FINAL DRAFT REMEDIAL INVESTIGATION REPORT

VOLUME 3: RECTIFIER YARD AND PLANT AREA – AREA OF CONCERN RESULTS AND SUMMARY

Columbia Gorge Aluminum Smelter Site

Revision 0
Goldendale, WA
Facility Site ID #95415874

Agreed Order DE 10483

June 14, 2022

On behalf of:

Lockheed Martin Corporation
6801 Rockledge Drive
Bethesda MD 20817

NSC Smelter LLC
85 John Day Dam Road
Goldendale, WA 98620

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Acronyms

AOC	Area of Concern
AST	Aboveground Storage Tank
BAU	Basalt Aquifer – Upper Zone
BMEC	Blue Mountain Environmental Consulting, Inc.
BPA	Bonneville Power Administration
CB	Catch Basin
CCR	Crucible Cleaning Room
COPC	Contaminants of Potential Concern
cPAHs	Carcinogenic Polycyclic Aromatic Hydrocarbons
DC	Direct Chill (casting pits)
Ecology	Washington Department of Ecology
FS	Feasibility Study
ft bgs	Feet below ground surface
gpm	Gallons per minute
GPS	Global Positioning System
GWAOC	Groundwater AOC
HEAF	High Efficiency Air Filtration
I&M	Industrial and Monitoring
HMW	High molecular-weight
LMW	Low molecular-weight
Lockheed Martin	Lockheed Martin Corporation
µg/kg	Micrograms per kilogram
mg/kg	Milligrams per kilogram
µg/L	Micrograms per liter
mg/L	Milligrams per liter
MTCA	Model Toxics Control Act
NPDES	National Pollutant Discharge Elimination System
NSC	NSC Smelter, LLC
OCBs	Oil Circuit Breakers
PAAOC	Plant Area AOC
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PGG	Plateau Geoscience Group, LLC

PID	Photoionization Detector
PLP	Potentially Liable Persons
PVC	Polyvinyl chloride
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
RYAOC	Rectifier Yard Area of Concern
SAP	Sampling and Analysis Plan
SE	Scrubber Effluent
SPL	Spent Pot Liner
SPLP	Synthetic Precipitation Leaching Procedure
SWMU	Solid Waste Management Unit
Tetra Tech	Tetra Tech, Inc.
TPH	Total Petroleum Hydrocarbons
TPH-Dx	Total Petroleum Hydrocarbons – Diesel-extended range
TPH-Gx	Total Petroleum Hydrocarbons – Gasoline-extended range
TTEC	Total Toxicity Equivalent Concentrations
UA	Unconsolidated Aquifer
WA	Washington Administrative Code
WA ELAP	Washington State Laboratory Accreditation Program
WA MCL	Washington State Maximum Contaminant Level
WPA	Work Plan Addendum
WSI	West Surface Impoundment

Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs)

(Agreed Order No. DE 10483)

Solid Waste Management Units (SWMUs)

NPDES Ponds (SWMU #1)
East Surface Impoundment (ESI) (SWMU #2)
Intermittent Sludge Disposal Ponds (SWMU #3)
West Surface Impoundment (SWMU #4)
Line A Secondary Scrubber Recycle Station (SWMU #5)
Line B, C, D Secondary Scrubber Recycle Stations (SWMU #6)
Decommissioned Air Pollution Control Equipment (SWMU #7)
Tertiary Treatment Plant (SWMU #8)
Paste Plant Recycle Water System (SWMU #9)
North Pot Liner Soaking Station (SWMU #10)
South Pot Liner Soaking Station (SWMU #11)
East SPL Storage Area (SWMU #12)
West SPL Storage Area (SWMU #13)
North SPL Storage Containment Building (SWMU #14)
South SPL Storage Building (SWMU #15)
SPL Handling Containment Building (SWMU #16)
East End Landfill (SWMU #17)
West End Landfill (SWMU #18)
Plant Construction Landfill (SWMU #19)
Drum Storage Area (SWMU #20)
Construction Rubble Storage Area (SWMU #21)
Wood Pallet Storage Area (SWMU #22)
Reduction Cell Skirt Storage Area (SWMU #23)
Carbon Waste Roll-off Area (SWMU #24)
Solid Waste Collection Bin and Dumpsters (SWMU #25)
HEAF Filter Roll-Off Bin (SWMU #26)
Tire and Wheel Storage Area (SWMU #27)
90-Day Drum Storage Area (SWMU #28)
Caustic Spill (SWMU #29)

Paste Plant Spill (SWMU #30)
Smelter Sign Area (SWMU #31)
Stormwater pond and appurtenant facilities (SWMU #32)

Areas of Concern (AOCs)

Columbia River Sediments
Groundwater in the Uppermost Aquifer at the Facility
Wetlands
Rectifier Yard
Plant Area

Preface

This Volume (Volume 3 of the revised RI Report) summarizes the Remedial Investigation (RI) and Work Plan Addendum (WPA) results for the Rectifier Yard Area of Concern (Rectifier Yard AOC), Plant Area – Area of Concern (PAAOC), and five conveyance line systems present within the PAAOC at the site. The five conveyance line systems include: Stormwater Collection, Groundwater Collection, Industrial and Monitoring Lines and associated Industrial Sump, Scrubber Effluent Lines, and Sanitary Sewer Lines. Results for the Rectifier Yard AOC, Plant Area AOC, and the five conveyance line systems are followed by a summary and recommendations section. The revised RI report consists of the following additional Volumes:

- **Volume 1, Introduction and Project Framework**, presents background information about the site, identified data needs, the site conceptual model, the regulatory framework including screening levels and risk-pathway evaluation and calculation approach, and data quality assessment. References for the entire RI report are also included in Volume 1.
- **Volume 2, SWMU Results and Summary**, presents the RI results for the 32 SWMUs at the site as well as three additional investigation areas that were investigated during the course of the RI and WPA. A summary and recommendation section is included at the end of the Volume.
- **Volume 4, Areas of Concern Results and Summary**, presents the RI results for three of the site AOCs including: the Columbia River Sediments AOC, and the Groundwater in the Uppermost Aquifer AOC, and the Wetlands AOC. A summary and recommendations section is included at the end of the Volume.
- **Volume 5, Appendices,** includes all Appendices for the RI report including: Appendix A – Introduction and Project Framework Supporting Documentation; Appendix B – SWMU Field Logs; Appendix C – Columbia River Sediments AOC; Appendix D – Groundwater in the Uppermost Aquifer AOC; Appendix E – Wetlands AOC; Appendix F – Rectifier Yard AOC; Appendix G – Plant Area AOC; Appendix H – Analytical Results; and Appendix I – Data Validation Reports.

Background information regarding the Rectifier Yard AOC, Plant Area AOC, and five conveyance line systems and the associated RI data needs are briefly summarized in Volume 1 of the RI, with further details summarized in the Final RI Phase 1 and Phase 2 Work Plans (Tetra Tech et al. 2015a,b), and the Final WPA (Tetra Tech et al. 2020b). Figure P-1 and P-2 show the locations of the SWMUs and other plant features and property ownership in the site vicinity.

Legend

▨ Wetlands

N
W
E
S

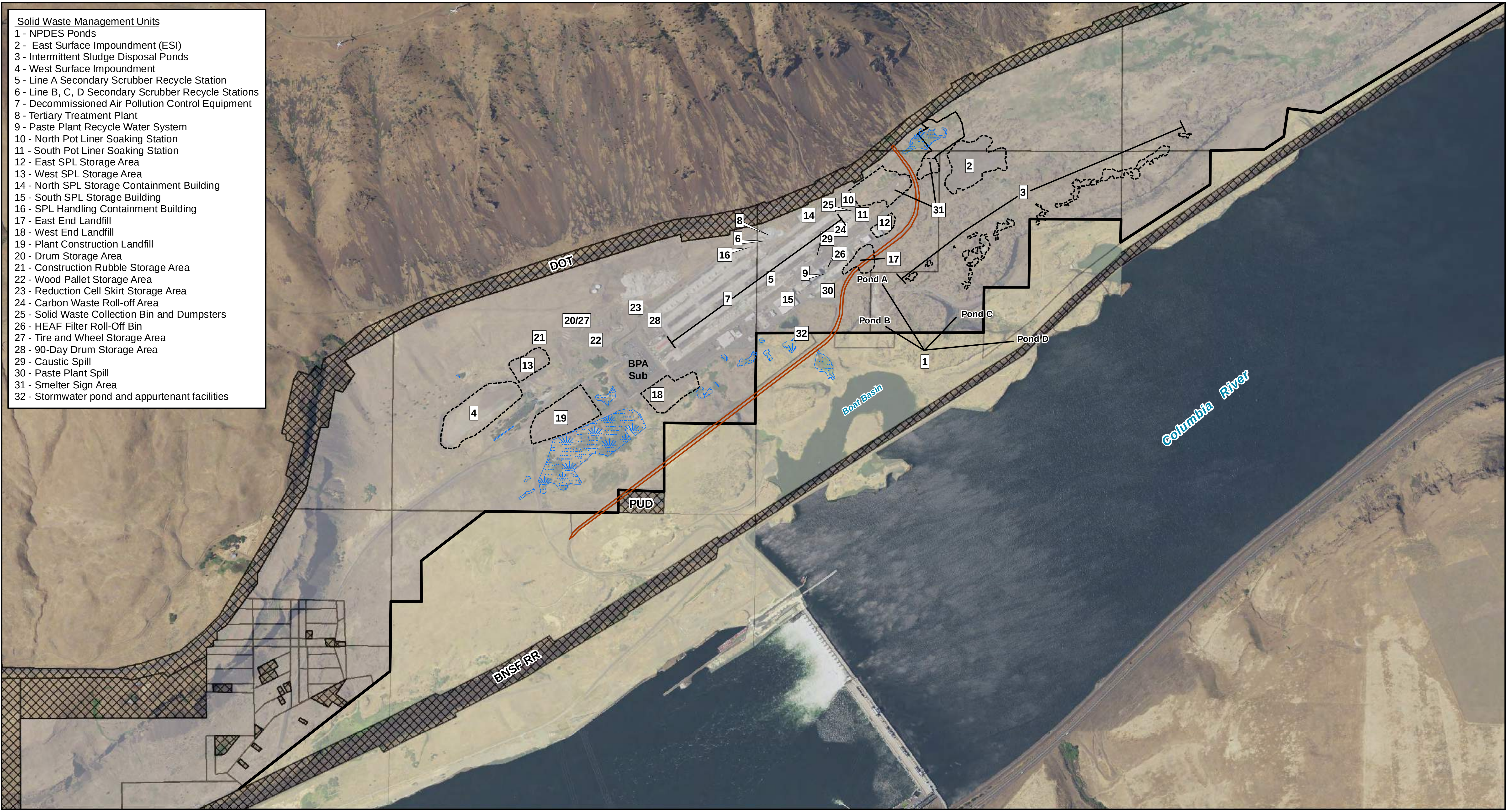
0 500 1,000 2,000
Feet

Imagery Data Sources: USDA NAIP 1-m Imagery, 2006.

