partial NFA/partial closure is recommended for these areas of the EMC Site.

Table 2-3
Significant Remedy Documents – 1 January 2020 through 31 December 2020
TSA Remedy – East Multnomah County Oregon

Date	Document Type	Author	Title	Comments
5/04/2020	Report	Geosyntec, Landau Associates, and SSPA	Annual Performance Report 1 January 2019 – 31 December 2019 East Multnomah County, Troutdale Sandstone Aquifer Remedy ECSI 1479	Annual report recommends temporary shutdown of EW-23 and continued temporary shutdown of EW-1.There are no proposed changes to the SVE system. The report proposes to decommission BOP-21(ds), BOP-42(ds), BOP-42(dg), and BOP-60(dg) and to discontinue water quality monitoring at PWB-1(uts) and PWB-1(lts).
6/26/2020	Email Letter	Geosyntec	CMW-26dg Monitoring Well Rehabilitation and Decommissioning Request East Multnomah County Troutdale Sandstone Aquifer Remediation (ECSI #1479) Fairview, Oregon	Request letter to Oregon Department of Environmental Quality (DEQ) seeking permission to decommission groundwater monitoring well CMW-26dg to irreparable damage during construction near the well.
7/3/2020	Memorandum	GSI for PWB	Peer Review of the Boeing Company and Cascade Corporation Request for a Partial No Further Action Determination at the East Multnomah County Site	GSI's peer review indicates that: (1) the RAOs for the SGA appear to have been met and therefore the SGA meets the criteria for a partial NFA, and (2) while Zone A of the TSA currently meets RAOs, there are data suggesting that Zone A of the TSA may not meet RAOs in the future because concentrations of trichloroethene (TCE) in groundwater have been steadily increasing in Zone A in recent years.
8/11/2020	Letter	DEQ	CMW-26dg Monitoring Well Rehabilitation and Decommissioning Request East Multnomah County Troutdale Sandstone Aquifer Remediation Fairview, Oregon. ECSI #1479	DEQ approval to decommission CMW-26dg due to irreparable damage during construction in the vicinity of the well. Also, no replacement well is prescribed at the time of the letter.

Table 2-3
Significant Remedy Documents – 1 January 2020 through 31 December 2020
TSA Remedy – East Multnomah County Oregon

Date	Document Type	Author	Title	Comments
8/20/20	Email	DEQ	East Multnomah County GW	DEQ preliminary comments on 2019 Annual Report and TSA Remedy Zone A Closure. Transmits PWB's comments on TSA Remedy Zone A Closure.
9/11/2020	Letter	DEQ	RE: Annual Performance Report 1 January 2019 – 31 December 2019. East Multnomah County Troutdale Sandstone Aquifer Remedy. ECSI #1479	DEQ approval of 2019 Annual Report: temporary shutdown of EW-23; continued temporary shutdown of EW-1; decommission BOP-21(ds), BOP-42(ds), BOP-42(dg), and BOP-60(dg); discontinue EMC water quality monitoring at PWB-1(uts) and PWB-1(lts) though PWB will monitor annually and plans will be made if TCE concentration approaches the MCL (5 ppb). (Note DEQ's letter references the date of the report, 5.4.20, incorrectly as 5.31.19.)

Table 3-1
Well Construction Data - 1 January 2020 through 31 December 2020
TSA Remedy - East Multnomah County

		NAD 1983 State Plane Oregon (ft)		Elevations (ft MSL)				
Well	**Aquifer Screened**	**X Coordinate**	**Y Coordinate**	**Ground Surface**	**Measuring Point**	**Top of Screen**	**Bottom of Screen**	**Depth of Boring (ft bgs)**
Extraction Wells								
EW-1 (pilot shutdown)	Lower TSA	7699560.1	689504.6	124.1	124.04	-27.8	-57.8	183
EW-2	Lower TSA	7700692.2	689205.9	126.2	126.01	-6.8	-46.8	179
EW-14	Lower TSA	7699952.7	689329.7	128.4	127.63	-21.9	-51.9	230
EW-23[3]	Lower TSA	7698806.9	690524.7	83.8	83.93	-26.2	-66.2	157
Monitoring Wells & Former Extraction Wells Approved for Monitoring Use								
BOP-13(ds)	Upper TSA	7699461.3	689388.4	126.7	128.94	9.0	-1.0	132
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	9.0	-11.0	97
BOP-20(dg)	Lower TSA	7698381.4	691042.6	78.1	77.32	-105.0	-125.0	209
BOP-23(dg)	Lower TSA	7699526.6	690832.2	75.2	76.96	-26.0	-46.0	125
BOP-31(ds)	Upper TSA	7699322.2	690090.6	97.1	99.04	17.0	7.0	91
BOP-31(dg)	Lower TSA	7699323.6	690105.1	96.5	98.51	-34.0	-54.0	154
BOP-44(ds)[2]	Upper TSA	7698995.4	691938.6	32.5	35.24	-23.0	-43.0	76
BOP-44(dg)[2]	Lower TSA	7699014.1	691938.6	32.6	35.15	-104.0	-124.0	166
BOP-61(ds)	Upper TSA	7698640.8	690240.7	96.3	94.64	6.0	-4.0	100
BOP-61(dg)	Lower TSA	7698632.5	690246.1	96.2	94.43	-60.0	-70.0	171
BOP-62(ds)	Upper TSA	7697855.5	689987.2	112.1	112.29	-42.0	-51.9	166
BOP-65(ds)	Upper TSA	7698234.0	690115.0	104.4	104.22	2.0	-8.0	113
BOP-66(ds)	Upper TSA	7698670.7	690111.4	103.3	102.97	13.0	3.0	102
D-17(ds)	Lower TSA	7699886.2	689530.7	121.9	123.28	12.0	2.0	121
D-17(dg)	Lower TSA	7699869.5	689532.2	121.8	124.61	-30.0	-50.0	178
EMC-2(dg)[2]	Lower TSA	7701014.5	692008.0	44.8	43.51	-75.0	-85.0	140
EW-3	Upper TSA	7697737.4	690313.3	97.1	94.26	-77.9	-102.9	205
EW-8	Lower TSA	7699521.9	690435.9	77.3	77.16	6.8	-33.2	163
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	234
EW-15	Lower TSA	7701759.5	689205.3	116.7	116.21	-27.3	-57.3	186
EW-16	Lower TSA	7702424.1	689665.5	84.2	83.71	-40.3	-80.3	198
CMW-8(dg)[2]	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	21.0	6.0	135
CMW-10(dg)[2]	Lower TSA	7700589.4	688923.9	135.3	135.05	-53.0	-68.0	210
CMW-14R(ds)	Lower TSA	7700852.9	689866.6	83.9	83.48	29.0	9.0	76
CMW-17(ds)	Upper TSA	7700547.4	689425.5	120.0	121.89	24.0	14.0	110
CMW-18(ds)	Upper TSA	7700889.2	689267.3	118.2	117.66	16.0	6.0	118
CMW-19(ds)	Upper TSA	7700297.2	688642.8	144.3	144.08	10.0	0.0	170
CMW-20(ds)	Upper TSA	7699683.6	688990.1	150.5	152.72	6.0	-4.0	158
CMW-22(dg)	Lower TSA	7701545.4	689850.7	82.1	81.65	-42.0	-52.0	142
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	-34.0	-44.0	131
CMW-26(dg)	Lower TSA	7703189.8	689303.5	106.3	108.98	-59.0	-69.0	238
CMW-36(dg)	Lower TSA	7701389.7	690792.4	79.1	78.84	-31.0	-41.0	162
PWB-1(lts)	Lower TSA	7700352.3	692604.8	14.0	16.48	-98.0	-118.0	134
PWB-1(uts)	Upper TSA	7700344.1	692612.1	13.9	15.98	-51.0	-71.0	86
BOP-44(usg)2[2]	SGA	7698996.3	691888.8	24.6	34.25	-181.0	-191.0	219

Table 3-1
Well Construction Data - 1 January 2020 through 31 December 2020
TSA Remedy - East Multnomah County

		NAD 1983 State Plane Oregon (ft)		Elevations (ft MSL)				
Well	**Aquifer Screened**	**X Coordinate**	**Y Coordinate**	**Ground Surface**	**Measuring Point**	**Top of Screen**	**Bottom of Screen**	**Depth of Boring (ft bgs)**
Soil Vapor and Groundwater Monitoring Wells								
VW-75d-95.5	Upper TSA-Vapor only	7700536.9	689410.4	120.0	-------	*44.5*	*24.5*	130
VMW-A	Upper TSA + Vapor	7700436.7	689423.9	121.0	-------	34.5	14.5	114
VMW-B	Upper TSA + Vapor	7700630.8	689380.7	120.7	-------	36.2	16.2	111
VMW-C	Upper TSA + Vapor	7700339.8	689398.9	122.0	-------	34.5	14.5	110
VMW-D	Upper TSA + Vapor	7700693.2	689302.0	120.6	-------	33.1	13.1	110
VMW-E*	Upper TSA + Vapor	7700720.3	689167.7	130.6	-------	30.7	9.49	171
VMW-F*	Upper TSA + Vapor	7700742.7	689252.3	126.4	-------	32.5	11.28	163
VMW-G*	Upper TSA + Vapor	7700722.3	689335.1	121.9	-------	30.05	8.83	160
VMW-H	Upper TSA + Vapor	7700240.9	689484.6	124.1	-------	37.76	17.76	106

NOTES:

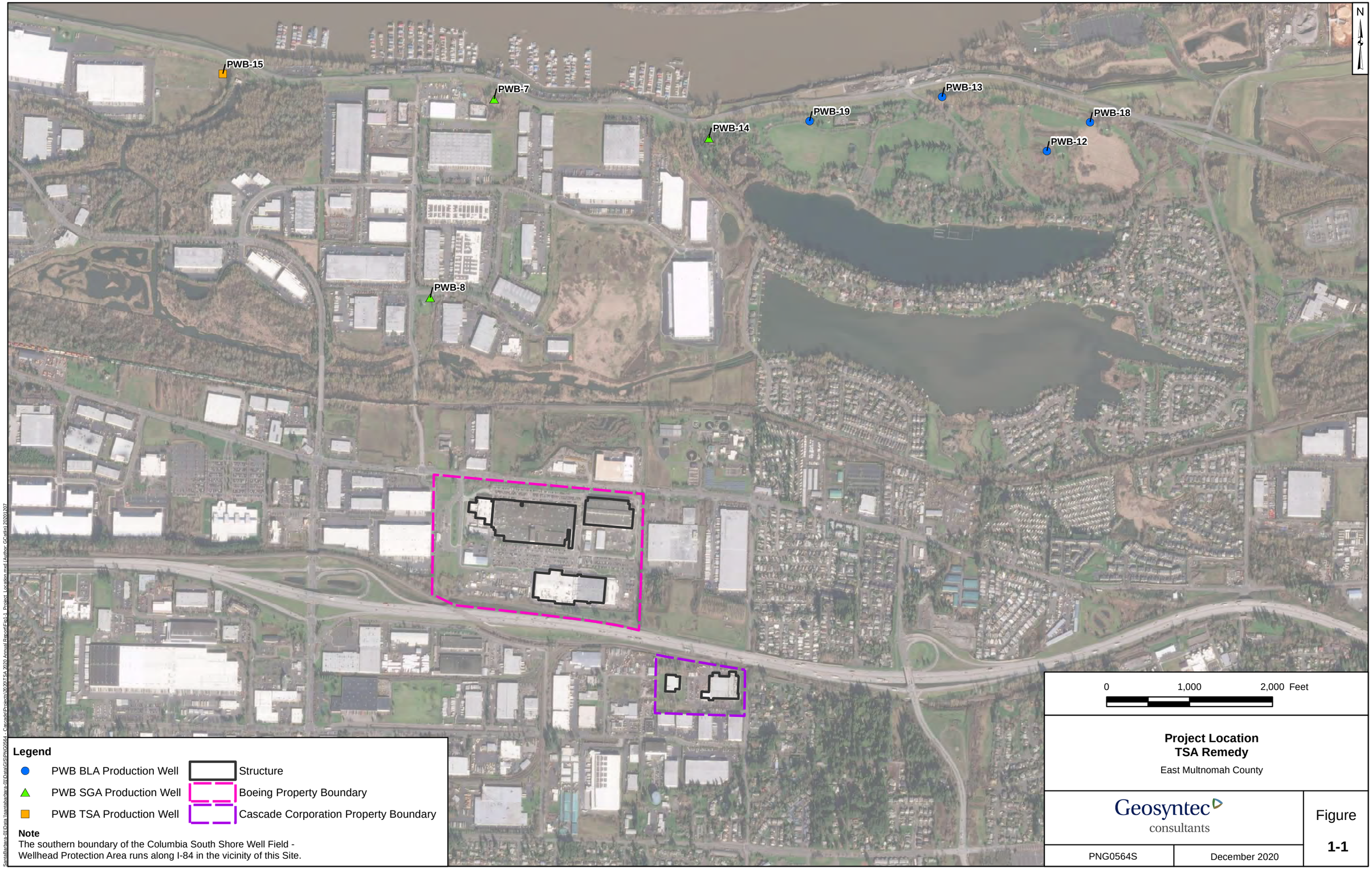
1. Monitoring wells indicated in red text were recommended for sampling frequency modifications (Table 2-2). Wells indicated in red text and green shading are recommended for decommissioning. Wells indicated in black text and green shading were previously approved for decommissioning but have not yet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

2. DEQ-approved monitoring wells pending decommissioning.

3. EW-23 was approved for pilot shutdown in September 2020.

ft = feet
MSL = mean sea level
bgs = below ground surface
*Angled well

FIGURES



Legend

- PWB BLA Production Well
- PWB SGA Production Well
- PWB TSA Production Well
- Structure
- Boeing Property Boundary
- Cascade Corporation Property Boundary

Note
The southern boundary of the Columbia South Shore Well Field - Wellhead Protection Area runs along I-84 in the vicinity of this Site.

0 1,000 2,000 Feet

Project Location
TSA Remedy
East Multnomah County

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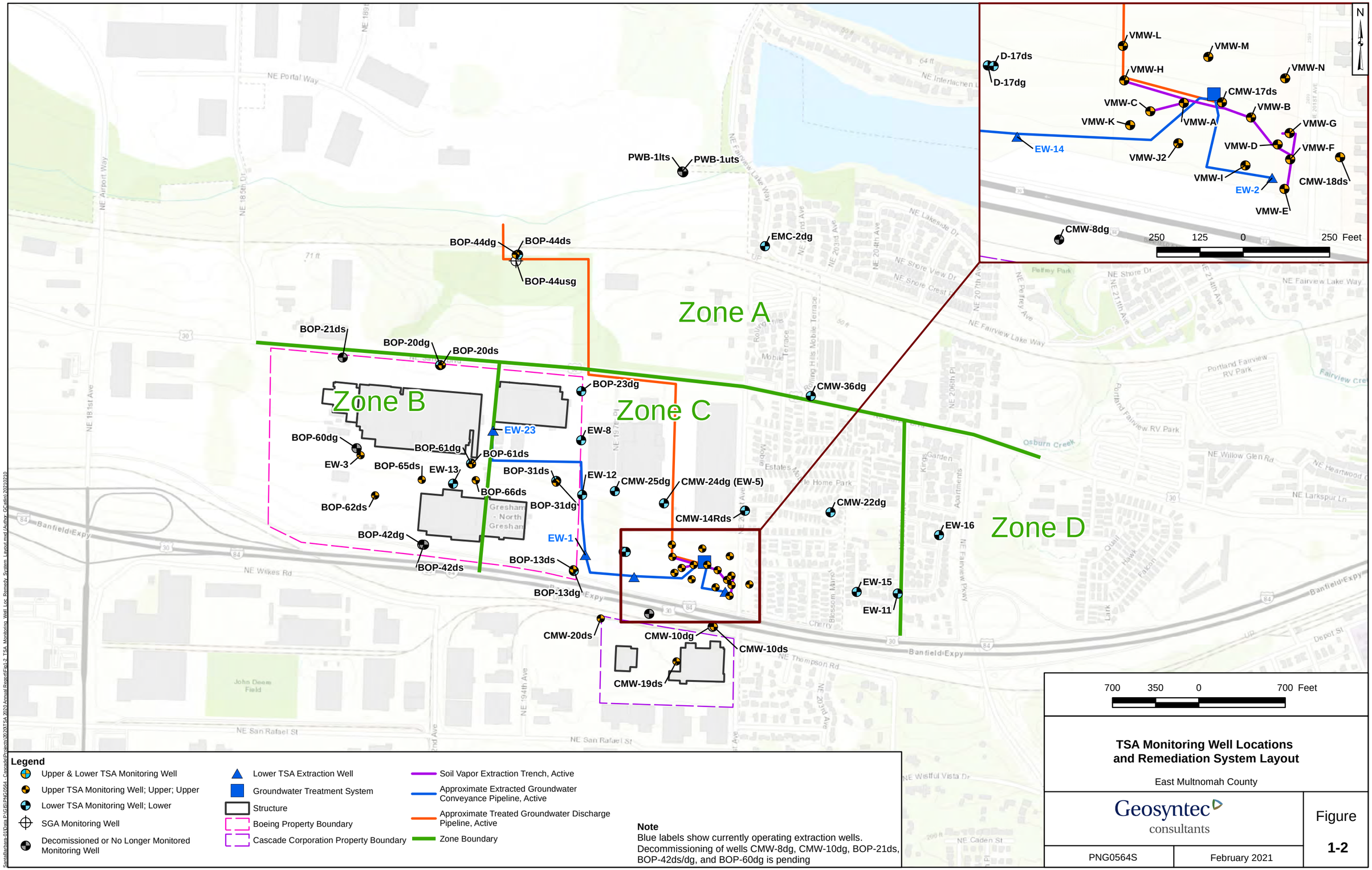
PNG0564S | December 2020

Figure **1-1**

SantaBarbara-01\Data \\santabarbara-01\Data\GIS\PNG0564 - Cascade\Projects\2020\TSA 2020 Annual Report\Fig1-1 Project_Location.mxd (Author: GCatlin) 20201207



Legend

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

Note
Blue labels show currently operating extraction wells.
Decommissioning of wells CMW-8dg, CMW-10dg, BOP-21ds, BOP-42ds/dg, and BOP-60dg is pending

TSA Monitoring Well Locations and Remediation System Layout

East Multnomah County

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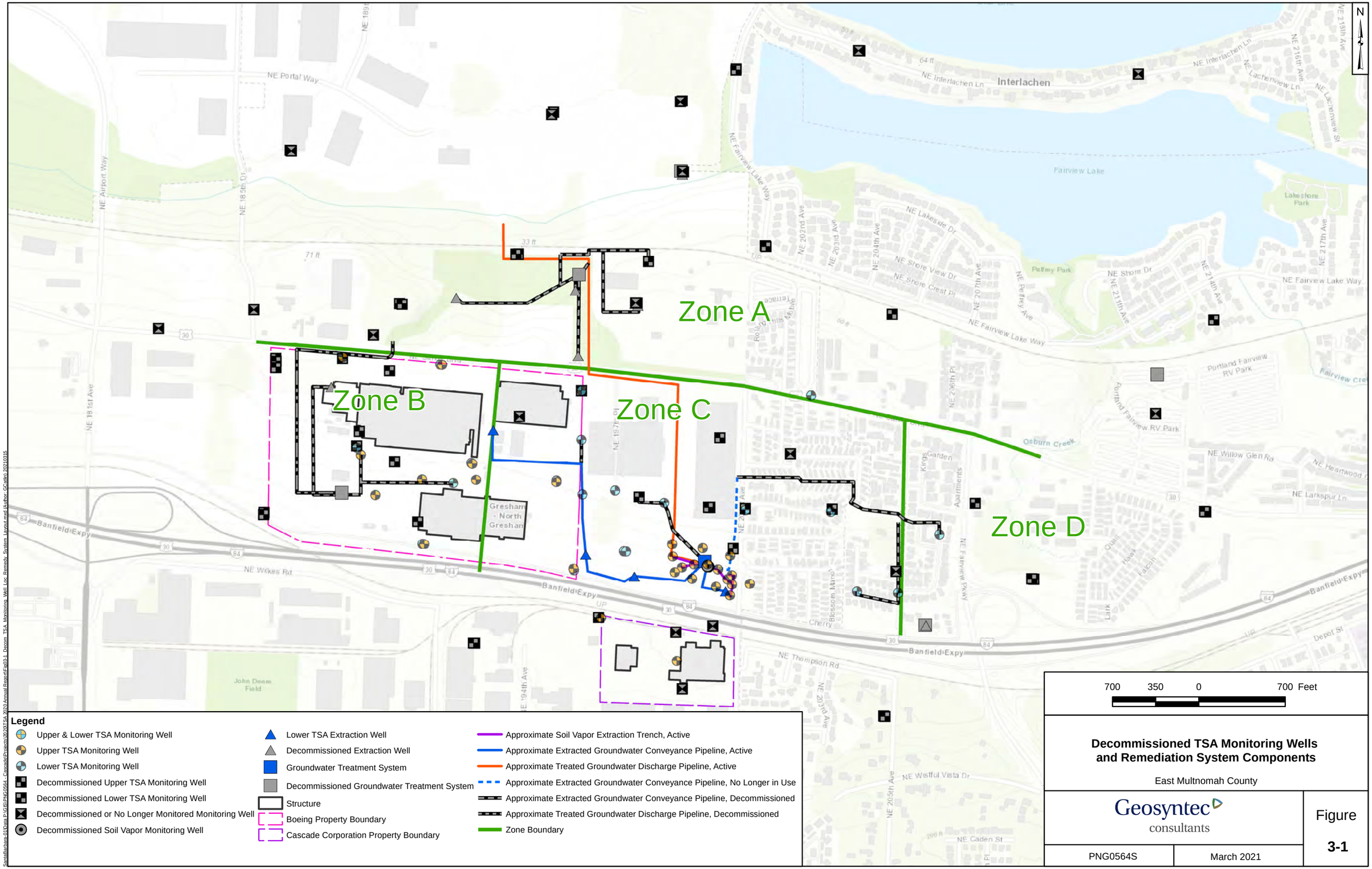
Figure 1-2



Legend

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

Decommissioned TSA Monitoring Wells and Remediation System Components

East Multnomah County

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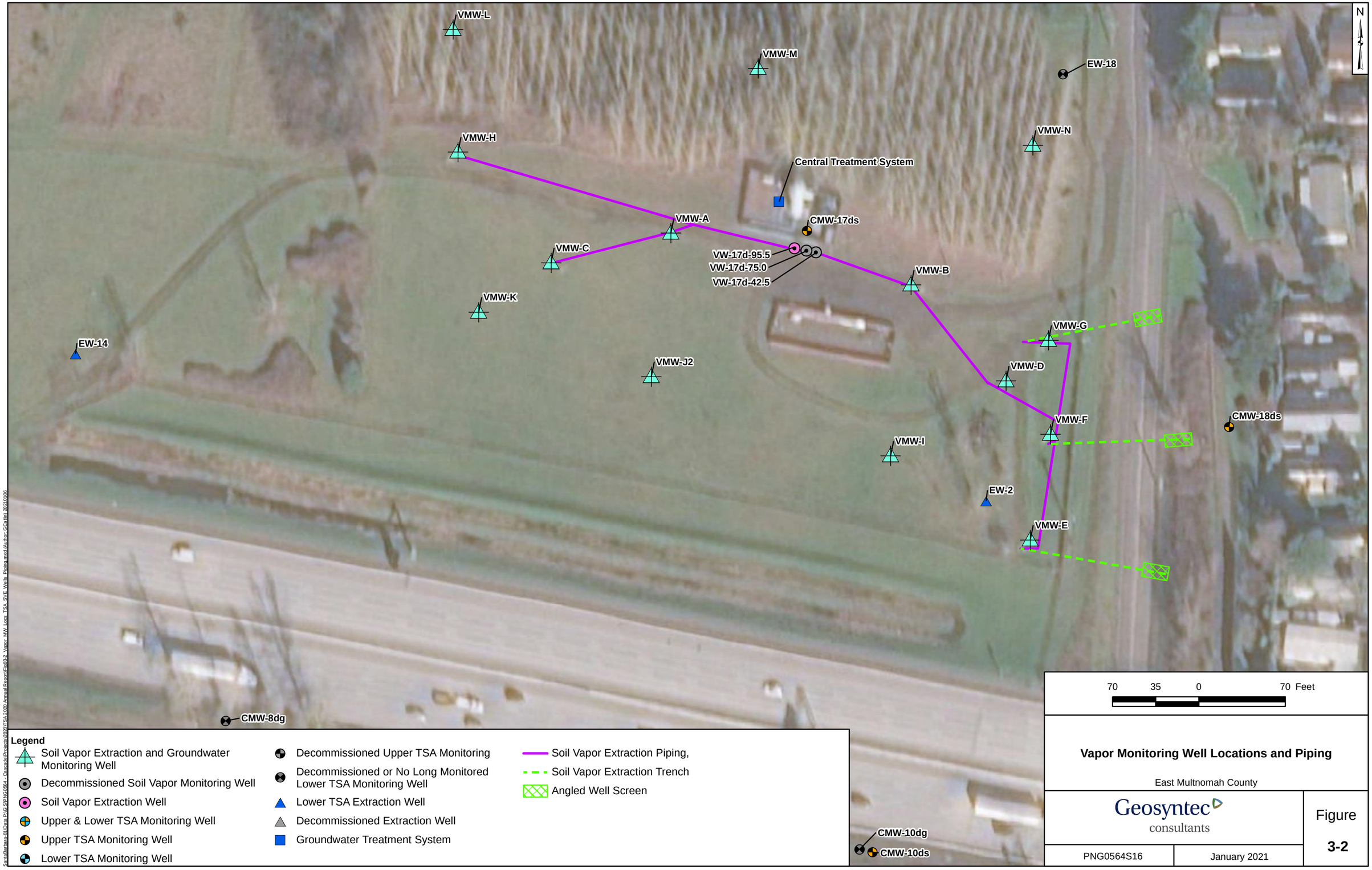
Figure **3-1**

S:\SeattleBarbara-01\Data P:\GIS\PNG0564 - Cascade\Projects\2020\TSA 2020 Annual Report\Fig03-1 Decom TSA Monitoring Well Loc Remedy System Layout.mxd (Author: GCatlin) 20210315



Legend

- Soil Vapor Extraction and Groundwater Monitoring Well
- Decommissioned Soil Vapor Monitoring Well
- Soil Vapor Extraction Well
- Upper & Lower TSA Monitoring Well
- Upper TSA Monitoring Well
- Lower TSA Monitoring Well
- Decommissioned Upper TSA Monitoring
- Decommissioned or No Long Monitored Lower TSA Monitoring Well
- Lower TSA Extraction Well
- Decommissioned Extraction Well
- Groundwater Treatment System
- Soil Vapor Extraction Piping,
- Soil Vapor Extraction Trench
- Angled Well Screen

Vapor Monitoring Well Locations and Piping

East Multnomah County

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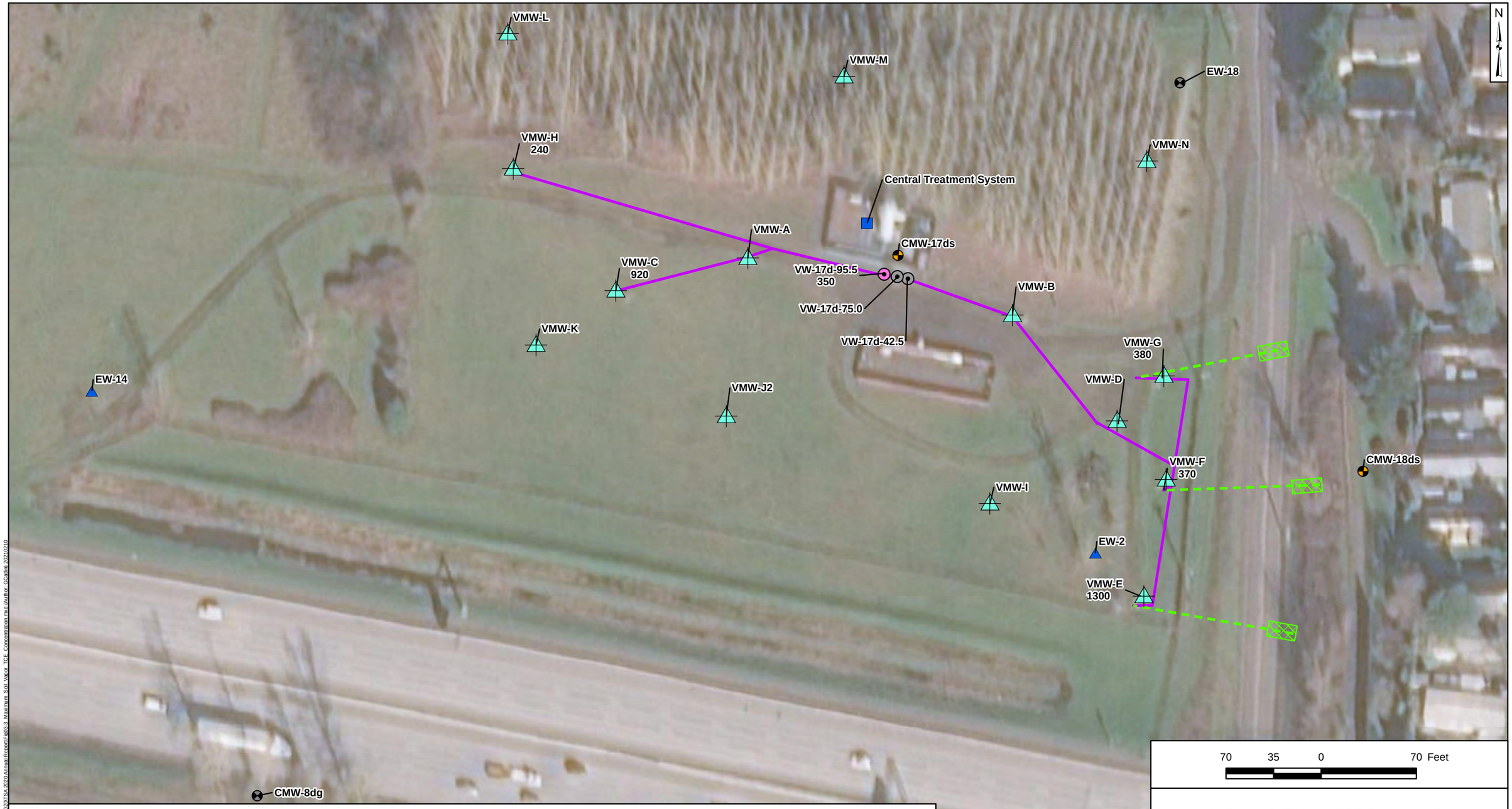
PNG0564S16 | January 2021

Figure **3-2**



Legend

- Soil Vapor Extraction and Groundwater Monitoring Well
- Decommissioned Soil Vapor Monitoring Well
- Soil Vapor Extraction Well
- Upper & Lower TSA Monitoring Well
- Upper TSA Monitoring Well
- Lower TSA Monitoring Well
- Decommissioned Upper TSA Monitoring Well
- Decommissioned or No Long Monitored Lower TSA Monitoring Well
- Lower TSA Extraction Well
- Decommissioned Extraction Well
- Groundwater Treatment System
- Soil Vapor Extraction Piping, Active
- Soil Vapor Extraction Trench
- Angled Well Screen

Notes

VMW-H = Soil Vapor Monitoring Well Location ID
240 = TCE Concentration ($\mu g/m^3$)

70 35 0 70 Feet

Maximum Soil Vapor TCE Concentration 2020

East Multnomah County

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Figure 3-3

S:\antaBarbara-01\Data P:\GIS\PNG0564 - Cascade\Projects\2020\TSA 2020 Annual Report\Fig03-3 Maximum Soil Vapor TCE Concentration.mxd (Author: GCadle) 20210210

BOP-20ds
11.99

BOP-61ds
9.69

BOP-66ds
11.30

BOP-31ds
11.48

BOP-13ds
9.31

VMW-C
19.86

VMW-A
18.62

CMW-17ds
18.08

VMW-H
23.08

VMW-B
23.36

VMW-D
27.61

CMW-18ds
14.03

CMW-10ds
11.62

CMW-19ds
10.27

12

10

14

16

18

20

22

24

64 ft

33 ft

71 ft

59 ft

NE Portal Way
NE Airport Way
NE 185th Dr
NE 181st Ave
NE Fairview Lake Way
NE Interlachen Ln
Interlachen
Fairview Lake
NE 202nd Ave
NE 203rd Ave
NE 204th Ave
NE Lakeside Dr
NE Shore Crest Pl
NE 205th Ave
NE Pelfrey Ave
Pelfrey Park
NE Shore Dr
NE 211th Ave
NE Fairview Lake Way
NE Sandy Blvd
NE 206th Pl
NE 197th Pl
Portland Fairview RV Park
Osburn Creek
Kings Garden Apartments
NE 205th Ave
Fairview Pkwy
Quail Hawk Falcon
Lark
Gresham - North Gresham
Banfield Expy
NE Wilkes Rd
NE 194th Ave
NE 192nd Ave
NE San Rafael St
NE 201st Ave
NE Thompson Rd
Cherry Blossom Manor
UP
30
84

N

600 300 0 600 Feet

Legend

- Upper TSA Monitoring Well
- Upper TSA Groundwater Elevation (ft. AMSL)
- Inferred Upper TSA Groundwater Elevation (ft. AMSL)
- Unsaturated Area
- Structure
- Boeing Property Boundary
- Cascade Corporation Property Boundary

Notes
CMW-17ds = Monitoring Well Location ID
18.08 = Groundwater Elevation (ft. AMSL)