Figure P-1
Primary Site and Vicinity
Features Map

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

R:\projects_2011\LockheedMartin_GoldendaleSiteInvestig\maps\2019_Reporting\Figure_1-1_Site_Features.mxd



Solid Waste Management Units

1 - NPDES Ponds
2 - East Surface Impoundment (ESI)
3 - Intermittent Sludge Disposal Ponds
4 - West Surface Impoundment
5 - Line A Secondary Scrubber Recycle Station
6 - Line B, C, D Secondary Scrubber Recycle Stations
7 - Decommissioned Air Pollution Control Equipment
8 - Tertiary Treatment Plant
9 - Paste Plant Recycle Water System
10 - North Pot Liner Soaking Station
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16 - SPL Handling Containment Building
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18 - West End Landfill
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27 - Tire and Wheel Storage Area
28 - 90-Day Drum Storage Area
29 - Caustic Spill
30 - Paste Plant Spill
31 - Smelter Sign Area
32 - Stormwater pond and appurtenant facilities

Legend

▢ NSC Smelter LLC Parcels
▢ USACE
▨ Other Ownership
▭ Klickitat County Road Right-of-Way (John Day Dam Road)
— Property Boundary
1 Solid Waste Management Unit
⬚ SWMU Investigation Areas
▨ Wetlands

Imagery Source: NAIP 2017

Figure P-2
Parcel Ownership and Solid Waste Management Units and Investigation Areas

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Section 1
Rectifier Yard

This section summarizes the results of the Remedial Investigation (RI) for the Rectifier Yard Area of Concern (Rectifier Yard AOC). Investigation of the Rectifier Yard AOC was included because as stated in the Agreed Order, “this type of facility has the potential to release contaminants to the soil if the electrical equipment fails. Polychlorinated biphenyls (PCBs) would comprise the potential contaminants at this location.” The Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a) includes a detailed summary of background information regarding the Rectifier Yard AOC. Investigation of the Rectifier Yard AOC was performed as part of the initial RI field mobilization and was not included in the Work Plan Addendum (WPA) field program.

1.1 BACKGROUND SUMMARY

As previously stated in the approved Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a), the Rectifier Yard AOC is defined as the area where the former rectifiers, transformers, and associated oil piping, and tanks used in plant operations were located. Rectifiers and primary and auxiliary transformers were located in an area bounded to the east by the Plant Area – Area of Concern (PAAOC), south by the plant entrance road, west by the Bonneville Power Administration (BPA) Harvalum Substation, and to the north by the north plant access road (refer to Figure P-1). The BPA facility is not part of Columbia Gorge Aluminum Smelter Site and is owned and maintained by BPA. This AOC includes both the Rectifier Yard and the associated Rectifier Building. In addition, 27 smaller transformer substations (termed the interior transformer substations) were located throughout the area of the main plant and are also included in the Rectifier Yard AOC.

As previously stated in the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a), site investigations of the Rectifier Yard were initially performed during 2011 and in association with plant demolition activities. More detailed information regarding the Rectifier Yard and environmental investigation activities are summarized by Plateau Geoscience Group LLC (PGG 2012b) and relevant supporting figures and tables from this report were included in the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a) and in Volume 5, Appendix F-1 of this report. The results for the 2011 investigation have been used to supplement the RI results and have been summarized and included in figures as appropriate.

Structures in this AOC include the Rectifier Building, main and auxiliary transformers, transformers for Production Buildings A through D, 27 interior transformer substations, three aboveground storage tanks (ASTs) for transformer oil storage, associated underground oil conveyance piping, and oil circuit breakers (OCBs) for servicing transformers (refer to Volume 5, Appendix F-1).

The various Rectifier Yard AOC features and areas have been organized for presentation purposes of into the following categories:

- Oil house ASTs located in the Rectifier Yard.
- Oil lines that conveyed oil from the Oil House to various substations at the Rectifier Yard. A few transformers near the oil lines were also sampled during the RI.
- Rectifier Building Transformer Bays and Basement area that were not characterized during the previous investigation (PGG 2012b).
- Northwest Area of the Rectifier Yard that was not characterized during previous investigation (PGG 2012b).
- Plant Interior Transformer Substations consisting of 27 substations located throughout the main plant.
- Catch Basin and Basement Trench Sumps that were not previously sampled during the previous investigation (PGG 2012b).

Results are presented in turn for each of these groupings within the results section of this report.

1.2 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

A summary of the data needs and data gaps identified for the Rectifier Yard AOC is included in the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a). The following investigation objectives are based on the identified data needs and gaps for the Rectifier Yard AOC:

- Characterize the nature and extent of contaminants of potential concern (COPC) in surface and subsurface soil at oil pipelines, Oil House, and oil storage ASTs.
- Confirm oil pipelines have been removed.

- Characterize the nature and extent of COPC in subsurface soil beneath Rectifier Building transformer bays and the Rectifier Building foundation.

- Characterize the nature and extent of COPC in surface and subsurface soil at select interior transformer substations that were either not sampled or not accessible during previous investigations.

- Evaluate whether additional soil removal is warranted at plant interior Transformer Substation 5.

- Characterize the nature and extent of COPC in surface soil in the north portion of the Rectifier Yard which was previously inaccessible as a result of demolition debris storage.

- Characterize extent of COPC in sediment in newly identified miscellaneous features including catch basins near the Oil House, and sumps in the Rectifier Building basement, and at the Rectifier Yard pump station.

The Rectifier Yard AOC RI field work was largely completed during two field mobilizations in April 2016 and September 2016. Following these two main mobilizations, three soil samples were collected from the Rectifier Building Basement after concrete coring was completed. Most of the investigation consisted of test pit explorations using a mini-excavator and with grab soil samples collected from the excavations at selected depths. In a few cases, a clean stainless-steel hand-auger was used to collect the samples. Two soil samples were also collected during drilling of the borings for wells RI-MW13-BAU and RI-MW14-BAU. These samples were collected from the core barrel used during sonic drilling operations.

The RI analytical data includes both soil results as well as a few sludge/solids samples collected from lined catch basins near the Oil House and in the Rectifier Building Basement. A total of 171 soil samples and 6 sludge/solids samples were collected including field duplicates. All collected RI samples were analyzed for PCBs, polycyclic aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons – diesel-extended range (TPH-Dx). A subset of the samples was analyzed for total cyanide, fluoride, and metals (Al, As, CD, Cr, Cu, Pb, Hg, Ni, Se, and Zn).

1.3 INVESTIGATION RESULTS

The Rectifier Yard AOC RI field investigation was completed in September 2016, in accordance with Washington Department of Ecology (Ecology)-approved Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). All project samples were shipped to TestAmerica Laboratories of Tacoma, Washington, a Washington State-accredited (WA ELAP) laboratory, for specified analysis. All samples were reported received in good condition and under standard chain-of-custody protocol. Sample results were validated by Laboratory Data Consultants of Carlsbad, California, an independent third-party data validation contractor. Laboratory analytical data reports are provided in Volume 5, Appendix H-1 and data validation reports for the Rectifier Yard AOC are included in Volume 5, Appendix I-1. The RI data quality objectives for the Rectifier Yard AOC were met with data qualifiers assigned as appropriate on the RI data summary tables. Refer to Volume 1, Section 6 for a summary of the data quality assessment performed for the RI. Field logs for the Rectifier Yard AOC are included in Volume 5, Appendix F-2.

The investigation result summary tables and figures for the Rectifier Yard AOC summarize exceedances of applicable soil screening levels, including the Model Toxics Control Act (MTCA) Method C Industrial screening levels, MTCA Method A Industrial soil screening levels (petroleum hydrocarbons and PCBs only), MTCA-derived soil screening levels for protection of groundwater, and terrestrial ecologic screening levels for protection of wildlife. The result summary tables also include comparison with natural background concentrations for selected metals. For carcinogenic polycyclic aromatic hydrocarbons (cPAHs), the calculated total toxicity equivalent concentrations (TTEC) for soil that exceed screening levels is shown on figures, in lieu of listing all individual cPAH chemicals that exceeded screening levels. Similarly, the calculated total high molecular-weight (HMW) PAHs and total low molecular-weight (LMW) PAHs were used in comparison with soil screening levels for protection of wildlife instead of listing individual PAHs.

As previously stated in the approved Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a), the PGG (2012b) Rectifier Yard investigation report included comparisons against MTCA Method B and Terrestrial Ecological Screening Levels. Results for individual cPAH were also not converted to TTEC cPAH in the original report. TTEC cPAH results have been calculated for the historical data and the data has been compared against the above-referenced industrial and soil screening levels for groundwater protection screening levels as described and explained in Volume 1 of this report. The revised historical data tables are included in Volume 5, Appendix F-1. The PGG (2012b) analytical data was not validated in accordance with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The data are provided and summarized for general comparison purposes only.

1.3.1 Oil House and Oil ASTs

The RI field investigation included soil sampling in the area of the three former ASTs on the northeast side of the Oil House. Analytical results for the collected solids/sludge samples from the two lined catch basins on the southeastern side of the oil house are summarized in Section 1.3.6. Soil sample results for nearby oil lines are summarized in Section 1.3.2.

RI results for the Oil House and Oil ASTs are summarized in Table 1-1 and Figure 1-1. Historical results (PGG 2012b) for this area are also shown in Figure 1-1 and included in Volume 5, Appendix F-1.

Soil samples were typically collected at depths and locations consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). Note that individual soil sample designations (sample nomenclature) include the depth of sample collection in feet below ground surface (ft bgs).

In one case, RYAOC-TP4, a shallow [4-feet (ft) deep] trench was excavated on the east side of the Oil House in lieu of a test pit based on field observations of suspected petroleum staining at the ground surface. The area of suspected petroleum staining extends at the surface laterally approximately 7 ft on either side of the oil-line pipe junction that goes inside of the Oil House. A 5-point composite soil samples were collected from the western sidewall of the trench from within the stained zone (RYAOC-TP-AST04-0.5) and a second sample (RYAOC-TP-AST04-3.0) was collected from beneath the zone of petroleum staining at about 3 ft bgs.

Results for the RI soil samples collected in the vicinity of the former ASTs show the following:

- Diesel-range organics [maximum of 3,700 milligrams per kilogram (mg/kg)] exceeded MTCA Method A Industrial screening levels in the surface composite soil sample (RYAOC-TP-AST-04-0.5) collected for the area of observed staining at the pipe junction. The second sample collected from 3.0 ft bgs at this location did not exceed soil screening levels. Diesel-range organics were not detected above screening levels in the other soil samples collected in the vicinity of the former ASTs.

- PCBs were generally not detected in soils from the Oil House vicinity. PCBs were detected in two of the AST soil samples (RYAOC-TP-AST-04-0.5 and RYAOC-TP-AST-04-3.0) below MTCA industrial and residential screening levels (maximum of 0.0054 J mg/kg, Aroclor 1260). This is similar to historical PCB results (PGG 2012b) for this area (refer to Figure 1-1 and Volume 5, Appendix F-1).

Table 1-1
Rectifier Yard AOC - Oil House ASTs, Oil Lines, and Nearby Transformers RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Winter 2015 - Spring 2016
(Page 1 of 6)

				Ecological Indicator				Analytical Results											
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	RYAOC-RI-MW13-2.0 12/9/2015	RYAOC-RI-MW14-3 12/11/2015	RYAOC-TP-AST-01-0.5 4/19/2016	RYAOC-TP-AST-01-3.0 4/19/2016	RYAOC-TP-AST-02-0.5 4/19/2016	RYAOC-TP-AST-02-3.0 4/19/2016	RYAOC-TP-AST-40-3.0 (Duplicate of RYAOC-TP-AST-02-3.0) 4/19/2016	RYAOC-TP-AST-03-0.5 4/19/2016	RYAOC-TP-AST-03-3.0 4/19/2016	RYAOC-TP-AST-04-0.5 4/19/2016	RYAOC-TP-AST-04-3.0 4/19/2016	RYAOC-TP-PL-01-0.5 4/18/2016
Aluminum Smelter																			
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	NA	NA	2 U	NA	2.2 U	NA	NA	2.2 U	NA	2.2 U	NA	2 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	NA	NA	6.7	NA	17	NA	NA	7.3	NA	5.6	NA	20 J
Polycyclic Aromatic Hydrocarbons (PAHs)																			
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.0017 U	0.0016 U	0.00061 U	0.00085 J	0.0006 U	0.00072 U	0.00067 J	0.00069 U	0.00063 U	0.0034 J	0.00064 U	0.0053
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.0022 U	0.0021 U	0.00044 U	0.001 J	0.00043 U	0.00068 J	0.00048 U	0.00049 U	0.001 J	0.0073	0.00046 U	0.0073
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.00066 U	0.00063 U	0.00058 U	0.011	0.0016 J	0.0033 J	0.0061	0.00066 U	0.0046 J	0.00056 U	0.00061 U	0.032
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00055 U	0.00052 U	0.00048 U	0.00052 U	0.00047 U	0.00057 U	0.00053 U	0.00055 U	0.0005 U	0.0061	0.00051 U	0.00049 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.00066 U	0.00063 U	0.00058 U	0.0075	0.0029 J	0.003 J	0.0046 J	0.00066 U	0.0045 J	0.00056 U	0.00061 U	0.073
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0017 U	0.0016 U	0.0049	0.1	0.019	0.033 J	0.06 J	0.00083 U	0.045	0.00071 U	0.0013 J	0.44
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.00044 U	0.00042 U	0.009	0.14	0.026	0.044 J	0.082 J	0.00044 U	0.067	0.0013 J	0.0011 J	0.47
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0017 U	0.0016 U	0.019	0.27	0.041	0.084 J	0.15 J	0.00065 U	0.099	0.006	0.011	0.58
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00055 U	0.00052 U	0.014	0.14	0.02	0.036 J	0.071 J	0.00055 U	0.055	0.0031 J	0.0042 J	0.4
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.00066 U	0.00063 U	0.0074	0.091	0.014	0.027 J	0.05 J	0.00066 U	0.036	0.0019 J	0.0031 J	0.26
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0017 U	0.0016 U	0.0078	0.13	0.023	0.041 J	0.079 J	0.0016 U	0.057	0.0014 U	0.0067	0.63
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.00022 U	0.00021 U	0.0029 J	0.025	0.0042 J	0.008 J	0.014 J	0.00079 U	0.01	0.00068 U	0.00083 J	0.06
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.0054 U	0.0051 U	0.011	0.15	0.028	0.045 J	0.085 J	0.0015 U	0.069	0.012	0.0055	0.73
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.00055 U	0.00052 U	0.00048 U	0.0053	0.00086 J	0.0017 J	0.0029 J	0.00055 U	0.0005 U	0.00047 U	0.00051 U	0.015
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.00066 U	0.00063 U	0.013	0.17	0.023	0.043 J	0.086 J	0.00066 U	0.061	0.0025 J	0.0044 J	0.38
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.00088 U	0.00084 U	0.00077 U	0.0019 J	0.00076 U	0.00099 J	0.0012 J	0.00088 U	0.0009 J	0.0033 J	0.00082 U	0.0095
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0017 U	0.0016 U	0.00067 U	0.065	0.011	0.02 J	0.033 J	0.00076 U	0.026	0.00065 U	0.0007 U	0.23
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.0049 U	0.0046 U	0.0093	0.14	0.025	0.042 J	0.078 J	0.0011 U	0.064	0.01	0.0078	0.71
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.0004755	0.0004515	0.013798	0.2069	0.03635	0.06391	0.11879	0.0004075	0.09267	0.0024165	0.00323	0.6483
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.00055 U	0.00052 U	0.011	0.24255	0.04436	0.07467	0.13347	0.00049 U	0.106	0.0321	0.0055	1.1021
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	0.00022 U	0.00021 U	0.0873	**1.206**	0.1952	0.358	0.67	0.00044 U	0.494	0.0248	0.04043	**3.93**
Polychlorinated Biphenyls (PCBs)																			
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.0079 U	0.0079 U	0.0078 U	0.0075 U	0.0079 U	0.0074 U	0.0079 U	0.0072 U	0.0071 U	0.0078 U	0.0072 U	0.0072 U
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.0045 U	0.0045 U	0.0045 U	0.0042 U	0.0045 U	0.0042 U	0.0045 U	0.0041 U	0.004 U	0.0044 U	0.0041 U	0.0041 U
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.0052 U	0.0052 U	0.0052 U	0.0049 U	0.0052 U	0.0049 U	0.0052 U	0.0048 U	0.0047 U	0.0052 U	0.0048 U	0.0048 U
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.0017 U	0.0017 U	0.0017 U	0.0016 U	0.0017 U	0.0016 U	0.0017 U	0.0016 U	0.0015 U	0.0017 U	0.0016 U	0.0016 U
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.0031 U	0.0031 U	0.0031 U	0.0029 U	0.0031 U	0.0029 U	0.0031 U	0.0028 U	0.0028 U	0.0031 U	0.0028 U	0.0072 J
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	0.71	NE	0.0016 U	0.0016 U	0.0016 U	0.0015 U	0.0016 U	0.0015 U	0.0016 U	0.0015 U	0.0014 U	0.0016 U	0.0015 U	0.0015 U
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	0.002 U	0.002 U	0.002 U	0.0019 U	0.002 U	0.0019 U	0.002 U	0.0018 U	0.0018 U	0.0054 J	0.0051 J	0.0069 J
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	0.00053 U	0.0005 U	0.00053 U	0.0005 U	0.00053 U	0.00049 U	0.00048 U	0.00053 U	0.00049 U	0.00049 U
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	0.00095 U	0.00091 U	0.00096 U	0.0009 U	0.00096 U	0.00088 U	0.00086 U	0.00095 U	0.00088 U	0.0077 J
Total PCB Aroclor (calc)	mg/kg	10	66	0.65	NE	0.65	NE	0.0016 U	0.0016 U	0.00053 U	0.0005 U	0.00053 U	0.0005 U	0.00053 U	0.00049 U	0.00048 U	0.0054	0.0051	0.0218
Metals																			
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	6,400	8,200	7,600	8,000	7,400	8,000	7,800	7,100	6,800	6,800	6,600	5,300
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	0.99	1.7	1.9	1.7	1.5	1.5	1.6	1.2	1.5	1.7	1.1	1.2
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.16	0.2	0.24	0.33	0.35	0.21	0.24	0.2	0.21	0.18	0.26	0.18 J
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	2 J	4.6 J	5.6 J	5.4 J	4.4 J	4.2 J	4.2 J	2.7 J	4.5 J	6.4 J	2.4 J	6.6 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	14	15	15	14	14	16	14	15	13	14	13	17
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	3.6	4.2	5	5.5	4.7	4.9	4.9	4.2	4.4	5.6	4.1	3.5
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.0064 U	0.0064 U	0.011 J	0.0089 J	0.057 J	0.015 J	0.0086 J	0.02 J	0.0093 J	0.0075 J	0.0059 UJ	0.0062 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	3.2	5.4 J	6.1	6.8	5	5	5.3	4.1	5	6	4.1	5.6 J
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**1.3**	**1.4**	**0.84**	**0.98**	**0.88**	**0.86**	**0.95**	**0.97**	**0.88**	**0.88**	**0.82**	**1.3**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	44	50	52	330	53	100	110	49	120	46	46	130
Total Petroleum Hydrocarbons (TPHs)																			
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NE	3.9 U	3.9 U	1,000	68	17 J	14 J	18 J	11 U	12 U	**3,700**	320	53
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NE	9.8 U	9.8 U	240	30 J	30 J	9.9 J	12 J	9.4 U	10 U	940	110	56

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established

PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
TPH = Total Petroleum Hydrocarbons

Table 1-1
Rectifier Yard AOC - Oil House ASTs, Oil Lines, and Nearby Transformers RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Winter 2015 - Spring 2016
(Page 2 of 6)