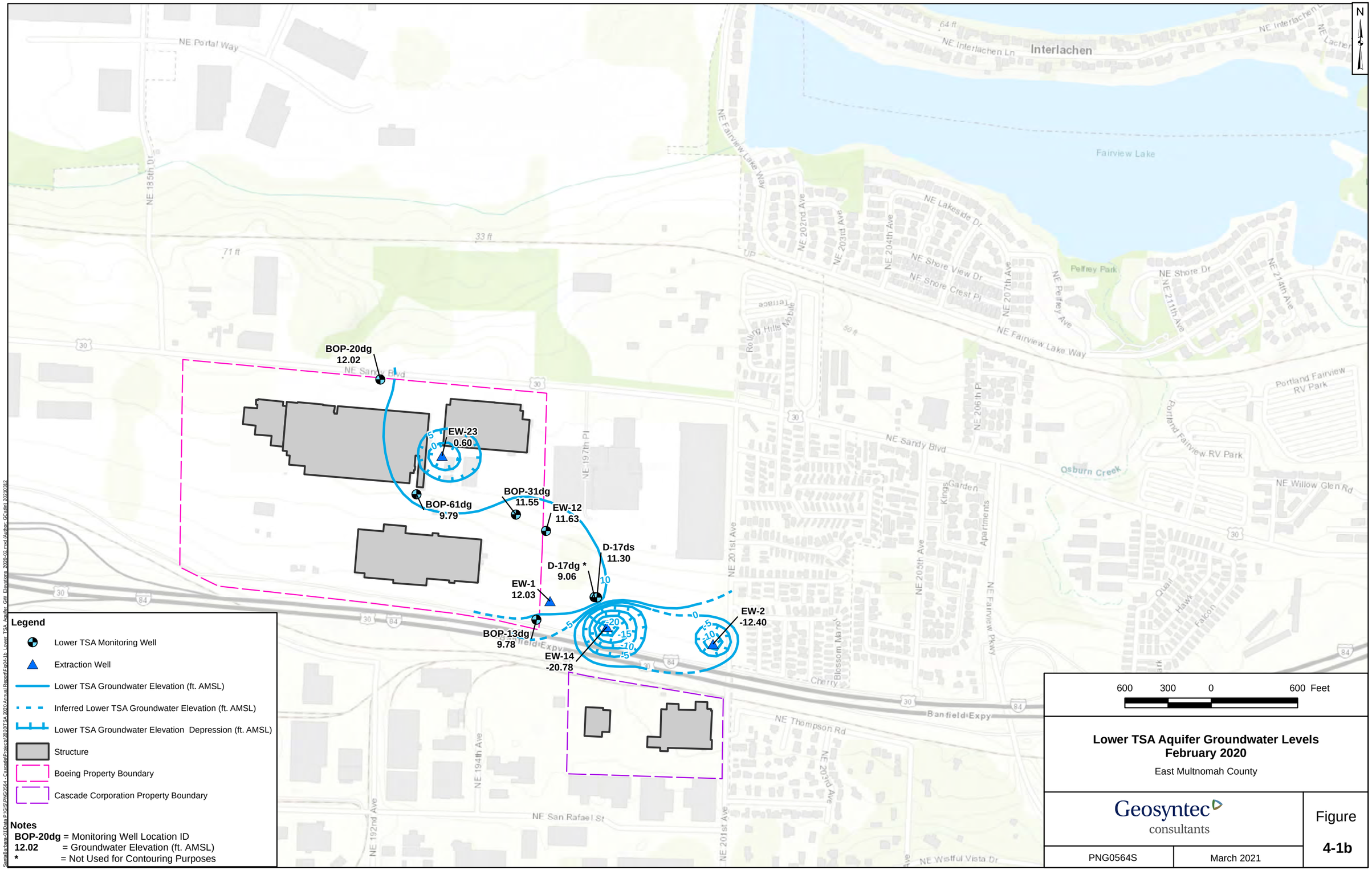
Upper TSA Aquifer Groundwater Levels February 2020

East Multnomah County

Geosyntec consultants

PNG0564S | March 2021

Figure **4-1a**



Lower TSA Aquifer Groundwater Levels
February 2020

East Multnomah County

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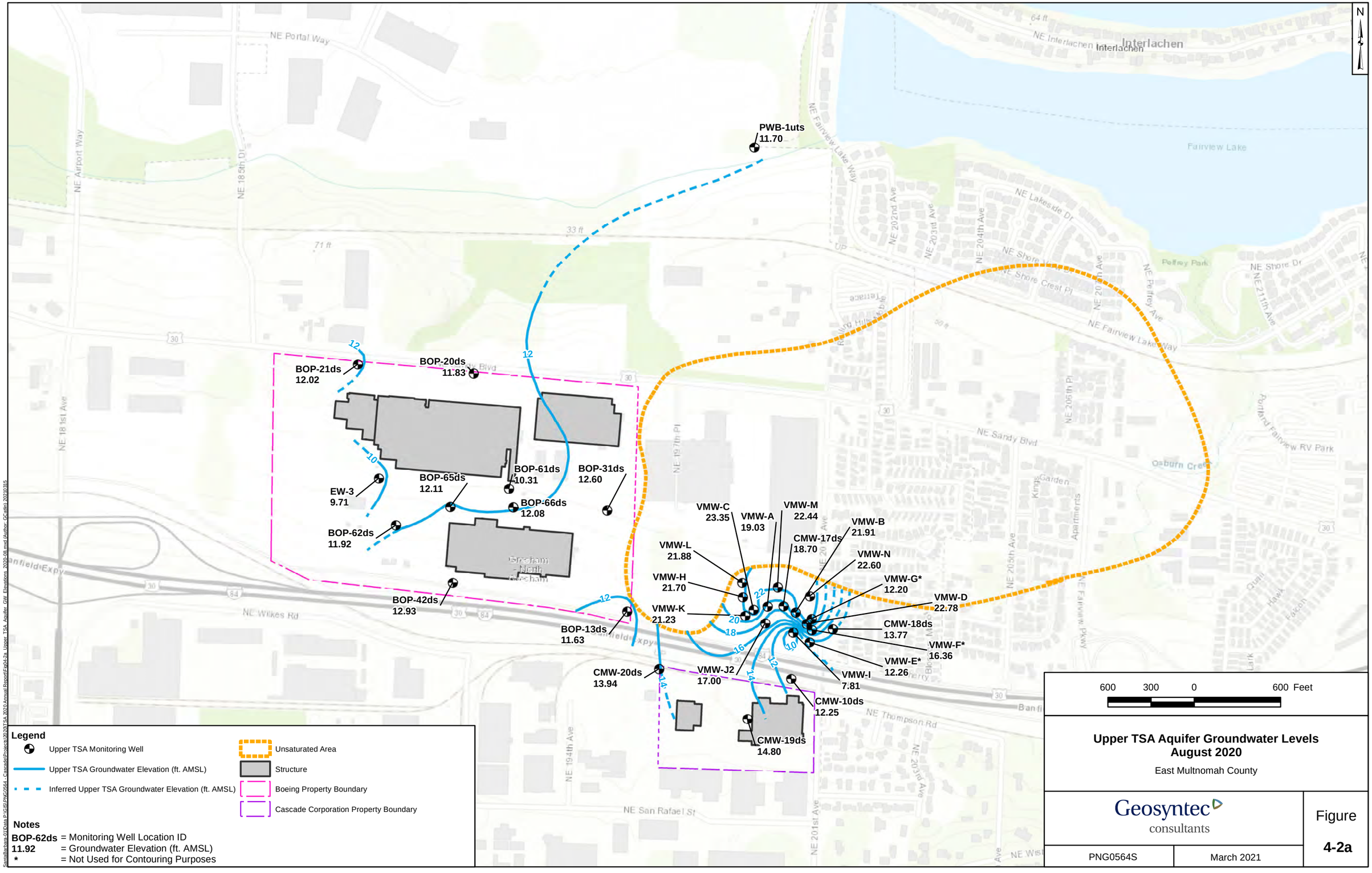
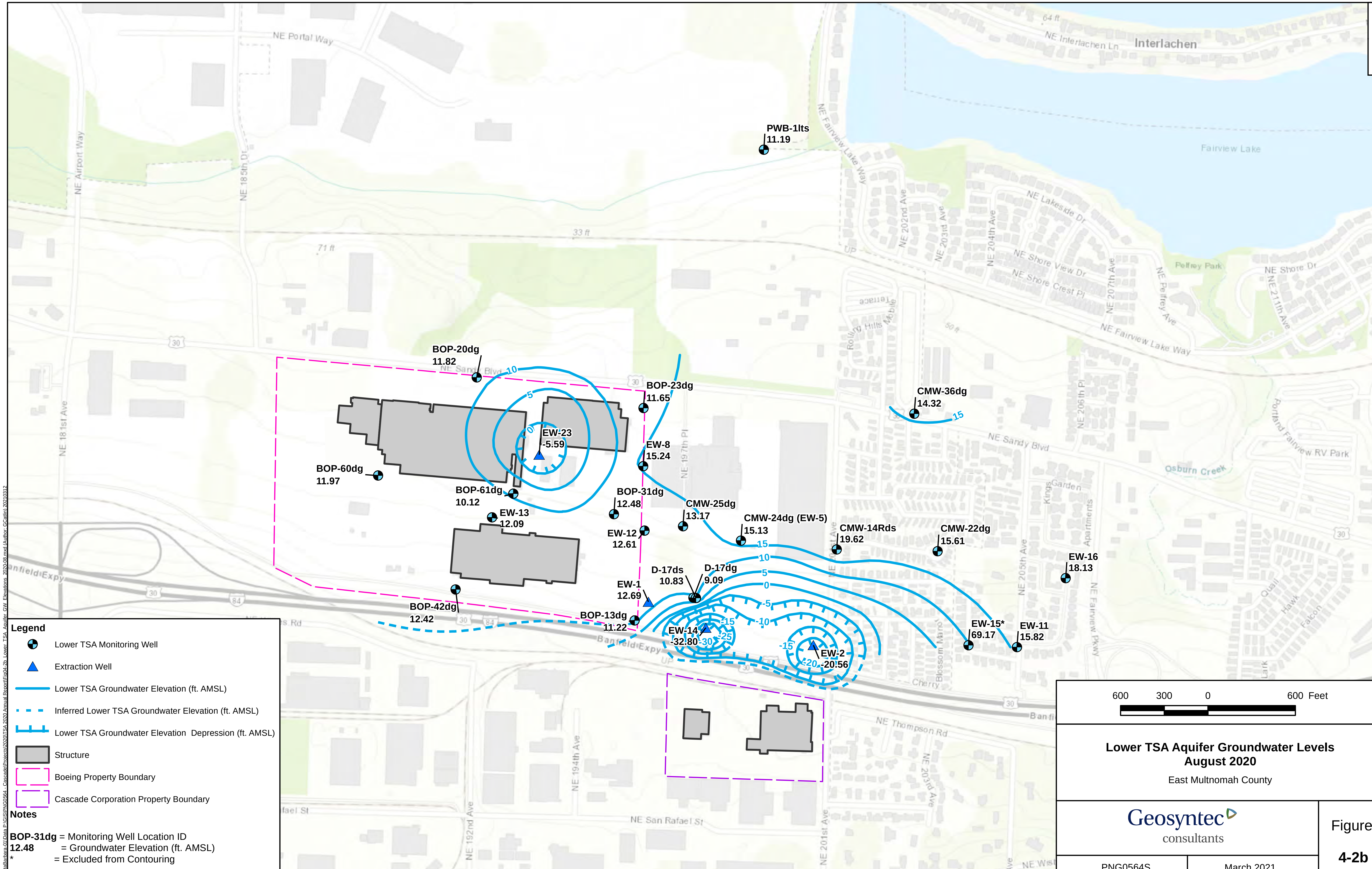
PNG0564S | March 2021

Figure **4-1b**



SantaBarbara:01Data P:\GIS\PNG0564 - Cascade\Projects\2020\TSA 2020 Annual Report\Fig04-2a Upper TSA Aquifer GW Elevations 2020-08.mxd (Author: GCallin) 20210315



N
NE Portal Way
NE Interlachen Ln
Interlachen
64 ft
Fairview Lake
PWB-1lts
11.19
NE Airport Way
NE 185th Dr
NE Fairview Lake Way
33 ft
71 ft
NE 202nd Ave
NE 203rd Ave
NE 204th Ave
NE Lakeside Dr
NE Shore View Dr
NE Shore Crest Pl
NE 207th Ave
NE Pelfrey Ave
Pelfrey Park
NE Shore Dr
NE 211th Ave
Rolling Hills Mobile Terrace
50 ft
NE Fairview Lake Way
BOP-20dg
11.82
NE Sandy Blvd
BOP-23dg
11.65
CMW-36dg
14.32
NE 181st Ave
EW-23
-5.59
EW-8
15.24
NE 197th Pl
NE Sandy Blvd
NE 206th Pl
Portland Fairview RV Park
Osburn Creek
BOP-60dg
11.97
BOP-61dg
10.12
BOP-31dg
12.48
CMW-25dg
13.17
Kings Garden Apartments
EW-13
12.09
CMW-24dg (EW-5)
15.13
EW-12
12.61
CMW-14Rds
19.62
CMW-22dg
15.61
EW-16
18.13
NE 205th Ave
NE Fairview Pkwy
D-17ds
10.83
D-17dg
9.09
EW-1
12.69
BOP-42dg
12.42
BOP-13dg
11.22
EW-14
-32.80
EW-2
-20.56
EW-15*
69.17
EW-11
15.82
Blossom Manor
Banfield Expy
NE Thompson Rd
NE 203rd Ave
NE 194th Ave
NE 192nd Ave
NE San Rafael St
NE 201st Ave
10
5
0
15
-5
-10
-15
-20
-25
-30

Legend

- Lower TSA Monitoring Well
- Extraction Well
- Lower TSA Groundwater Elevation (ft. AMSL)
- Inferred Lower TSA Groundwater Elevation (ft. AMSL)
- Lower TSA Groundwater Elevation Depression (ft. AMSL)
- Structure
- Boeing Property Boundary
- Cascade Corporation Property Boundary

Notes

BOP-31dg = Monitoring Well Location ID
12.48 = Groundwater Elevation (ft. AMSL)
* = Excluded from Contouring

600 300 0 600 Feet

Lower TSA Aquifer Groundwater Levels August 2020

East Multnomah County

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PNG0564S | March 2021

Figure **4-2b**

BOP-61ds
3:8

BOP-66ds
1.8

BOP-31ds
< 0.20

BOP-13ds
2.3

VMW-C
11.3

VMW-A
5.76

CMW-17ds
51.8

VMW-B
25.2

VMW-H
< 0.50

VMW-G
7.14

CMW-18ds
81.3

VMW-D
1.30

VMW-E
42.5

VMW-F
2.67

CMW-20ds
< 0.500

CMW-19ds
2.81

CMW-10ds
14.2

65
45
25
25
5

Legend

- Upper TSA Monitoring Well
- Upper TSA Trichloroethene Contour (µg/L)
- Inferred Upper TSA Trichloroethene Contour (µg/L)
- Unsaturated Area
- Structure
- Boeing Property Boundary
- Cascade Corporation Property Boundary

Notes

CMW-18ds = Monitoring Well Location ID
81.3 = TCE Concentration (µg/L)

Maximum values are reported for locations with field duplicates and/or multiple depths.
If analyte was not detected, the minimum reporting limit was shown.

N

500 250 0 500 Feet

Upper TSA Aquifer Trichloroethene Concentrations February 2020

East Multnomah County

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PNG0564S | April 2021

Figure **5-1a**

SantaBarbara-01\Data P:\GIS\PNG\0564 - Cascade\Projects\2020\TSA 2020 Annual Report\Fig5-1a Upper TSA Aquifer TCE Contours 2020-02.mxd (Author: GCollin) 21010409

EW-23
1.74

BOP-61dg
0.60

BOP-31dg
3.0

EW-12
1.85

CMW-25dg
< 0.500

CMW-24dg (EW-5)
< 0.500

CMW-14Rds
< 0.500

EW-16
< 0.500

D-17ds
50.8

EW-1
< 0.500

BOP-13dg
0.40

D-17dg*
0.748

EW-14
7.74

EW-2
13.3

25

5

Legend

- Lower TSA Monitoring Well
- Extraction Well
- Decomissioned or No Longer Monitored Monitoring Well
- Lower TSA Trichloroethene Contour (µg/L)
- Inferred Lower TSA Trichloroethene Contour (µg/L)
- Structure
- Boeing Property Boundary
- Cascade Corporation Property Boundary

Notes

D-17dg = Monitoring Well Location ID
0.748 = TCE Concentration (µg/L)
(U) = Upper interval at long screened well location
(L) = Lower interval at long screened well location

Maximum values are reported for locations with field duplicates and/or multiple depths.
If analyte was not detected, the minimum reporting limit was shown.
*D-17dg value not used in contouring due to the greater D-17ds concentration.

N

500 250 0 500 Feet

Lower TSA Aquifer Trichloroethene Concentrations February 2020

East Multnomah County

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PNG0564S | April 2021

Figure **5-1b**

SantaBarbara-01\Data P:\GIS\PNG0564 - Cascade\Projects\2020\TSA 2020 Annual Report\Fig5-1b_Lower_TSA_Aquifer_TCE_Contours_2020-02.mxd (Author: GCallin) 2021/04/09

BOP-20ds
< 0.20

EW-3
< 0.20

BOP-61ds
3.2

BOP-65ds
0.23

BOP-62ds
1.00

BOP-66ds
0.71

BOP-31ds
< 0.20

BOP-13ds
2.0

VMW-L
< 0.500

VMW-M
14.2

CMW-17ds
48.4

VMW-A
5.09

VMW-C
5.85

VMW-B
18.7

VMW-N
19.3

VMW-H
0.619

VMW-G
4.79

VMW-K
1.26

VMW-D
7.86

VMW-J2
58.9

CMW-18ds
96.6

VMW-F
< 0.500

CMW-20ds
< 0.500

VMW-E
34.5

VMW-I
53.9

CMW-19ds
1.29

CMW-10ds
13.2

45

25

5

N

500 250 0 500 Feet

Legend

- Upper TSA Monitoring Well
- Upper TSA Trichloroethene Countour (µg/L)
- Inferred Upper TSA Trichloroethene Countour (µg/L)
- Unsaturated Area
- Structure
- Boeing Property Boundary
- Cascade Corporation Property Boundary

Notes

CMW-10ds = Monitoring Well Location ID
13.2 = TCE Concentration (µg/L)

Maximum values are reported for locations with field duplicates and/or multiple depths.
If analyte was not detected, the minimum reporting limit was shown.

Upper TSA Aquifer Trichloroethene Concentrations August 2020

East Multnomah County

Geosyntec consultants

PNG0564S | April 2021

Figure **5-2a**

BOP-23dg
1.0

EW-23
1.71

EW-8
1.41

BOP-61dg
3.7

EW-13
0.75

BOP-31dg
2.9

CMW-25dg
< 0.500

CMW-24dg
(EW-5)
< 0.500

EW-12
2.21

D-17ds
40.7

EW-1
< 0.500

D-17dg
4.38

BOP-13dg
0.39

EW-14
6.54

EW-2
11.0

CMW-36dg
< 0.500

CMW-14Rds
< 0.500

CMW-22dg
< 0.500

EW-16
< 0.500

5

25

40

N

Legend

- Lower TSA Monitoring Well
- Extraction Well
- Decomissioned or No Longer Monitored Monitoring Well
- Lower TSA Trichloroethene Countour (µg/L)
- Inferred Upper TSA Trichloroethene Countour (µg/L)
- Structure
- Boeing Property Boundary
- Cascade Corporation Property Boundary

Notes

D-17dg = Monitoring Well Location ID
4.38 = TCE Concentration (µg/L)
(U) = Upper interval at long screened well location
(L) = Lower interval at long screened well location

Maximum values are reported for locations with field duplicates and/or multiple depths.
If analyte was not detected, the minimum reporting limit was shown.
*D-17dg value not used in contouring due to the greater D-17ds concentration.

500 250 0 500 Feet

Lower TSA Aquifer Trichloroethene Concentrations August 2020

East Multnomah County

Geosyntec consultants

Figure **5-2b**

PNG0564S | April 2021

SantaBarbara-01\Data P:\GIS\PNG\0564 - Cascade\Projects\2020\TSA 2020 Annual Report\Fig5-2b Lower TSA Aquifer TCE Contours 2020-08.mxd (Author: GCallin) 20210409

APPENDIX A
Extraction Rates

Table A-1
TSA Extraction Rates 1 January 2020 through 31 December 2020 and
12-Month Averages through 31 December 2020
East Multnomah County TSA Remedy

Zone	12-Mo. Avg.	01/2020	02/2020	03/2020	04/2020	05/2020	06/2020	07/2020	08/2020	09/2020	10/2020	11/2020	12/2020
Zone B	**31**	**31**	**33**	**33**	**34**	**34**	**33**	**31**	**29**	**29**	**29**	**22**	**30**
EW-23	*31*	*31*	*33*	*33*	*34*	*34*	*33*	*31*	*29*	*29*	*29*	*22*	*30*
Zone C	**54**	**57**	**60**	**60**	**62**	**63**	**63**	**62**	**52**	**48**	**48**	**39**	**38**
EW-2	*30*	*35*	*38*	*38*	*38*	*38*	*37*	*35*	*22*	*17*	*21*	*21*	*20*
EW-14	*24*	*22*	*22*	*22*	*23*	*25*	*26*	*27*	*29*	*30*	*26*	*18*	*18*
Total Avg Flow TSA	**85**	**88**	**93**	**93**	**95**	**97**	**96**	**93**	**81**	**77**	**77**	**61**	**68**

NOTES:

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

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

Table A-2
Discharge Monitoring Summary - Cental Treatment System
1 January 2020 through 31 December 2020
East Multnomah County TSA Remedy

Parameter	Discharge Limitations[a]	Unit	Sample Date	System Discharge			Number of Exceedances	Sample Frequency
				Min	Avg	Max		
Jan-20								
pH	6.0 – 9.0	su	—	7.45	7.74	7.88	0	Weekly
Temperature	—	ºF	—	59	60	60	—	Weekly
Flow[#]	—	gpm	—	--	88	--	—	Daily
Feb-20								
Trichloroethene	5.0	µg/L	2/5/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
1,1-Dichloroethene	7.0	µg/L	2/5/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
cis-1,2-Dichloroethene	70	µg/L	2/5/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
Tetrachloroethene	5.0	µg/L	2/5/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
Vinyl Chloride	2.0	µg/L	2/5/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
pH	6.0 – 9.0	su	—	7.86	7.87	7.88	0	Weekly
Temperature	—	ºF	—	60	60	61	—	Weekly
Flow[#]	—	gpm	—	--	93	--	—	Daily
Mar-20								
pH	6.0 – 9.0	su	—	7.65	7.78	7.89	0	Weekly
Temperature	—	ºF	—	57	59	61	—	Weekly
Flow[#]	—	gpm	—	--	93	--	—	Daily
Apr-20								
pH	6.0 – 9.0	su	—	7.82	7.88	7.98	0	Weekly
Temperature	—	ºF	—	55	58	59	—	Weekly
Flow[#]	—	gpm	—	--	95	--	—	Daily
May-20								
Trichloroethene	5.0	µg/L	5/5/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
1,1-Dichloroethene	7.0	µg/L	5/5/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
cis-1,2-Dichloroethene	70	µg/L	5/5/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
Tetrachloroethene	5.0	µg/L	5/5/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
Vinyl Chloride	2.0	µg/L	5/5/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
pH	6.0 – 9.0	su	—	7.82	7.86	7.91	0	Weekly
Temperature	—	ºF	—	59	59	60	—	Weekly
Flow[#]	—	gpm	—	--	97	--	—	Daily
Jun-20								
pH	6.0 – 9.0	su	—	7.82	7.86	7.89	0	Weekly
Temperature	—	ºF	—	59	60	64	—	Weekly
Flow[#]	—	gpm	—	--	96	--	—	Daily
Jul-20								
pH	6.0 – 9.0	su	—	7.70	7.82	7.92	0	Weekly
Temperature	—	ºF	—	60	61	63	—	Weekly
Flow[#]	—	gpm	—	--	93	--	—	Daily
Aug-20								
Trichloroethene	5.0	µg/L	8/4/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
1,1-Dichloroethene	7.0	µg/L	8/4/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
cis-1,2-Dichloroethene	70	µg/L	8/4/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
Tetrachloroethene	5.0	µg/L	8/4/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
Vinyl Chloride	2.0	µg/L	8/4/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
pH	6.0 – 9.0	su	—	7.11	7.72	8.01	0	Weekly
Temperature	—	ºF	—	60	63	68	—	Weekly
Flow[#]	—	gpm	—	--	81	--	—	Daily

Table A-2
Discharge Monitoring Summary - Cental Treatment System
1 January 2020 through 31 December 2020
East Multnomah County TSA Remedy

Parameter	Discharge Limitations[a]	Unit	Sample Date	System Discharge			Number of Exceedances	Sample Frequency
				Min	Avg	Max		
Sep-20								
pH	6.0 – 9.0	su	—	7.25	7.58	7.90	0	Weekly
Temperature	—	ºF	—	60	62	65	—	Weekly
Flow	—	gpm	—	--	77	--	—	Daily
Oct-20								
pH	6.0 – 9.0	su	—	7.55	7.76	8.04	0	Weekly
Temperature	—	ºF	—	52	59	64	—	Weekly
Flow[#]	—	gpm	—	--	77	--	—	Daily
Nov-20								
Trichloroethene	5.0	µg/L	11/4/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
1,1-Dichloroethene	7.0	µg/L	11/4/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
cis-1,2-Dichloroethene	70	µg/L	11/4/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
Tetrachloroethene	5.0	µg/L	11/4/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
Vinyl Chloride	2.0	µg/L	11/4/2020	< 0.500	< 0.500	< 0.500	0	Quarterly
pH	6.0 – 9.0	su	—	7.56	7.75	7.91	0	Weekly
Temperature	—	ºF	—	60	60	60	—	Weekly
Flow[#]	—	gpm	—	--	61	--	—	Daily
Dec-20								
pH	6.0 – 9.0	su	—	7.84	7.86	7.88	0	Weekly
Temperature	—	ºF	—	60	60	60	—	Weekly
Flow[#]	—	gpm	—	--	68	--	—	Daily

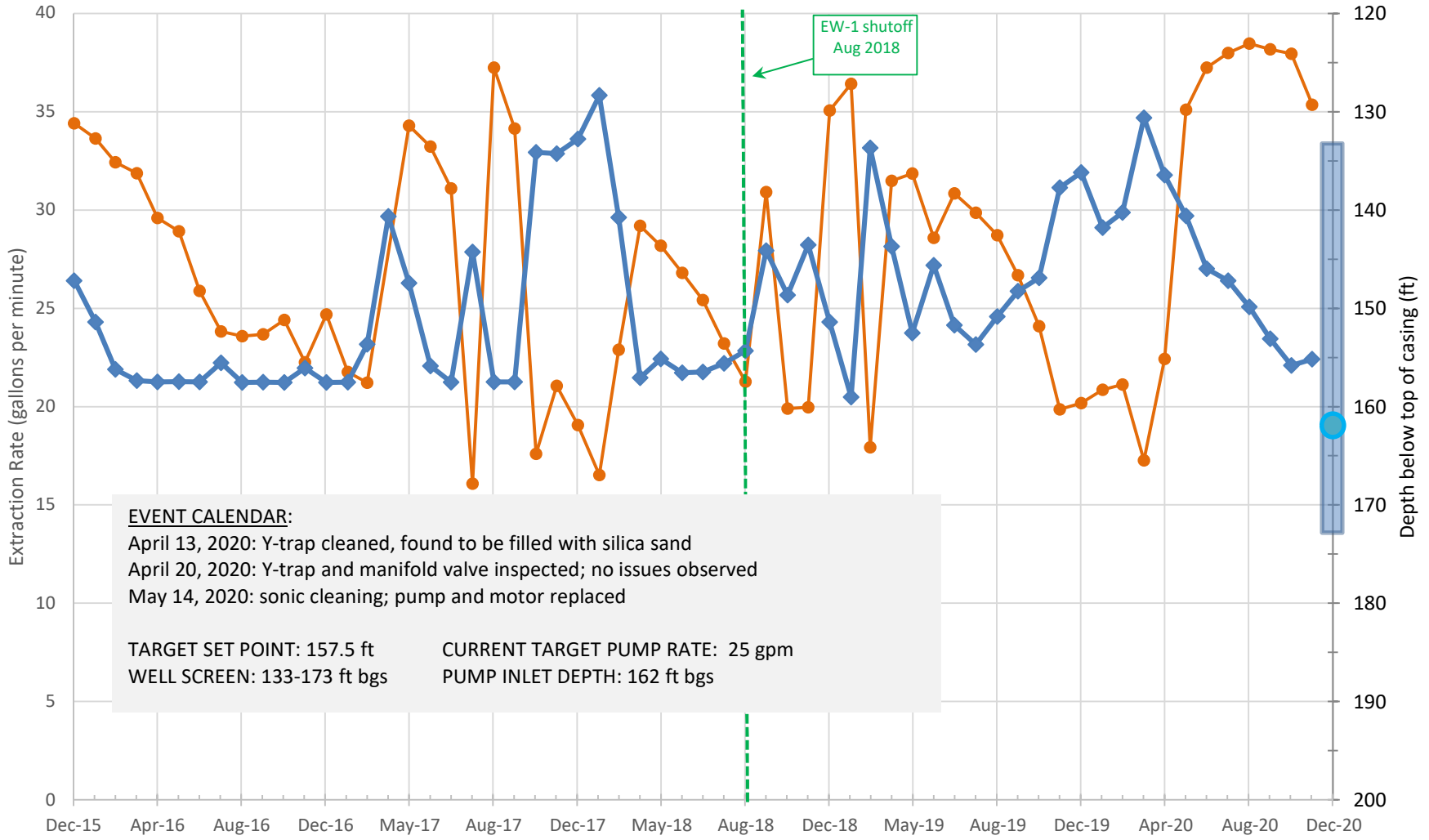
NOTES:

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

The effluent VOC sample is identified as TS-C-Eff.

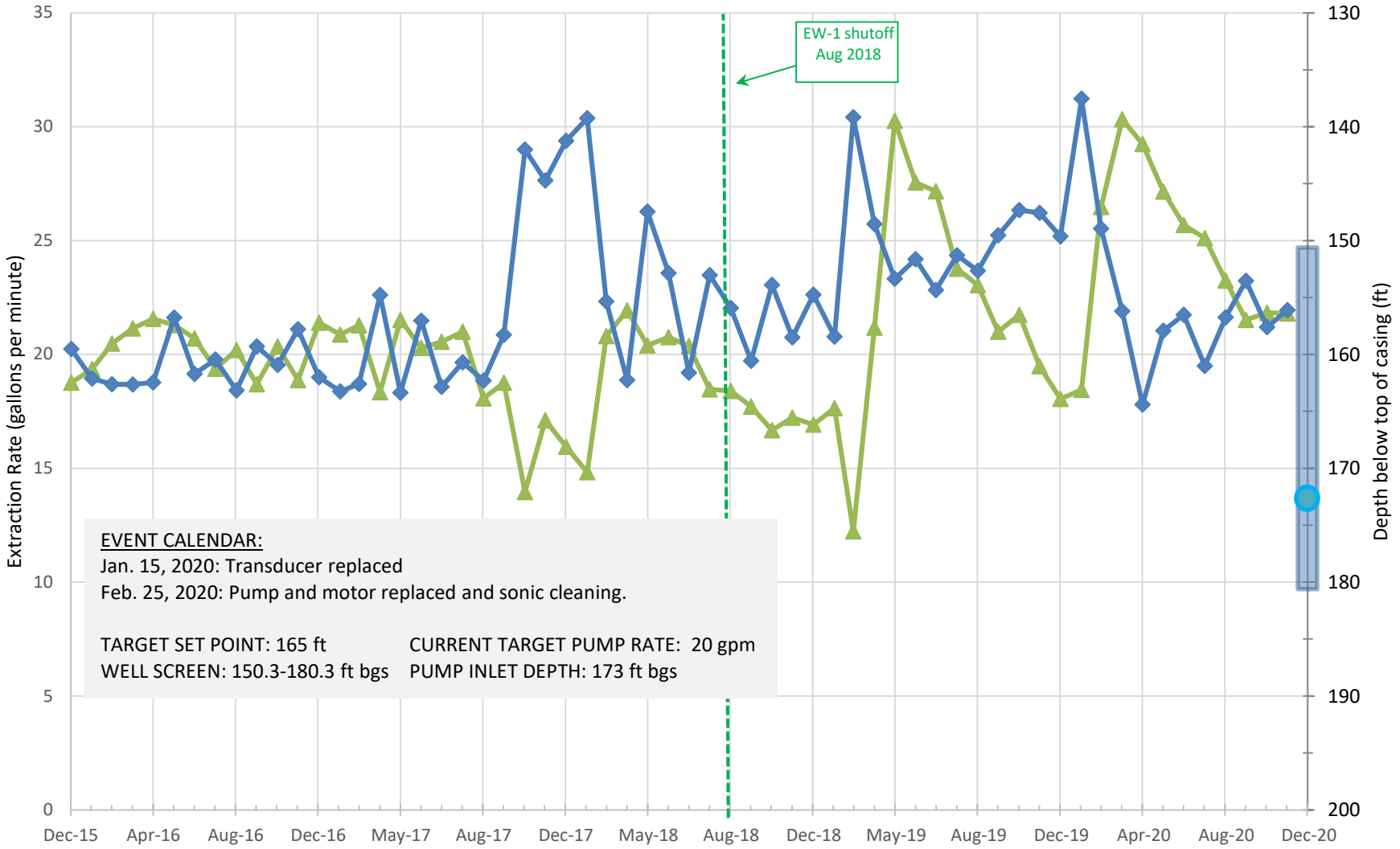
[#]Flow includes EW-2, EW-14, and EW-23.

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



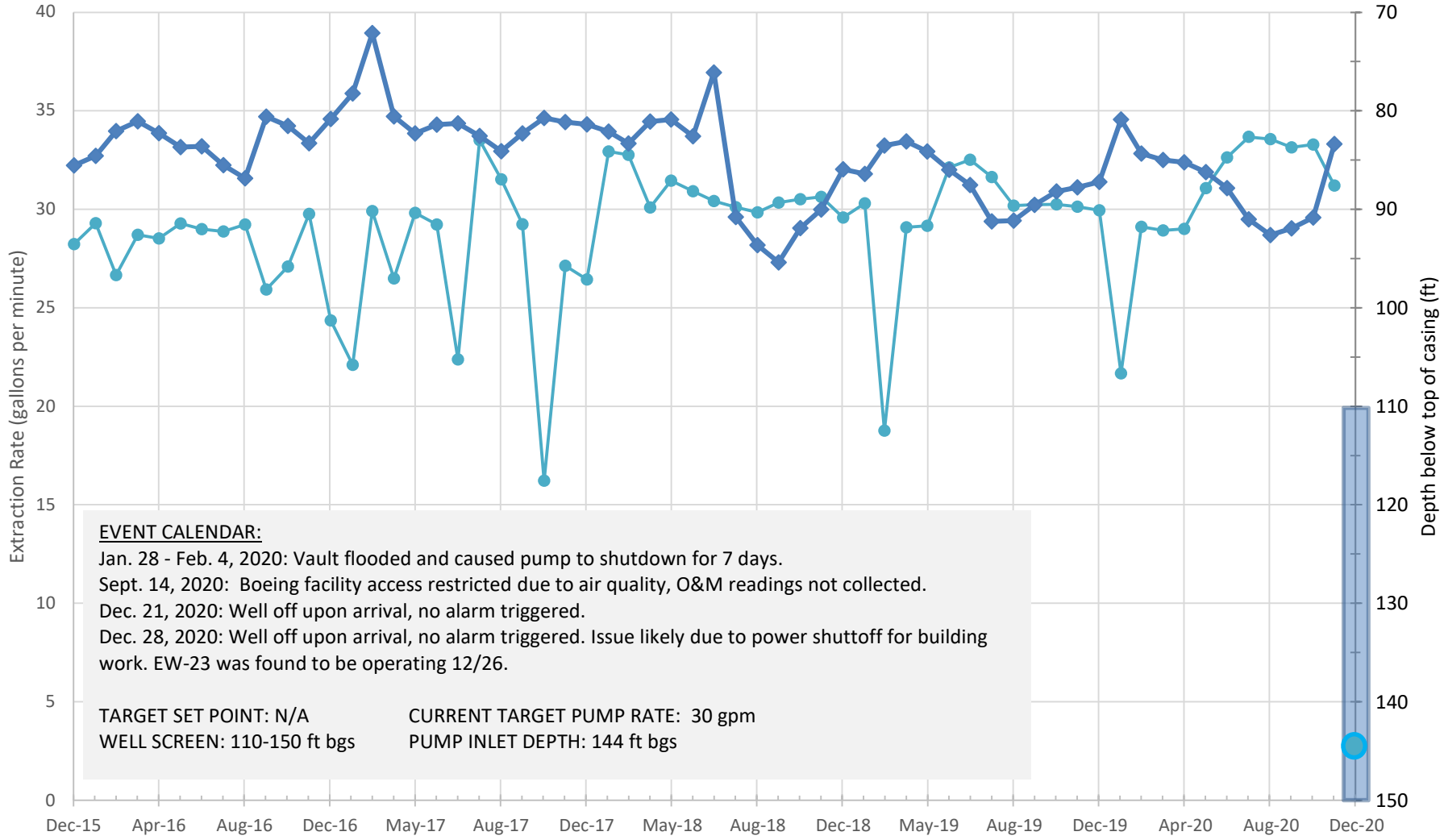
Geosyntec consultants

Cascade Corporation Gresham, Oregon	**EW-2 Monthly Average Extraction Rate** **TSA Remedy**	Figure A-1



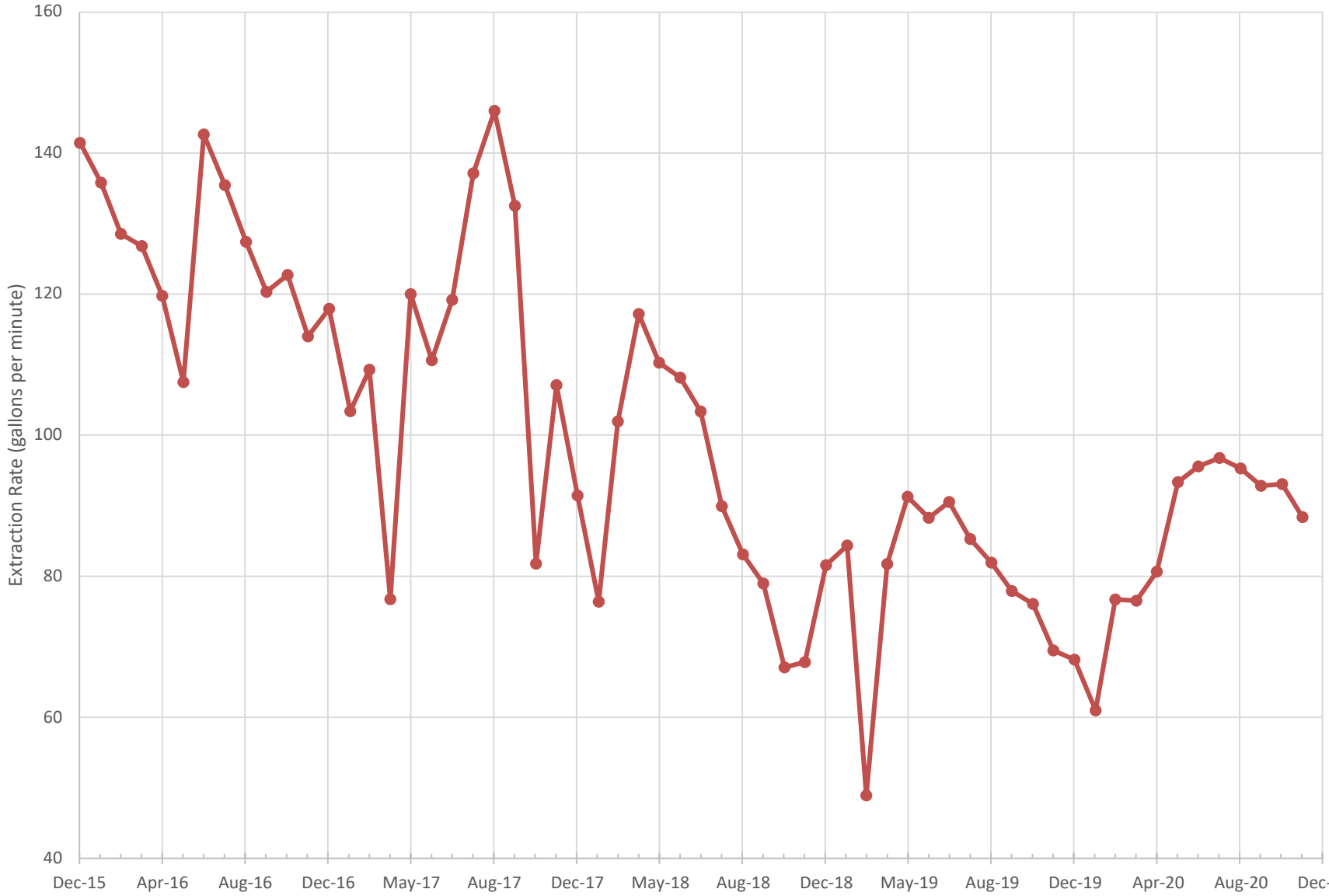
Geosyntec consultants

Cascade Corporation Gresham, Oregon	**EW-14 Monthly Average Extraction Rate** **TSA Remedy**	Figure A-2



Geosyntec consultants

Cascade Corporation Gresham, Oregon	**EW-23 Monthly Average Extraction Rate** **TSA Remedy**	Figure A-3



Geosyntec consultants

Cascade Corporation Gresham, Oregon	**Total Extraction Rate for Remedy All Wells** **TSA Remedy**	Figure A-4

EW-Total Monthly Average Extraction Rate

APPENDIX B
Well Decommissioning

Oregon
Kate Brown, Governor

Water Resources Department
North Mall Office Building
725 Summer St NE, Suite A
Salem, OR 97301
Phone (503) 986-0900
Fax (503) 986-0904
www.wrd.state.or.us

January 12, 2018

PETER S. LARSEN MWC# 10408
CASCADE DRILLING LP
13600 SE AMBLER ROAD
CLACKAMAS, OREGON 97015

FINAL ORDER

Dear Mr. Larson:

The Special Standards Request Form you submitted for owner: Michael Cereghino, Start Card number 1035838 (BOP71(ds)) is hereby approved; you may decommission this monitoring well with cement grout as outlined on your Special Standards Request Form. All other monitoring well decommissioning rules shall be adhered to. A copy of your Special Standards Request Form is enclosed.

If you have any questions regarding this letter, I may be contacted at (503) 986-0852, or by e-mail at Joel.W.Jeffery@oregon.gov.

Sincerely,

Joel Jeffery, Coordinator
Well Construction Program
Well Construction and Compliance Section

enclosure

cc: Barry Sanford, Well Inspector: Northwest Region
File

This is a final order in other than contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review must be filed within the 60 day time period specified by ORS 183.484(2). Pursuant to ORS 536.075 and OAR 137-004-0080 you may either petition for judicial review or petition the Director for reconsideration of this order. A petition for reconsideration may be granted or denied by the director, and if no action is taken within 60 days following the date the petition was filed, the petition shall be deemed denied.

Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem Oregon 97301-1266
(503) 986-0900
www.wrd.state.or.us

Special Standards
Request Form

REQUEST FOR WRITTEN APPROVAL TO USE CONSTRUCTION METHODS NOT INCLUDED IN OREGON ADMINISTRATIVE RULES 690-200 THROUGH 690-240

Before the request can be considered, this form must be completed. Requests shall be submitted to the Well Construction Program Coordinator, Water Resources Department, 725 Summer Street NE, Suite A, Salem OR 97301-1266. Requests may also be considered by the appropriate Regional Manager.

Date of request: 11-15-17 **Oral approval date (if applicable):** _____

Bonded Well Constructor (**name, license #, and mailing address**): Pete Larsen #10408 13600 SE Ambler Rd. Clackamas OR. 97015

(1) Location of Well: NE 1/4 SW 1/4 Tax lot 00202 / 00600 Section 29, Township 1 N, Range 3E W, Multnomah County

Address at well site: undeveloped agricultural field north of Sandy Blvd

(2) Start Card Number(s)(for work to be done): 1035838

(3) Name and Address of Land Owner: Michael Cereghino 20525 NE Wistful Vista Drive Fairview Oregon 97024

(4) Distance to the nearest septic tank, drainfield, closed sewage line (if water supply well)

N/A

(5) The unusual site conditions which necessitate this request: well is located very close to a rock retaining wall for sandy blvd and drive way for buildings/business adjacent to east. Both constructed after well install/setup for Rig difficult

(6) The proposed construction methods that the bonded well constructor believes will be adequate for this well: (attach additional pages if needed)

Grout in place from bottom up with tremie pipe

RECEIVED

JAN 10 2018

ENF

OWRD

BOP - 71(ds)

(7) Diagram showing the pertinent features of the proposed well design and construction: (attach additional pages if needed)

Repair Surface	0	to	3
Bentonite Seal	3	to	T.D.
Blank Casing		to	
Well Screen		to	
Filter Pack		to	
Well Diameter		to	
Total Depth		to	

Well Name	Original Start	Depth
BOP-71(ds)	1000617	294

PLEASE NOTE:

(1) The Well Construction Standards serve to protect ground water resources. By approving and issuing this special construction standard the Oregon Water Resources Department is not representing that a well constructed in accordance with this condition will maintain structural integrity or that it meets engineering standards. The well constructor/or landowner is responsible for ensuring that a well is constructed in a manner that protects ground water resources as required under Oregon Administrative Rules 690-200 through 690-240

(2) If it should be determined at some future date that the well, due to its construction, is allowing ground water contamination, waste or loss of artesian pressure, the undersigned shall return to the site and rectify the problem.

(3) If oral approval was granted, a written request must be submitted to the Department either within three (3) working days of the date of oral approval or prior to the completion of the associated well work. Failure to submit a written request as described above may void prior oral approval.

I have read and understand the above information. I further attest that the information provided is accurate to the best of my knowledge

Bonded Constructor Signature: _____

RECEIVED

JAN 10 2018

OWRD

MONITORING WELL REPORT - continuation page

MULT 134344

3/27/2020

Map of Hole

Oregon
Kate Brown, Governor

Water Resources Department
North Mall Office Building
725 Summer St NE, Suite A
Salem, OR 97301
Phone (503) 986-0900
Fax (503) 986-0904
www.wrd.state.or.us

January 12, 2018

PETER S. LARSEN MWC# 10408
CASCADE DRILLING LP
13600 SE AMBLER ROAD
CLACKAMAS, OREGON 97015

FINAL ORDER

Dear Mr. Larson:

The Special Standards Request Form you submitted for owner: Michael Cereghino, Start Card number 1035838 (BOP71(ds)) is hereby approved; you may decommission this monitoring well with cement grout as outlined on your Special Standards Request Form. All other monitoring well decommissioning rules shall be adhered to. A copy of your Special Standards Request Form is enclosed.

If you have any questions regarding this letter, I may be contacted at (503) 986-0852, or by e-mail at Joel.W.Jeffery@oregon.gov.

Sincerely,

Joel Jeffery, Coordinator
Well Construction Program
Well Construction and Compliance Section

enclosure

cc: Barry Sanford, Well Inspector: Northwest Region
File

This is a final order in other than contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review must be filed within the 60 day time period specified by ORS 183.484(2). Pursuant to ORS 536.075 and OAR 137-004-0080 you may either petition for judicial review or petition the Director for reconsideration of this order. A petition for reconsideration may be granted or denied by the director, and if no action is taken within 60 days following the date the petition was filed, the petition shall be deemed denied.

MULT 134344

STATE OF OREGON
MONITORING WELL REPORT
(as required by ORS 537.765 & OAR 690-240-0395)

3/27/2020

WELL I.D. LABEL# L 88978

START CARD # 1035838

(1) LAND OWNER

Owner Well I.D. BOP-71(DS)

First Name _____ Last Name _____

Company THE BOEING COMPANY / CASCADE CORPORATION

Address 19000 NE SANDY BLVD

City PORTLAND State OR Zip 97230

(2) TYPE OF WORK

☐ New ☐ Deepening ☐ Conversion ☐ Alteration (repair/recondition) ☒ Abandonment

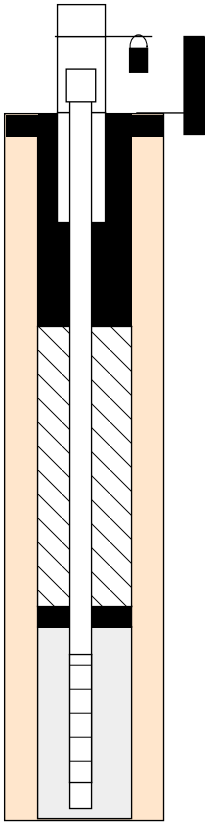
(3) DRILL METHOD

☐ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Hollow Stem Auger ☐ Cable Mud ☐ Reverse Rotary ☒ Other ABANDON IN PLACE

(4) CONSTRUCTION

Piezometer Well ☐

Depth of Completed Well 294.00 ft. Special Standard ☒



MONUMENT/VAULT Above Ground
From 0 To 3

BORE HOLE
Diameter 3 From 0 To 294

CASING
Dia. _____ From ☐ _____ To _____
Gauge _____ Wld ☐ Thrd ☐
Material ◯ Steel ◯ Plastic

LINER
Dia. _____ From ☐ _____ To _____
Gauge _____ Wld ☐ Thrd ☐
Material ◯ Steel ◯ Plastic

SEAL
From 0 To 3
Material Concrete
Amount 6 Sacks Grout weight _____

SCREEN
Casing/Liner _____ Material _____
Diameter _____ From _____ To _____
Slot Size _____

FILTER
From _____ To _____ Material _____ Size of pack _____

(5) WELL TESTS

◯ Pump ◯ Bailer ◯ Air ◯ Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Temperature 54 °F Lab analysis ☐ Yes By _____

Supervising Geologist/Engineer _____

Water quality concerns? ☐ Yes (describe below) TDS amount 100 ppm

From	To	Description	Amount	Units

(6) LOCATION OF WELL (legal description)

County MULTNOMAH Twp 1.00 N N/S Range 3.00 E E/W WM
Sec 30 NW 1/4 of the NW 1/4 Tax Lot ROW / 600
Tax Map Number _____ Lot _____
Lat ° ' " or _____ DMS or DD
Long ° ' " or _____ DMS or DD

◯ Street address of well ◉ Nearest address

BOP71(DS) ROW EAST OF 18111 NE SANDY BLVD, PORTLAND, OR 97230 & N OF SANDY BLVD

(7) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening	3/23/2020		☐	35
Completed Well			☐	

Flowing Artesian? ☐ Dry Hole? ☐

WATER BEARING ZONES Depth water was first found _____

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
					☐	
					☐	
					☐	
					☐	
					☐	

(8) WELL LOG

Ground Elevation _____

Material	From	To
Abandon 3"MW in Place as per Final Order	0	294

Date Started 3/23/2020 Completed 3/24/2020

(unbonded) Monitor Well Constructor Certification

I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon monitoring well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number 10618 Date 3/27/2020
Password : (if filing electronically) _____
Signed CHRISTOPHER BAKER (E-filed)

(bonded) Monitor Well Constructor Certification

I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon monitoring well construction standards. This report is true to the best of my knowledge and belief.

License Number 10408 Date 3/27/2020
Password : (if filing electronically) _____
Signed PETER LARSEN (E-filed)
Contact Info (optional) CDLP 110-20-1023

ORIGINAL - WATER RESOURCES DEPARTMENT
THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Form Version:

MONITORING WELL REPORT - continuation page

MULT 134344

WELL I.D. LABEL# L 88978

START CARD # 1035838

3/27/2020

(4) CONSTRUCTION

BORE HOLE

Dia	From	To

FILTER PACK

From	To	Material	Size

SEAL

Material	From	To	Amt	sacks/ lbs	grout weight
C5	3	294	35	S	

CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd

SCREENS

Perf/ Screen	Casing/ Liner	Screen Dia	From	To	Scrn size/ slot width	Slot length	# of slots	Tele/ pipe size

(5) WELL TESTS

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Water Quality Concerns

From	To	Description	Amount	Units

(7) STATIC WATER LEVEL

Water Bearing Zones

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)

(8) WELL LOG

Material	From	To

Comments/Remarks

Abandon Well in place as per Final Order with cement grout. Remove monument, bollards and upper portion of well. Restore surface.
Original Start Card: 1000617
Well Tag: 88978

MONITORING WELL REPORT - Map with location identified must be attached and shall include an approximate scale and north arrow

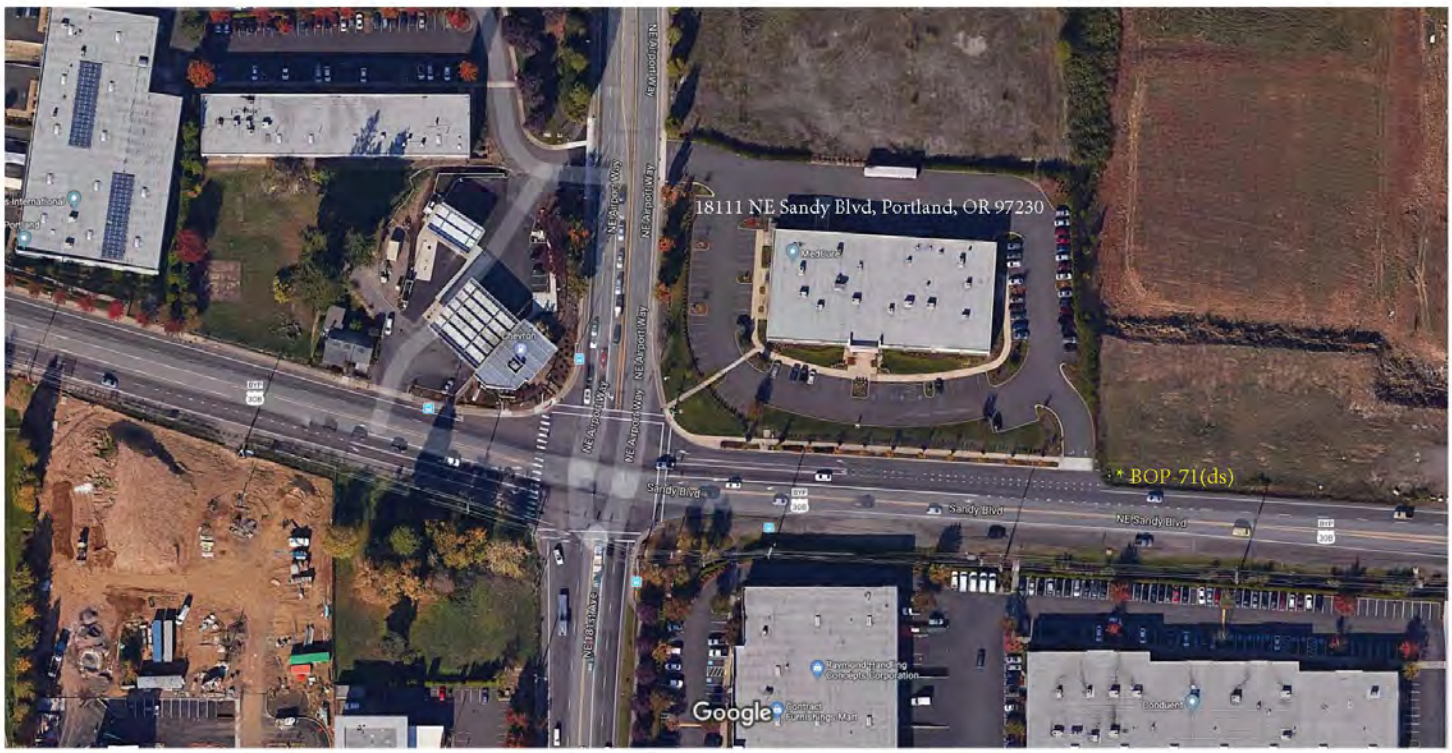
MULT 134344

3/27/2020

Map of Hole

12/30/2019 NE 185th ave and NE sandy blvd, Portland, Or - Google Maps

Google Maps NE 185th ave and NE sandy blvd, Portland, Or



Imagery ©2019 Maxar Technologies, Metro, Portland Oregon, State of Oregon, U.S. Geological Survey, Map data ©2019 50 ft

"NE 185th" "and"
NE 185th Dr
Oregon

"and NE sandy blvd, Portland, Or"
NE Sandy Blvd

N
W + E
S

https://www.google.com/maps/search/NE+185th+ave+and+NE+sandy+blvd,+Portland,+Or/@45.5462603,-122.4767243,227m/data=!3m1!1e3?hl=en 1/2

MULT 135402

STATE OF OREGON
MONITORING WELL REPORT
(as required by ORS 537.765 & OAR 690-240-0395)

10/22/2020

WELL I.D. LABEL# L

START CARD # 1049397

(1) LAND OWNER

Owner Well I.D. MW26-DG

First Name _____ Last Name _____

Company FAIRVIEW STORAGE LLC

Address 3033 W VIEW CIRCLE

City LAKE OSWEGO State OR Zip 97034

(2) TYPE OF WORK

☐ New ☐ Deepening ☐ Conversion
☐ Alteration (repair/recondition) ☒ Abandonment

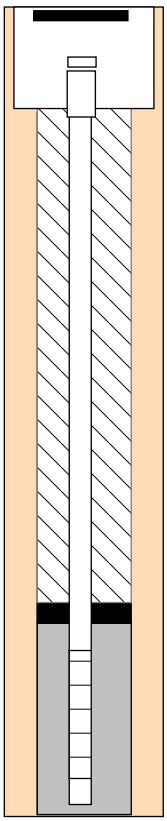
(3) DRILL METHOD

☐ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Hollow Stem Auger ☐ Cable Mud
☐ Reverse Rotary ☒ Other SONIC

(4) CONSTRUCTION

Piezometer Well ☐

Depth of Completed Well 180.00 ft. Special Standard ☐



MONUMENT/VAULT
From _____ To _____

BORE HOLE
Diameter 10 From 0 To 60

CASING
Dia. _____ From ☐ _____ To _____
Gauge _____ Wld Thrd
Material ◯Steel ◯Plastic ☐ ☐

LINER
Dia. _____ From ☐ _____ To _____
Gauge _____ Wld Thrd
Material ◯Steel ◯Plastic ☐ ☐

SEAL
From 0 To 5
Material Bentonite Chips
Amount 300 Pounds Grout weight _____

SCREEN
Casing/Liner _____ Material _____
Diameter _____ From _____ To _____
Slot Size _____

FILTER
From _____ To _____ Material _____ Size of pack _____

(5) WELL TESTS

◯ Pump ◯ Bailer ◯ Air ◯ Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Temperature _____ °F Lab analysis ☐ Yes By _____

Supervising Geologist/Engineer _____

Water quality concerns? ☐ Yes (describe below) TDS amount 300 ppm

From	To	Description	Amount	Units

(6) LOCATION OF WELL (legal description)

County MULTNOMAH Twp 1.00 N N/S Range 3.00 E E/W WM
Sec 28 NE 1/4 of the SW 1/4 Tax Lot 2102
Tax Map Number _____ Lot _____
Lat ° ' " or 45.54083300 DMS or DD
Long ° ' " or -122.44722200 DMS or DD
◉ Street address of well ◯ Nearest address
20918 NE SANDY BLVD FAIRVIEW OR 97024

(7) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening			☐	
Completed Well			☐	

Flowing Artesian? ☐ Dry Hole? ☐

WATER BEARING ZONES Depth water was first found _____

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
					☐	
					☐	
					☐	
					☐	
					☐	

(8) WELL LOG

Ground Elevation _____

Material	From	To
Well abandonment by overdrill method	0	180
pre-grouted well casing with bentonite	0	180
prior to overdrilling	0	180

Date Started 10/19/2020 Completed 10/21/2020

(unbonded) Monitor Well Constructor Certification

I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon monitoring well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number _____ Date _____
Password : (if filing electronically) _____
Signed _____

(bonded) Monitor Well Constructor Certification

I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon monitoring well construction standards. This report is true to the best of my knowledge and belief.

License Number 10432 Date 10/22/2020
Password : (if filing electronically) _____
Signed DONALD LARSON (E-filed)
Contact Info (optional) Yellow Jacket Drilling Services

ORIGINAL - WATER RESOURCES DEPARTMENT
THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Form Version:

MONITORING WELL REPORT - continuation page

MULT 135402

10/22/2020

WELL I.D. LABEL# L

START CARD # 1049397

(4) CONSTRUCTION

BORE HOLE

Dia	From	To
8	60	180

FILTER PACK

From	To	Material	Size

SEAL

Material	From	To	Amt	sacks/ lbs	grout weight
Bentonite Grout	5	180	26	S	

CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐

SCREENS

Perf/ Screen	Casing/ Liner	Screen Dia	From	To	Scrn size/ slot width	Slot length	# of slots	Tele/ pipe size

(5) WELL TESTS

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Water Quality Concerns

From	To	Description	Amount	Units

(7) STATIC WATER LEVEL

Water Bearing Zones

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
					☐	
					☐	
					☐	
					☐	
					☐	
					☐	
					☐	
					☐	
					☐	
					☐	

(8) WELL LOG

Material	From	To

Comments/Remarks

MONITORING WELL REPORT - Map with location identified must be attached and shall include an approximate scale and north arrow

MULT 135402

10/22/2020

Map of Hole

STATE OF OREGON
WELL LOCATION MAP

This map is supplemental to the WATER SUPPLY WELL REPORT

Oregon Water Resources Department
725 Summer St NE, Salem OR 97301
(503)986-0900

LOCATION OF WELL
Latitude: 45.54083300 Datum: WGS84
Longitude: -122.44722200
Township/Range/Section/Quarter-Quarter Section:
WM1.00N3.00E28SENW
Address of Well:
20918 NE SANDY BLVD FAIRVIEW OR 97024

Hole Nbr: MW26-DG

Printed: October 22, 2020

DISCLAIMER: This map is intended to represent the approximate location the well. It is not intended to be construed as survey accurate in any manner.

Provided by well constructor

APPENDIX C
SVE Data

Table C-1
Soil Vapor Extraction 1 January 2020 through 31 December 2020
East Multnomah County TSA Remedy

Well ID	Date	Time (hrs)	Temperature (degrees F)	Flow Rate[1] (scfm)	PID Measurement (ppm)	Calculated VOC Concentrations (µg/L)
Soil Vapor Extraction Outlet						
SVE System Outlet	1/7/2020	10:00	110	360	0.3	1.8
SVE System Outlet	1/13/2020	10:50	110	405	0.4	2.3
SVE System Outlet	1/21/2020	8:50	110	341	0.4	2.3
SVE System Outlet	1/28/2020	8:10	110	327	0.4	2.3
SVE System Outlet	**2/4/2020**	**8:15**	**100**	**345**	**0.4**	**2.3**
SVE System Outlet	2/11/2020	9:00	100	376	0.4	2.3
SVE System Outlet	2/18/2020	9:00	100	367	0.4	2.3
SVE System Outlet	2/25/2020	9:09	90	394	0.4	2.3
SVE System Outlet	**3/3/2020**	**9:00**	**95**	**387**	**0.4**	**2.3**
SVE System Outlet	3/10/2020	9:00	95	387	0.5	2.9
SVE System Outlet	3/17/2020	9:05	92	379	0.4	2.3
SVE System Outlet	3/24/2020	8:00	92	410	0.4	2.3
SVE System Outlet	3/31/2020	14:04	90	397	0.4	2.3
SVE System Outlet	**4/7/2020**	**9:00**	**90**	**445**	**0.5**	**2.9**
SVE System Outlet	4/13/2020	9:00	100	344	0.4	2.3
SVE System Outlet	4/21/2020	9:00	90	386	0.4	2.3
SVE System Outlet	4/28/2020	9:00	---	345	0.4	2.3
SVE System Outlet	5/5/2020	10:05	110	373	0.4	2.3
SVE System Outlet	**5/11/2020**	**10:40**	**100**	**395**	**0.4**	**2.3**
SVE System Outlet	5/19/2020	10:40	90	370	0.5	2.9
SVE System Outlet	5/26/2020	14:40	110	386	0.4	2.3
SVE System Outlet	**6/2/2020**	**13:15**	**110**	**396**	**0.5**	**2.9**
SVE System Outlet	6/9/2020	8:20	---	382	0.5	2.9
SVE System Outlet	6/16/2020	13:50	100	389	0.5	2.9
SVE System Outlet	6/22/2020	9:00	100	390	0.4	2.3
SVE System Outlet	6/30/2020	10:20	100	387	0.4	2.3
SVE System Outlet	**7/7/2020**	**13:40**	**95**	**374**	**0.4**	**2.3**
SVE System Outlet	7/14/2020	8:20	90	381	0.4	2.3
SVE System Outlet	7/21/2020	14:00	110	379	0.4	2.3
SVE System Outlet	7/28/2020	9:00	95	371	0.4	2.3
SVE System Outlet	**8/4/2020**	**7:15**	**90**	**389**	**0.4**	**2.3**
SVE System Outlet	8/11/2020	13:15	110	391	0.4	2.3
SVE System Outlet	8/18/2020	15:40	110	386	0.4	2.3
SVE System Outlet	8/25/2020	15:50	125	384	0.4	2.3
SVE System Outlet	**9/1/2020**	**14:00**	**130**	**397**	**0.4**	**2.3**
SVE System Outlet	9/8/2020	14:50	120	393	0.4	2.3

Table C-1
Soil Vapor Extraction 1 January 2020 through 31 December 2020
East Multnomah County TSA Remedy

Well ID	Date	Time (hrs)	Temperature (degrees F)	Flow Rate[1] (scfm)	PID Measurement (ppm)	Calculated VOC Concentrations (µg/L)
Soil Vapor Extraction Outlet						
SVE System Outlet	9/15/2020	16:00	110	386	0.4	2.3
SVE System Outlet	9/22/2020	15:15	100	376	0.4	2.3
SVE System Outlet	9/28/2020	14:55	110	397	0.3	1.8
SVE System Outlet	**10/6/2020**	**9:45**	**90**	**391**	**0.3**	**1.8**
SVE System Outlet	10/12/2020	16:00	90	398	0.3	1.8
SVE System Outlet	10/20/2020	15:45	95	386	0.3	1.8
SVE System Outlet	10/27/2020	10:00	95	370	0.3	1.8
SVE System Outlet	**11/3/2020**	**10:30**	**90**	**386**	**0.4**	**2.3**
SVE System Outlet	11/10/2020	7:40	90	389	0.4	2.3
SVE System Outlet	11/17/2020	14:45	52[2]	362	0.4	2.3
SVE System Outlet	11/23/2020	13:40	90	384	0.5	2.9
SVE System Outlet	**12/1/2020**	**12:00**	**95**	**391**	**0.4**	**2.3**
SVE System Outlet	12/8/2020	10:40	90	378	0.4	2.3
SVE System Outlet	12/15/2020	12:40	95	396	0.4	2.3
SVE System Outlet	12/21/2020	9:40	90	369	0.4	2.3
SVE System Outlet	12/29/2020	16:15	90	395	0.3	1.8

Notes:

ID = identification
hrs = hours
F = Fahrenheit
ppm = parts per million
µg/L = micrograms per liter
VOC = volatile organic compounds
NM = not measured
--- = Measurement not available

Bold text indicates sample for lab analysis was taken at the same time and is shown on Table C-2

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

[2] System was shut down due to leak. The shutdown most likely caused the lower than expected temperature.