				Ecological Indicator				Analytical Results												
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	RYAOC-TP-PL-01-3.0 4/18/2016	RYAOC-TP-PL-02-0.5 4/18/2016	RYAOC-TP-PL-02-3.0 4/18/2016	RYAOC-TP-PL-40-3.0 (Duplicate of RYAOC-TP-PL-02-3.0) 4/18/2016	RYAOC-TP-PL-03-0.5 4/18/2016	RYAOC-TP-PL-03-3.0 4/18/2016	RYAOC-TP-PL-04-0.5 4/18/2016	RYAOC-TP-PL-04-3.0 4/18/2016	RYAOC-TP-PL-05-0.5 4/18/2016	RYAOC-TP-PL-05-3.0 4/18/2016	RYAOC-TP-PL-06-0.5 4/18/2016	RYAOC-TP-PL-06-3.0 4/18/2016	RYAOC-TP-PL-07-0.5 4/18/2016
Aluminum Smelter																				
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	NA	2.1 U	NA	NA	2.1 U	NA	2.1 U	NA	2 U	NA	2.1 U	NA	2 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	NA	45 J	NA	NA	17 J	NA	6.6 J	NA	**580 J**	NA	20 J	NA	4.7 B
Polycyclic Aromatic Hydrocarbons (PAHs)																				
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.0045	0.0076 J	0.00094 J	0.001 J	0.015 J	0.00065 U	0.00066 U	0.00062 U	0.0081 J	0.00074 U	0.0013 J	0.00066 U	0.0012 J
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.0033 J	0.011 J	0.0015 J	0.0013 J	0.019 J	0.00046 U	0.00047 U	0.00044 U	0.02 J	0.00053 U	0.0013 J	0.00047 U	0.0015 J
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.034	0.088	0.0052	0.0065	0.18	0.00061 U	0.012	0.00059 U	0.041 J	0.0007 U	0.0085	0.0028 J	0.017
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0039 J	0.0023 U	0.00049 U	0.00049 U	0.0025 U	0.00051 U	0.00052 U	0.00049 U	0.034 J	0.00058 U	0.00089 J	0.00053 U	0.00047 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.077	0.087	0.0032 J	0.0069	0.21	0.00061 U	0.012	0.00059 U	1.1	0.0019 J	0.0085	0.014	0.012
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.43	0.92	0.039 J	0.064 J	1.7	0.0013 J	0.12	0.00095 J	8.3	0.0084	0.039	0.075	0.12
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.3	1.3	0.051 J	0.086 J	2.1	0.0019 J	0.15	0.0016 J	7.8	0.017	0.045	0.084	0.19
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.41	1.7	0.068 J	0.13 J	2.5	0.0023 J	0.19	0.0022 J	21	0.031	0.063	0.1	0.26
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.21	1.8	0.047	0.064	2	0.0016 J	0.13	0.0014 J	13	0.036	0.035	0.057	0.15
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.13	0.48	0.028 J	0.044 J	1.1	0.0013 J	0.079	0.001 J	5.8	0.01	0.025	0.043	0.098
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.42	1.2	0.052 J	0.08 J	2	0.0015 U	0.15	0.0015 U	20	0.019	0.045	0.083	0.17
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.039	0.21	0.0077 J	0.013 J	0.29	0.00074 U	0.02	0.00071 U	3.3	0.0052 J	0.0053	0.011	0.026
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.87	1.5	0.06 J	0.1 J	2.6	0.0029 J	0.17	0.0025 J	26	0.013	0.079	0.13	0.2
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.036	0.036	0.0022 J	0.0045 J	0.072	0.00051 U	0.0054	0.00049 U	0.044 J	0.00085 J	0.0057	0.0029 J	0.0078
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.23	1.6	0.047 J	0.077 J	1.9	0.0016 J	0.13	0.0014 J	12	0.031	0.037	0.065	0.17
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.0046	0.017 J	0.0015 J	0.0015 J	0.037	0.00082 U	0.0022 J	0.00079 U	0.046 J	0.00094 U	0.0044 J	0.001 J	0.003 J
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.58	0.57	0.025 J	0.039 J	1	0.00082 J	0.065	0.00096 J	2.3	0.0049 J	0.047	0.038	0.079
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.67	1.5	0.054 J	0.089 J	2.4	0.0041 J	0.16	0.0035 J	29	0.016	0.068	0.13	0.18
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.4281	1.803	0.07049	0.1196	2.869	0.0025945	0.2054	0.002198	**13.04**	0.02575	0.06238	0.11423	0.2591
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	1.6133	2.3166	0.09954	0.1607	4.133	0.00372	0.2666	0.00346	29.5931	0.02065	0.15659	0.1887	0.3215
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**2.839**	**10.71**	0.3937	0.647	**15.99**	0.0141	**1.129**	0.01205	**120**	0.1736	0.3623	0.648	**1.364**
Polychlorinated Biphenyls (PCBs)																				
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.0068 U	0.0068 U	0.0068 U	0.0074 U	0.0071 U	0.0079 U	0.0075 U	0.0071 U	0.0074 U	0.0075 U	0.0068 U	0.0067 U	0.0074 U
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.0038 U	0.0038 U	0.0039 U	0.0042 U	0.004 U	0.0045 U	0.0043 U	0.0041 U	0.0042 U	0.0042 U	0.0039 U	0.0038 U	0.0042 U
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.0045 U	0.0045 U	0.0045 U	0.0049 U	0.0047 U	0.0052 U	0.0068 J	0.0047 U	0.0049 U	0.0049 U	0.0045 U	0.0045 U	0.0049 U
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.0015 U	0.0015 U	0.0015 U	0.0016 U	0.0015 U	0.0017 U	0.0016 U	0.0015 U	0.0016 U	0.0016 U	0.0015 U	0.0015 U	0.0016 U
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.0027 U	0.0027 U	0.0027 U	0.0029 U	0.18 J	0.0031 U	0.0029 U	0.0028 U	0.0029 U	0.0029 U	0.0027 U	0.0026 U	0.0029 U
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	0.71	NE	0.0014 U	0.0014 U	0.0014 U	0.0015 U	0.0014 U	0.0016 U	0.0015 U	0.0014 U	0.02	0.0015 U	0.0014 U	0.0014 U	0.0015 U
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	0.0032 J	0.018	0.0017 U	0.0019 U	0.0086 J	0.002 U	0.0019 U	0.0018 U	0.0019 U	0.0019 U	0.0018 U	0.0017 U	0.0019 U
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	0.00046 U	0.00046 U	0.00046 U	0.0005 U	0.00048 U	0.00053 U	0.00051 U	0.00048 U	0.0005 U	0.0005 U	0.00046 U	0.00045 U	0.0005 U
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	0.00082 U	0.00082 U	0.00083 U	0.0009 U	0.0083 J	0.00096 U	0.00092 U	0.00087 U	0.0009 U	0.00091 U	0.00083 U	0.00082 U	0.0009 U
Total PCB Aroclor (calc)	mg/kg	10	66	0.65	NE	0.65	NE	0.0032	0.018	0.00046 U	0.0005 U	0.1969	0.00053 U	0.0068	0.00048 U	0.02	0.0005 U	0.00046 U	0.00045 U	0.0005 U
Metals																				
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	4,900	9,100	5,700	5,300	8,300	5,800	6,000	4,500	37,000	10,000	7,400	8,600	4,800
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	1.1	1.7	1.2 J	1.5 J	2.2	1.2	1.7	0.94	**11**	2.4	2.7	2.5	1.4
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.59 J	0.44 J	0.13 J	0.21 J	0.68 J	0.19	0.22	0.18	**7.6**	0.28	0.24	0.23	0.17
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	10 J	14 J	8.7 J	11 J	20 J	11	11	11	22	6.6	10	6.8	20
Copper	mg/Kg	NA	140,000	217	280	217	28.4	24	34	17	16	36	15	16	16	33	18	16	16	15
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	3.9	6.1	2.8	3.1	8.1	2.9	3.8	2.2	44	5.2	7.1	5.6	2.8
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.0058 U	0.009 J	0.0093 J	0.0057 U	0.0085 J	0.01 J	0.011 J	0.019 J	0.072	0.0069 J	0.072	0.027	0.0057 U
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	4.7 J	9 J	4.7 J	5.9 J	14 J	4.6	6.7	4.8	89	7.6	7.4	7	6.8
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**1.1**	**1.5**	**1.3 J**	**0.87 J**	**1.5**	**0.87**	**0.88**	**0.83**	**1.3**	**1.1**	**0.88**	**0.94**	**0.83**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	77	**410**	56	57	180	43	63	42	310	62	62	53	46
Total Petroleum Hydrocarbons (TPHs)																				
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NE	470	1,300	10 U	11 U	66	12 U	11 U	9.3 U	290	11 U	11 U	11 U	9.7 U
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NE	160	500	8.5 U	8.8 U	470	9.8 U	17 J	7.8 U	910	8.9 U	72	24 J	13 J

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established

PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
TPH = Total Petroleum Hydrocarbons

Table 1-1
Rectifier Yard AOC - Oil House ASTs, Oil Lines, and Nearby Transformers RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Winter 2015 - Spring 2016
(Page 3 of 6)

				Ecological Indicator				Analytical Results											
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	RYAOC-TP-PL-07-3.0 4/18/2016	RYAOC-TP-PL-08-0.5 4/18/2016	RYAOC-TP-PL-08-3.0 4/18/2016	RYAOC-TP-PL-09-0.5 4/19/2016	RYAOC-TP-PL-09-2.5 4/19/2016	RYAOC-TP-PL-41-2.5 (Duplicate of RYAOC-TP-PL-09-2.5) 4/19/2016	RYAOC-TP-PL-10-0.5 4/19/2016	RYAOC-TP-PL-10-3.0 4/19/2016	RYAOC-TP-PL-11-0.5 4/19/2016	RYAOC-TP-PL-11-ALT-3.0 4/19/2016	RYAOC-TP-PL-12-0.5 4/19/2016	RYAOC-TP-PL-12-3.0 4/19/2016
Aluminum Smelter																			
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	NA	2 U	NA	2 U	NA	NA	2 U	NA	2 U	NA	2.1 U	NA
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	NA	11 J	NA	16	NA	NA	4.9	NA	9.6	NA	25	NA
Polycyclic Aromatic Hydrocarbons (PAHs)																			
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.0006 U	0.00048 U	0.00065 U	0.00059 U	0.00066 U	0.00054 U	0.00065 U	0.00062 U	0.00058 U	0.00067 U	0.00056 U	0.00062 U
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.00043 U	0.00034 U	0.00047 U	0.00042 U	0.00047 U	0.00039 U	0.00047 U	0.00044 U	0.00041 U	0.00048 U	0.0004 U	0.00044 U
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.0011 J	0.00046 U	0.00098 J	0.00056 U	0.00063 U	0.00051 U	0.00062 U	0.00059 U	0.00055 U	0.00064 U	0.0012 J	0.00059 U
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00048 U	0.00038 U	0.00052 U	0.00047 U	0.00053 U	0.00043 U	0.00052 U	0.00049 U	0.00046 U	0.00053 U	0.00044 U	0.00049 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.0023 J	0.00046 U	0.0019 J	0.00056 U	0.00063 U	0.00051 U	0.00062 U	0.00059 U	0.00075 J	0.00064 U	0.0017 J	0.00059 U
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.013	0.0011 J	0.01	0.0035 J	0.0008 U	0.00065 U	0.00079 U	0.00074 U	0.0078	0.0008 U	0.027	0.00075 U
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.017	0.0016 J	0.012	0.0046 J	0.00042 U	0.00034 U	0.00042 U	0.00039 U	0.0078	0.00042 U	0.025	0.0004 U
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.028	0.0031 J	0.019	0.0091	0.00062 U	0.0016 J	0.00061 U	0.00058 U	0.011	0.0022 J	0.031	0.00058 U
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.018	0.0016 J	0.013	0.0069	0.00053 U	0.00099 J	0.00052 U	0.00049 U	0.0074	0.00053 U	0.016	0.00049 U
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.011	0.001 J	0.0074	0.003 J	0.00063 U	0.00051 U	0.00062 U	0.00059 U	0.0035 J	0.00064 U	0.011	0.00059 U
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.017	0.0015 J	0.013	0.0051	0.0016 U	0.0013 U	0.0016 U	0.0015 U	0.0082	0.0016 U	0.029	0.0015 U
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0038 J	0.00055 U	0.0022 J	0.0011 J	0.00076 U	0.00062 U	0.00075 U	0.0007 U	0.0013 J	0.00076 U	0.0033 J	0.00071 U
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.022	0.0017 J	0.015	0.0076	0.0015 U	0.0012 U	0.0015 U	0.0014 U	0.012	0.0015 U	0.026	0.0014 U
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.0012 J	0.00038 U	0.00091 J	0.00047 U	0.00053 U	0.00043 U	0.00052 U	0.00049 U	0.00046 U	0.00053 U	0.0012 J	0.00049 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.016	0.0014 J	0.011	0.0073	0.00063 U	0.00051 U	0.00062 U	0.00059 U	0.0072	0.00064 U	0.018	0.00059 U
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.00077 U	0.00061 U	0.00083 U	0.00075 U	0.00084 U	0.00069 U	0.00083 U	0.00078 U	0.00073 U	0.00085 U	0.0015 J	0.00079 U
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0081	0.00061 J	0.0074	0.0038 J	0.00084 J	0.00059 U	0.00072 U	0.00068 U	0.0045 J	0.00073 U	0.0055	0.00068 U
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.022	0.0015 J	0.015	0.011	0.0061	0.0053	0.0057	0.0052	0.014	0.0059	0.033	0.0042 J
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.02435	0.0023025	0.01709	0.007051	0.00039	0.000451	0.0003875	0.0003625	0.010962	0.00058	0.03432	0.0003685
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.0347	0.00231	0.02619	0.0114	0.00084	0.00039 U	0.00047 U	0.00044 U	0.01725	0.00048 U	0.0371	0.00044 U
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	0.1458	0.0128	0.1026	0.0516	0.0061	0.00789	0.0057	0.0052	0.0682	0.0081	0.1933	0.0042
Polychlorinated Biphenyls (PCBs)																			
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.0083 U	0.0066 U	0.0083 U	0.0065 U	0.0079 U	0.008 U	0.0079 U	0.0071 U	0.007 U	0.0081 U	0.007 U	0.0082 U
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.0047 U	0.0037 U	0.0047 U	0.0037 U	0.0045 U	0.0045 U	0.0045 U	0.004 U	0.004 U	0.0046 U	0.0039 U	0.0047 U
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.0055 U	0.0043 U	0.0055 U	0.0043 U	0.0052 U	0.0053 U	0.0052 U	0.0047 U	0.0046 U	0.0054 U	0.0046 U	0.0054 U
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.0018 U	0.0014 U	0.0018 U	0.0014 U	0.0017 U	0.0017 U	0.0017 U	0.0015 U	0.0015 U	0.0018 U	0.0015 U	0.0018 U
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.0032 U	0.0026 U	0.0032 U	0.0025 U	0.0031 U	0.0031 U	0.0031 U	0.0028 U	0.0027 U	0.0032 U	0.0027 U	0.0032 U
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	0.71	NE	0.0017 U	0.0013 U	0.0017 U	0.0013 U	0.0016 U	0.0016 U	0.0016 U	0.0014 U	0.0014 U	0.0038 J	0.0023 J	0.0017 U
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	0.0021 U	0.0017 U	0.0021 U	0.0017 U	0.002 U	0.0021 U	0.002 U	0.0018 U	0.0018 U	0.0021 U	0.0018 U	0.0021 U
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	0.00056 U	0.00044 U	0.00056 U	0.004 J	0.00053 U	0.00054 U	0.00053 U	0.00048 U	0.00047 U	0.00055 U	0.00047 U	0.00056 U
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	0.001 U	0.0008 U	0.001 U	0.0037 J	0.037 J	0.024 J	0.00096 U	0.00086 U	0.0013 J	0.23	0.00085 U	0.0013 J
Total PCB Aroclor (calc)	mg/kg	10	66	0.65	NE	0.65	NE	0.00056 U	0.00044 U	0.00056 U	0.0077	0.037	0.024	0.00053 U	0.00048 U	0.0013	0.2338	0.0023	0.0013
Metals																			
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	7,700	3,500	7,900	6,700	6,200	6,300	6,600	6,400	5,600	6,700	7,100 J	7,300 J
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	2.7	1.1	2.9	2.4	4.2	4.1	3.3	3.5	1.5	4.2	1.8	4.7
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.19	0.14	0.24	0.19	0.18	0.15	0.18	0.19	0.21	0.18	0.22	0.2
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	9.1	16	7	6.8 J	9.9 J	9.5 J	9.6 J	9.9 J	8 J	10 J	4.8 J	12 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	16	18	16	14	12	13	14	14	14	13	15	15
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	7.1	2.1	5.6	4.7	5.1	5.2	5.2	5.1	3	13	4.7	5.9
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.0099 J	0.0083 J	0.0064 U	0.012 J	0.0077 J	0.0082 J	0.0057 J	0.021 J	0.0073 J	0.008 J	0.04 J	0.0081 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	8.2	8.3	7.5	7.4	10	9.5	10	10	5.4	9.7	5.8	12
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.89**	**0.76**	**0.97**	**0.83**	**0.6**	**0.61**	**0.7**	**0.66**	**0.76**	**0.62**	**0.86**	**0.73**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	53	40	55	50	42 J	69 J	48	43	42	43	84	46
Total Petroleum Hydrocarbons (TPHs)																			
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NE	15 J	10 U	11 U	75 J	15 J	31	9.1 U	11 U	11 U	7.8 U	9.1 U	12 U
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NE	170	8.5 U	12 J	31 J	17 J	32 J	7.6 U	9.6 U	9.1 U	9.9 J	26 J	10 U