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

Well ID	Date	cis-1,2-dichloroethene (µg/m^3)	Trichloro-ethene (µg/m3)	Tetrachloro-ethene (µg/m3)	Total VOCs (µg/m3)	Flow Rate (scfm)[1]
System Outlet	1/7/20	66	600	44	710	360.1
	2/4/20	50	510	38	598	344.6
	3/3/20	53	570	51	674	386.7
	4/7/20	65	490	43	598	444.8
	5/11/20	55	530	53	638	394.6
	6/2/20	41	490	41	572	396.1
	7/7/20	55	500	40	595	374.3
	8/5/20	57	610	50	717	388.6
	9/1/20	56	550	52	658	396.9
	10/6/20	61	610	44	715	391.0
	11/3/20	55	470	51	576	386.1
	12/1/20	7	57	2.9	66.9	391.2
Well VW17D-95.5	2/4/20	33	290	21	344	64.1
	5/11/20	36	350	24	410	65.1
	8/5/20	33	300	25	358	63.8
	11/3/20	17	150	12	179	63.4
Well VMW-C	2/4/20	45	920	73	1038	59.8
	5/11/20	42	780	66	888	89.1
	8/5/20	32	590	50	672	66.7
	11/3/20	52	770	77	899	62.1
Well VMW-E	2/4/20	82	1100	86	1268	72.1
	5/11/20	85	1300	78	1463	89.8
	8/5/20	25	340	28	393	75.4
	11/3/20	<2.0	12	<2.0	14	73.6
Well VMW-F	2/4/20	1.05	1.05	1.05	3.15	80.0
	5/11/20	49	370	35	454	90.9
	8/5/20	49	210	31	290	73.1
	11/3/20	<2.2	<2.2	<2.2	3.3	75.1
Well VMW-G	2/4/20	<2.2	26	5.6	32.7	79.9
	5/11/20	1.05	2.2	1.05	4.3	92.3
	8/5/20	1.05	<2.2	1.05	3.2	76.7
	11/3/20	70	380	28	478	71.2
Well VMW-H	2/4/20	77	390	18	485	84.8
	5/11/20	50	270	9.8	329.8	86.5
	8/5/20	1.05	<2.2	1.05	3.2	65.2
	11/3/20	81	400	20	501	70.6

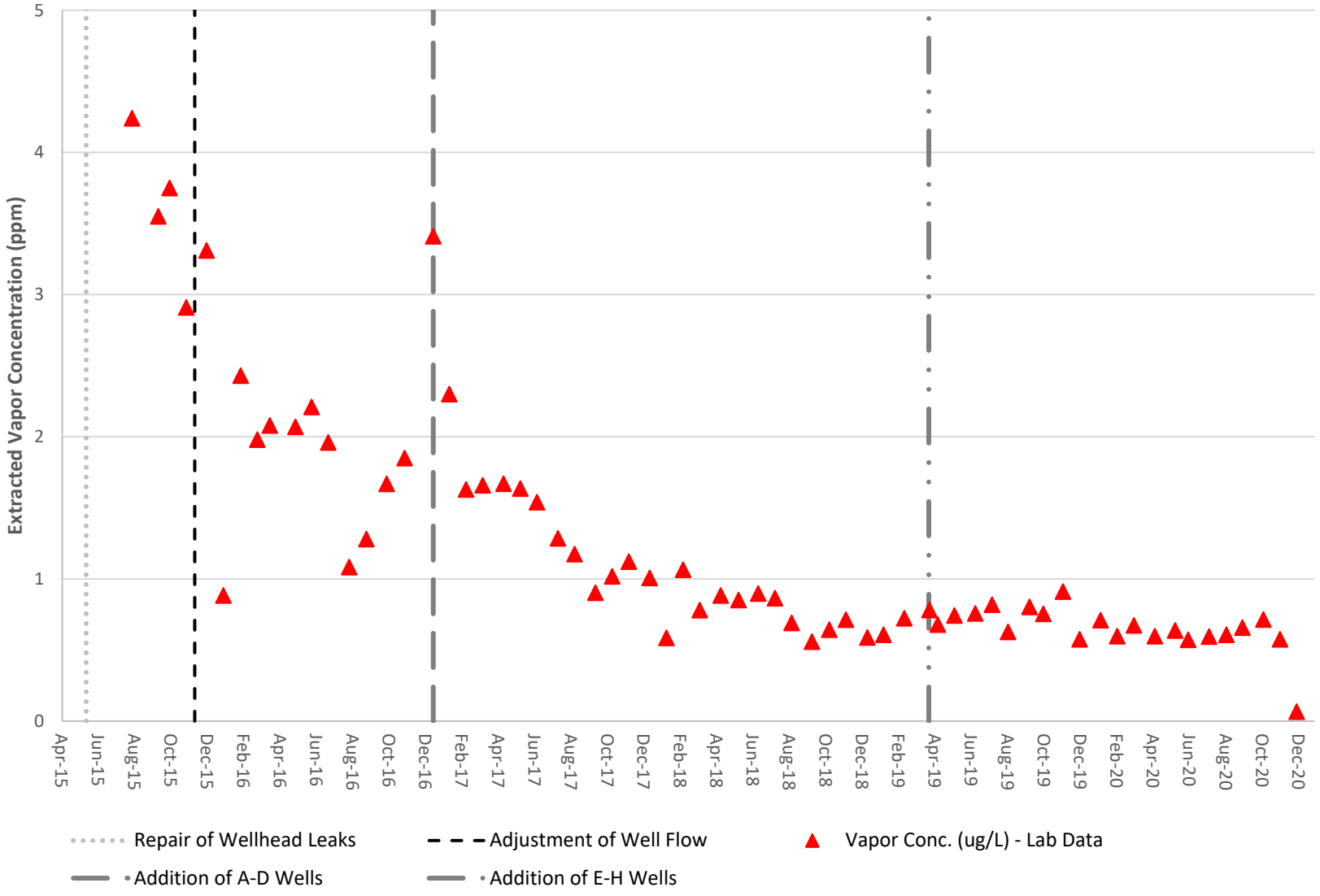
Notes:
ID = identification
scfm = standard cubic feet per minute
µg/m^3 = micrograms per cubic meter
VOC = volatile organic compounds
Total VOCs are the cal Total VOCs are the calculated sum of the three VOCs shown
[1] Flowrates associated with the analytical data for 8/5/20 were measured on 8/4/20

Table C-3
Soil Vapor Extraction VOC Mass Removal - April 2015 through
December 2020 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%

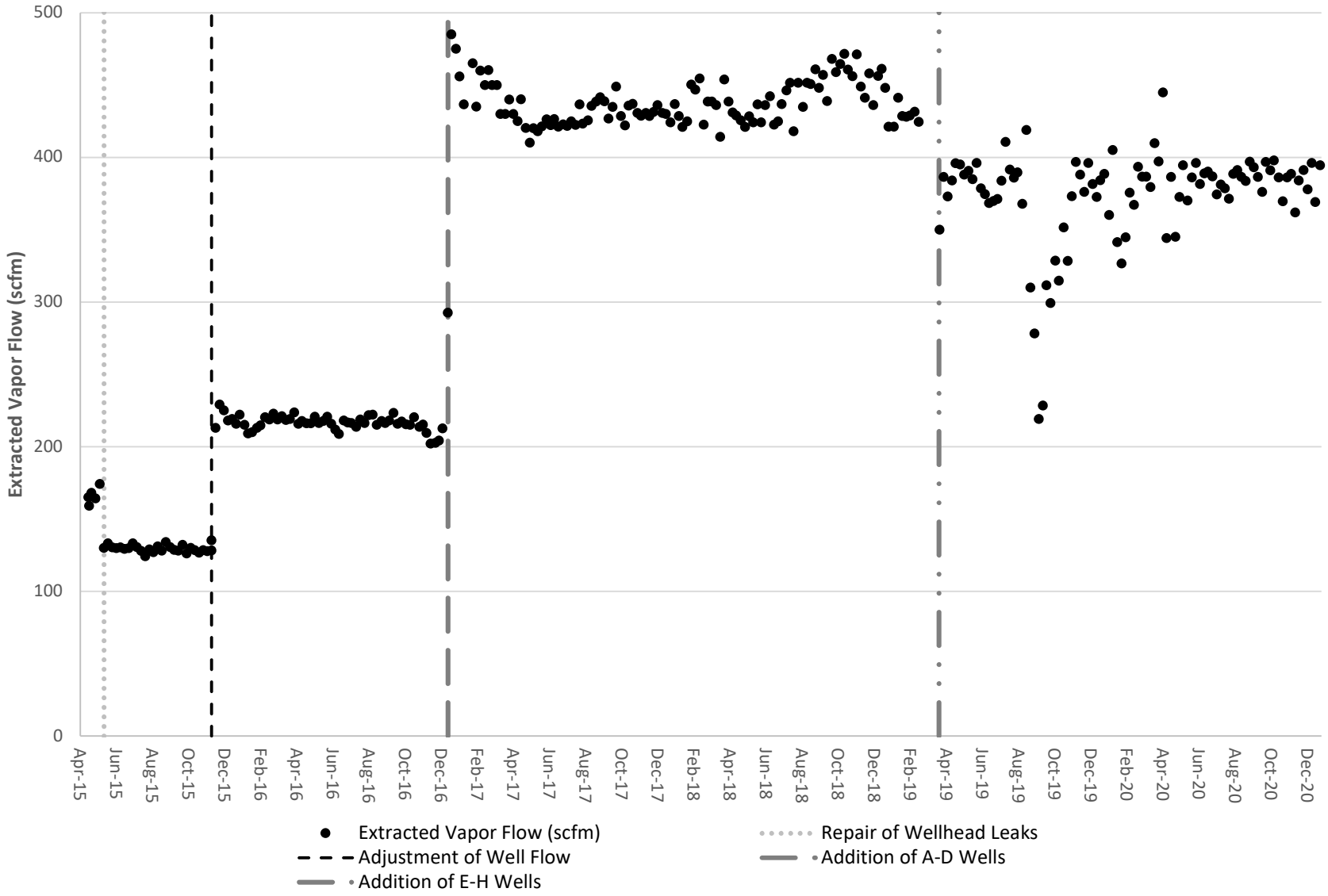
Table C-3
Soil Vapor Extraction VOC Mass Removal - April 2015 through
December 2020 East Multnomah County TSA Remedy

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%



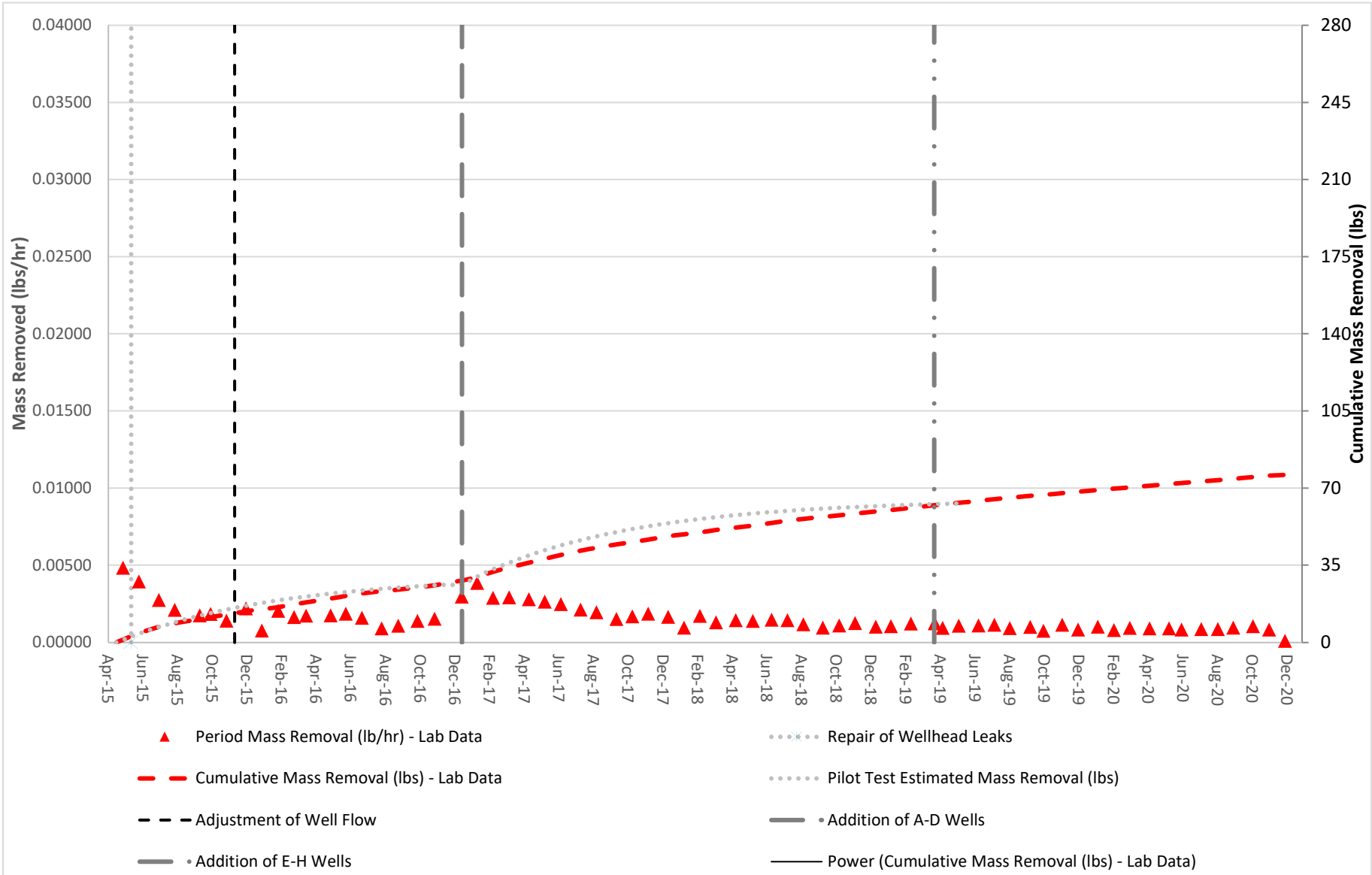
Geosyntec consultants

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



Geosyntec consultants

Cascade Corporation Gresham, Oregon	**SVE Extracted Vapor Flow (Weekly Average)** **TSA Remedy**	Figure C-2



Geosyntec consultants

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 2020 through 31 December 2020
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	2/4/2020	14:00	127.63	148.41	-20.78
Lower	EW-14	5/5/2020	8:11	127.63	165.08	-37.45
Lower	EW-14	8/3/2020	8:58	127.63	160.43	-32.80
Lower	EW-14	11/2/2020	10:18	127.63	153.88	-26.25
Lower	EW-2	2/4/2020	14:10	126.01	138.41	-12.40
Lower	EW-2	5/5/2020	8:08	126.01	139.7	-13.69
Lower	EW-2	8/3/2020	9:47	126.01	146.57	-20.56
Lower	EW-2	11/2/2020	10:10	126.01	154.9	-28.89
Lower	EW-23	2/4/2020	12:03	83.93	83.33	0.60
Lower	EW-23	5/5/2020	7:56	83.93	85.61	-1.68
Lower	EW-23	8/3/2020	12:47	83.93	89.52	-5.59
Lower	EW-23	11/2/2020	8:47	83.93	91.31	-7.38
Monitoring Wells						
Upper	BOP-13ds	2/3/2020	0:00	128.94	119.63	9.31
Upper	BOP-13ds	5/4/2020	11:15	128.94	117.64	11.30
Upper	BOP-13ds	8/3/2020	13:23	128.94	117.31	11.63
Upper	BOP-13ds	11/2/2020	14:45	128.94	118.41	10.53
Upper	BOP-20ds	2/3/2020	0:00	77.45	65.46	11.99
Upper	BOP-20ds	8/3/2020	12:20	77.45	65.62	11.83
Upper	BOP-21ds	8/4/2020	14:00	78.02	66	12.02
Upper	BOP-31ds	2/3/2020	0:00	99.04	87.56	11.48
Upper	BOP-31ds	5/4/2020	11:02	99.04	86.08	12.96
Upper	BOP-31ds	8/3/2020	14:05	99.04	86.44	12.60
Upper	BOP-31ds	11/2/2020	15:42	99.04	88.05	10.99
Upper	BOP-42ds	8/4/2020	9:57	130.74	117.81	12.93
Upper	BOP-61ds	2/3/2020	0:00	94.64	84.95	9.69
Upper	BOP-61ds	8/3/2020	13:42	94.64	84.33	10.31
Upper	BOP-62ds	8/3/2020	10:41	112.29	100.37	11.92
Upper	BOP-65ds	8/3/2020	11:32	104.22	92.11	12.11
Upper	BOP-66ds	2/3/2020	0:00	102.97	91.67	11.30
Upper	BOP-66ds	8/3/2020	13:35	102.97	90.89	12.08
Upper	CMW-10ds	2/4/2020	15:58	134.54	122.64	11.90
Upper	CMW-10ds	5/5/2020	11:58	134.54	122.7	11.84
Upper	CMW-10ds	8/3/2020	10:45	134.54	122.29	12.25
Upper	CMW-10ds	11/2/2020	14:00	134.54	122.78	11.76
Upper	CMW-17ds	2/4/2020	14:40	121.89	103.81	18.08
Upper	CMW-17ds	5/5/2020	10:28	121.89	103.03	18.86
Upper	CMW-17ds	8/3/2020	11:43	121.89	103.19	18.70
Upper	CMW-17ds	11/2/2020	11:50	121.89	103.43	18.46
Upper	CMW-18ds	2/4/2020	15:45	117.66	103.63	14.03
Upper	CMW-18ds	5/5/2020	11:35	117.66	102.93	14.73
Upper	CMW-18ds	8/3/2020	11:01	117.66	103.89	13.77
Upper	CMW-18ds	11/2/2020	13:22	117.66	103.97	13.69
Upper	CMW-19ds	2/4/2020	16:31	144.08	133.81	10.27
Upper	CMW-19ds	5/5/2020	12:18	144.08	129.54	14.54
Upper	CMW-19ds	8/3/2020	10:37	144.08	129.28	14.80

Table D-1
Groundwater Elevations - 1 January 2020 through 31 December 2020
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	CMW-19ds	11/2/2020	13:41	144.08	129.64	14.44
Upper	CMW-20ds	8/3/2020	11:00	152.72	138.78	13.94
Upper	EW-3	8/4/2020	12:24	94.26	84.55	9.71
Upper	PWB-1uts	8/3/2020	10:08	15.98	4.28	11.70
Lower	BOP-13dg	2/3/2020	0:00	128.71	118.93	9.78
Lower	BOP-13dg	5/4/2020	11:20	128.71	118.44	10.27
Lower	BOP-13dg	8/4/2020	10:10	128.71	117.49	11.22
Lower	BOP-13dg	11/2/2020	14:47	128.71	118.21	10.50
Lower	BOP-20dg	2/3/2020	0:00	77.32	65.3	12.02
Lower	BOP-20dg	8/3/2020	12:45	77.32	65.5	11.82
Lower	BOP-23dg	8/3/2020	12:04	76.96	65.31	11.65
Lower	BOP-31dg	2/3/2020	0:00	98.51	86.96	11.55
Lower	BOP-31dg	5/4/2020	11:05	98.51	85.56	12.95
Lower	BOP-31dg	8/3/2020	14:00	98.51	86.03	12.48
Lower	BOP-31dg	11/2/2020	15:44	98.51	87.52	10.99
Lower	BOP-42dg	8/4/2020	9:50	130.71	118.29	12.42
Lower	BOP-60dg	8/4/2020	12:35	93.59	81.62	11.97
Lower	BOP-61dg	2/3/2020	0:00	94.43	84.64	9.79
Lower	BOP-61dg	8/3/2020	13:39	94.43	84.31	10.12
Lower	CMW-14Rds	8/3/2020	8:18	83.48	63.86	19.62
Lower	CMW-22dg	8/3/2020	8:30	81.65	66.04	15.61
Lower	CMW-24dg (EW-5)	8/3/2020	10:28	77.74	62.61	15.13
Lower	CMW-25dg	8/3/2020	10:23	75.28	62.11	13.17
Lower	CMW-26dg	8/3/2020	9:35	108.98	41.31	67.67
Lower	CMW-36dg	8/3/2020	7:50	78.84	64.52	14.32
Lower	D-17dg	2/4/2020	13:15	124.61	114.22	10.39
Lower	D-17dg	5/5/2020	10:40	124.61	113.75	10.86
Lower	D-17dg	8/3/2020	9:30	124.61	115.52	9.09
Lower	D-17dg	11/2/2020	11:04	124.61	115.53	9.08
Lower	D-17ds	2/4/2020	13:15	123.28	113.31	9.97
Lower	D-17ds	5/5/2020	10:43	123.28	111.85	11.43
Lower	D-17ds	8/3/2020	9:25	123.28	112.45	10.83
Lower	D-17ds	11/2/2020	11:08	123.28	113.51	9.77
Lower	EW-1	2/4/2020	14:08	124.04	112.01	12.03
Lower	EW-1	5/5/2020	9:50	124.04	162.93	-38.89
Lower	EW-1	8/3/2020	9:07	124.04	111.35	12.69
Lower	EW-1	11/2/2020	11:12	124.04	112.78	11.26
Lower	EW-11	8/3/2020	9:15	114.73	98.91	15.82
Lower	EW-12	2/4/2020	14:22	94.14	82.51	11.63
Lower	EW-12	5/5/2020	11:10	94.14	80.95	13.19
Lower	EW-12	8/3/2020	9:15	94.14	81.53	12.61
Lower	EW-12	11/2/2020	11:18	94.14	83.11	11.03
Lower	EW-13	8/3/2020	11:50	103.59	91.5	12.09
Lower	EW-15	8/3/2020	9:22	116.21	47.04	69.17
Lower	EW-16	8/3/2020	9:10	83.71	65.58	18.13
Lower	EW-8	8/3/2020	13:01	77.16	61.92	15.24
Lower	PWB-1lts	8/3/2020	10:12	16.48	5.29	11.19

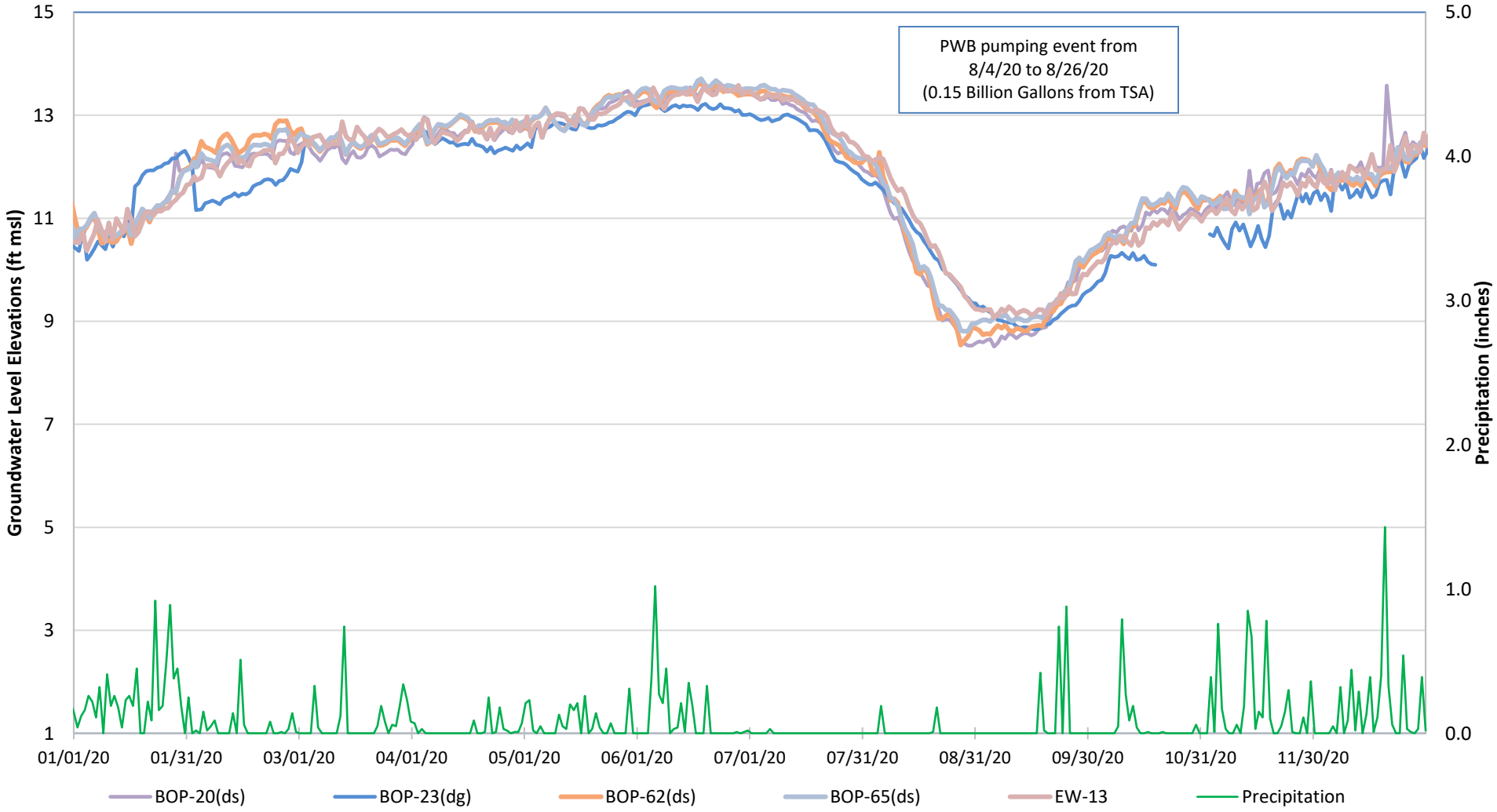
Table D-1
Groundwater Elevations - 1 January 2020 through 31 December 2020
East Multnomah County TSA Remedy

TSA Zone	Well ID	Date	Time	Top of Casing Elevation (ft MSL)	Depth to Water (ft below TOC)	Groundwater Elevation (ft MSL)
Vapor Monitoring Wells						
Upper	VMW-A	2/4/2020	10:30	123.34	104.72	18.62
Upper	VMW-A	5/5/2020	13:55	123.34	104.21	19.13
Upper	VMW-A	8/3/2020	11:18	123.34	104.31	19.03
Upper	VMW-A	11/2/2020	12:59	123.34	104.51	18.83
Upper	VMW-B	2/4/2020	10:44	123.25	99.89	23.36
Upper	VMW-B	5/5/2020	13:43	123.25	99.97	23.28
Upper	VMW-B	8/3/2020	11:25	123.25	101.34	21.91
Upper	VMW-B	11/2/2020	12:17	123.25	99.98	23.27
Upper	VMW-C	2/4/2020	11:00	124.17	104.31	19.86
Upper	VMW-C	5/5/2020	14:10	124.17	102.71	21.46
Upper	VMW-C	8/3/2020	11:31	124.17	100.82	23.35
Upper	VMW-C	11/2/2020	12:54	124.17	103.9	20.27
Upper	VMW-D	2/4/2020	12:00	126.78	99.17	27.61
Upper	VMW-D	5/5/2020	13:28	126.78	103.66	23.12
Upper	VMW-D	8/3/2020	11:40	126.78	104	22.78
Upper	VMW-D	11/2/2020	12:23	126.78	107.09	19.69
Upper	VMW-E [1]	2/4/2020		132.39	--	--
Upper	VMW-E [1]	5/5/2020		132.39	--	--
Upper	VMW-E [1]	8/3/2020	12:00	132.39	--	12.26
Upper	VMW-F [1]	2/4/2020		127.51	--	--
Upper	VMW-F [1]	5/5/2020		127.51	--	--
Upper	VMW-F [1]	8/3/2020	13:00	127.51	--	16.36
Upper	VMW-G [1]	2/4/2020		123.14	--	--
Upper	VMW-G [1]	5/5/2020		123.14	--	--
Upper	VMW-G [1]	8/3/2020	14:00	123.14	--	12.20
Upper	VMW-H	2/4/2020	11:25	126.88	103.8	23.08
Upper	VMW-H	5/5/2020	14:36	126.88	104.71	22.17
Upper	VMW-H	8/3/2020	11:48	126.88	105.18	21.70
Upper	VMW-H	11/2/2020	12:44	126.88	104.91	21.97
Upper	VMW-I	8/3/2020	10:09	131.98	124.17	7.81
Upper	VMW-I	11/2/2020	12:27	131.98	125.09	6.89
Upper	VMW-J2	8/3/2020	11:50	130.12	113.12	17
Upper	VMW-J2	11/2/2020	12:32	130.12	113.08	17.04
Upper	VMW-K	8/3/2020	10:15	129.80	108.57	21.23
Upper	VMW-K	11/2/2020	12:37	129.80	108.52	21.28
Upper	VMW-L	8/3/2020	10:20	115.23	93.35	21.88
Upper	VMW-L	11/2/2020	12:48	115.23	94.38	20.85

Table D-1
Groundwater Elevations - 1 January 2020 through 31 December 2020
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-M	8/3/2020	10:29	114.72	92.28	22.44
Upper	VMW-M	11/2/2020	13:04	114.72	93.06	21.66
Upper	VMW-N	8/3/2020	10:41	115.77	93.17	22.6
Upper	VMW-N	11/2/2020	13:10	115.77	93.7	22.07

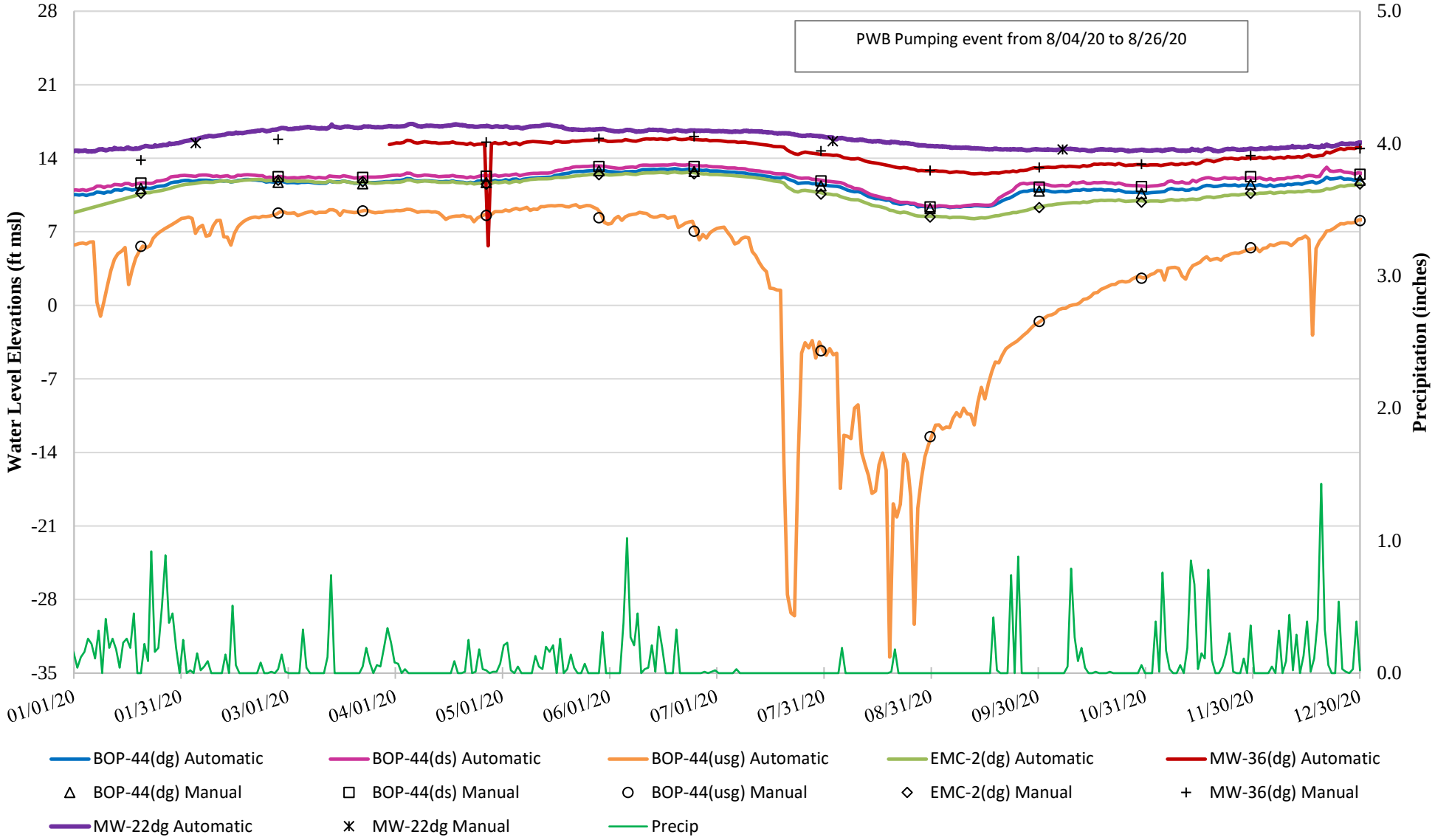
Notes:
ft MSL = feet above mean sea level
TOC = top of casing
-- = data were not available
NM = Not Measured
[1] Wells VMW-E, VMW-F, VMW-G are angled wells and depth to water could not be measured. However, the



Notes:
PWB Pumping: 0.15 BGal from TSA, 0.21 BGal from SGA, and 0.05 BGal from BLA.
Datalogger replacement at BOP-23(dg) on 11/3/20.