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established

PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
TPH = Total Petroleum Hydrocarbons

Table 1-1
Rectifier Yard AOC - Oil House ASTs, Oil Lines, and Nearby Transformers RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Winter 2015 - Spring 2016
(Page 4 of 6)

				Ecological Indicator				Analytical Results												
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	RYAOC-TP-PL-13-0.5 4/19/2016	RYAOC-TP-PL-13-2.5 4/19/2016	RYAOC-TP-PL-14-0.5 4/19/2016	RYAOC-TP-PL-14-2.0 4/19/2016	RYAOC-TP-PL-15-0.5 4/19/2016	RYAOC-TP-PL-15-2.5 4/19/2016	RYAOC-TP-PL-16-0.5 4/19/2016	RYAOC-TP-PL-16-3.5 4/19/2016	RYAOC-TP-PL-17-0.5 4/19/2016	RYAOC-TP-PL-17-4.0 4/19/2016	RYAOC-TP-PL-18-0.5 4/19/2016	RYAOC-TP-PL-18-2.0 4/19/2016	RYAOC-TP-PL-19-0.5 4/19/2016
Aluminum Smelter																				
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	2.1 U	NA	2 U	NA	2.1 U	NA	2.1 U	NA	2.1 U	NA	0.25	NA	2.1 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	21	NA	24	NA	19	NA	12	NA	17	NA	53	NA	18
Polycyclic Aromatic Hydrocarbons (PAHs)																				
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.00062 U	0.00067 U	0.0023 J	0.00061 U	0.00066 U	0.00057 U	0.00064 U	0.00057 U	0.0024 J	0.00061 U	0.0048	0.0092	0.00061 U
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.00044 U	0.00048 U	0.0023 J	0.00043 U	0.00047 U	0.00041 U	0.00046 U	0.00041 U	0.002 J	0.00043 U	0.0044	0.0071	0.00044 U
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.00059 U	0.00064 U	0.022	0.00067 J	0.002 J	0.00054 U	0.00061 U	0.00054 U	0.00054 U	0.00058 U	0.048	0.079	0.00059 U
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00049 U	0.00053 U	0.0013 J	0.00048 U	0.00052 U	0.00045 U	0.00051 U	0.00045 U	0.00045 U	0.00048 U	0.0032 J	0.0046 J	0.00049 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.00059 U	0.22	0.029	0.00071 J	0.0018 B	0.00054 U	0.00061 U	0.00054 U	0.00054 U	0.00058 U	0.085	0.14	0.00059 U
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.00074 U	0.0008 U	0.36	0.0087	0.029	0.00069 U	0.0022 J	0.00069 U	0.00079 B	0.00073 U	0.93	1.4	0.011 B
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.00039 U	0.00042 U	0.38	0.01	0.039	0.00036 U	0.0027 J	0.00036 U	0.0016 B	0.00038 U	1	1.6	0.014
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.00058 U	0.00062 U	0.57	0.021	0.07	0.00054 U	0.0048 J	0.00054 U	0.0023 B	0.00057 U	2.1	3.4	0.056
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00049 U	0.0058	0.42	0.0097	0.037	0.00045 U	0.004 J	0.00045 U	0.0017 B	0.00048 U	0.71	1.1	0.032
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.00059 U	0.071	0.18	0.005	0.017 B	0.00054 U	0.0019 J	0.00054 U	0.0013 B	0.00058 U	0.64	0.88	0.011 B
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0015 U	0.0016 U	0.4	0.0089	0.041	0.0014 U	0.0035 J	0.0014 U	0.0013 U	0.0014 U	1.4	2.2	0.018 B
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0007 U	0.00076 U	0.069	0.0018 J	0.01 B	0.00065 U	0.00074 U	0.00065 U	0.00065 U	0.00069 U	0.17	0.26	0.0081 B
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.0023 J	0.098	0.46	0.013	0.04	0.0013 U	0.0055	0.0013 U	0.0015 B	0.0013 U	1.6	2.4	0.017
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.00049 U	0.00053 U	0.0089	0.00048 U	0.00052 U	0.00045 U	0.00051 U	0.00045 U	0.00045 U	0.00048 U	0.028	0.048	0.00049 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.00059 U	0.0042 J	0.44	0.01	0.048	0.00054 U	0.0034 J	0.00054 U	0.0015 B	0.00058 U	0.91	1.3	0.042
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.00078 U	0.00085 U	0.0037 J	0.00077 U	0.00084 U	0.00073 U	0.00082 U	0.00073 U	0.0026 J	0.00077 U	0.0071	0.011	0.0015 J
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00067 U	0.23	0.15	0.0045 J	0.012	0.00063 U	0.0018 J	0.00063 U	0.00062 U	0.00066 U	0.46	0.74	0.068
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.0042 J	0.001 U	0.44	0.014	0.036	0.00088 U	0.0083	0.0033 J	0.0015 B	0.00093 U	1.4	2.2	0.015
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.0003625	0.007847	0.5459	0.014739	0.05681	0.000335	0.004002	0.000335	0.002228	0.0003545	1.489	2.346	0.02699
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.0023	0.548	0.6795	0.01888	0.0558	0.00041 U	0.0073	0.00041 U	0.0085	0.00043 U	2.2405	3.4389	0.0865
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	0.0042	0.081	**3.259**	0.0891	0.327	0.00036 U	0.0308	0.0033	0.01069	0.00038 U	**9.26**	**14.34**	0.2071
Polychlorinated Biphenyls (PCBs)																				
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.0077 U	0.0087 U	0.0075 U	0.0076 U	0.0078 U	0.0079 U	0.0078 U	0.0078 U	0.007 U	0.0076 U	0.0076 U	0.0079 U	0.018 J
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.0043 U	0.0049 U	0.0042 U	0.0043 U	0.0044 U	0.0045 U	0.0044 U	0.0044 U	0.004 U	0.0043 U	0.0043 U	0.0045 U	0.0037 U
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.0051 U	0.0058 U	0.005 U	0.005 U	0.0052 U	0.0052 U	0.0052 U	0.0052 U	0.0047 U	0.005 U	0.0051 U	0.0052 U	0.0044 U
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.0017 U	0.0019 U	0.0016 U	0.0016 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0015 U	0.0016 U	0.027 J	0.0017 U	0.0014 U
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.003 U	0.0034 U	0.0029 U	0.003 U	0.0031 U	0.0031 U	0.0031 U	0.0031 U	0.0028 U	0.003 U	0.003 U	0.031 J	0.0026 U
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	0.71	NE	0.0016 U	0.063 J	0.0015 U	0.0015 U	0.0016 U	0.0016 U	0.0016 U	0.0016 U	0.0014 U	0.0015 U	0.0015 U	0.0016 U	0.0013 U
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	0.014	0.0022 U	0.0019 U	0.0019 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0018 U	0.002 U	0.002 U	0.002 U	0.0063 J
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	0.00052 U	0.00059 U	0.0024 J	0.00051 U	0.00053 U	0.00053 U	0.00053 U	0.00053 U	0.00048 U	0.00051 U	0.00052 U	0.00053 U	0.00045 U
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	0.00093 U	9.5	0.0039 J	3.1	0.00095 U	0.00096 U	0.00095 U	0.00095 U	0.00086 U	0.0038 J	0.079 J	0.26 J	0.0008 U
Total PCB Aroclor (calc)	mg/kg	10	66	0.65	NE	0.65	NE	0.014	**9.563**	0.0063	**3.1**	0.00053 U	0.00053 U	0.00053 U	0.00053 U	0.00048 U	0.0038	0.106	0.291	0.0243
Metals																				
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	8,400 J	7,400 J	5,700 J	6,800 J	7,700 J	7,300 J	7,000 J	6,800 J	6,300 J	7,100 J	7,600 J	7,800 J	7,300 J
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	4.8	4.9	1.8	3.9	3.9	5	3.3	3.6	3.3	3.8	2.5	2.5	1.9
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.21	0.18	0.58	0.23	0.23	0.17	0.2	0.18	0.15	0.17	0.65	0.68	0.25
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	12 J	12 J	6.3 J	10 J	11 J	11 J	9.1 J	9.8 J	9 J	11 J	9.4 J	12 J	7.3 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	15	14	22	16	16	14	15	15	14	15	23	150	27
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	6.8	7.2	5.6	7.4	6.3	6.4	8.5	5.3	5.4	5.8	8.7	12	5.7
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.021 J	0.011 J	0.01 J	0.0059 UJ	0.011 J	0.0089 J	0.0079 J	0.022 J	0.0077 J	0.007 J	0.023 J	0.026 J	0.0058 U
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	12	12	7.1	11	11	12	9.4	11	9.6	11	11	11	6.8
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.62**	**0.71**	**0.88**	**0.6**	**0.75**	**0.67**	**0.76**	**0.75**	**0.67**	**0.74**	**0.9**	**0.93**	**0.85**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	65	46	170	95	67	48	48	45	43	45	260	330	120
Total Petroleum Hydrocarbons (TPHs)																				
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NE	1,000	**28,000**	89	87	12 U	11 U	18 J	12 U	11 U	10 U	50	100	**2,900**
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NE	390	**5,700**	100	72	10 U	9.1 U	68	10 U	8.8 U	8.3 U	210	400	570