LANDAU ASSOCIATES

East Multnomah County Cleanup	**Hydrograph for Zone B TSA Wells January - December 2020**	Figure D-1



Geosyntec consultants

Cascade Corporation Gresham, Oregon	**Hydrograph for TSA Wells** **1 January 2020 through 31 December 2020**	Figure D-2

APPENDIX E
Groundwater Quality Data

Table E-1
Groundwater Analytical Results
1 January 2020 through 31 December 2020
East Multnomah County 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-020520-DUP	2/5/2020	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	1
Lower	TS-C-Eff	TS-C-EFF-020520	2/5/2020	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	TS-C-Eff	TS-C-EFF-050520	5/5/2020	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	TS-C-Eff	TS-C-EFF-050520-DUP	5/5/2020	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	1
Lower	TS-C-Eff	TS-C-EFF-080420	8/4/2020	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	
Lower	TS-C-Eff	TS-C-EFF-080420-DUP	8/4/2020	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	1
Lower	TS-C-Eff	TS-C-EFF-110420	11/4/2020	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	TS-C-Eff	TS-C-EFF-110420-DUP	11/4/2020	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	1
Lower	TS-C-Inf	TS-C-INF-020520	2/5/2020	**3.97**	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	TS-C-Inf	TS-C-INF-050520	5/5/2020	**3.94**	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	TS-C-Inf	TS-C-INF-080520	8/5/2020	**6.49**	< 0.50	**0.684**	< 0.500	< 0.500	
Lower	TS-C-Inf	TS-C-INF-110420	11/4/2020	**4.96**	< 0.500	**0.558**	< 0.500	< 0.500	
Extraction Wells									
Lower	EW-14	EW14-020520	2/5/2020	**7.74**	**0.523**	**1.06**	< 0.500	< 0.500	
Lower	EW-14	EW14-050520	5/5/2020	**5.95**	< 0.50	**0.919**	< 0.500	< 0.500	
Lower	EW-14	EW14-080420	8/4/2020	**6.54**	< 0.50	**0.918**	< 0.500	< 0.500	
Lower	EW-14	EW14-110420	11/4/2020	**5.97**	< 0.500	**0.988**	< 0.500	< 0.500	
Lower	EW-2	EW2-020520	2/5/2020	**13.3**	**0.815**	**1.53**	< 0.500	< 0.500	
Lower	EW-2	EW2-050520	5/5/2020	**12.5**	**0.844**	**1.36**	< 0.500	< 0.500	
Lower	EW-2	EW2-080420	8/4/2020	**11.0**	**0.908**	**1.14**	< 0.500	< 0.500	
Lower	EW-2	EW2-110420	11/4/2020	**9.13**	**0.850**	**1.05**	< 0.500	< 0.500	
Lower	EW-23	EW23-020520	2/5/2020	**1.74**	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	EW-23	EW23-080420	8/4/2020	**1.71**	< 0.50	< 0.500	< 0.500	< 0.500	
Lower	EW-23	EW23-110420	11/4/2020	**1.64**	< 0.500	< 0.500	< 0.500	< 0.500	
Monitoring Wells									
Upper	BOP-13ds	BOP-13DS;BOP-Z-0220;20200204	2/4/2020	**2.2**	< 0.20	**0.30**	< 0.20	< 0.20	1
Upper	BOP-13ds	BOP-13DS;BOP-13DS-0220;20200204	2/4/2020	**2.3**	< 0.20	**0.30**	< 0.20	< 0.20	
Upper	BOP-13ds	BOP-13DS;BOP-13DS-0520;20200504	5/4/2020	**2.6**	< 0.20	**0.40**	< 0.20	< 0.20	
Upper	BOP-13ds	BOP-13DS;BOP-13DS-0820;20200805	8/5/2020	**2.0**	< 0.20	**0.32**	< 0.20	< 0.20	
Upper	BOP-13ds	BOP-13DS;BOP-13DS-1120;20201103	11/3/2020	**2.24**	< 0.20	**0.33**	< 0.20	< 0.20	
Upper	BOP-20ds	BOP-20DS;BOP-20DS-0820;20200806	8/6/2020	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	
Upper	BOP-31ds	BOP-31DS;BOP-31DS-0220;20200204	2/4/2020	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	
Upper	BOP-31ds	BOP-31DS;BOP-31DS-0520;20200504	5/4/2020	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	
Upper	BOP-31ds	BOP-31DS;BOP-31DS-0820;20200805	8/5/2020	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	
Upper	BOP-31ds	BOP-31DS;BOP-31DS-1120;20201103	11/3/2020	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	
Upper	BOP-61ds	BOP-61DS;BOP-61DS-0220;20200204	2/4/2020	**3.8**	< 0.20	**0.40**	< 0.20	< 0.20	
Upper	BOP-61ds	BOP-61DS;BOP-61DS-0820;20200806	8/6/2020	**3.2**	< 0.20	**0.27**	< 0.20	< 0.20	
Upper	BOP-62ds	BOP-62DS;BOP-62DS-0820;20200805	8/5/2020	**1.00**	< 0.20	**0.36**	< 0.20	< 0.20	
Upper	BOP-65ds	BOP-65DS;BOP-65DS-0820;20200805	8/5/2020	**0.23**	< 0.20	< 0.20	< 0.20	< 0.20	
Upper	BOP-66ds	BOP-66DS;BOP-66DS-0220;20200204	2/4/2020	**1.8**	< 0.20	< 0.20	< 0.20	< 0.20	
Upper	BOP-66ds	BOP-66DS;BOP-66DS-0820;20200806	8/6/2020	**0.71**	< 0.20	< 0.20	< 0.20	< 0.20	
Upper	CMW-10ds	CMW10DS-020420	2/4/2020	**14.2**	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	CMW-10ds	CMW10DS-050520	5/5/2020	**9.54**	< 0.50	< 0.500	< 0.500	< 0.500	
Upper	CMW-10ds	CMW10DS-080420	8/4/2020	**13.2**	**0.62**	< 0.500	< 0.500	< 0.500	
Upper	CMW-10ds	CMW-10DS-110420	11/4/2020	**11.3**	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	CMW-17ds	CMW17DS-020420	2/4/2020		**0.625 J**	**2.26 J**	< 0.500	< 0.500	

Table E-1
Groundwater Analytical Results
1 January 2020 through 31 December 2020
East Multnomah County 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-17ds	CMW17DS-020420-DUP	2/4/2020		**2.09 J**	**6.36 J**	< 0.500	< 0.500	1
Upper	CMW-17ds	CMW17DS-030920-DUP	3/9/2020	**51.8**	**2.09**	**7.24**	< 0.500	< 0.500	1
Upper	CMW-17ds	CMW17DS-030920	3/9/2020	**49.8**	**1.92**	**7.22**	< 0.500	< 0.500	
Upper	CMW-17ds	CMW17DS-050520	5/5/2020	**48.1**	**2.29**	**7.26**	< 0.500	< 0.500	
Upper	CMW-17ds	CMW17DS-080420	8/4/2020	**48.4**	**2.98**	**6.73**	< 0.500	< 0.500	
Upper	CMW-17ds	CMW17DS-080420-DUP	8/4/2020	**47.9**	**2.74**	**6.57**	< 0.500	< 0.500	1
Upper	CMW-17ds	CMW17DS-110420-DUP	11/4/2020	**40.9**	**2.05**	**5.28**	< 0.500	< 0.500	1
Upper	CMW-17ds	CMW17DS-110420	11/4/2020	**37.9**	**1.93**	**5.01**	< 0.500	< 0.500	
Upper	CMW-18ds	CMW18DS-020420-DUP	2/4/2020	**80.6**	**2.22**	**9.05**	< 0.500	< 0.500	1
Upper	CMW-18ds	CMW18DS-020420	2/4/2020	**81.3**	**2.04**	**9.55**	< 0.500	< 0.500	
Upper	CMW-18ds	CMW18DS-050520-DUP	5/5/2020	**91.5**	**3.43**	**14.4**	< 0.500	< 0.500	1
Upper	CMW-18ds	CMW18DS-050520	5/5/2020	**90.7**	**3.27**	**15.2**	< 0.500	< 0.500	
Upper	CMW-18ds	CMW18DS-080420-DUP	8/4/2020	**95.3**	**3.2**	**13.9**	< 0.500	< 0.500	1
Upper	CMW-18ds	CMW18DS-080420	8/4/2020	**96.6**	**3.84**	**14.2**	< 0.500	< 0.500	
Upper	CMW-18ds	CMW18DS-110420-DUP	11/4/2020	**90.1**	**3.10**	**13.2**	< 0.500	< 0.500	1
Upper	CMW-18ds	CMW18DS-110420	11/4/2020	**86.9**	**3.04**	**12.2**	< 0.500	< 0.500	
Upper	CMW-19ds	CMW19DS-020420	2/4/2020	**2.81**	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	CMW-19ds	CMW19DS-050520	5/5/2020	**1.22**	< 0.50	< 0.500	< 0.500	< 0.500	
Upper	CMW-19ds	CMW19DS-080420	8/4/2020	**1.29**	< 0.50	< 0.500	< 0.500	< 0.500	
Upper	CMW-19ds	CMW19DS-110420	11/4/2020	**2.74**	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	CMW-20ds	CMW20DS-020420	2/4/2020	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	CMW-20ds	CMW20DS-080420	8/4/2020	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	
Upper	EW-3	EW-3;EW-3-0820;20200805	8/5/2020	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	
Lower	BOP-13dg	BOP-13DG;BOP-13DG-0220;20200204	2/4/2020	**0.40**	< 0.20	< 0.20	< 0.20	< 0.20	
Lower	BOP-13dg	BOP-13DG;BOP-13DG-0520;20200504	5/4/2020	**0.40**	< 0.20	< 0.20	< 0.20	< 0.20	
Lower	BOP-13dg	BOP-13DG;BOP-13DG-0820;20200805	8/5/2020	**0.39**	< 0.20	< 0.20	< 0.20	< 0.20	
Lower	BOP-13dg	BOP-13DG;BOP-13DG-1120;20201103	11/3/2020	**0.384**	< 0.20	< 0.20	< 0.20	< 0.20	
Lower	BOP-23dg	BOP-23DG;BOP-23DG-0820;20200806	8/6/2020	**1.0**	< 0.20	< 0.20	< 0.20	< 0.20	
Lower	BOP-23dg	BOP-23DG;BOP-Z-0820;20200806	8/6/2020	**0.99**	< 0.20	< 0.20	< 0.20	< 0.20	1
Lower	BOP-31dg	BOP-31DG;BOP-31DG-0220;20200204	2/4/2020	**3.0**	**0.40**	**0.30**	< 0.20	< 0.20	
Lower	BOP-31dg	BOP-31DG;BOP-31DG-0520;20200504	5/4/2020	**3.0**	**0.40**	**0.30**	< 0.20	< 0.20	
Lower	BOP-31dg	BOP-31DG;BOP-Y-0820;20200805	8/5/2020	**2.9**	**0.38**	**0.27**	< 0.20	< 0.20	1
Lower	BOP-31dg	BOP-31DG;BOP-31DG-0820;20200805	8/5/2020	**2.8**	**0.34**	**0.26**	< 0.20	< 0.20	
Lower	BOP-31dg	BOP-31DG;BOP-31DG-1120;20201103	11/3/2020	**2.71**	**0.369**	**0.239**	< 0.20	< 0.20	
Lower	BOP-61dg	BOP-61DG;BOP-61DG-0220;20200204	2/4/2020	**0.60**	< 0.20	< 0.20	< 0.20	< 0.20	
Lower	BOP-61dg	BOP-61DG;BOP-61DG-0820;20200806	8/6/2020	**3.7**	< 0.20	**0.24**	< 0.20	< 0.20	
Lower	CMW-14Rds	CMW14RDS-020520	2/5/2020	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	CMW-14Rds	CMW14RDS-080420	8/4/2020	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	
Lower	CMW-22dg	CMW22DG-080420	8/4/2020	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	
Lower	CMW-24dg (EW-5)	CMW24DG-020420	2/4/2020	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	CMW-24dg (EW-5)	CMW24DG-080420	8/4/2020	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	
Lower	CMW-25dg	CMW25DG-020420	2/4/2020	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	CMW-25dg	CMW25DG-080420	8/4/2020	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	
Lower	CMW-36dg	CMW36DG-080420	8/4/2020	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	
Lower	D-17dg	D17DG-020420	2/4/2020	**0.748**	**1.02**	**11.4**	< 0.500	< 0.500	
Lower	D-17dg	D17DG-050520	5/5/2020	**0.864**	< 0.50	< 0.500	< 0.500	< 0.500	
Lower	D-17dg	D17DG-080420	8/4/2020	**4.38**	< 0.50	**0.873**	< 0.500	< 0.500	

Table E-1
Groundwater Analytical Results
1 January 2020 through 31 December 2020
East Multnomah County 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
Lower	D-17dg	D17DG-110420	11/4/2020	**3.87**	< 0.500	**0.907**	< 0.500	< 0.500	
Lower	D-17ds	D17DS-020420	2/4/2020	**50.8**	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	D-17ds	D17DS-050520	5/5/2020	**59.9**	**1.51**	**18.0**	< 0.500	< 0.500	
Lower	D-17ds	D17DS-080420	8/4/2020	**40.7**	**1.35**	**13.0**	< 0.500	< 0.500	
Lower	D-17ds	D17DS-110420	11/4/2020	**34.6**	**0.876**	**9.95**	< 0.500	< 0.500	
Lower	EW-1	EW1-020520	2/5/2020	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	EW-1	EW-1-050520	5/5/2020	< 0.50	< 0.50	< 0.500	< 0.500	< 0.500	
Lower	EW-1	EW1-080420	8/4/2020	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	
Lower	EW-1	EW1-110420	11/4/2020	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	EW-8	EW8-080420	8/4/2020	**1.41**	< 0.50	< 0.500	< 0.500	< 0.500	
Lower	EW-12	EW12-020420	2/4/2020	**1.85**	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	EW-12	EW12-050520	5/5/2020	**2.04**	< 0.50	< 0.500	< 0.500	< 0.500	
Lower	EW-12	EW12-080420	8/4/2020	**2.21**	< 0.50	< 0.500	< 0.500	< 0.500	
Lower	EW-12	EW12-110420	11/4/2020	**2.18**	< 0.500	< 0.500	< 0.500	< 0.500	
Lower	EW-13	EW-13;EW-13-0820;20200805	8/5/2020	**0.75**	< 0.20	**0.22**	< 0.20	< 0.20	
Lower	EW-16	EW16-020420	2/4/2020	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Vapor Monitoring Wells									
Upper	VMW-A	VMWA-020520	2/5/2020	**5.76**	< 0.500	**0.714**	< 0.500	< 0.500	
Upper	VMW-A	VMWA-050520	5/5/2020	**6.53**	< 0.50	**0.771**	< 0.500	< 0.500	
Upper	VMW-A	VMWA-080420	8/4/2020	**5.09**	< 0.50	**0.603**	< 0.500	< 0.500	
Upper	VMW-A	VMWA-110420	11/4/2020	**4.75**	< 0.500	**0.643**	< 0.500	< 0.500	
Upper	VMW-B	VMWB-020520	2/5/2020	**25.2**	**1.14**	**4.05**	< 0.500	< 0.500	
Upper	VMW-B	VMWB-050520	5/5/2020	**18.5**	**0.891**	**3.29**	< 0.500	< 0.500	
Upper	VMW-B	VMWB-080420	8/4/2020	**18.7**	**0.82**	**3.02**	< 0.500	< 0.500	
Upper	VMW-B	VMWB-110420	11/4/2020	**17.0**	**0.751**	**2.62**	< 0.500	< 0.500	
Upper	VMW-C	VMWC-020520	2/5/2020	**11.3**	**0.505**	**0.888**	< 0.500	< 0.500	
Upper	VMW-C	VMWC-050520	5/5/2020	**5.87**	< 0.50	**0.631**	< 0.500	< 0.500	
Upper	VMW-C	VMWC-080420	8/4/2020	**5.85**	< 0.50	< 0.500	< 0.500	< 0.500	
Upper	VMW-C	VMWC-110420	11/4/2020	**6.69**	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-D	VMWD-020520	2/5/2020	**1.30**	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-D	VMWD-050520	5/5/2020	**0.934**	< 0.50	< 0.500	< 0.500	< 0.500	
Upper	VMW-D	VMWD-080420	8/4/2020	**7.86**	< 0.50	< 0.500	< 0.500	< 0.500	
Upper	VMW-D	VMWD-110420	11/4/2020	**0.936**	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-E	VMWE-020520	2/5/2020	**42.5**	**2.33**	**7.18**	< 0.500	< 0.500	
Upper	VMW-E	VMWE-050520	5/5/2020	**38.6**	**2.53**	**7.07**	< 0.500	< 0.500	
Upper	VMW-E	VMWE-080420	8/4/2020	**34.5**	**2.47**	**5.66**	< 0.500	< 0.500	
Upper	VMW-E	VMWE-110420	11/4/2020	**30.1**	**1.91**	**4.59**	< 0.500	< 0.500	
Upper	VMW-F	VMWF-020520	2/5/2020	**2.67**	< 0.500	**1.49**	< 0.500	< 0.500	
Upper	VMW-F	VMWF-050520	5/5/2020	**0.57**	< 0.50	< 0.500	< 0.500	< 0.500	
Upper	VMW-F	VMWF-080420	8/4/2020	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	
Upper	VMW-F	VMWF-110420	11/4/2020	**3.72**	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-G	VMWG-020520	2/5/2020	**7.14**	< 0.500	**2.58**	< 0.500	< 0.500	
Upper	VMW-G	VMWG-050520	5/5/2020	**4.81**	< 0.50	**1.75**	< 0.500	< 0.500	
Upper	VMW-G	VMWG-080420	8/4/2020	**4.79**	< 0.50	**0.914**	< 0.500	< 0.500	
Upper	VMW-G	VMWG-110420	11/4/2020	**3.22**	< 0.500	**0.788**	< 0.500	< 0.500	
Upper	VMW-H	VMWH-020520	2/5/2020	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-H	VMWH-050520	5/5/2020	< 0.50	< 0.50	< 0.500	< 0.500	< 0.500	

Table E-1
Groundwater Analytical Results
1 January 2020 through 31 December 2020
East Multnomah County 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-H	VMWH-080420	8/4/2020	**0.619**	< 0.50	< 0.500	< 0.500	< 0.500	
Upper	VMW-H	VMWH-110420	11/4/2020	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-I	VMWI-081020-B	8/10/2020	**37.8**	**1.59**	**3.05**	< 0.500	< 0.500	
Upper	VMW-I	VMWI-081020-M	8/10/2020	**38.7**	**1.58**	**3.08**	< 0.500	< 0.500	
Upper	VMW-I	VMWI-081020-T	8/10/2020	**53.9**	**2.18**	**5.30**	< 0.500	< 0.500	
Upper	VMW-I	VMWI-110520-143.7	11/5/2020	**36.5**	**1.48 J+**	**2.75**	< 0.500	< 0.500	
Upper	VMW-I	VMWI-110520-131.6	11/5/2020	**35.6**	< 0.500	**2.74**	< 0.500	< 0.500	
Upper	VMW-I	VMWI-110520-148.1	11/5/2020	**35.5**	**1.41 J+**	**2.58**	< 0.500	< 0.500	
Upper	VMW-I	VMWI-110520-137.3	11/5/2020	**30.9**	**1.25 J+**	**2.16**	< 0.500	< 0.500	
Upper	VMW-I	VMWI-110520-140.5	11/5/2020	**34.5**	< 0.500	**2.57**	< 0.500	< 0.500	
Upper	VMW-I	VMWI-110520-126.4	11/5/2020	**28.1**	< 0.500	**1.82**	< 0.500	< 0.500	
Upper	VMW-J2	VMWJ2-081020-B	8/10/2020	**58.9**	**0.732**	**10.0**	< 0.500	< 0.500	
Upper	VMW-J2	VMWJ2-081020-M	8/10/2020	**41.7**	**0.725**	**5.52**	< 0.500	< 0.500	
Upper	VMW-J2	VMWJ2-110520-120.2	11/5/2020	**85.4**	**1.92 J+**	**9.95**	< 0.500	< 0.500	
Upper	VMW-J2	VMWJ2-110520-114.0	11/5/2020	**12.5**	< 0.500	**2.00**	< 0.500	< 0.500	
Upper	VMW-J2	VMWJ2-110520-115.8	11/5/2020	**13.4**	< 0.500	**2.20**	< 0.500	< 0.500	
Upper	VMW-J2	VMWJ2-110520-117.8	11/5/2020	**23.5**	< 0.500	**3.44**	< 0.500	< 0.500	
Upper	VMW-J2	VMWJ2-110520-122.7	11/5/2020	**76.3**	**1.95 J+**	**8.94**	< 0.500	< 0.500	
Upper	VMW-K	VMWK-081020-B	8/10/2020	**1.26**	< 0.50	< 0.500	< 0.500	< 0.500	
Upper	VMW-K	VMWK-081020-M	8/10/2020	**1.02**	< 0.50	< 0.500	< 0.500	< 0.500	
Upper	VMW-K	VMWK-110520-114.3	11/5/2020	**2.26**	< 0.500	**0.741**	< 0.500	< 0.500	
Upper	VMW-K	YMWK-110520-119.0	11/5/2020	**2.10**	< 0.500	**0.794**	< 0.500	< 0.500	
Upper	VMW-K	VMWK-110520-110.0	11/5/2020	**2.19**	< 0.500	**0.782**	< 0.500	< 0.500	
Upper	VMW-L	VMWL-081020-B	8/10/2020	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	
Upper	VMW-L	VMWL-081020-T	8/10/2020	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	
Upper	VMW-L	VMWL-081020-M	8/10/2020	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	
Upper	VMW-L	VMWL-110520-103.3	11/5/2020	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-L	VMWL-110520-96.0	11/5/2020	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-L	VMWL-110520-113.4	11/5/2020	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-M	VMWM-081020-B	8/10/2020	**6.21**	< 0.50	**0.993**	< 0.500	< 0.500	
Upper	VMW-M	VMWM-081020-M	8/10/2020	**7.20**	< 0.50	**1.06**	< 0.500	< 0.500	
Upper	VMW-M	VMWM-081020-T	8/10/2020	**14.2**	< 0.50	**2.44**	< 0.500	< 0.500	
Upper	VMW-M	VMWM-110520-97.7	11/5/2020	**5.00**	< 0.500 J	**0.616**	< 0.500	< 0.500	
Upper	VMW-M	VMWM-110520-101.8	11/5/2020	**3.96**	< 0.500	**0.524**	< 0.500	< 0.500	
Upper	VMW-M	VMWM-110520-106.2	11/5/2020	**3.68**	< 0.500	< 0.500	< 0.500	< 0.500	

Table E-1
Groundwater Analytical Results
1 January 2020 through 31 December 2020
East Multnomah County 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-M	VMWM-110520-94.0	11/5/2020	**12.7**	< 0.500	**1.87**	< 0.500	< 0.500	
Upper	VMW-M	VMWM-110520-110.7	11/5/2020	**3.84**	< 0.500	< 0.500	< 0.500	< 0.500	
Upper	VMW-N	VMWN-081020-M	8/10/2020	**18.5**	**0.696**	**3.19**	< 0.500	< 0.500	
Upper	VMW-N	VMWN-081020-T	8/10/2020	**19.3**	**0.959**	**3.41**	< 0.500	< 0.500	
Upper	VMW-N	VMWN-081020-B	8/10/2020	**18.4**	**0.703**	**2.94**	< 0.500	< 0.500	
Upper	VMW-N	VMWN-110520-110.8	11/5/2020	**22.9**	**1.50 J**	**3.92**	< 0.500	< 0.500	
Upper	VMW-N	VMWN-110520-95.0	11/5/2020	**22.4**	< 0.500	**3.70**	< 0.500	< 0.500	
Upper	VMW-N	VMWN-110520-106.5	11/5/2020	**22.0**	**1.32 J+**	**3.63**	< 0.500	< 0.500	
Upper	VMW-N	VMWN-110520-98.3	11/5/2020	**22.2**	< 0.500	**3.66**	< 0.500	< 0.500	
Upper	VMW-N	VMWN-110520-102.3	11/5/2020	**21.9**	**1.23 J+**	**3.61**	< 0.500	< 0.500	

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.

< = 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

Table E-2
TCE Mass Removal - January 1998 through December 2020
TSA Remedy - East Multnomah County

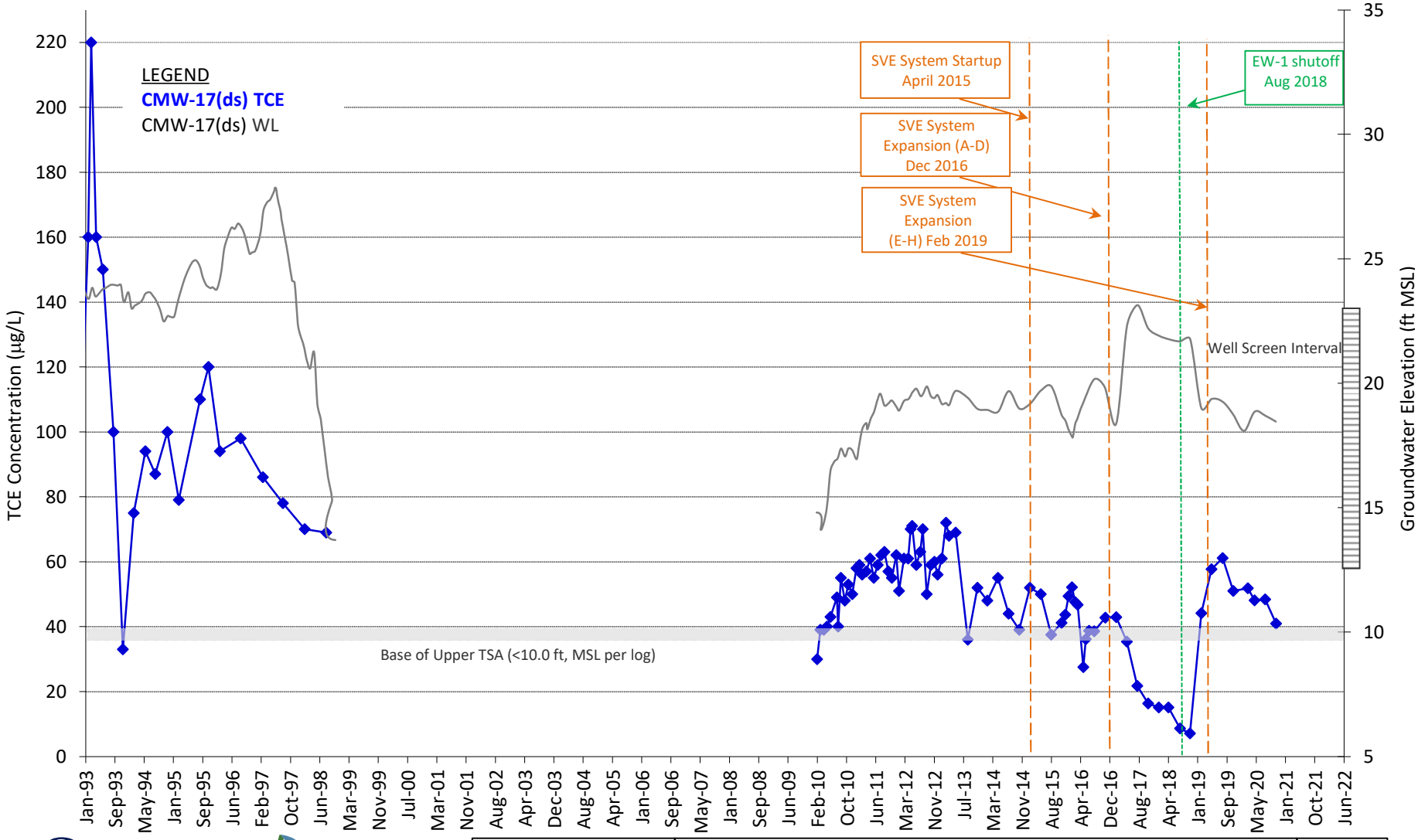
Date	Pounds of TCE Removed Per Year	Cumulative Pounds of TCE Removed
Jan-98	0.00	0.00
Aug-98	116.00	116.00
Feb-00	110.00	226.00
Feb-01	55.00	281.00
Feb-02	51.20	332.20
Feb-03	32.30	364.50
Feb-08	81.00	445.50
Feb-09	8.10	453.60
Feb-10	6.11	459.71
Feb-11	4.59	464.30
Feb-12	5.48	469.79
Feb-13	7.17	476.96
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

Table E-3
TCE Mass Removal Per Extraction Well
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
Total (5 years)	1.85	6.95	0.00	0.00	3.33	0.00	0.00	0.00	0.00	1.25	13.39
Total (10 years)	7.51	15.62	0.00	0.00	8.66	0.00	0.36	0.00	0.00	3.73	35.88

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 lbs in the 2018 TSA Annual Report and has been corrected here to 2.65 lbs.



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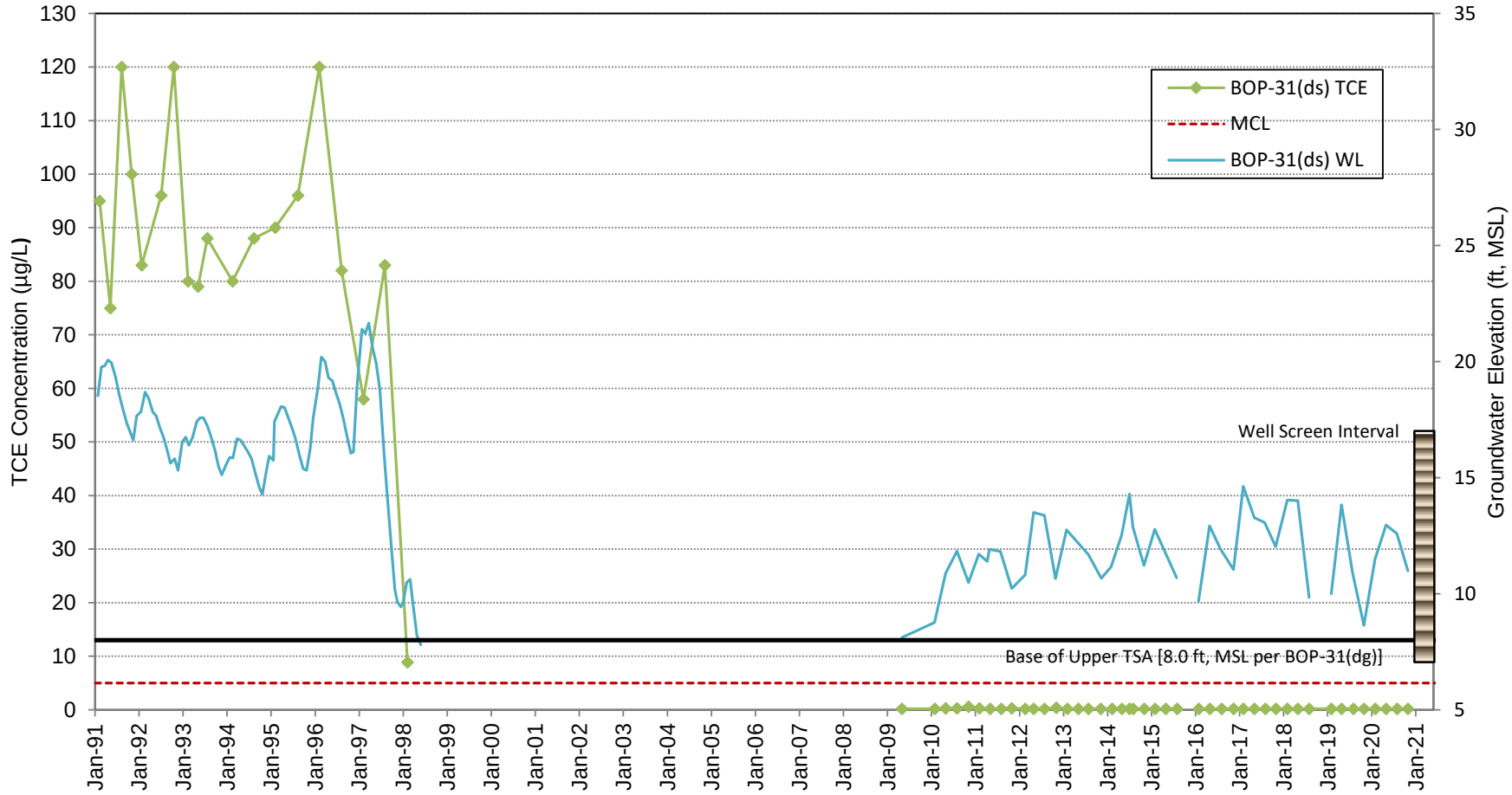
Cascade Corporation Gresham, Oregon	**TCE Concentration Profile CMW-17(ds)** **TSA Remedy**	Figure E-1

P:\025\116\WIP\R\TSA\2019 Annual Report\SourceFiles\BOP13ds-BOP31ds-TCE-WL



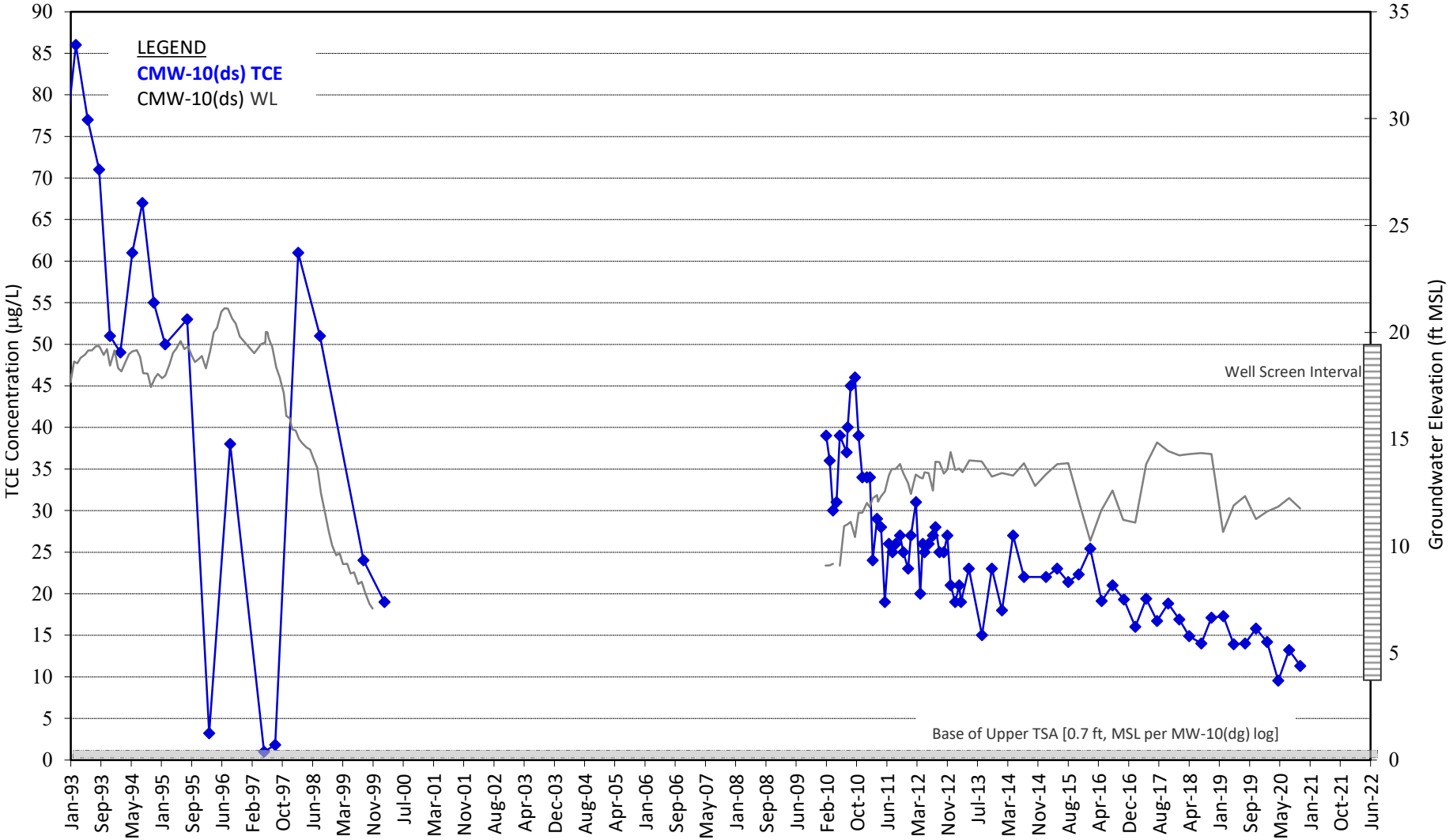
NOTES: Where TCE concentrations are below reporting limit, reporting limit is shown. Highest TCE concentration shown where sample collected in duplicate.
Top of well screen = 17.0 ft, MSL (screen length = 10 ft).
Well was dry between February 1998 and May 2009, November 2015, and November 2018. No samples were collected.