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established

PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
TPH = Total Petroleum Hydrocarbons

Table 1-1
Rectifier Yard AOC - Oil House ASTs, Oil Lines, and Nearby Transformers RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Winter 2015 - Spring 2016
(Page 5 of 6)

				Ecological Indicator				Analytical Results											
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	RYAOC-TP-PL-19-2.5 4/19/2016	RYAOC-TP-PL-20-0.5 4/19/2016	RYAOC-TP-PL-20-2.5 4/19/2016	RYAOC-TP-PL-21-0.5 4/20/2016	RYAOC-TP-PL-43-0.5 (Duplicate of RYAOC-TP-PL-21-0.5) 4/20/2016	RYAOC-TP-PL-21-2.5 4/20/2016	RYAOC-TP-PL-22-0.5 4/20/2016	RYAOC-TP-PL-22-2.5 4/20/2016	RYAOC-TP-PL-23-0.5 4/20/2016	RYAOC-TP-PL-23-2.5 4/20/2016	RYAOC-TP-PL-24-0.5 4/20/2016	RYAOC-TP-PL-24-2.5 4/20/2016
Aluminum Smelter																			
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	NA	2.1 U	NA	2 U	1.9 U	NA	1.8 U	NA	2 U	NA	1.9 U	NA
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	NA	19	NA	39	44	NA	38	NA	43	NA	41	NA
Polycyclic Aromatic Hydrocarbons (PAHs)																			
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.00053 U	0.0006 U	0.0005 U	0.01 J	0.03 J	0.00067 U	0.024	0.00067 U	0.014	0.00066 U	0.013	0.00061 U
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.00038 U	0.00043 U	0.00036 U	0.014 J	0.038 J	0.00048 U	0.022	0.00048 U	0.012	0.0011 J	0.011	0.00043 U
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.0005 U	0.00057 U	0.00048 U	0.15 J	0.35 J	0.00064 U	0.29	0.00063 U	0.19	0.00063 U	0.16	0.00058 U
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00042 U	0.00047 U	0.0004 U	0.0033 J	0.0054	0.00053 U	0.0048 J	0.00053 U	0.0038 J	0.00053 U	0.0035 J	0.00048 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.16	0.00057 U	0.00048 U	0.17 J	0.36 J	0.00064 U	0.32	0.00063 U	0.17	0.00063 U	0.19	0.00058 U
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.00064 U	0.0052 B	0.0006 U	2.2 J	4.1 J	0.00081 U	3.8	0.0008 U	2.5	0.0035 B	2.7	0.0025 B
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.00034 U	0.0047 B	0.00086 B	2.5 J	4.6 J	0.00043 U	5	0.00042 U	3.9	0.0059 B	3.6	0.0044 B
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0005 U	0.0081 B	0.00097 B	3.3 J	6 J	0.00063 U	9.9	0.00062 U	7.3	0.047	6.2	0.0072 B
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00042 U	0.0028 B	0.0007 B	2.3 J	4.6 J	0.00053 U	3.2	0.00053 U	2.7	0.0074 B	2.4	0.0042 B
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0005 U	0.0027 B	0.00072 B	1.2 J	2.7 J	0.00064 U	2.5	0.00063 U	1.5	0.0049 B	1.5	0.0022 B
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0013 U	0.0067 B	0.0012 U	2.7 J	4.8 J	0.0016 U	6.2	0.0016 U	4.6	0.0055 B	4.2	0.0038 B
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0006 U	0.00068 U	0.00057 U	0.44 J	0.95 J	0.00077 U	0.9	0.00076 U	0.75	0.00076 U	0.67	0.0007 U
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.036	0.0075 B	0.0011 U	3.5 J	6.2 J	0.0015 U	4.9	0.0015 U	3.6	0.0057 B	3.5	0.004 B
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.00042 U	0.00047 U	0.0004 U	0.072 J	0.17 J	0.00053 U	0.12	0.00053 U	0.072	0.00053 U	0.067	0.00048 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0005 U	0.0037 B	0.00059 B	2.5 J	4.2 J	0.00064 U	3.5	0.00063 U	3	0.008 B	2.8	0.0048 B
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.00067 U	0.00076 U	0.00064 U	0.02 J	0.074 J	0.00085 U	0.034	0.00085 U	0.017	0.00084 U	0.017	0.00077 U
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.16	0.0032 B	0.00055 U	1.2 J	2.6 J	0.00074 U	1.9	0.00073 U	1.4	0.00073 U	1.3	0.0013 B
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.00081 U	0.0057 B	0.00077 U	3.4 J	5.6 J	0.001 U	4.3	0.001 U	3.4	0.0055 B	3.5	0.0037 B
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.0003135	0.006771	0.0011525	3.491	**6.443**	0.0003975	**7.122**	0.00039	**5.451**	0.012333	**5.029**	0.006143
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.356	0.0107	0.00036 U	5.1393	9.8274	0.00048 U	7.6148	0.00048 U	5.4788	0.0068	5.2615	0.0053
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	0.00034 U	0.0396	0.00384	**20.54**	**37.55**	0.00043 U	**39.3**	0.00042 U	**29.65**	0.0877	**27.57**	0.0328
Polychlorinated Biphenyls (PCBs)																			
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.0062 U	0.0072 U	0.0069 U	0.0072 U	0.0072 U	0.0069 U	0.0075 U	0.0082 U	0.0063 U	0.0078 U	0.0067 U	0.0065 U
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.0035 U	0.0041 U	0.0039 U	0.0041 U	0.0041 U	0.0039 U	0.0043 U	0.0047 U	0.0035 U	0.0044 U	0.0038 U	0.0037 U
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.0041 U	0.0047 U	0.0045 U	0.0048 U	0.0047 U	0.0046 U	0.005 U	0.0054 U	0.0041 U	0.0052 U	0.0044 U	0.0043 U
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.0013 U	0.0015 U	0.0015 U	0.0016 U	0.0015 U	0.0015 U	0.0016 U	0.0018 U	0.041 J	0.002 J	0.0014 U	0.0014 U
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.0024 U	0.0028 U	0.0027 U	0.0028 U	0.0028 U	0.0027 U	0.0029 U	0.0032 U	0.0025 U	0.0031 U	0.0026 U	0.0026 U
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	0.71	NE	0.0013 U	0.0015 U	0.0014 U	0.0086 J	0.01 J	0.0014 U	0.0015 UJ	0.0017 UJ	0.0013 UJ	0.0016 UJ	0.0014 UJ	0.0013 UJ
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	0.054	0.0018 U	0.0018 U	0.0019 U	0.0018 U	0.0018 U	0.0061 J	0.0021 U	0.0078 J	0.002 U	0.011 J	0.0017 U
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	0.00042 U	0.00048 U	0.00046 U	0.00049 U	0.00048 U	0.00047 U	0.00051 U	0.00055 U	0.00042 U	0.00053 U	0.00045 U	0.00044 U
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	0.00075 U	0.00087 U	0.00083 U	0.00088 U	0.00087 U	0.00084 U	0.00091 U	0.001 U	0.00076 U	5.2	0.00081 U	0.00079 U
Total PCB Aroclor (calc)	mg/kg	10	66	0.65	NE	0.65	NE	0.054	0.00048 U	0.00046 U	0.0086	0.01	0.00047 U	0.0061	0.00055 U	0.0488	**5.202**	0.011	0.00044 U
Metals																			
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	6,700 J	7,100 J	7,000 J	9,200 J	6,200 J	6,700	7,300	6,600	7,300	7,000	6,200	6,900
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	3.3	2.8	3.4	2.9 J	1.6 J	3.5	2	3.3	1.9	4.2	1.5	3.4
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.17	0.2	0.18	0.4	0.35	0.19	**7.8**	0.17	0.65	0.23	**2.3**	0.23
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	10 J	8.5 J	11 J	12 J	6.9 J	11 J	9 J	9.3 J	9.5 J	10 J	8.7 J	9.6 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	15	16	16	26	23	15	**300**	15	32	17	95	23
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	5.5	5.3	5.6	9.1 J	7.1 J	5.6	62	5.3	16	7.2	27	5.5
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.0071 J	0.0093 J	0.013 J	0.0092 J	0.012 J	0.0066 U	0.053	0.0068 J	0.012 J	0.0062 U	0.019 J	0.0089 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	11	8.5	11	13 J	8.8 J	11 J	13 J	10 J	14 J	12 J	15 J	11 J
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.78**	**0.78**	**0.77**	**0.88**	**0.76**	**0.71**	**0.82**	**0.72**	**0.92**	**0.74**	**0.86**	**0.72**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	47	51	47	130	150	44	**7,200**	57	**600**	87	**1,500**	98
Total Petroleum Hydrocarbons (TPHs)																			
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NE	**11,000**	8.9 U	10 U	37 J	110 J	11 U	72	9.1 U	56	150	130	11 U
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NE	1,300	18 J	8.3 U	200 J	990 J	9.5 U	280	7.6 U	200	210	190	9 U

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established

PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
TPH = Total Petroleum Hydrocarbons

Table 1-1
Rectifier Yard AOC - Oil House ASTs, Oil Lines, and Nearby Transformers RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Winter 2015 - Spring 2016
(Page 6 of 6)