LANDAU ASSOCIATES

East Multnomah County Cleanup Project
Portland, Oregon

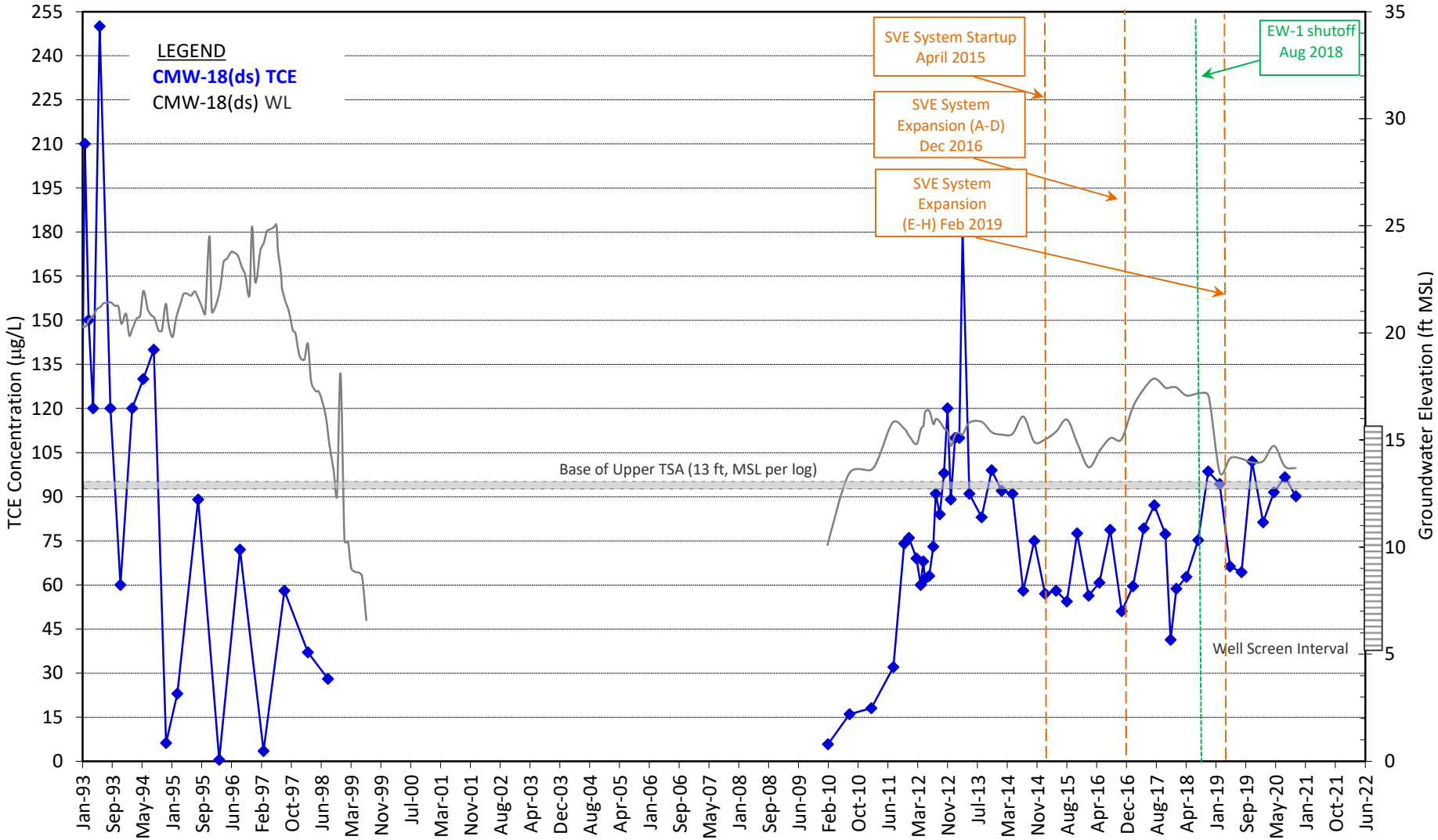
BOP-31(ds)
TCE and Groundwater Elevation

Figure
E-2



Geosyntec consultants

Cascade Corporation Gresham, Oregon	**TCE Concentration Profile CMW-10(ds)** **TSA Remedy**	Figure E-3



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Cascade Corporation Gresham, Oregon	**TCE Concentration Profile CMW-18(ds)** **TSA Remedy**	Figure E-4

P:\025\116\WIP\R\TSA\2019 Annual Report\SourceFiles\BOP13ds-BOP31ds-TCE-WL

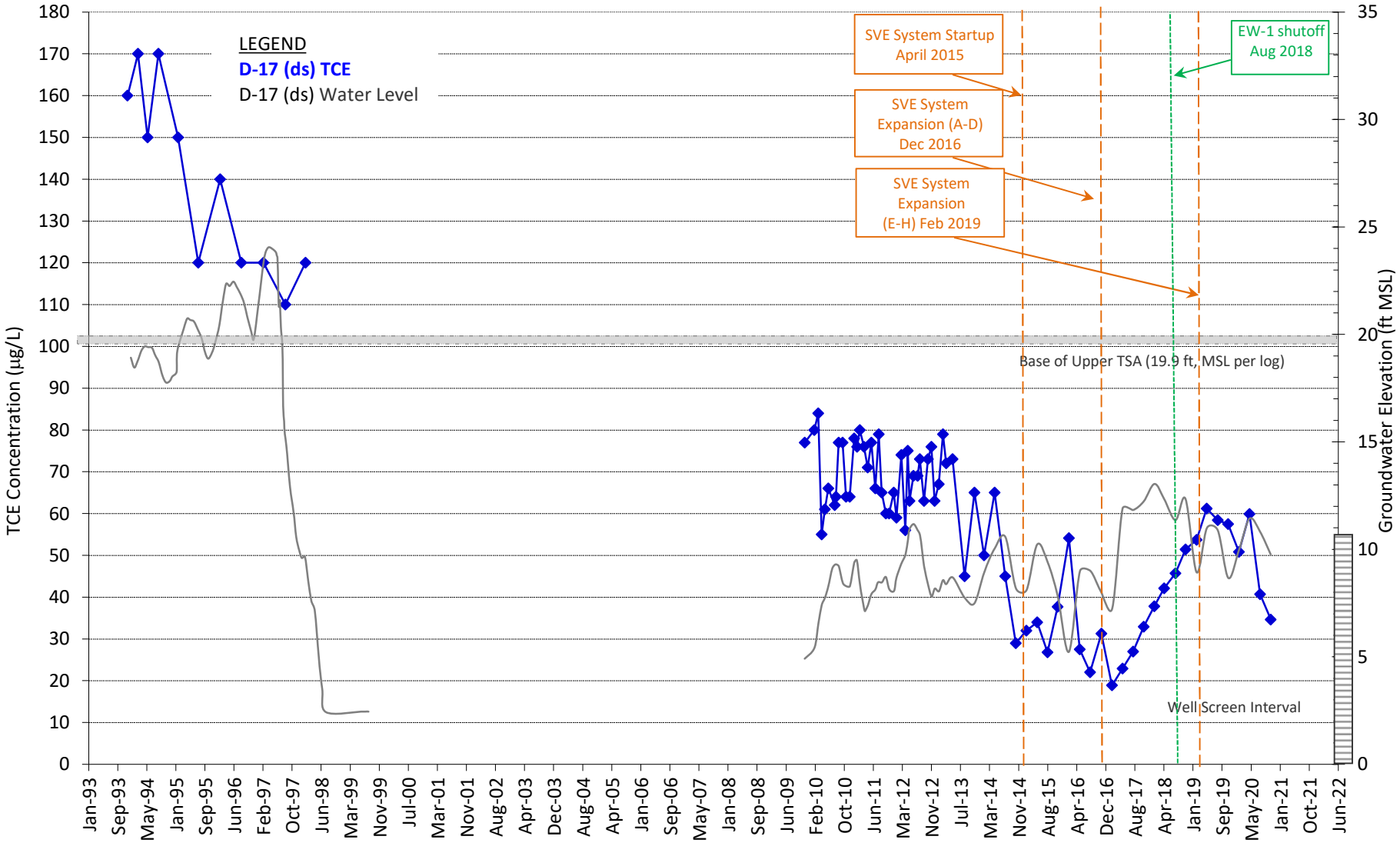
NOTES: Where TCE concentrations are below reporting limit, reporting limit is shown. Highest TCE concentration shown where sample collected in duplicate. Top of

LANDAU ASSOCIATES

East Multnomah County Cleanup Project
Portland, Oregon

BOP-31(dg)
TCE and Groundwater Elevation

Figure
E-5



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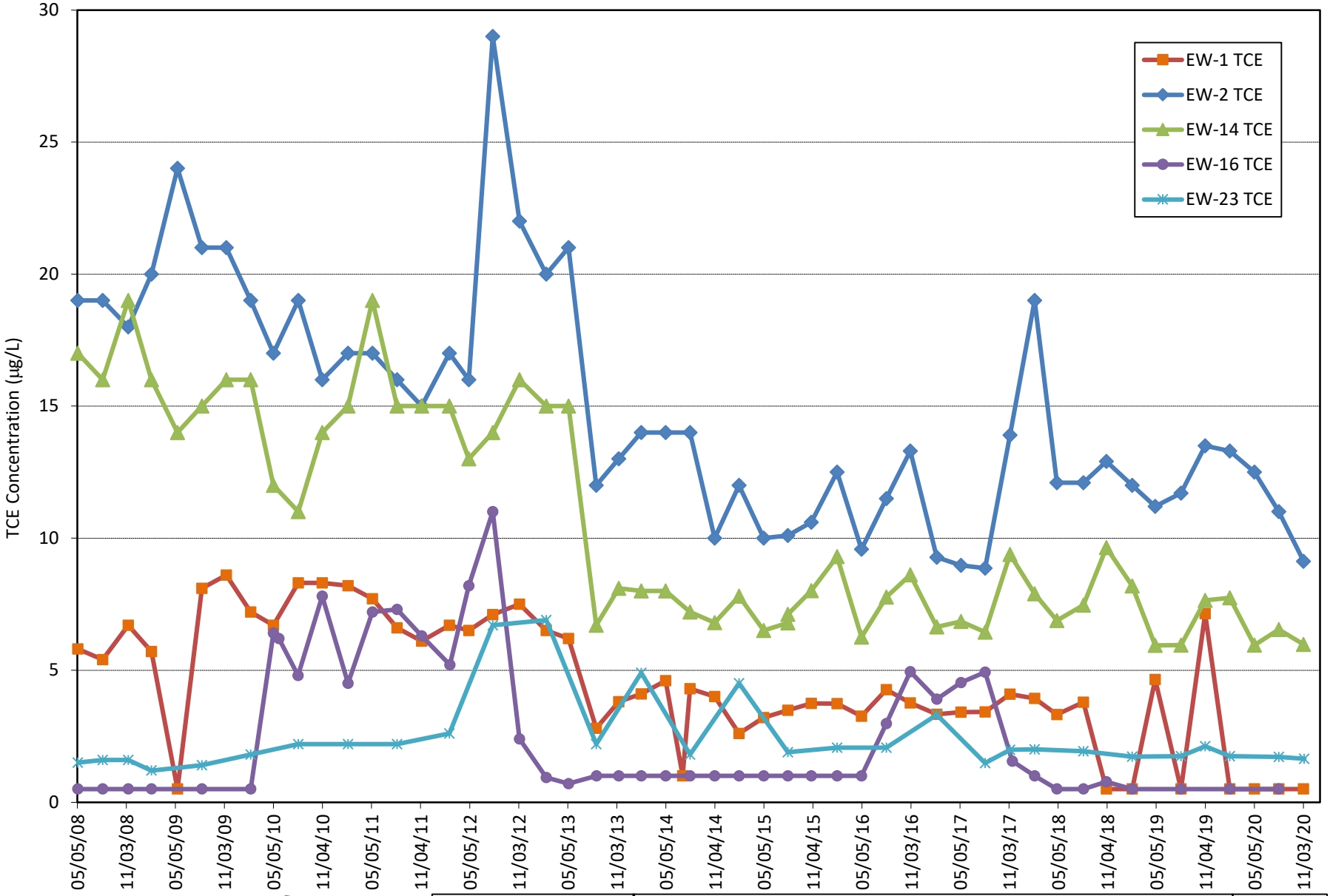
Cascade Corporation Gresham, Oregon	**TCE Concentration Profile D-17(ds) TSA Remedy**	Figure E-6



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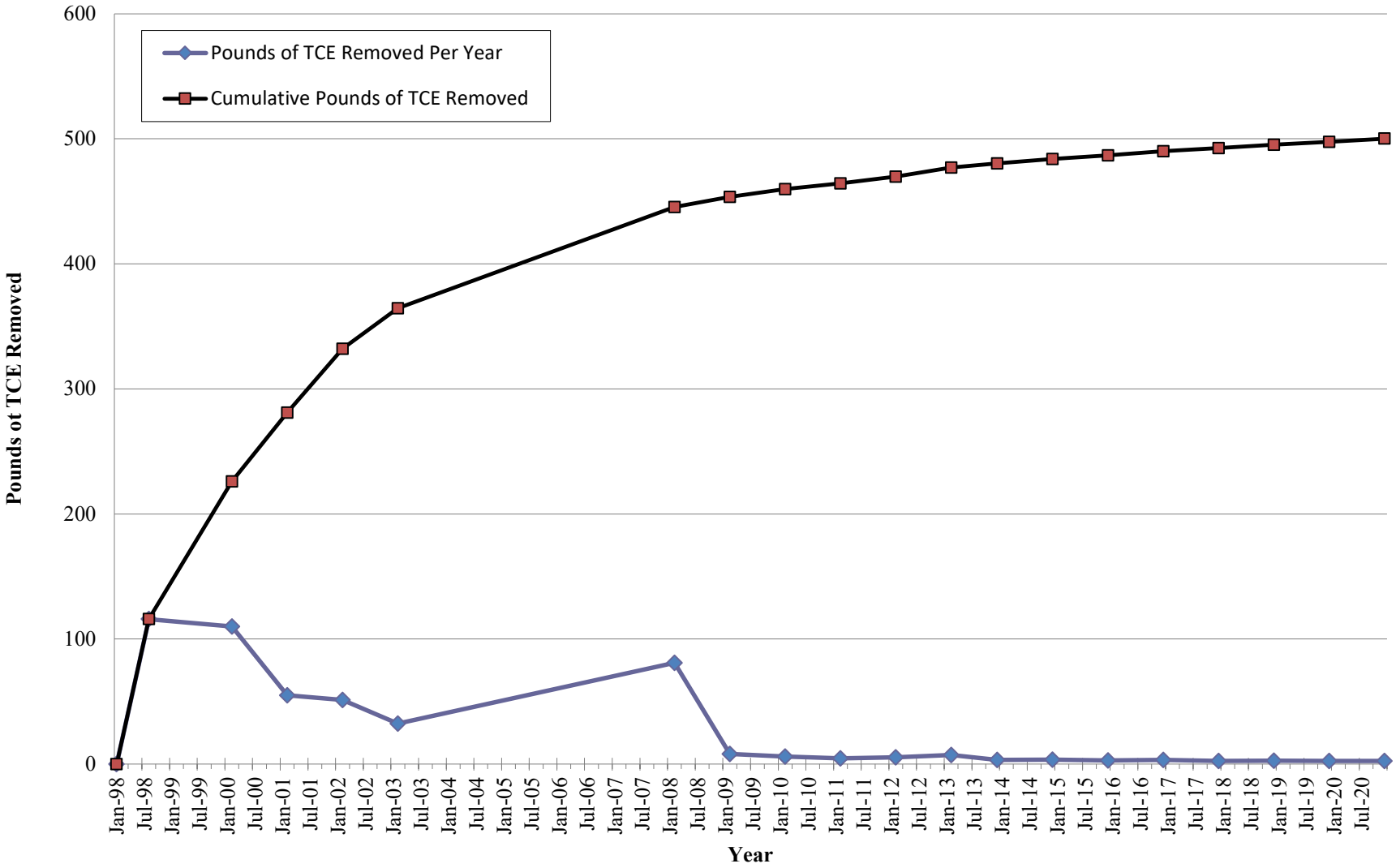
Cascade Corporation Gresham, Oregon	**Operating Extraction Wells TCE Concentration Profiles TSA Remedy**	Figure E-7



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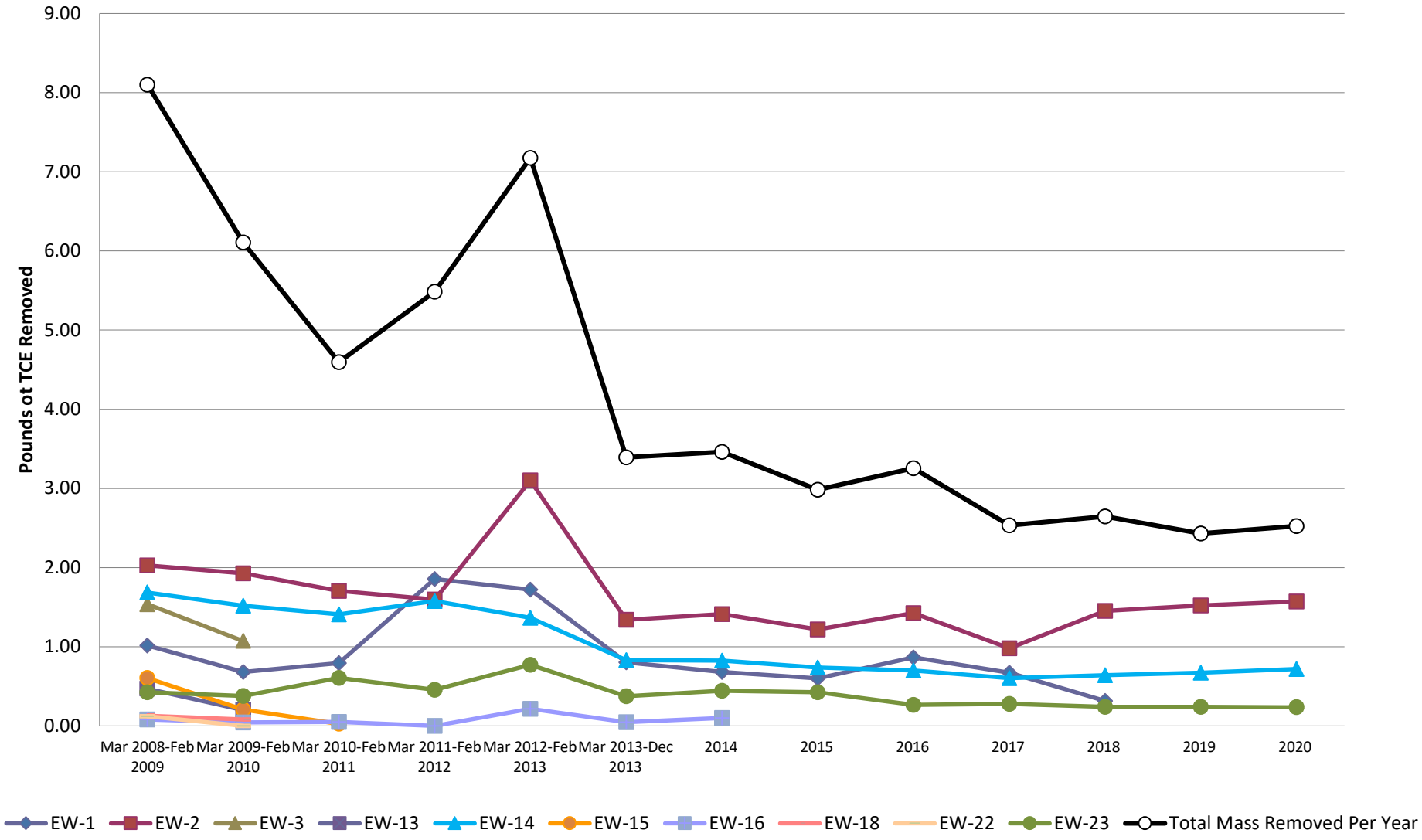
Cascade Corporation Gresham, Oregon	**TCE Mass Removal** **TSA Remedy**	Figure E-8



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

APPENDIX F

Data Validation Memoranda

Laboratory Reports (CD)

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

Geosyntec consultants

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Memorandum

Date:	27 May 2020
To:	Cindy Bartlett, RG, LG
	Geosyntec Consultants, Portland, Oregon
From:	Matthew Richardson
CC:	J. Caprio
Subject:	**Stage 2A Data Validation - Level II Data Deliverables – ALS Environmental Service Request Numbers P2000110, P2000687, and P2001270 and Pace Analytical Sample Delivery Groups L1187219, L1187224, and L1197154**

SITE: Cascade TSA; Job No: PNG0564519

INTRODUCTION

This report summarizes the findings of the Stage 2A data validation of twenty-eight water samples, three trip blanks, four field duplicate samples and nine air samples collected on January 7, 2020, February 4-5, 2020, March 3, 2020, and March 9, 2020 as part of the site investigation activities for the Cascade Corp., Fairview Oregon sampling event.

The water samples were analyzed by Pace Analytical [formerly ESC Lab Sciences (ESC)], Mt. Juliet, Tennessee for the following analytical test:

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

The air samples were analyzed by ALS Environmental, Simi Valley, California for the following analytical test:

- US EPA 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.

The data were reviewed based on the US EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, January 2017 (EPA-540-R-2017-002), the pertinent methods referenced in the data packages and professional and technical judgment.

The following samples were analyzed in the data sets:

Laboratory ID	Client ID
P2000110-001	SVE-EFF-01072020
P2000687-001	SVE-EFF-020420
P2000687-002	VW-17D-95.5-020420
P2000687-003	VMWC-020420
P2000687-004	VMWE-0204020
P2000687-005	VMWF-020420
P2000687-006	VMWG-020420
P2000687-007	VMWH-020420
P2001270-001	SVE-EFF-030320
L1187219-01	TS-C-EFF-020520
L1187219-02	TS-C-EFF-020520-DUP
L1187219-03	TS-C-INF-020520
L1187219-04	TRIP BLANK LOT#440
L1187224-01	D17DS-020420
L1187224-02	D17DG-020420
L1187224-03	EW12-020420
L1187224-04	EW16-020420
L1187224-05	CMW10DS-020420
L1187224-06	CMW17DS-020420
L1187224-07	CMW17DS-020420-DUP
L1187224-08	CMW18DS-020420
L1187224-09	CMW18DS-020420-DUP

Laboratory ID	Client ID
L1187224-10	CMW19DS-020420
L1187224-11	CMW20DS-020420
L1187224-12	CMW24DG-020420
L1187224-13	CMW25DG-020420
L1187224-14	EW1-020520
L1187224-15	EW2-020520
L1187224-16	EW14-020520
L1187224-17	EW23-020520
L1187224-18	CMW14RDS-020520
L1187224-19	VMWA-020520
L1187224-20	VMWB-020520
L1187224-21	VMWC-020520
L1187224-22	VMWD-020520
L1187224-23	VMWE-020520
L1187224-24	VMWF-020520
L1187224-25	VMWG-020520
L1187224-26	VMWH-020520
L1187224-27	TRIP BLANK LOT#440
L1197154-01	CMW17DS-030920
L1197154-02	CMW17DS-030920-DUP
L1197154-03	TRIP BLANK

The water samples were received at the laboratory within the temperature criteria of 0-6°C.

The following issues were noted on the chain of custody (COC) forms. No qualifications were applied to the data based on the issues discussed below.

- The sample receipt was not documented by the laboratory on the COC for laboratory report P2000110.

- Incorrect error corrections were observed on the COCs in laboratory reports L1187219, L1187224, and P2000687, instead of the proper procedure of a single strike through, correction, and initials and date of person making the corrections.

- No collection times were listed for the trip blanks on the COCs in laboratory reports L1187219, L1187224, and L1197154. The laboratory assigned the collection time of 00:00.

- The trip blank in laboratory report L1197154 was identified as Trip Blank Lot #414 on the COC. The level II report and electronic data deliverable (EDD) identified the trip blank as Trip Blank.

1.0 VOLATILE ORGANIC COMPOUNDS

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

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

⊗ Overall Assessment
✓ Holding Times
✓ Method Blank
✓ Matrix Spike/Matrix Spike Duplicate
⊗ Laboratory Control Sample
✓ Surrogate
⊗ Field Duplicate
⊗ Trip Blank
✓ Sensitivity
⊗ Electronic Data Deliverable Review

1.1 Overall Assessment

1.1.1 Completeness

The VOC data reported in these sample set are considered usable for supporting project objectives. 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

L1187224: The recoveries of 1,2-dibromo-3-chloropropane and naphthalene were low and the recoveries of acetone and 2-butanone were high all outside the laboratory specified acceptance criteria in the continuing calibration verification (CCV) in batch WG1425102. Since the percent differences (%Ds) for 1,2-dibromo-3-chloropropane, acetone, and 2-butanone were within validation guidelines, no qualifications were applied to the 1,2-dibromo-3-chloropropane, acetone, and 2-butanone data. However, the non-detect naphthalene results in the associated samples were UJ qualified as estimated less than the reported detection limit (RDL).

L1187224 and L1187219: The recoveries of dichlorodifluoromethane and 1,2,3-trichlorobenzene were low and outside the laboratory specified acceptance criteria in the CCV in batch WG1425103. Since the %Ds for dichlorodifluoromethane and 1,2,3-trichlorobenzene were within validation guidelines, no qualifications were applied to the data.

L1187224: The recoveries of acrolein and chloromethane were low and outside the laboratory specified acceptance criteria in the CCV in batch WG1425591. Therefore, the non-detect acrolein and chloromethane results in the associated samples were UJ qualified as estimated less than the RDLs.

L1197154: The recovery of chloroethane was low and outside the laboratory specified acceptance criteria in the CCV in batch WG1442408. Since the %D for chloroethane was within validation guidelines, no qualifications were applied to the data.

L1197154: The recoveries of acrolein and naphthalene were low and outside the laboratory specified acceptance criteria in the CCV in batch WG1444521. Therefore, the non-detect acrolein and naphthalene results in the trip blank were UJ qualified as estimated less than the RDLs.

Sample	Analyte	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier*	Reason Code**
CMW14RDS-020520	Acrolein	0.0500	U,J0	0.0500	UJ	9
EW14-020520	Acrolein	0.0500	U,J0	0.0500	UJ	9
EW2-020520	Acrolein	0.0500	U,J0	0.0500	UJ	9
EW23-020520	Acrolein	0.0500	U,J0	0.0500	UJ	9
VMWA-020520	Acrolein	0.0500	U,J0	0.0500	UJ	9
VMWB-020520	Acrolein	0.0500	U,J0	0.0500	UJ	9
TRIP BLANK	Acrolein	0.0500	U,J0	0.0500	UJ	9
CMW14RDS-020520	Chloromethane	0.00125	U,J0,J4	0.0013	UJ	9
EW14-020520	Chloromethane	0.00125	U,J0,J4	0.0013	UJ	9
EW2-020520	Chloromethane	0.00125	U,J0,J4	0.0013	UJ	9
EW23-020520	Chloromethane	0.00125	U,J0,J4	0.0013	UJ	9
VMWA-020520	Chloromethane	0.00125	U,J0,J4	0.0013	UJ	9
VMWB-020520	Chloromethane	0.00125	U,J0,J4	0.0013	UJ	9
CMW10DS-020420	Naphthalene	0.0025	U,J0	0.0025	UJ	9
CMW17DS-020420	Naphthalene	0.0025	U,J0	0.0025	UJ	9
CMW17DS-020420-DUP	Naphthalene	0.0025	U,J0	0.0025	UJ	9
CMW18DS-020420	Naphthalene	0.0025	U,J0	0.0025	UJ	9
CMW18DS-020420-DUP	Naphthalene	0.0025	U,J0	0.0025	UJ	9
CMW19DS-020420	Naphthalene	0.0025	U,J0	0.0025	UJ	9
CMW20DS-020420	Naphthalene	0.0025	U,J0	0.0025	UJ	9
CMW24DG-020420	Naphthalene	0.0025	U,J0	0.0025	UJ	9
CMW25DG-020420	Naphthalene	0.0025	U,J0	0.0025	UJ	9
D17DG-020420	Naphthalene	0.0025	U,J0	0.0025	UJ	9

Sample	Analyte	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier*	Reason Code**
D17DS-020420	Naphthalene	0.0025	U,J0	0.0025	UJ	9
EW1-020520	Naphthalene	0.0025	U,J0	0.0025	UJ	9
EW12-020420	Naphthalene	0.0025	U,J0	0.0025	UJ	9
EW16-020420	Naphthalene	0.0025	U,J0	0.0025	UJ	9
TRIP BLANK	Naphthalene	0.0025	U,J0	0.0025	UJ	9

ppm-parts per million
U-not detected at the RDL
J0-laboratory flag indicating the identification of the analyte is acceptable, but the reported concentration is an estimate
J4-laboratory flag indicating 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). Eight method blanks were reported (batches WG1425102, WG1425103, WG1425591, WG1426837, WG1427714, WG1442408, WG1444521, and WG1445279). VOCs were not detected in the method blanks above the method detection limits (MDLs), with the following exceptions.

L1187219 and L1187224: 2-Butanone was detected in the method blank in batch WG1425103 at an estimated concentration greater than the MDL and less than the RDL. Since 2-butanone was not detected in the associated samples, no qualifications were applied to the data.

L1187224: Naphthalene was detected in the method blank in batch WG1425102 at an estimated concentration greater than the MDL and less than the RDL. Since naphthalene was not detected in the associated samples, no qualifications were applied to the data.

L1187224: Acetone and chloromethane were detected in the method blank in batch WG1426837 at estimated concentrations greater than the MDLs and less than the RDLs. Since acetone and chloromethane were either not detected or detected above the RDLs in the associated samples, no qualifications were applied to the data.

L1197154: Hexachloro-1,3-butadiene, naphthalene, and 1,2,3-trichlorobenzene were detected in the method blank in batch WG1442408 at estimated concentrations greater than the MDLs and less than the RDLs. Since these analytes were not detected in the associated samples, no qualifications were applied to the data.

L1197154: Trichloroethene was detected in the method blank in batch WG1444521 at an estimated concentrations greater than the MDL and less than the RDL. Since trichloroethene was not detected or in the associated sample, no qualifications were applied to the data.

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

MS/MSD pairs were not reported.

1.5 Laboratory Control Sample (LCS)

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

L1187224: The recovery of acrylonitrile in the LCS in batch WG1425102 was high and outside the laboratory specified acceptance criteria. Since acrylonitrile was not detected in the associated samples, no qualifications were applied to the data.

L1187224: The recovery of chloromethane in the LCS in batch WG1425591 was low and outside the laboratory specified acceptance criteria. Therefore, the non-detect chloromethane results in the associated samples were UJ qualified as estimated less than the MDLs.

L1187224: The RPD for 1,2,3-trichloropropane in batch WG1426837 was high and outside the laboratory specified acceptance criteria. Since 1,2,3-trichloropropane was not detected in the associated sample, no qualifications were applied to the data.

L1197154: One or both the recoveries of n-butylbenzene, 4-chlorotoluene, n-propylbenzene, and 1,3,5-trimethylbenzene in the LCS/LCSD pair in batch WG1442408 were high and outside the laboratory specified acceptance criteria. Since these analytes were not detected in the associated samples, no qualifications were applied to the data

Sample	Analyte	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier*	Reason Code**
CMW14RDS-020520	Chloromethane	0.00125	U,J0,J4	0.0013	UJ	9
EW14-020520	Chloromethane	0.00125	U,J0,J4	0.0013	UJ	9
EW2-020520	Chloromethane	0.00125	U,J0,J4	0.0013	UJ	9
EW23-020520	Chloromethane	0.00125	U,J0,J4	0.0013	UJ	9
VMWA-020520	Chloromethane	0.00125	U,J0,J4	0.0013	UJ	9
VMWB-020520	Chloromethane	0.00125	U,J0,J4	0.0013	UJ	9

ppm-parts per million
U-not detected at the RDL
J0-laboratory flag indicating the identification of the analyte is acceptable, but the reported concentration is an estimate
J4-laboratory flag indicating the 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 Field Duplicate

Four field duplicate samples were collected with the sample set, CMW17DS-020420-DUP, CMW17DS-030920-DUP, CMW18DS-020420-DUP, and TS-C-EFF-020520-DUP. Acceptable precision (RPD ≤30%) was demonstrated between the field duplicates and the original samples, CMW17DS-020420, CMW17DS-030920, CMW18DS-020420, and TS-C-EFF-020520; respectively, with the following exceptions.

L1197154: 2-Butanone was detected at a concentration greater than the RDL in the field duplicate sample CMW17DS-030920-DUP and was not detected in sample CMW17DS-030920, resulting in a non-calculable RPD. Therefore, the non-detect 2-butanone result in CMW17DS-030920 was UJ qualified as estimated less than the RDL and the 2-butanone concentration in CMW17DS-030920-DUP was J qualified as estimated.

L1187224: The RPDs for cis-1,2-dichloroethene, tetrachloroethene, and trichloroethene were greater than 30% in field duplicate pair CMW17DS-020420/CMW17DS-020420-DUP. Therefore, the concentrations for these analytes in the field duplicate pair were J qualified as estimated.

Sample	Analyte	Laboratory Result (ppm)	Laboratory Flag	RPD	Validation Result (ppm)	Validation Qualifier	Reason Code
CMW17DS-020420	cis-1,2-Dichloroethene	0.00226	NA	95	0.0023	J	7
CMW17DS-020420-DUP	cis-1,2-Dichloroethene	0.00636	NA		0.0064	J	7
CMW17DS-030920	2-Butanone	0.00500	U	NC	0.00500	UJ	7
CMW17DS-030920-DUP	2-Butanone	0.00626	NA		0.0063	J	7
CMW17DS-020420	Tetrachloroethene	0.000625	NA	108	0.0006	J	7
CMW17DS-020420-DUP	Tetrachloroethene	0.00209	NA		0.0021	J	7
CMW17DS-020420	Trichloroethene	0.0168	NA	106	0.0168	J	7
CMW17DS-020420-DUP	Trichloroethene	0.055	NA		0.055	J	7

ppm-parts per million
U-not detected at the RDL
NC-noncalculable
NA-not applicable

1.8 Trip Blank

Three trip blanks, two identified as TRIP BLANK LOT#440 and TRIP BLANK, accompanied the sample shipment. VOCs were not detected in the trip blanks above the RDLs with the following exception.

L1197154: Chloroform was detected in the trip blank at a concentration greater than the RDL. Therefore, the chloroform concentrations in the associated samples greater than the RDL and less than the trip blank concentration were U qualified as not detected at the reported concentrations.

Sample	Analyte	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier	Reason Code
CMW17DS-030920	Chloroform	0.000636	NA	0.000636	U	3
CMW17DS-030920-DUP	Chloroform	0.00069	NA	0.00069	U	3

ppm-parts per million
NA-not applicable

1.9 Sensitivity

The sample results were reported to the RDLs. 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 report at a minimum of 20% as part of the data validation process. It was noted that the samples were reported to the RDLs in the level II report; both the RDLs and the MDLs were listed in the EDD. It was also noted that the data were reported in units of parts per million (ppm) in the EDD, while the sample data were reported in units of parts per billion (or microgram per liter, µg/L) in the level II report. This did not affect the quality of the data. No other discrepancies were identified between the level II report and the EDD.

2.0 SELECTED VOLATILE ORGANIC COMPOUNDS

The air samples were analyzed for selected VOCs per US EPA method TO-15 (1,1-dichloroethene, cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, and vinyl chloride).

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
✓ Method Blank

- ✓ Laboratory Control Sample
- ✓ Laboratory Duplicate
- ✓ Surrogates
- ✓ Field Duplicate
- ✓ Sensitivity
- ⊗ Electronic Data Deliverable Review

2.1 Overall Assessment

2.1.1 Completeness

The VOC data reported in the sample set are considered usable for supporting project objectives. 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%.

2.1.2 Analysis Anomaly

P2001270: The recovery of vinyl chloride was low and outside the laboratory specified acceptance criteria in the CCV. Therefore, the vinyl chloride concentration in sample SVE-EFF-030320 was J qualified as estimated.

Sample	Analyte	Laboratory Result (µg/m³)	Laboratory Flag	Validation Result (µg/m³)	Validation Qualifier	Reason Code
SVE-EFF-030320	Vinyl Chloride	2.2	U, V	2.2	UJ	9

µg/m³-microgram per cubic meter
U-not detected at the method reporting limit (MRL)
V-laboratory flag indicating the CCV standard was outside the specified limits for this compound and biased low

2.2 Holding Time

The holding time for the VOC 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). Five method blanks were reported (batches P200121, P200312, P200313, P200210, and P200211). VOCs were not detected in the method blanks above the method reporting limits (MRLs).

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). Five LCSs were reported. The recovery results were within the laboratory specified acceptance criteria.

2.5 Laboratory Duplicate

A laboratory duplicate was not reported.

2.6 Surrogates

Acceptable surrogate recoveries were reported for the sample analyses.

2.7 Field Duplicate

A field duplicate was not collected with the sample set.

2.8 Sensitivity

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

2.9 Electronic Data Deliverable Review

Results and the sample ID 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. The vinyl chloride concentration reported for sample SVE-EFF-030320 was "V" flagged in the level II report and was not "V" flagged in the EDD. It was noted that the sample was reported to the MRLs in the level II report; both the MRLs and the MDLs were listed in the EDD. It was also noted that the data were reported in micrograms per cubic meter ($\mu g/m^3$) in the EDD, while the sample data were reported in both $\mu g/m^3$ and parts per billion by volume (ppbv) in the level II report. This did not affect the quality of the data. No other discrepancies were identified between the level II report and the EDD.

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* * * * *

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

Geosyntec consultants

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Memorandum

Date: 28 August 2020

To: Cindy Bartlett

From: Jennifer Pinion

CC: J. Caprio

Subject: Stage 2A Data Validation - Level II Data Deliverables – Pace Analytical Sample Delivery Groups L1209161, L1215750 and L1215754 and ALS Environmental Service Request Numbers P2001954, P2002596 Revision 1, P2003067

SITE: Cascade TSA; Job No: PNG0564519

INTRODUCTION

This report summarizes the findings of the Stage 2A data validation of one soil sample and one trip blank collected on April 15, 2020, twenty groundwater samples, two trip blanks and two field duplicate samples collected on May 5, 2020 and nine air samples collected on April 7, May 11, and June 2, 2020, as part of the site investigation activities for the Cascade Corp., Fairview Oregon sampling event.

The soil and water samples were analyzed by Pace National Analytical [formerly ESC Lab Sciences (ESC)], Mt. Juliet, Tennessee for the following analytical test:

- United States Environmental Protection Agency (US EPA) Method 8260D – Volatile Organic Compounds (VOCs)
- US EPA Method 6020B – Metals by Inductively Coupled Plasma/Mass Spectrometry (ICP/MS)
- US EPA Method 7471B – Mercury
- Standard Method (SM) 2540 G-2011 – Total Solids

The air samples were analyzed by ALS Environmental, Simi Valley, California for the following analytical test:

- US EPA 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.

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

- US EPA National Functional Guidelines for Organic Superfund Methods Data Review, January 2017 (EPA-540-R-2017-002)
- US EPA National Functional Guidelines for Inorganic Superfund Data Review, January 2017 (EPA-540-R-2017-001)

The following samples were analyzed in the data sets:

Laboratory ID	Client ID
L1209161-01	MW26IDW_041520
L1209161-02	TRIP BLANK
L1215750-01	EW-1-050520
L1215750-02	EW2-050520
L1215750-03	EW14-050520
L1215750-04	VMWA-050520
L1215750-05	VMWB-050520
L1215750-06	VMWC-050520
L1215750-07	VMWD-050520
L1215750-08	VMWE-050520
L1215750-09	VMWF-050520
L1215750-10	VMWG-050520
L1215750-11	VMWH-050520
L1215750-12	EW12-050520
L1215750-13	D17DG-050520
L1215750-14	D17DS-050520
L1215750-15	CMW10DS-050520
L1215750-16	CMW17DS-050520

Laboratory ID	Client ID
L1215750-17	CMW18DS-050520
L1215750-18	CMW18DS-050520-DUP
L1215750-19	CMW19DS-050520
L1215750-20	TRIP BLANK LOT 440
L1215754-01	TS-C-EFF-050520
L1215754-02	TS-C-EFF-050520-DUP
L1215754-03	TS-C-INF-050520
L1215754-05	TRIP BLANK LOT 440
P2001954-001	SVE-EFF-040720
P2002596-001	VW-17d-95.5-051120
P2002596-002	VMWC-051120
P2002596-003	VMWH-051120
P2002596-004	VMWG-051120
P2002596-005	VMWF-051120
P2002596-006	VMWE-051120
P2002596-007	SVE-EFF-051120
P2003067-001	SVE-EFF-060220

The water and solid samples were received at the laboratory within the temperature criteria of 0-6ºC.

The following issues were noted on the chain of custody (COC) forms. No qualifications were applied to the data based on the issues discussed below.

- Incorrect error corrections were observed on the COC in laboratory reports L1215750 and L1215754 instead of the proper procedure of a single strike through, correction, and initials and date of person making the corrections.

- No collection times were listed for the trip blanks on the COCs in laboratory reports L1215750 and L1215754. The laboratory assigned the collection times of 00:00.

- There was a discrepancy in the time of collection listed for sample CMW19DS-050520. The COC lists the time of collection as 12:20 and the laboratory logged the samples in with a collection time of 12:00. Per client email, the correct time of collection should be listed as 12:20.

- L1215750: The laboratory indicated on the COC that trip blanks were not received with the sample shipment; however, TRIP BLANK LOT 440 was shipped with the samples.

The laboratory report P2002596 was revised on 8/5/2020 to correct the sample ID for sample VW-17d-95.5-051120. The revised report was identified as P2002596, Revision 1.

Solid samples were analyzed for Percent Solids by Method 2540G for dry-weight reporting in laboratory report L1209161; however, the solids data were not validated.

1.0 VOLATILE ORGANIC COMPOUNDS

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

1.1 Overall Assessment

1.1.1 Completeness

The VOC data reported in this sample set are considered usable for supporting project objectives. 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

Multiple results were flagged J0 to indicate the recoveries of the specified compound(s) in the continuing calibration verification (CCV) standards were outside the laboratory specified acceptance criteria. Upon request, the laboratory provided the information for the compounds and recoveries that were outside of the acceptance criteria.

L1209161: The percent differences (%Ds) in the CCVs for bromoform, butylbenzene, 1,2-dibromo-3-chloropropane, hexachlorobutadiene (HCBD), 2-butanone (MEK), naphthalene, 1,2,3-trichlorobenzene and 1,2,4-trichlorobenzene were outside of the laboratory specified acceptance criteria with low biases. Since the %Ds for bromoform, 1,2-dibromo-3-chloropropane, 2-butanone (MEK), 1,2,3-trichlorobenzene and 1,2,4-trichlorobenzene were within the validation guidelines, no qualifications were applied to the bromoform, 1,2-dibromo-3-chloropropane, 2-butanone (MEK), 1,2,3-trichlorobenzene and 1,2,4-trichlorobenzene data. However, the non-detect butylbenzene, hexachlorobutadiene and naphthalene results in the associated samples were UJ qualified as estimated less than the reported detection limits (RDLs).

L1215750: The %D in the CCV for acetone was outside the laboratory specified acceptance criteria with a high bias. Therefore, the concentrations of acetone in the associated samples were J qualified as estimated. Qualifications were not applied to the non-detect acetone results in the associated samples based on professional and technical judgement.

L1215754: The %Ds for naphthalene, 1,2-dibromo-3-chloropropane and acrolein were outside of the laboratory specified acceptance criteria with low biases. Since the %D for 1,2-dibromo-3-chloropropane was within the validation guidelines, no qualifications were applied to the 1,2-dibromo-3-chloropropane data. However, the non-detect naphthalene and acrolein results in the associated samples were UJ qualified as estimated less than the RDLs.

Sample ID	Compound	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier*	Reason Code**
MW26IDW_041520	Butylbenzene	0.130	U,J0	0.130	UJ	9
MW26IDW_041520	Hexachlorobutadiene (HCBD)	0.260	U,J0	0.260	UJ	9
TRIP BLANK	Hexachlorobutadiene (HCBD)	0.001	U,J0 J3	0.001	UJ	9

Sample ID	Compound	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier*	Reason Code**
MW26IDW_041520	Naphthalene	0.130	U,J0	0.130	UJ	9
TRIP BLANK	Naphthalene	0.0025	U,J0 J3	0.0025	UJ	9
CMW10DS-050520	Acetone	0.117	J0 J4	0.117	J	9
CMW18DS-050520	Acetone	0.134	J0 J4	0.134	J	9
CMW18DS-050520-DUP	Acetone	0.0835	J0 J4	0.0835	J	9
CMW19DS-050520	Acetone	0.0991	J0 J4	0.0991	J	9
D17DG-050520	Acetone	0.0430	J0 J4	0.0430	J	9
D17DS-050520	Acetone	0.0405	J0 J4	0.0405	J	9
EW12-050520	Acetone	0.0597	J0 J4	0.0597	J	9
VMWA-050520	Acetone	0.0305	J0 J4	0.0305	J	9
VMWB-050520	Acetone	0.242	J0 J4	0.242	J	9
VMWC-050520	Acetone	0.0287	J0 J4	0.0287	J	9
VMWE-050520	Acetone	0.0429	J0 J4	0.0429	J	9
VMWF-050520	Acetone	0.0398	J0 J4	0.0398	J	9
VMWG-050520	Acetone	0.0519	J0 J4	0.0519	J	9
TS-C-EFF-050520	Naphthalene	0.0025	U,J0	0.0025	UJ	9
TS-C-EFF-050520	Acrolein	0.0500	U,J0	0.0500	UJ	9
TS-C-EFF-050520-DUP	Naphthalene	0.0025	U,J0	0.0025	UJ	9
TS-C-EFF-050520-DUP	Acrolein	0.0500	U,J0	0.0500	UJ	9
TS-C-INF-050520	Naphthalene	0.0025	U,J0	0.0025	UJ	9
TS-C-INF-050520	Acrolein	0.0500	U,J0	0.0500	UJ	9

ppm-parts per million
U-not detected at or above the RDLs
J0-laboratory flag indicating the identification of the analyte is acceptable, but the reported concentration is an estimate
J3-laboratory flag indicating the associated batch QC was outside the established quality control range for precision
J4-laboratory flag indicating 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 for VOC analysis of a water preserved soil sample collected in a Terra Core® sample are 48 hours from sample collection to freezing and 14 days from sample 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). Seven method blanks were reported (batches WG1461691, WG1461987, WG1462414, WG1472473, WG1475270, WG1472473 and WG1472732). VOCs were not detected in the method blanks above the method detection limits (MDLs), with the following exceptions.

L1209161: Hexachloro-1,3-butadiene, methylene chloride, naphthalene and 1,2,3-trichlorobenzene were detected at estimated concentrations greater than the MDLs and less than the RDLs in the method blank in batch WG1461987. Since hexachloro-1,3-butadiene, methylene chloride, naphthalene and 1,2,3-trichlorobenzene were not detected in the associated samples, no qualifications were applied to the data based on technical and professional judgement.

L1215754: Naphthalene was detected at an estimated concentration greater than the MDL and less than the RDL in the method blank in batch WG1472732. Since naphthalene was not detected in the associated samples, no qualifications were applied to the data based on technical and professional judgement.

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

One batch MS/MSD pair was reported in laboratory report L1215754. Since these were batch QC, the results do not affect the samples in this data set and qualifications were not applied to the data.

1.5 Laboratory Control Sample (LCS)

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

L1209161: One or both the recoveries of 1,4-dichlorobenzene and 1,1,2-trichloroethane in the LCS/LSCD pair in batch WG1461691 were low and outside the laboratory specified acceptance criteria. Therefore, the non-detect 1,4-dichlorobenzene and 1,1,2-trichloroethane results in the associated samples were UJ qualified as estimated less than the RDLs.

L1209161: The RPD results for carbon tetrachloride, 2,2-dichloropropane and 1,1,1-trichloroethane in batch WG1461691 and hexachlorobutadiene (HCBD), naphthalene and 1,2,3-trichlorobenzene in batch WG1461987 were high and outside the laboratory specified acceptance criteria. Since carbon tetrachloride, 2,2-dichloropropane, 1,1,1-trichloroethane hexachlorobutadiene, naphthalene and 1,2,3-trichlorobenzene were not detected in the associated samples, no qualifications were applied to the data based on technical and professional judgement.

L1215750: The recovery of acetone in the LCS in batch WG1472473 was high and outside the laboratory specified acceptance criteria. Therefore, the concentrations of acetone in the associated samples were J qualified as estimated.

L1215754: The recovery of acetone in the LCS in batch WG1472473 was high and outside the laboratory specified acceptance criteria. Since acetone was not detected in the associated samples, no qualifications were applied to the data.

Sample ID	Compound	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier*	Reason Code**
MW26IDW_041520	1,1,2-Trichloroethane	0.026	U,J4	0.026	UJ	5
MW26IDW_041520	1,4-Dichlorobenzene	0.052	U,J4	0.052	UJ	5
CMW10DS-050520	Acetone	0.117	J0 J4	0.117	J	5
CMW18DS-050520	Acetone	0.134	J0 J4	0.134	J	5
CMW18DS-050520-DUP	Acetone	0.0835	J0 J4	0.0835	J	5
CMW19DS-050520	Acetone	0.0991	J0 J4	0.0991	J	5
D17DG-050520	Acetone	0.043	J0 J4	0.043	J	5
D17DS-050520	Acetone	0.0405	J0 J4	0.0405	J	5
EW12-050520	Acetone	0.0597	J0 J4	0.0597	J	5
VMWA-050520	Acetone	0.0305	J0 J4	0.0305	J	5
VMWB-050520	Acetone	0.242	J0 J4	0.242	J	5
VMWC-050520	Acetone	0.0287	J0 J4	0.0287	J	5
VMWE-050520	Acetone	0.0429	J0 J4	0.0429	J	5
VMWF-050520	Acetone	0.0398	J0 J4	0.0398	J	5
VMWG-050520	Acetone	0.0519	J0 J4	0.0519	J	5

ppm-parts per million
U-not detected at the RDL
J0-laboratory flag indicating the identification of the analyte is acceptable, but the reported concentration is an estimate
J4-laboratory flag indicating the 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 Field Duplicate

Two field duplicate samples were collected with the sample set, CMW18DS-050520-DUP and TS-C-EFF-050520-DUP. Acceptable precision (RPD $\leq$30%) was demonstrated between the field duplicates and the original samples, CMW18DS-050520 and TS-C-EFF-050520, respectively, with the following exceptions.

L1215750: The RPD for acetone in the field duplicate pair CMW18DS-050520/CMW18DS-050520-DUP was high and outside of the specified acceptance criteria. Therefore, the concentrations of acetone in the field duplicate pair were J qualified as estimated, based on professional and technical judgement.

L1215750: Methyl ethyl ketone was detected greater than the RDL in sample CMW18DS-050520 and not detected in the field duplicate CMW18DS-050520-DUP, resulting in a non-calculable RPD. Therefore, the concentration of methyl ethyl ketone was J qualified as estimated and the non-detect methyl ethyl ketone result was UJ qualified as estimated less than the RDL, based on professional and technical judgement.

Sample ID	Compound	Laboratory Result (ppm)	Laboratory Flag	RPD	Validation Result (ppm)	Validation Qualifier*	Reason Code**
CMW18DS-050520	Acetone	0.134	J0 J4	46	0.134	J	7
CMW18DS-050520-DUP	Acetone	0.0835	J0 J4		0.0835	J	7
CMW18DS-050520	Methyl ethyl ketone	0.00502	NA	NC	0.00502	J	7
CMW18DS-050520-DUP	Methyl ethyl ketone	0.00500	U		0.00500	UJ	7

ppm-parts per million
U-not detected at the RDL
NC-noncalculable
NA-not applicable

1.8 Trip Blank

Two trip blanks, identified as TRIP BLANK LOT 440 and TRIP BLANK, accompanied the sample shipment. VOCs were not detected in the trip blanks above the RDLs.

1.9 Sensitivity

The sample results were reported to the RDLs. 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 report at a minimum of 20% as part of the data validation process. It was noted that the samples were reported to the RDLs and the method blank QC reported to the MDLs in the level II report; both the RDLs and the MDLs were listed in the EDD. It was also noted that the data were reported in units of parts per million (ppm) in the EDD, while the groundwater sample data were reported in units of parts per billion (PPB or microgram per liter, µg/L) and the soil samples were reported to milligrams per kilogram on a dry weight basis, mg/kg (dry) in the level

II report. This did not affect the quality of the data. No other discrepancies were identified between the level II report and the EDD.

2.0 SELECTED VOLATILE ORGANIC COMPOUNDS

The air samples were analyzed for selected VOCs per US EPA method TO-15 (1,1-dichloroethene, cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, and vinyl chloride).

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
✓ Method Blank
✓ Laboratory Control Sample
✓ Laboratory Duplicate
✓ Surrogates
✓ Field Duplicate
✓ Sensitivity
⊗ Electronic Data Deliverable Review

2.1 Overall Assessment

The VOC data reported in this sample set are considered usable for supporting project objectives. 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%.

2.2 Holding Time

The holding time for the VOC 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). Five method blanks were reported (batches P200410, P200413, P200519, P200520 and P200610). VOCs were not detected in the method blanks above the method reporting limits (MRLs).

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). Five LCSs were reported. The recovery results were within the laboratory specified acceptance criteria.

2.5 Laboratory Duplicate

A laboratory duplicate was not reported.

2.6 Surrogates

Acceptable surrogate recoveries were reported for the sample analyses.

2.7 Field Duplicate

A field duplicate was not collected with the sample set.

2.8 Sensitivity

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

2.9 Electronic Data Deliverable Review

Results and the sample ID 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. It was noted that the samples were reported to the MRLs and the method blank QC reported to the MDLs in the level II report; both the MRLs and the MDLs were listed in the EDD. It was also noted that the data were reported in micrograms per cubic meter ($\mu g/m^3$) in the EDD, while the sample data were reported in both $\mu g/m^3$ and parts per billion by volume (ppbv) in the level II report. This did not affect the quality of the data. No other discrepancies were identified between the level II report and the EDD.

3.0 METALS

The soil samples were analyzed for metals by USEPA Method 6020B. Mercury was assessed separately, in section 4.0, below.

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 over the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Overall Assessment
- ✓ Holding Times
- ✓ Method Blank
- ✓ Matrix Spike/Matrix Spike Duplicate
- ✓ Laboratory Control Sample
- ✓ Laboratory Duplicate
- ✓ Field Duplicate
- ✓ Sensitivity
- ✓ Electronic Data Deliverable Review

3.1 Overall Assessment

The metals data reported in this sample set 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 the samples submitted for these analyses, for this sample set is 100%.

3.2 Holding Times

The holding time for the metals analysis of a solid sample is 180 days from sample collection to analysis. The holding times were met for the sample analyses.

3.3 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 (batch WG1461747). Metals were not detected in the method blank above the MDLs.

3.4 Matrix Spike/Matrix Spike Duplicate

MS/MSD pairs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). One batch MS/MSD pair was reported. Since these were batch QC, the results do not affect the samples in this data set and qualifications were not applied to the data.

3.5 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 was reported. The recovery results were within the laboratory specified acceptance criteria.

3.6 Laboratory Duplicate

Laboratory duplicates were not reported with the sample set.

3.7 Field Duplicate

Field duplicates were not submitted with the sample set.

3.8 Sensitivity

The sample results were reported to the RDLs with the exception of selenium which was reported to the MDL. Elevated non-detect results were reported due to the dilutions analyzed.

3.9 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. It was noted that the samples were reported to the RDLs and the method blank QC reported to the MDLs in the level II report; both the RDLs and the MDLs were listed in the EDD. It was also noted that the data were reported in units of parts per million (ppm) in the EDD, while the soil samples were reported to mg/kg (dry) in the level II report. This did not affect the quality of the data. No other discrepancies were identified between the level II report and the EDD.

4.0 MERCURY

The soil samples were analyzed for mercury by US EPA Method 7471B.

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 over the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Overall Assessment
- ✓ Holding Times
- ✓ Method Blank
- ✓ Matrix Spike/Matrix Spike Duplicate
- ✓ Laboratory Control Sample
- ✓ Laboratory Duplicate
- ✓ Field Duplicate
- ✓ Sensitivity
- ✓ Electronic Data Deliverable Review

4.1 Overall Assessment

The mercury data reported in this sample set 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 the samples submitted for this analysis, for this sample set is 100%.

4.2 Holding Times

The holding time for mercury analyses of a solid sample is 28 days from sample collection to analysis. The holding times were met for the sample analyses.

4.3 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 (batch WG1462107). Mercury was not detected in the method blank above the MDL.

4.4 Matrix Spike/Matrix Spike Duplicate

MS/MSD pairs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). One batch MS/MSD pair was reported in laboratory report L1209161. Since these were batch QC, the results do not affect the samples in this data set and qualifications were not applied to the data.

4.5 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 was reported. The recovery results were within the laboratory specified acceptance criteria.

4.6 Laboratory Duplicate

A laboratory duplicate was not reported with the sample set.

4.7 Field Duplicate

A field duplicate was not reported with the sample set.

4.8 Sensitivity

The samples were reported to the RDLs. Elevated non-detect results were not reported.

4.9 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. It was noted that the samples were reported to the RDLs and the method blank QC reported to the MDLs in the level II report; both the RDLs and the MDLs were listed in the EDD. It was also noted that the data were reported in units of parts per million (ppm) in the EDD, while the soil samples were reported to mg/kg (dry) in the level II report. This did not affect the quality of the data. No other discrepancies were identified between the level II report and the EDD.

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

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Memorandum

Date:	21 September 2020
To:	Cindy Bartlett, RG, LG
	Geosyntec Consultants, Portland, Oregon
From:	Jennifer Pinion
CC:	J. Caprio
Subject:	**Stage 2A Data Validation - Level II Data Deliverables – Pace Analytical Sample Delivery Groups L1247052, L1247054, L1247644, L1247645, L1249774 and ALS Environmental Service Request Numbers P2003801, P2004382**

SITE: Cascade TSA; Job No: PNG0564519

INTRODUCTION

This report summarizes the findings of the Stage 2A data validation of forty-five groundwater samples, two soil samples, five trip blanks, three field duplicate samples and eight air samples collected on July 7, 2020, August 4-5, 2020 and August 10, 2020, as part of the site investigation activities for the Cascade Corp., Fairview Oregon sampling event.

The water and soil samples were analyzed by Pace Analytical [formerly ESC Lab Sciences (ESC)], Mt. Juliet, Tennessee for the following analytical test:

- United States Environmental Protection Agency (US EPA) Method 8260D – Volatile Organic Compounds (VOCs)
- Standard Methods (SM) 2540G – Total Solids

The air samples were analyzed by ALS Environmental, Simi Valley, California for the following analytical test:

- US EPA 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.

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

- US EPA National Functional Guidelines for Organic Superfund Methods Data Review, January 2017 (EPA-540-R-2017-002)
- US EPA National Functional Guidelines for Inorganic Superfund Data Review, January 2017 (EPA-540-R-2017-001)

The following samples were analyzed in the data sets:

Laboratory IDs	Client IDs
L1247052-01	VMWA-080420
L1247052-02	VMWB-080420
L1247052-03	VMWC-080420
L1247052-04	VMWD-080420
L1247052-05	VMWE-080420
L1247052-06	VMWF-080420
L1247052-07	VMWG-080420
L1247052-08	VMWH-080420
L1247052-09	EW1-080420
L1247052-10	EW2-080420
L1247052-11	EW14-080420
L1247052-12	EW23-080420
L1247052-13	D17DG-080420
L1247052-14	D17DS-080420
L1247052-15	EW12-080420
L1247052-16	CMW17DS-080420
L1247052-17	CMW17DS-080420-DUP
L1247052-18	CMW18DS-080420
L1247052-19	CMW18DS-080420-DUP
L1247052-20	TRIP BLANK LOT# 448
L1247052-21	EW8-080420
L1247052-22	CMW24DG-080420
L1247052-23	CMW25DG-080420
L1247052-24	EW16-080420
L1247052-25	CMW14RDS-080420
L1247052-26	CMW19DS-080420
L1247052-27	CMW20DS-080420
L1247052-28	CMW10DS-080420
L1247052-29	CMW36DG-080420
L1247052-30	CMW22DG-080420

Laboratory IDs	Client IDs
L1247054-01	TS-C-EFF-080420
L1247054-02	TS-C-EFF-080420-DUP
L1247054-03	TRIP BLANK LOT# 448
L1247644-01	NVWD-080520
L1247644-02	ROB-080520
L1247644-03	TRIP BLANK LOT#448
L1247645-01	TS-C-INF-080520
L1247645-02	TRIP BLANK LOT #444
L1249774-01	VMWI-081020-T
L1249774-02	VMWI-081020-M
L1249774-03	VMWI-081020-B
L1249774-04	VMWJ2-081020-M
L1249774-05	VMWJ2-081020-B
L1249774-06	VMWK-081020-M
L1249774-07	VMWK-081020-B
L1249774-08	VMWL-081020-T
L1249774-09	VMWL-081020-M
L1249774-10	VMWL-081020-B
L1249774-11	VMWM-081020-T
L1249774-12	VMWM-081020-M
L1249774-13	VMWM-081020-B
L1249774-14	VMWN-081020-T
L1249774-15	VMWN-081020-M
L1249774-16	VMWN-081020-B
L1249774-17	TRIP BLANK LOT#444
P2003801-001	SVE-EFF-070720
P2004382-001	VW-17D-95.5-080520
P2004382-002	SVE-EFF-080520
P2004382-003	VMW C-080520
P2004382-004	VMW E-080520

Laboratory IDs	Client IDs
P2004382-005	VMW F-080520
P2004382-006	VMW G-080520

Laboratory IDs	Client IDs
P2004382-007	VMW H-080520

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

The following issues were noted on the chain of custody (COC) forms. No qualifications were applied to the data based on the issues discussed below.

- Incorrect error corrections were observed on the COC in laboratory reports L1247052, L1247054, L1247644 and L1249774 instead of the proper procedure of a single strike through, correction, and initials and date of person making the corrections.

- No collection times were listed for the trip blanks on the COCs in laboratory reports L1247052, L1247054, L1247644, L1247645 and L1249774. The laboratory assigned the collection time of 00:00. The laboratory assigned the collected date of 8/5/2020.

- The COC for laboratory report L1247054 indicates that sample TS-C-INF-080420 was shipped with the sample set; however, the sample was indicated as not received by the laboratory. The sample set was analyzed without sample TS-C-INF-080420 per client request.

- The sample matrix for TRIP BLANK LOT #444 in laboratory report L1247645 was not selected on the COC. The laboratory logged the sample in as a water sample.

- The relinquished by dates for the first sample transfers were not included on the COC in laboratory reports P2003801 and P2004382.

1.0 VOLATILE ORGANIC COMPOUNDS

The water and soil 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
✓ Method Blank
✓ Matrix Spike/Matrix Spike Duplicate
⊗ Laboratory Control Sample

✓ Surrogate
✓ Field Duplicate
✓ Trip Blank
✓ 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 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

Multiple results were flagged J0 to indicate the recoveries of the specified compound(s) in the continuing calibration verification (CCV) standards were outside the laboratory specified acceptance criteria. Upon request, the laboratory provided the information for the compounds and recoveries that were outside of the acceptance criteria.

L1247052: The percent differences (%Ds) in the CCVs for acetone (24.4 %D) and 2,2-dichloropropane (25.7 %D) were outside of the laboratory specified acceptance criteria with low biases. Since the %D for acetone was within the validation guidelines, no qualifications were applied to the acetone data. However, the non-detect 2,2-dichloropropane results were UJ qualified as estimated less than the reported detection limit (RDL) in the associated samples.

L1247054: The %D in the CCV for 2,2-dichloropropane (25.7 %D) was outside of the laboratory specified acceptance criteria with low bias. Therefore, the non-detect 2,2-dichloropropane results were UJ qualified as estimated less than the RDL in the associated samples.

L1247644: The %Ds in the CCV for 1,2,3-trichlorobenzene (26.9%D), 2-butanone (MEK) (44.8%D) and naphthalene (25.1 %D) were outside of the laboratory specified acceptance criteria with low biases. Since the %D for 1,2,3-trichlorobenzene was within the validation guidelines, no qualifications were applied to the 1,2,3-trichlorobenzene results. However, the non-detect 2-butanone (MEK) and naphthalene results in the associated samples were UJ qualified as estimated less than the RDLs.

L1249774: The %D in the CCV for acrolein (80.7 %D) was outside the laboratory specified acceptance criteria with a high bias. Since the bias was high, and acrolein was not detected in the associated samples, no qualifications were applied to the acrolein results based on technical and professional judgement.

Sample ID	Compound	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier*	Reason Code**
CMW17DS-080420	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
CMW17DS-080420-DUP	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
CMW18DS-080420	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
CMW18DS-080420-DUP	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
CMW24DG-080420	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
CMW25DG-080420	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
D17DG-080420	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
D17DS-080420	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
EW1-080420	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
EW12-080420	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
EW14-080420	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
EW16-080420	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
EW2-080420	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
EW23-080420	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
EW8-080420	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
VMWE-080420	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
VMWF-080420	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
VMWG-080420	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
VMWH-080420	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
TS-C-EFF-080420	2,2-Dichloropropane	0.0005	U	0.0005	UJ	9
TS-C-EFF-080420-DUP	2,2-Dichloropropane	0.0005	U	0.0005	UJ	9
TRIP BLANK LOT# 448	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
TRIP BLANK LOT# 448	2,2-Dichloropropane	0.0005	U,J0	0.0005	UJ	9
NVWD-080520	Methyl ethyl ketone	0.281	U,J0	0.281	UJ	9
NVWD-080520	Naphthalene	0.0352	U,J0	0.0352	UJ	9

Sample ID	Compound	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier*	Reason Code**
ROB-080520	Methyl ethyl ketone	0.244	U,J0	0.244	UJ	9
ROB-080520	Naphthalene	0.0305	U,J0	0.0305	UJ	9

ppm-parts per million
U-not detected at the RDL
J0-laboratory flag indicating the identification of the analyte is acceptable, but the reported concentration is an estimate
J3-laboratory flag indicating the associated batch QC was outside the established quality control range for precision
*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 for VOC analysis of a water preserved soil sample collected in a Terra Core® are 48 hours from sample collection to freezing and 14 days from sample collection to analysis. The holding times were met for the sample analyses.

1.3 Method Blank

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Eleven method blanks were reported (batches WG1522607, WG1522639, WG1522640, WG1523009, WG1522640, WG1524018, WG1523155, WG1524427, WG1523155, WG1525849, WG1528159). VOCs were not detected in the method blanks above the method detection limits (MDLs), with the following exceptions.

L1247052: 1,2,3-trichlorobenzene was detected at estimated concentrations greater than the MDLs and less than the RDLs in the method blanks in in batches WG1522607 and WG1523009. Since 1,2,3-trichlorobenzene was not detected in the associated samples, no qualifications were applied to the data.

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

Two batch MS/MSD pairs were reported in laboratory reports L1247644 and L1247645. Since these were batch QC, the results do not affect the samples in this data set and qualifications were not applied to the data.

1.5 Laboratory Control Sample (LCS)

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

L1247052: The recovery results of acetone, acrolein and 1,2,3-trichloropropane in the LCS in batch WG1522640 were high and outside the laboratory specified acceptance criteria. Therefore, the concentrations of acetone in the associated samples were J qualified as estimated. No qualifications were applied to the non-detect acetone, acrolein and 1,2,3-trichloropropane results in the associated samples based on technical and professional judgment.

L1247054: The recovery results of acetone, acrolein and 1,2,3-trichloropropane in the LCS in batch WG1522640 were high and outside the laboratory specified acceptance criteria. Since acetone, acrolein and 1,2,3-trichloropropane were not detected in the associated samples, no qualifications were applied to the data.

L1249774: One or both of the recovery results for acetone, acrolein, bromobenzene, chlorobenzene, chlorodibromomethane, 4-chlorotoluene, 1,2-dibromoethane, dibromomethane, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,3-dichloropropane, trans-1,3-dichloropropene, ethylbenzene, isopropylbenzene, styrene, 1,1,1,2-tetrachloroethane, toluene, 1,1,2-trichloroethane, 1,2,4-trimethylbenzene, 1,2,3-trimethylbenzene, 1,3,5-trimethylbenzene and xylenes in the LCS/LCSD pair in batch WG1525849 were high and outside of the laboratory specified acceptance criteria. With the exception of acetone, since the remaining compounds were not detected in the associated samples, no qualifications were applied to the results based on technical and professional judgment. Acetone was reported from QC batch WG1528159.