				Ecological Indicator				Analytical Results											
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	RYAOC-TP-PL-25-0.5 4/20/2016	RYAOC-TP-PL-48-0.5 (Duplicate of RYAOC-TP-PL-25-0.5) 4/20/2016	RYAOC-TP-PL-25-4.0 4/20/2016	RYAOC-TP-PLS-01-0.5 4/18/2016	RYAOC-TP-PLS-01-3.0 4/18/2016	RYAOC-TP-PLS-01-5.0 4/18/2016	RYAOC-TP-TR-14-0.5 4/20/2016	RYAOC-TP-TR-14-2.5 4/20/2016	RYAOC-TP-TR-15-0.5 4/20/2016	RYAOC-TP-TR-15-2.5 4/20/2016	RYAOC-TP-TR-16-0.5 4/20/2016	RYAOC-TP-TR-16-2.5 4/20/2016
Aluminum Smelter																			
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	2.1 U	1.9 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	5	4.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons (PAHs)																			
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.0071 J	0.0017 J	0.00068 U	0.064	0.00056 U	0.00055 U	0.0065 U	0.0007 U	0.0075 J	0.02	0.0059	0.0013 J
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.0094 J	0.0022 J	0.00048 U	0.027	0.0004 U	0.00039 U	0.0046 U	0.0005 U	0.0083 J	0.028	0.0074	0.0017 J
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.09 J	0.025 J	0.00064 U	0.017	0.00054 U	0.00052 U	0.041 J	0.00067 U	0.078 J	0.18	0.057	0.0097
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00052 U	0.00045 U	0.00054 U	0.028	0.031	0.00043 U	0.0052 U	0.00056 U	0.0031 J	0.00049 U	0.0022 J	0.00046 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.097 J	0.02 J	0.00064 U	0.035	0.00054 U	0.00052 U	0.043 J	0.00067 U	0.084 J	0.2	0.056	0.0085
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.98 J	0.18 J	0.00081 U	0.036	0.00068 U	0.00066 U	0.25	0.00085 U	0.63 J	1.6	0.62	0.12
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	1.2 J	0.25 J	0.00043 U	0.11	0.0036 U	0.00058 J	0.36	0.066	0.72 J	1.9	0.75	0.12
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	1.9 J	0.4 J	0.00063 U	0.18	0.0053 U	0.0011 J	0.55	0.13	1.1 J	2.8	1.5	0.3
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	1 J	0.2 J	0.00054 U	0.2	0.07	0.00092 J	0.31	0.045	0.53 J	1.5	0.61	0.12
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.57 J	0.11 J	0.00064 U	0.066	0.0054 U	0.00052 U	0.19	0.029	0.38 J	1	0.32	0.086
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	1.2 J	0.26 J	0.0016 U	0.18	0.0013 U	0.0013 U	0.37	0.0017 U	0.76 J	2	0.84	0.18
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.17 J	0.029 J	0.00077 U	0.0064 U	0.0064 U	0.00063 U	0.044 J	0.0008 U	0.12 J	0.31	0.15	0.032
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	1.5 J	0.29 J	0.0015 U	0.16	0.0013 U	0.0012 U	0.4	0.056	1.1 J	2.7	1	0.2
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.039 J	0.0094 J	0.00054 U	0.061	0.00045 U	0.00043 U	0.014 J	0.00056 U	0.046 J	0.088	0.027	0.00046 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	1.1 J	0.23 J	0.00064 U	0.1	0.0054 U	0.00052 U	0.31	0.05	0.62 J	1.7	0.76	0.15
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.016 J	0.0043 J	0.00086 U	0.00071 U	0.00072 U	0.0007 U	0.0083 U	0.00089 U	0.014 J	0.038	0.013	0.0024 J
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.54 J	0.11 J	0.00074 U	0.14	0.00062 U	0.0006 U	0.19	0.00077 U	0.46 J	1.1	0.39	0.089
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	1.4 J	0.26 J	0.001 U	0.23	0.08	0.00084 U	0.37	0.065	0.92 J	2.4	0.96	0.17
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	1.684	0.3475	0.0003975	0.15032	0.0029655	0.000813	0.4981	0.086991	1.0126	2.661	1.0934	0.1906
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	2.2985	0.4626	0.00048 U	0.532	0.031	0.00039 U	0.688	0.056	1.8009	4.354	1.5585	0.3126
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**9.52**	**1.919**	0.00043 U	**1.102**	0.15	0.0026	**2.754**	0.385	**5.78**	**15.21**	**6.51**	**1.278**
Polychlorinated Biphenyls (PCBs)																			
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.0078 U	0.0067 U	0.0081 U	0.0071 U	0.0069 U	0.0076 U	0.0077 U	0.0076 U	0.0067 U	0.0063 U	0.007 U	0.0079 U
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.0044 U	0.0038 U	0.0046 U	0.0041 U	0.0039 U	0.0043 U	0.0044 U	0.0043 U	0.0038 U	0.0036 U	0.004 U	0.0045 U
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.0052 U	0.0044 U	0.0054 U	0.0047 U	0.0045 U	0.005 U	0.0051 U	0.005 U	0.0044 U	0.0042 U	0.0046 U	0.0053 U
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.083 J	0.013 J	0.0018 U	0.0015 U	0.0015 U	0.0016 U	0.0017 U	0.0016 U	0.0015 U	0.0014 U	0.0015 U	0.0017 U
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.0031 U	0.0026 U	0.0032 U	0.0028 U	0.0027 U	0.003 U	0.003 U	0.003 U	0.0026 U	0.0025 U	0.0027 U	0.0031 U
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	0.71	NE	0.0016 U	0.0013 U	0.0016 U	0.0014 U	0.0014 U	0.0015 U	0.0016 U	0.066 J	0.0014 U	0.0013 U	0.0014 U	0.084 J
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	0.002 U	0.0017 U	0.0021 U	0.0018 U	0.0018 U	0.0019 U	0.0039 J	0.19 J	0.036	0.0016 U	0.0018 U	0.002 U
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	0.00053 U	0.00045 U	0.00055 U	0.00048 U	0.00046 U	0.00051 U	0.00052 U	0.00051 U	0.00045 U	0.057 J	0.044 J	0.00054 U
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	0.00095 U	0.00081 U	0.00099 U	0.00087 U	0.00083 U	0.00092 U	0.0062 J	0.94 J	0.00082 U	0.00077 U	0.00085 U	4 J
Total PCB Aroclor (calc)	mg/kg	10	66	0.65	NE	0.65	NE	0.083	0.013	0.00055 U	0.00048 U	0.00046 U	0.00051 U	0.0101	**1.196**	0.036	0.057	0.044	**4.084**
Metals																			
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	7,200 J	8,900 J	8,300	NA	NA	NA	7,700	6,800	11,000	12,000	7,500	7,800
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	7.3 J	2.5 J	3.7 J	NA	NA	NA	3.7 J	3.4 J	4	3.9 J	1.9 J	3.8 J
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.2	0.22 J	0.16	NA	NA	NA	0.57	0.26	**0.82 J**	**1.8**	0.81	**1.4**
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	6.8 J	8.7 J	14 J	NA	NA	NA	12 J	10 J	17 J	41 J	14 J	11 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	15	17 J	14	NA	NA	NA	29	17	45 J	98	**400**	19
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	4.7	5.6 J	4.7	NA	NA	NA	14	7.5	19 J	**130**	24	6.5
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.0062 U	0.0061 U	0.011 J	NA	NA	NA	0.064	0.0066 U	0.015 J	0.032	0.083	0.0079 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	7.2 J	9.3 J	11	NA	NA	NA	13	11	17 J	27	11	11
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.98 J**	**1.5 J**	**0.67**	NA	NA	NA	**0.79**	**0.78**	**1.3**	**0.84**	**0.89**	**0.81**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	49 J	62 J	42	NA	NA	NA	**980**	250	**2,800 J**	**2,000**	**1,100**	**2,400**
Total Petroleum Hydrocarbons (TPHs)																			
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NE	13 J	11 J	11 U	**8,300**	**3,200**	9.6 U	11 U	**18,000**	84	270	1,900	**2,100**
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NE	62	47	11 J	**45,000**	**17,000**	14 J	32 J	**4,100**	410 J	570	740	860

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established

PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
TPH = Total Petroleum Hydrocarbons

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RYAOC-TP-PL01	-0.5	-3.0
cPAH (mg/kg)		
Total HMW PAH	3.93	2.839
Metals (mg/kg)		
Selenium	1.3	1.1

RYAOC-TP-PL02	-0.5	-3.0	-3.0 Duplicate
cPAH (mg/kg)			
Total HMW PAH	10.71	0.3937	0.647
Metals (mg/kg)			
Selenium	1.5	1.3 J	0.87 J
Zinc	410	56	57

SL4-3	
TPHs (mg/kg)	
Mineral Oil	18,000

SL4-2	
TPHs (mg/kg)	
Mineral Oil	25,000

RYAOC-TP-PLS-01	-0.5	-3.0	-5.0
cPAH (mg/kg)			
Total HMW PAH	1.102	0.15	0.0026
TPHs (mg/kg)			
Diesel Range Organics	8,300	3,200	9.6 U
Residual Range Organics	45,000	17,000	14 J

RYAOC-TP-PL03	-0.5	-3.0
cPAH (mg/kg)		
Total HMW PAH	15.99	0.0141
Metals (mg/kg)		
Selenium	1.5	0.87

RYAOC-SD02	
cPAH (mg/kg)	
TTEC cPAH (calc)	6.787
Total HMW PAH	51
PCBs (mg/kg)	
Total PCB Aroclor (calc)	0.78
Metals (mg/kg)	
Arsenic	15
Cadmium	2.6 J
Mercury	4.70
Selenium	0.87 J
Zinc	1,400 J
TPHs (mg/kg)	
Diesel Range Organics	130,000
Residual Range Organics	19,000

RYAOC-TP-PL04	-0.5	-3.0
cPAH (mg/kg)		
Total HMW PAH	1.129	0.01205
Metals (mg/kg)		
Selenium	0.88	0.83

RYAOC-TP-PL05	-0.5	-3.0
Fluoride	580 J	NA
cPAH (mg/kg)		
TTEC cPAH (calc)	13.04	0.02575
Total HMW PAH	120	0.1736
Metals (mg/kg)		
Arsenic	11	2.4
Cadmium	7.6	0.28
Selenium	1.3	1.1

RYAOC-TP-AST02	-0.5	-3.0	-3.0 Duplicate
Metals (mg/kg)			
Selenium	0.88	0.86	0.95

RYAOC-TP-PL15	-0.5	-2.5
Metals (mg/kg)		
Selenium	0.75	0.67

SL3-3	
cPAH (mg/kg)	
TTEC cPAH (calc)	4.277
TPHs (mg/kg)	
Mineral Oil	3,300

RYAOC-TP-PL06	-0.5	-3.0
Metals (mg/kg)		
Selenium	0.88	0.94

RYAOC-TP-PL07	-0.5	-3.0
cPAH (mg/kg)		
Total HMW PAH	1.364	0.1458
Metals (mg/kg)		
Selenium	0.83	0.89

RYAOC-RI-MW13	
Metals (mg/kg)	
Selenium	1.3

RYAOC-TP-AST01	-0.5	-3.0
cPAH (mg/kg)		
Total HMW PAH	0.0873	1.206
Metals (mg/kg)		
Selenium	0.84	0.98

RYAOC-TP-AST03	-0.5	-3.0
Metals (mg/kg)		
Selenium	0.97	0.88

RYAOC-TP-PL14	-0.5	-3.0
cPAH (mg/kg)		
Total HMW PAH	3.259	0.0891
PCBs (mg/kg)		
Total PCB Aroclor (calc)	0.0063	3.1
Metals (mg/kg)		
Selenium	0.88	0.6

RYAOC-SD01	
cPAH (mg/kg)	
TTEC cPAH (calc)	14.152
Total HMW PAH	87.3
Metals (mg/kg)	
Arsenic	11
Cadmium	4 J
Copper	260
Selenium	1
Zinc	3,400 J
TPHs (mg/kg)	
Residual Range Organics	2,800