L1249774: The RPD results for acetone and acrolein in the LCS/LCSD pair in batch WG1525849 and acetone in batch WG1528159 were high and outside the laboratory specified acceptance criteria. Therefore, the concentrations of acetone in the associated samples were J qualified as estimated. No qualifications were applied to the non-detect acetone and acrolein results in the associated samples, based on technical and professional judgment.

Sample ID	Compound	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier*	Reason Code**
CMW10DS-080420	Acetone	0.0317	J4	0.0317	J	5
CMW20DS-080420	Acetone	0.0795	J4	0.0795	J	5
CMW22DG-080420	Acetone	0.195	J4	0.195	J	5
CMW36DG-080420	Acetone	0.134	J4	0.134	J	5
VMWI-081020-B	Acetone	0.0372	J3	0.0372	J	5
VMWI-081020-M	Acetone	0.0967	J3	0.0967	J	5
VMWI-081020-T	Acetone	0.0398	J3	0.0398	J	5
VMWJ2-081020-B	Acetone	0.0622	J3	0.0622	J	5
VMWJ2-081020-M	Acetone	0.0772	J3	0.0772	J	5
VMWK-081020-B	Acetone	0.0722	J3	0.0722	J	5
VMWK-081020-M	Acetone	0.0989	J3	0.0989	J	5

Sample ID	Compound	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier*	Reason Code**
VMWL-081020-B	Acetone	0.113	J3	0.113	J	5
VMWL-081020-M	Acetone	0.0565	J3	0.0565	J	5
VMWL-081020-T	Acetone	0.0927	J3	0.0927	J	5
VMWM-081020-B	Acetone	0.0876	J3	0.0876	J	5
VMWM-081020-M	Acetone	0.0742	J3	0.0742	J	5
VMWM-081020-T	Acetone	0.0526	J3	0.0526	J	5
VMWN-081020-B	Acetone	0.0512	J3	0.0512	J	5
VMWN-081020-M	Acetone	0.149	J3	0.149	J	5
VMWN-081020-T	Acetone	0.0845	J3	0.0845	J	5

ppm-parts per million
J3-laboratory flag indicating the associated batch QC was outside the established quality control range for precision
J4-laboratory flag indicating the 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 Field Duplicate

Three field duplicate samples were collected with the sample set, CMW17DS-080420-DUP, CMW18DS-080420-DUP and TS-C-EFF-080420-DUP. Acceptable precision (RPD $\leq$30%) was demonstrated between the field duplicates and the original samples, CMW17DS-080420, CMW18DS-080420, and TS-C-EFF-080420, respectively.

1.8 Trip Blank

Five trip blanks, two identified as TRIP BLANK LOT#444 and three identified as TRIP BLANK LOT#448, accompanied the sample shipments. VOCs were not detected in the trip blanks above the RDLs.

1.9 Sensitivity

The sample results were reported to the RDLs. Elevated non-detect results were reported in sample ROB-080520 due to the dilution 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. It was noted that the samples were reported to the RDLs and the method blank QC was reported to the MDLs in the level II report; both the RDLs and the MDLs were listed in the EDD. It was also noted that

the data were reported in units of parts per million (ppm) in the EDD, while the groundwater sample data were reported in units of parts per billion (PPB or microgram per liter, µg/L) and the soil sample data were reported to milligrams per kilogram on a dry weight basis, mg/kg (dry) in the level II report. This did not affect the quality of the data. No other discrepancies were identified between the level II report and the EDD.

2.0 SELECTED VOLATILE ORGANIC COMPOUNDS

The air samples were analyzed for selected VOCs per US EPA method TO-15 (1,1-dichloroethene, cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, and vinyl chloride).

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
✓ Method Blank
✓ Laboratory Control Sample
✓ Laboratory Duplicate
✓ Surrogates
✓ Field Duplicate
✓ Sensitivity
⊗ Electronic Data Deliverable Review

2.1 Overall Assessment

The VOC data reported in these data packages are considered usable for supporting project objectives. 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%.

2.2 Holding Time

The holding time for the VOC 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 (batches P200720, P200721, P200814 and P200817). VOCs were not detected in the method blanks above the method reporting limits (MRLs).

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 LCSs were reported. The recovery results were within the laboratory specified acceptance criteria.

2.5 Laboratory Duplicate

Laboratory duplicates were not reported.

2.6 Surrogates

Acceptable surrogate recoveries were reported for the sample analyses.

2.7 Field Duplicate

A field duplicate was not collected with the sample set.

2.8 Sensitivity

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

2.9 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. The data were reported to the MRLs in the laboratory report. The MDLs for the reported compounds were listed in the EDD. In addition, the results were reported in both parts per billion by volume (ppbv) and micrograms per cubic meter ($\mu g/m^3$) in the laboratory report; the results were reported in $\mu g/m^3$ in the EDD. No other discrepancies were identified between the level II report and the EDD.

3.0 TOTAL SOLIDS

The samples were analyzed for Total Solids by SM 2540G.

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
- ✓ Laboratory Control Sample
- ✓ Laboratory Duplicate
- ✓ Electronic Data Deliverable

3.1 Overall Assessment

The solids data reported in this package 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 these sample sets is 100%.

3.2 Holding Time

The holding times for total solids analysis of a water preserved soil sample collected in a Terra Core® is 7 days from sample collection to analysis. The holding times were met for the sample analyses.

3.3 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 (batch WG1524343). Total solids were not detected in the method blank above the MRL.

3.4 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 was reported. The recovery results were within the laboratory specified acceptance criteria.

3.5 Laboratory Duplicate

One laboratory duplicate was reported, using sample NVWD-080520. The RPD results were within the laboratory specified acceptance criteria.

3.6 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. It was noted that the total solids data were reported in percent in the level II report. No discrepancies were identified between the level II report and the EDD.

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

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Memorandum

Date:	11 January 2021
To:	Cindy Bartlett, RG, LG
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From:	Jennifer Pinion
CC:	J. Caprio
Subject:	**Stage 2A Data Validation - Level II Data Deliverables – Pace Analytical Sample Delivery Groups L1282223 and L1283273 and ALS Environmental Service Request Numbers P2004912, P2005667, P2006290 and P2006798**

SITE: Cascade TSA; Job No: PNG0564519

INTRODUCTION

This report summarizes the findings of the Stage 2A data validation of forty-eight groundwater samples, three field duplicate samples and two trip blanks collected on 04 – 05 November 2020 and ten soil vapor samples collected on 01 September, 06 October, 03 November and 01 December 2020 as part of the site investigation activities for the Cascade Corp., Fairview Oregon sampling event.

The water samples were analyzed by Pace Analytical [formerly ESC Lab Sciences (ESC)], Mt. Juliet, Tennessee for the following analytical test:

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

The air samples were analyzed by ALS Environmental, Simi Valley, California for the following analytical test:

- US EPA 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.

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

- US EPA National Functional Guidelines for Organic Superfund Methods Data Review, January 2017 (EPA-540-R-2017-002)

The following samples were analyzed in the data sets:

Laboratory IDs	Client IDs
L1282223-01	EW2-110420
L1282223-02	EW14-110420
L1282223-03	EW23-110420
L1282223-04	EW1-110420
L1282223-05	D17DS-110420
L1282223-06	D17DG-110420
L1282223-07	EW12-110420
L1282223-08	CMW17DS-110420
L1282223-09	CMW17DS-110420-DUP
L1282223-10	CMW18DS-110420
L1282223-11	CMW18DS-110420-DUP
L1282223-12	CMW19DS-110420
L1282223-13	VMWA-110420
L1282223-14	VMWB-110420
L1282223-15	VMWC-110420
L1282223-16	VMWD-110420
L1282223-17	VMWE-110420
L1282223-18	VMWF-110420
L1282223-19	VMWG-110420
L1282223-20	VMWH-110420
L1282223-21	TS-C-EFF-110420
L1282223-22	TS-C-EFF-110420-DUP
L1282223-23	TS-C-INF-110420
L1282223-24	TRIP BLANK LOT #454
L1282223-25	CMW-10DS
L1283273-01	VMWI-110520-126.4
L1283273-02	VMWI-110520-131.6
L1283273-03	VMWI-110520-137.3
L1283273-04	VMWI-110520-140.5
L1283273-05	VMWI-110520-143.7
L1283273-06	VMWI-110520-148.1
L1283273-07	VMWJ2-110520-114.0

Laboratory IDs	Client IDs
L1283273-08	VMWJ2-110520-115.8
L1283273-09	VMWJ2-110520-117.8
L1283273-10	VMWJ2-110520-120.2
L1283273-11	VMWJ2-110520-122.7
L1283273-12	VMWK-110520-110.0
L1283273-13	VMWK-110520-114.3
L1283273-14	VMWL-110520-96.0
L1283273-15	VMWL-110520-103.3
L1283273-16	VMWL-110520-113.4
L1283273-17	VMWM-110520-94.0
L1283273-18	VMWM-110520-101.8
L1283273-19	VMWM-110520-106.2
L1283273-20	VMWM-110520-110.7
L1283273-21	VMWN-110520-95.0
L1283273-22	VMWN-110520-98.3
L1283273-23	VMWN-110520-102.3
L1283273-24	VMWN-110520-106.5
L1283273-25	VMWN-110520-110.8
L1283273-26	TRIP BLANK LOT#454
L1283273-27	VMWM-110520-97.7
L1283273-28	YMWK-110520-119.0
P2004912-001	SVE-EFF-090120
P2005667-001	SVE-EFF-100620
P2006290-001	SVE-EFF-110320
P2006290-002	VW-17d-95.5-110320
P2006290-003	VMWC-110320
P2006290-004	VMWE-110320
P2006290-005	VMWF-110320
P2006290-006	VMWG-110320
P2006290-007	VMWH-110320
P2006798-001	SVE-EFF-120120

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

The following issues were noted on the chain of custody (COC) forms. No qualifications were applied to the data based on the issues discussed below.

- Incorrect error corrections were observed on the COC in laboratory reports L1282223 and L1283273 instead of the proper procedure of a single strike through, correction, and initials and date of person making the corrections.

- No collection times were listed for the trip blanks on the COCs in laboratory reports L1282223 and L1283273. The laboratory assigned the collection time of 00:00. No collection date was listed for the trip blank on the COC in laboratory report L1283273. The laboratory assigned the collection date of 11/5/2020.

- Samples VMWM-110520-97.7 and YMWK-110520-119.0 were received with the sample set, but were not included on the COC. The laboratory logged sample VMWM-110520-97.7 in with the collection date and time of 11/5/20, 1300 and sample YMWK-110520-119.0 with a collection date and time of 11/5/20, 1133.

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
✓ Method Blank
✓ Matrix Spike/Matrix Spike Duplicate
✓ Laboratory Control Sample
✓ Surrogate
✓ Field Duplicate
⊗ Trip Blank
✓ 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 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

Multiple results were flagged C3, C4 and C5 to indicate the recoveries of the specified compound(s) in the continuing calibration verification (CCV) standards were outside the laboratory specified acceptance criteria. These qualifications are summarized in Attachment 3.

L1282223: The percent difference (%D) in the CCV for acrolein was outside of the laboratory specified acceptance criteria with a low bias. Therefore, based on professional and technical judgement, the non-detect acrolein results were UJ qualified as estimated less than the reported detection limit (RDL) in the associated samples.

L1282223: The %D in the CCV for methyl ethyl ketone was outside the laboratory specified acceptance criteria with a high bias. Therefore, based on professional and technical judgement, the concentrations of methyl ethyl ketone in the associated samples were J qualified as estimated.

L1283273: The %Ds in the CCV for acetone, methyl ethyl ketone and tetrachloroethene were outside the laboratory specified acceptance criteria with high biases. Therefore, based on professional and technical judgement, the concentrations of acetone, methyl ethyl ketone and tetrachloroethene in the associated samples were J qualified as estimated.

L1283273: The %Ds in the CCV for 1,2,3-trichlorobenzene, bromoform, carbon tetrachloride and methyl bromide were outside of the laboratory specified acceptance criteria with low biases. Therefore, based on professional and technical judgement, the non-detect 1,2,3-trichlorobenzene, bromoform, carbon tetrachloride and methyl bromide results were UJ qualified as estimated less than the RDLs in the associated samples.

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 WG1574906,

WG1575329, WG1576160, WG1576437 and WG1577018). VOCs were not detected in the method blanks above the method detection limits (MDLs).

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

MS/MSD pairs were not reported.

1.5 Laboratory Control Sample (LCS)

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

L1282223: The recovery of methylene chloride in the LCS in batch WG1575329 was high and outside the laboratory specified acceptance criteria. Since methylene chloride was not detected in the associated samples, no qualifications were applied to the data.

L1283273: The recoveries of acrolein in the LCSD in batch WG1576160 and carbon disulfide in the LCS/LCSD pair in batch WG1577018 were high and outside the laboratory specified acceptance criteria. Since acrolein and carbon disulfide were not detected in the associated samples, no qualifications were applied to the data.

1.6 Surrogates

Acceptable surrogate recoveries were reported for the sample analyses.

1.7 Field Duplicate

Three field duplicate samples were collected with the sample set, CMW17DS-110420-DUP, CMW18DS-110420-DUP and TS-C-EFF-110420-DUP. Acceptable precision (RPD $\leq$30%) was demonstrated between the field duplicates and the original samples, CMW17DS-110420, CMW18DS-110420 and TS-C-EFF-110420, respectively.

1.8 Trip Blank

Two trip blanks, both identified as TRIP BLANK LOT#454 accompanied the sample shipments. VOCs were not detected in the trip blanks above the RDLs, with the following exception.

Tetrachloroethene (1.20 µg/L) was detected in trip blank TRIP BLANK LOT #454 (L1283273) at a concentration greater than the RDL. Therefore, the concentrations of tetrachloroethene greater than the RDL but less than the blank result were U qualified as not detected at the reported concentrations and the tetrachloroethene concentrations in samples VMWJ2-110520-120.2, VMWJ2-110520-122.7, VMWN-110520-102.3, VMWN-110520-106.5, VMWN-110520-110.8,

VMWI-110520-137.3, VMWI-110520-143.7 and VMWI-110520-148.1 were J+ qualified as estimated with high biases, based on professional and technical judgment.

Sample ID	Compound	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier*	Reason Code**
VMWM-110520-97.7	Tetrachloroethene (PCE)	0.000538	C5	0.000538	U	3
VMWN-110520-95.0	Tetrachloroethene (PCE)	0.00107	NA	0.00107	U	3
VMWN-110520-98.3	Tetrachloroethene (PCE)	0.00115	NA	0.00115	U	3
VMWI-110520-126.4	Tetrachloroethene (PCE)	0.00108	NA	0.00108	U	3
VMWI-110520-131.6	Tetrachloroethene (PCE)	0.00103	NA	0.00103	U	3
VMWI-110520-140.5	Tetrachloroethene (PCE)	0.00118	NA	0.00118	U	3
VMWJ2-110520-120.2	Tetrachloroethene (PCE)	0.00192	NA	0.00192	J+	3
VMWJ2-110520-122.7	Tetrachloroethene (PCE)	0.00195	NA	0.00195	J+	3
VMWN-110520-102.3	Tetrachloroethene (PCE)	0.00123	NA	0.00123	J+	3
VMWN-110520-106.5	Tetrachloroethene (PCE)	0.00132	NA	0.00132	J+	3
VMWN-110520-110.8	Tetrachloroethene (PCE)	0.0015	C5	0.0015	J+	3
VMWI-110520-137.3	Tetrachloroethene (PCE)	0.00125	NA	0.00125	J+	3
VMWI-110520-143.7	Tetrachloroethene (PCE)	0.00148	NA	0.00148	J+	3
VMWI-110520-148.1	Tetrachloroethene (PCE)	0.00141	NA	0.00141	J+	3

ppm-parts per million
NA-not applicable
C5-laboratory flag indicating the CCV standard recovery for the report compound was outside the laboratory specified acceptance criteria with a high bias

1.9 Sensitivity

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

1.10 Electronic Data Deliverable (EDD) 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. It was noted that the samples were reported to the RDLs and the method blank QC was reported to the MDLs in the level II report; both the RDLs and the MDLs were listed in the EDD. It was also noted that

the data were reported in units of parts per million (ppm) in the EDD, while the groundwater sample data were reported in units of parts per billion (PPB or microgram per liter, µg/L) in the level II report. This did not affect the quality of the data. No other discrepancies were identified between the level II report and the EDD.

2.0 SELECTED VOLATILE ORGANIC COMPOUNDS

The air samples were analyzed for selected VOCs per US EPA method TO-15 (1,1-dichloroethene, cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, and vinyl chloride).

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
✓ Method Blank
✓ Laboratory Control Sample
✓ Laboratory Duplicate
✓ Surrogates
✓ Field Duplicate
✓ Sensitivity
⊗ Electronic Data Deliverable Review

2.1 Overall Assessment

The VOC data reported in these data packages are considered usable for supporting project objectives. 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%.

2.2 Holding Time

The holding time for the VOC 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). Six method blanks were reported (batches P200908, P200914, P201016, P201016(2), P201120 and P201210). VOCs were not detected in the method blanks above the method reporting limits (MRLs).

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). Six LCSs were reported. The recovery results were within the laboratory specified acceptance criteria.

2.5 Laboratory Duplicate

Laboratory duplicates were not reported.

2.6 Surrogates

Acceptable surrogate recoveries were reported for the sample analyses.

2.7 Field Duplicate

A field duplicate was not collected with the sample set.

2.8 Sensitivity

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

2.9 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. The data were reported to the MRLs in the laboratory report. The MDLs for the reported compounds were listed in the EDD. In addition, the results were reported in both parts per billion by volume (ppbv) and micrograms per cubic meter ($\mu g/m^3$) in the laboratory report; the results were reported in $\mu g/m^3$ in the EDD. No other discrepancies were identified between the level II report 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	Analysis holding time exceeded
3	Blank contamination (i.e., method, trip, equipment, etc.)
4	Matrix spike/matrix spike duplicate recovery or RPD outside limits
5	LCS recovery outside limits and RPD outside limits (LCS/LCSD)
6	Surrogate recovery outside limits
7	Field Duplicate RPD exceeded
8	Serial dilution percent difference exceeded
9	Calibration criteria not met
10	Linear range exceeded
11	Internal standard criteria not met
12	Lab duplicates RPD exceeded
13	Other

ATTACHMENT 3
QUALIFICATIONS DUE TO CCV FAILURE

Sample ID	Compound	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier*	Reason Code**
CMW-10DS-110420	Methyl ethyl ketone	0.00973	C5	0.00973	J	9
CMW17DS-110420	Methyl ethyl ketone	0.0102	C5	0.0102	J	9
CMW17DS-110420-DUP	Methyl ethyl ketone	0.011	C5	0.011	J	9
CMW18DS-110420	Methyl ethyl ketone	0.0116	C5	0.0116	J	9
CMW18DS-110420-DUP	Methyl ethyl ketone	0.0125	C5	0.0125	J	9
CMW19DS-110420	Methyl ethyl ketone	0.00773	C5	0.00773	J	9
D17DG-110420	Methyl ethyl ketone	0.0158	C5	0.0158	J	9
EW12-110420	Methyl ethyl ketone	0.00987	C5	0.00987	J	9
VMWA-110420	Methyl ethyl ketone	0.0104	C5	0.0104	J	9
VMWB-110420	Methyl ethyl ketone	0.0105	C5	0.0105	J	9
VMWC-110420	Methyl ethyl ketone	0.0113	C5	0.0113	J	9
VMWD-110420	Methyl ethyl ketone	0.0106	C5	0.0106	J	9
VMWE-110420	Methyl ethyl ketone	0.0155	C5	0.0155	J	9
VMWF-110420	Methyl ethyl ketone	0.0144	C5	0.0144	J	9
VMWG-110420	Methyl ethyl ketone	0.0142	C5	0.0142	J	9
VMWH-110420	Methyl ethyl ketone	0.00853	C5	0.00853	J	9
D17DS-110420	Acrolein	0.0500	U,C3	0.0500	UJ	9
EW1-110420	Acrolein	0.0500	U,C3	0.0500	UJ	9
EW14-110420	Acrolein	0.0500	U,C3	0.0500	UJ	9
EW2-110420	Acrolein	0.0500	U,C3	0.0500	UJ	9
EW23-110420	Acrolein	0.0500	U,C3	0.0500	UJ	9
VMWJ2-110520-120.2	Methyl ethyl ketone	0.00962	C5	0.00962	J	9
VMWK-110520-114.3	Methyl ethyl ketone	0.00604	C5	0.00604	J	9
VMWL-110520-103.3	Methyl ethyl ketone	0.00922	C5	0.00922	J	9
VMWL-110520-113.4	Methyl ethyl ketone	0.0109	C5	0.0109	J	9
VMWL-110520-96.0	Methyl ethyl ketone	0.0101	C5	0.0101	J	9
VMWM-110520-101.8	Methyl ethyl ketone	0.00942	C5	0.00942	J	9
VMWM-110520-106.2	Methyl ethyl ketone	0.00958	C5	0.00958	J	9
VMWM-110520-110.7	Methyl ethyl ketone	0.0106	C5	0.0106	J	9
VMWM-110520-94.0	Methyl ethyl ketone	0.0104	C5	0.0104	J	9
VMWM-110520-97.7	Acetone	0.0548	C5	0.0548	J	9
VMWM-110520-97.7	Tetrachloroethene (PCE)	0.000538	C5	0.000538	J	9

Sample ID	Compound	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier*	Reason Code**
VMWN-110520-102.3	Acetone	0.0367	C5	0.0367	J	9
VMWN-110520-110.8	Acetone	0.0569	C5	0.0569	J	9
VMWN-110520-110.8	Tetrachloroethene (PCE)	0.0015	C5	0.0015	J	9
VMWN-110520-95.0	Acetone	0.0433	C5	0.0433	J	9
VMWN-110520-98.3	Acetone	0.0531	C5	0.0531	J	9
YMWK-110520-119.0	Acetone	0.0402	C5	0.0402	J	9
VMWI-110520-126.4	Methyl ethyl ketone	0.00681	C5	0.00681	J	9
VMWI-110520-131.6	Methyl ethyl ketone	0.0089	C5	0.0089	J	9
VMWI-110520-140.5	Methyl ethyl ketone	0.00934	C5	0.00934	J	9
VMWJ2-110520-114.0	Methyl ethyl ketone	0.00963	C5	0.00963	J	9
VMWJ2-110520-115.8	Methyl ethyl ketone	0.00941	C5	0.00941	J	9
TRIP BLANK LOT#454	Tetrachloroethene (PCE)	0.0012	C5	0.0012	J	9
VMWJ2-110520-117.8	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWJ2-110520-117.8	Bromoform	0.0005	U,C4	0.0005	UJ	9
VMWJ2-110520-117.8	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWJ2-110520-117.8	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWJ2-110520-120.2	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWJ2-110520-120.2	Bromoform	0.0005	U,C4	0.0005	UJ	9
VMWJ2-110520-120.2	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWJ2-110520-120.2	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWJ2-110520-122.7	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWJ2-110520-122.7	Bromoform	0.0005	U,C4	0.0005	UJ	9
VMWJ2-110520-122.7	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWJ2-110520-122.7	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWK-110520-110.0	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWK-110520-110.0	Bromoform	0.0005	U,C4	0.0005	UJ	9
VMWK-110520-110.0	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWK-110520-110.0	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWK-110520-114.3	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWK-110520-114.3	Bromoform	0.0005	U,C4	0.0005	UJ	9

Sample ID	Compound	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier*	Reason Code**
VMWK-110520-114.3	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWK-110520-114.3	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWL-110520-103.3	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWL-110520-103.3	Bromoform	0.0005	U,C4	0.0005	UJ	9
VMWL-110520-103.3	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWL-110520-103.3	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWL-110520-113.4	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWL-110520-113.4	Bromoform	0.0005	U,C4	0.0005	UJ	9
VMWL-110520-113.4	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWL-110520-113.4	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWL-110520-96.0	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWL-110520-96.0	Bromoform	0.0005	U,C4	0.0005	UJ	9
VMWL-110520-96.0	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWL-110520-96.0	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWM-110520-101.8	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWM-110520-101.8	Bromoform	0.0005	U,C4	0.0005	UJ	9
VMWM-110520-101.8	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWM-110520-101.8	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWM-110520-106.2	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWM-110520-106.2	Bromoform	0.0005	U,C4	0.0005	UJ	9
VMWM-110520-106.2	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWM-110520-106.2	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWM-110520-110.7	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWM-110520-110.7	Bromoform	0.0005	U,C4	0.0005	UJ	9
VMWM-110520-110.7	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWM-110520-110.7	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWM-110520-94.0	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWM-110520-94.0	Bromoform	0.0005	U,C4	0.0005	UJ	9
VMWM-110520-94.0	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWM-110520-94.0	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWI-110520-126.4	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWI-110520-126.4	Bromoform	0.0005	U,C4	0.0005	UJ	9

Sample ID	Compound	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier*	Reason Code**
VMWI-110520-126.4	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWI-110520-126.4	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWI-110520-131.6	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWI-110520-131.6	Bromoform	0.0005	U,C4	0.0005	UJ	9
VMWI-110520-131.6	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWI-110520-131.6	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWI-110520-137.3	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWI-110520-137.3	Bromoform	0.0005	U,C4	0.0005	UJ	9
VMWI-110520-137.3	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWI-110520-137.3	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWI-110520-140.5	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWI-110520-140.5	Bromoform	0.0005	U,C4	0.0005	UJ	9
VMWI-110520-140.5	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWI-110520-140.5	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWI-110520-143.7	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWI-110520-143.7	Bromoform	0.0005	U,C4	0.0005	UJ	9
VMWI-110520-143.7	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWI-110520-143.7	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWI-110520-148.1	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWI-110520-148.1	Bromoform	0.0005	U,C4	0.0005	UJ	9
VMWI-110520-148.1	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWI-110520-148.1	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWJ2-110520-114.0	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWJ2-110520-114.0	Bromoform	0.0005	U,C4	0.0005	UJ	9
VMWJ2-110520-114.0	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWJ2-110520-114.0	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9
VMWJ2-110520-115.8	1,2,3-Trichlorobenzene	0.0005	U,C4	0.0005	UJ	9
VMWJ2-110520-115.8	Bromoform	0.0005	U,C4	0.0005	UJ	9
VMWJ2-110520-115.8	Carbon Tetrachloride	0.0005	U,C4	0.0005	UJ	9
VMWJ2-110520-115.8	Methyl Bromide	0.0025	U,C3	0.0025	UJ	9

ppm-parts per million
U-not detected at the RDL
C3-laboratory flag indicating that the CCV standard recovery was outside of the laboratory specified acceptance criteria with a low bias
C4-laboratory flag indicating that the CCV recovery was outside of the laboratory specified acceptance criteria wit a low bias.

C5-laboratory flag indicating that the CCV standard recovery was outside the laboratory specified acceptance criteria with a high bias
*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

Technical Memorandum

TO: Chris Kimmel, Project Manager

FROM: Kristi Schultz and Danille Jorgensen

DATE: March 20, 2020

RE: **Boeing Portland (TSA)**
First Quarter 2020 Groundwater Quality Sampling
Laboratory Data Quality Evaluation

This technical memorandum provides the results of a focused data validation associated with 8 groundwater samples and 1 trip blank collected during the first quarter 2020 TSA water quality sampling event at Boeing Portland. Samples were analyzed by Eurofins Lancaster Laboratories Environmental LLC (LLI), located in Lancaster, Pennsylvania. This data quality evaluation covers LLI data package 2086672. Samples submitted to LLI 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 2016). 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 packages. The laboratory received all samples in good condition. All analyses were performed as requested. No special cleanups or handling methods were requested.

Upon receipt by LLI, 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 ≤6°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-0220/BOP-13ds-0220) was submitted for analysis with data package 2086672.

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

Quantitation Limits

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

Audit/Corrective Action Records

No audits were performed or required. No corrective action records were generated for this sample batch. Based on the laboratory's case narratives, continuing calibration verification (CCV) recovery results were within laboratory-specified control limits, with the following exceptions:

- The CCV recoveries for trichlorofluoromethane; 1,1,1-trichloroethane; and carbon tetrachloride were greater than the laboratory-specified control limit. The affected compounds were not detected at concentrations greater than the laboratory reporting limit in the associated samples. 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.

Kristi Schultz
Data Specialist

Danille Jorgensen
Environmental Data Manager

DRJ/kes
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References

EPA. 2016. National Functional Guidelines for Superfund Organic Methods Data Review. edited by Office of Superfund Remediation and Technology Innovation (OSRTI). Washington, DC: US Environmental Protection Agency.

Technical Memorandum

TO: Chris Kimmel, Project Manager

FROM: Kristi Schultz and Danille Jorgensen

DATE: June 5, 2020

RE: **Boeing Portland (TSA)**
Second Quarter 2020 Groundwater Quality Sampling
Laboratory Data Quality Evaluation

This technical memorandum provides the results of a focused data validation associated with 4 groundwater samples and 1 trip blank collected during the second quarter 2020 TSA water quality sampling event at Boeing Portland. Samples were analyzed by Eurofins Lancaster Laboratories Environmental LLC (LLI), located in Lancaster, Pennsylvania. This data quality evaluation covers LLI data package 2098566. Samples submitted to LLI 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 2016). 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 packages. The laboratory received all samples in good condition. All analyses were performed as requested. No special cleanups or handling methods were requested.

Upon receipt by LLI, 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 ≤6°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.

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.

Kristi Schultz
Data Specialist

Danille Jorgensen
Environmental Data Manager

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References

EPA. 2016. National Functional Guidelines for Superfund Organic Methods Data Review. edited by Office of Superfund Remediation and Technology Innovation (OSRTI). Washington, DC: US Environmental Protection Agency.

Technical Memorandum

TO: Evelyn Ives, Project Manager

FROM: Kristi Schultz and Danille Jorgensen

DATE: October 1, 2020

RE: **Boeing Portland (TSA)**
Third Quarter 2020 Groundwater Quality Sampling
Laboratory Data Quality Evaluation

This technical memorandum provides the results of a focused data validation associated with 15 groundwater samples and 1 trip blank collected during the third quarter 2020 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 LLI data package 410-10167-1. 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 2016). 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 packages. The laboratory received all samples in good condition. All analyses were performed as requested. No special cleanups or handling methods were requested.

Upon receipt by LLI, 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 ≤6°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. Two pairs of blind field duplicate water samples (BOP-Z-0819/BOP-23dg-0820 and BOP-Y-0819/BOP-31dg) were submitted for analysis with data package 410-10167-1.

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. No qualification of the data was necessary.

Quantitation Limits

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

Audit/Corrective Action Records

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

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.

Kristi Schultz
Data Specialist

Danille Jorgensen
Environmental Data Manager

DRJ/kes
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References

EPA. 2016. National Functional Guidelines for Superfund Organic Methods Data Review. edited by Office of Superfund Remediation and Technology Innovation (OSRTI). Washington, DC: US Environmental Protection Agency.

Technical Memorandum

TO: Chris Kimmel, Project Manager

FROM: Kristi Schultz and Danille Jorgensen

DATE: December 8, 2020

RE: **Boeing Portland (TSA)**
Fourth Quarter 2020 Groundwater Quality Sampling
Laboratory Data Quality Evaluation

This technical memorandum provides the results of a focused data validation associated with 4 groundwater samples and 1 trip blank collected during the fourth quarter 2020 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 410-19636-1. Samples submitted to LLI 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 2016). 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. Data qualifiers are summarized in Table 1.

Chain-of-Custody Records

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

Upon receipt by LLI, 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 ≤6°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, with the following exception:

- The LCSD recovery for freon 113 was less than the laboratory-specified control limit. The associated sample results were qualified as estimated (J, UJ), as indicated in Table 1.

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, with the following exceptions:

- The CCV recoveries were low for bromomethane, chloromethane, and vinyl chloride associated with the VOC analysis of analytical batch 410-65414. The associated sample results were qualified as estimated (J, UJ), as indicated in Table 1.

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.

Kristi Schultz
Data Specialist

Danille Jorgensen
Environmental Data Manager

DRJ/kes
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References

EPA. 2016. National Functional Guidelines for Superfund Organic Methods Data Review. edited by Office of Superfund Remediation and Technology Innovation (OSRTI). Washington, DC: US Environmental Protection Agency.

Table 1
Summary of Data Qualifiers
Boeing Portland TSA Phase I

Data Package	Sample Number	Analyte	Result	Lab Qualifier	Data Qualifier	Reason
410-19636-1	BOP-13ds-1120	Bromomethane	0.500	U	UJ	Low continuing calibration recovery
410-19636-1	BOP-13ds-1120	Chloromethane	0.500	U	UJ	Low continuing calibration recovery
410-19636-1	BOP-13ds-1120	Freon 113	0.500	U	UJ	Low laboratory control sample recovery
410-19636-1	BOP-13ds-1120	Vinyl Chloride	0.200	U	UJ	Low continuing calibration recovery
410-19636-1	BOP-13dg-1120	Bromomethane	0.500	U	UJ	Low continuing calibration recovery
410-19636-1	BOP-13dg-1120	Chloromethane	0.500	U	UJ	Low continuing calibration recovery
410-19636-1	BOP-13dg-1120	Freon 113	0.500	U	UJ	Low laboratory control sample recovery
410-19636-1	BOP-13dg-1120	Vinyl Chloride	0.200	U	UJ	Low continuing calibration recovery
410-19636-1	BOP-31ds-1120	Bromomethane	0.500	U	UJ	Low continuing calibration recovery
410-19636-1	BOP-31ds-1120	Chloromethane	0.500	U	UJ	Low continuing calibration recovery
410-19636-1	BOP-31ds-1120	Freon 113	0.500	U	UJ	Low laboratory control sample recovery
410-19636-1	BOP-31ds-1120	Vinyl Chloride	0.200	U	UJ	Low continuing calibration recovery
410-19636-1	BOP-31dg-1120	Bromomethane	0.500	U	UJ	Low continuing calibration recovery
410-19636-1	BOP-31dg-1120	Chloromethane	0.500	U	UJ	Low continuing calibration recovery
410-19636-1	BOP-31dg-1120	Freon 113	0.500	U	UJ	Low laboratory control sample recovery
410-19636-1	BOP-31dg-1120	Vinyl Chloride	0.200	U	UJ	Low continuing calibration recovery

U = The analyte was analyzed for but was not detected above the level of the reported sample quantitation limit.
UJ = The analyte was not detected in the sample; the reported sample reporting limit is an estimate.