RYAOC-TP-AST04	-0.5	-3.0
Metals (mg/kg)		
Selenium	0.88	0.82
TPHs (mg/kg)		
Diesel Range Organics	130,000	320

RYAOC-TP-PL08	-0.5	-3.0
Metals (mg/kg)		
Selenium	0.76	0.97

RYAOC-TP-PL13	-0.5	-3.0
PCBs (mg/kg)		
Total PCB Aroclor (calc)	0.014	9.563
Metals (mg/kg)		
Selenium	0.62	0.71
TPHs (mg/kg)		
Diesel Range Organics	1,000	28,000
Residual Range Organics	390	5,700

RYAOC-TP-PL09	-0.5	-3.0	-3.0 Duplicate
Metals (mg/kg)			
Selenium	0.83	0.6	0.61

SL2-3	
cPAH (mg/kg)	
TTEC cPAH (calc)	25.810
TPHs (mg/kg)	
Mineral Oil	2,900
Lube Oil	2,900

RYAOC-TP-PL25	-0.5	-0.5 Duplicate	-4.0
cPAH (mg/kg)			
Total HMW PAH	9.52	1.919	0.00043 U
Metals (mg/kg)			
Selenium	0.98 J	1.5 J	0.67

RYAOC-TP-PL10	-0.5	-3.0
Metals (mg/kg)		
Selenium	0.7	0.66

RYAOC-RI-MW14	
Metals (mg/kg)	
Selenium	1.4

RYAOC-TP-PL11	-0.5
Metals (mg/kg)	
Selenium	0.76

RYAOC-TP-PL12	-0.5	-3.0
Metals (mg/kg)		
Selenium	0.86	0.73

SL1-3	
TPHs (mg/kg)	
Mineral Oil	2,500

RYAOC-TP-PL24	-0.5	-2.5
cPAH (mg/kg)		
TTEC cPAH (calc)	5.029	0.006143
Total HMW PAH	27.57	0.0328
Metals (mg/kg)		
Cadmium	2.3	0.23
Selenium	0.86	0.72
Zinc	1,500	98

RYAOC-TP-TR14	-0.5	-2.5
cPAH (mg/kg)		
Total HMW PAH	2.754	0.385
PCBs (mg/kg)		
Total PCB Aroclor (calc)	0.0101	1.196
Metals (mg/kg)		
Selenium	0.79	0.78
Zinc	980	250
TPHs (mg/kg)		
Diesel Range Organics	11 U	18,000
Residual Range Organics	32 J	4,100

RYAOC-TP-PL11-ALT	-0.5
Metals (mg/kg)	
Selenium	0.62

RYAOC-TP-PL16	-0.5	-2.5
Metals (mg/kg)		
Selenium	0.76	0.75

SL1-2	
TPHs (mg/kg)	
Mineral Oil	2,100

RYAOC-TP-TR15	-0.5	-2.5
cPAH (mg/kg)		
Total HMW PAH	5.78	15.21
Metals (mg/kg)		
Cadmium	0.82 J	1.8
Lead	19 J	130
Selenium	1.3	0.84
Zinc	2,800 J	2,000

SL2-2	
cPAH (mg/kg)	
TTEC cPAH (calc)	11.210

TAB-14	
PCBs (mg/kg)	
Aroclor 1260	0.87
Total PCBs	0.87

RYAOC-TP-PL23	-0.5	-2.5
cPAH (mg/kg)		
TTEC cPAH (calc)	5.451	0.012333
Total HMW PAH	29.65	0.0877
PCBs (mg/kg)		
Total PCB Aroclor (calc)	0.0488	5.202
Metals (mg/kg)		
Selenium	0.92	0.74
Zinc	600	87

RYAOC-TP-PL22	-0.5	-2.5
cPAH (mg/kg)		
TTEC cPAH (calc)	7.122	0.00039
Total HMW PAH	39.3	0.00042 U
Metals (mg/kg)		
Cadmium	7.8	0.17
Copper	300	15
Selenium	0.82	0.72
Zinc	7,200	57

RYAOC-TP-TR16	-0.5	-2.5
cPAH (mg/kg)		
Total HMW PAH	6.51	1.278
PCBs (mg/kg)		
Total PCB Aroclor (calc)	0.044	4.084
Metals (mg/kg)		
Cadmium	0.81	1.4
Copper	400	19
Selenium	0.89	0.81
Zinc	1,100	2,400
TPHs (mg/kg)		
Diesel Range Organics	1,900	2,100

RYAOC-TP-PL17	-0.5	-3.5
Metals (mg/kg)		
Selenium	0.67	0.74

RYAOC-TP-PL18	-0.5	-2.0
cPAH (mg/kg)		
Total HMW PAH	9.26	14.34
Metals (mg/kg)		
Selenium	0.9	0.93

RYAOC-TP-PL19	-0.5	-2.5
Metals (mg/kg)		
Selenium	0.85	0.78
TPHs (mg/kg)		
Diesel Range Organics	2,900	11,000

RYAOC-TP-PL20	-0.5	-3.5
Metals (mg/kg)		
Selenium	0.78	0.77

RYAOC-TP-PL21	-0.5	-0.5 Duplicate	-2.5
cPAH (mg/kg)			
TTEC cPAH (calc)	3.491	6.443	0.0003975
Total HMW PAH	20.54	37.55	0.00043 U
Metals (mg/kg)			
Selenium	0.88	0.76	0.71

Legend

- ■ Test Pit Location
- ▲ 5-point Composite Sample
- ● Catch Basin Solids Sample Location
- ⊕ Well Boring
- - - Former Oil Line Alignment
- — Oil Line Present
- ▬ Trench Location

- ▭ Former Oil Line Excavation Area
- ▭ Basement Lined Sump or Trench

Previous Investigation Soil Samples (PGG 2012b)

- ● 3-point Composite Soil Sample
- ▲ Discrete Soil Sample
- ■ Soil Removal Confirmation Sample

Historical sample labels and results only included for samples exceeding screening levels.

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
TPH = Total Petroleum Hydrocarbons
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

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0 25 50 100
Feet

Figure 1-1
Rectifier Yard AOC
Oil House ASTs, Oil Lines, and Nearby Transformers
RI and Historical Soil Sample Locations and
Results Above Screening Levels

Rectifier Yard Area of Concern
Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

- PAHs (maximum of 1.206 mg/kg as total HMW PAH) exceeded the terrestrial ecologic screening level of 1.1 mg/kg as total HMW PAH in one of 11 samples. PAH concentrations were reported at concentrations below MTCA Method C screening levels, and MTCA-derived soil screening levels for protection of groundwater.

- Metals when detected were not reported at concentrations above MTCA Method C screening levels, MTCA-derived soil screening levels for protection of groundwater. Selenium (maximum of 1.4 mg/kg) exceed the terrestrial ecological soil screening level for protection of wildlife of 0.3 mg/kg and site background in all 11 samples.

1.3.2 Oil Lines and Nearby Transformers

The RI analytical results are summarized in Table 1-1, and historical analytical results (PGG 2012b) are summarized in Volume 5, Appendix F-1. The RI and historical sampling locations and results of screening level exceedances are shown in Figure 1-1. The RI analytical program for the oil pipelines and associated transformers included: total cyanide, fluoride, PAHs, PCBs, metals, and diesel-range petroleum hydrocarbons in accordance with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b).

At each sampling station of former and current oil pipelines, at least one sample was collected from beneath the expected depth of the pipeline.

One new RI finding is the oil lines are still in place in the main portion of the Rectifier Yard (refer to Figure 1-1), and that the lines have been removed from the areas north of the Oil House. Spill kits and pipe repair tools were brought to the field in case the lines were damaged during excavation activities; however, no lines were damaged during excavation activities.

In general, the oil lines appeared to be in good condition and were intact with only small amounts of petroleum odor and staining observed at a few locations (RYAOC-TP-PL-13, RYAOC-TP-PL-19, and RYAOC-TP-PL-23). All of the encountered oil lines consisted of 2-inch diameter metal pipe that were wrapped with tape labelled “3M, 10 mL”. At most of the excavation locations, a pair of 2-inch lines were present. The pipes were often embedded in sand backfill and no information was available regarding whether these lines had been previously purged. Presumably, the oil lines have been purged based on the fact based on the fact that the transformers and ASTs have already been decommissioned and removed in this area.

A few additional samples were collected based on field observations and are summarized below:

- During the process of locating the former oil line that trends northwest-southeast and is located north of the water tower (see Figure 1-1), an area of suspected petroleum staining was observed north of the foundation for the Harmonic Filter and near the former location of the Rectifier Auxiliary Building (Substation 19) (see Volume 5, Appendix F-1). Samples were not previously collected at this location. A 3-ft x 6-ft x 5-ft test pit was excavated in this area (i.e., RYAOC-TP-PLS01) as shown on Figure 1-1. Petroleum odor and staining was noted to approximately 5 ft bgs, where the excavation was terminated due to an encountered concrete footing that prevented further excavation.

- Four additional stations were sampled to better characterize oil lines near the main transformers in the western portion of the Rectifier Yard including: RYAOC-TP-PL-25, RYAOC-TP-TR-14, RYAOC-TP-TR-15, and RYAOC-TP-TR-16.

RI soil analytical results from the oil line areas and nearby transformers (RYAOC-TP-TR-14, RYAOC-TP-TR-15, and RYAOC-TP-TR-16) are summarized as follows:

- Fluoride (maximum of 580 J mg/kg) exceeded the MTCA-derived soil screening level for protection of groundwater of 147.6 mg/kg in one surface soil sample (RYAOC-TP-PL-05-0.5).

- cPAH concentrations did not exceed the MTCA Method C Industrial screening level of 130 mg/kg TTEC. Five of the soil samples (maximum of 13.04 mg/kg at RYAOC-TP-PL-05-0.5) exceeded the MTCA soil screening level of 3.9 mg/kg cPAH TTEC that is based on groundwater protection. Twenty-four of the 63 samples (maximum of 120 mg/kg at RYAOC-TP-PL-05-0.5) exceeded the terrestrial ecological screening level of wildlife protection for total HMW PAHs of 1.1 mg/kg.

- PCBs were detected at low concentrations below the MTCA Method A Industrial screening level of 10 mg/kg. Total PCBs were detected at concentrations (maximum of 9.563 mg/kg) above the terrestrial ecologic screening level for protection of wildlife (0.65 mg/kg) in two stations (RYAOC-TP-PL-13-2.5, RYAOC-TP-PL-14-2.0, and RYAOC-TP-PL-23-2.5). Aroclors 1268, 1260, and 1254 were the main PCBs detected.

- For metals, arsenic (maximum of 11 mg/kg), cadmium (maximum of 7.8 mg/kg), copper (maximum 300 mg/kg), zinc (maximum of 7,200 mg/kg), and lead (maximum of 130 mg/kg) were detected in soils above MTCA-derived screening levels for protection of groundwater, and/or terrestrial ecological screening levels for wildlife protection, as well as background concentrations. Selenium (maximum of 1.5 mg/kg) was detected above terrestrial ecological screening levels for wildlife protection in all of the collected samples.

- Diesel-range organics and residual-range organics were detected above the MTCA Method A Industrial screening level of 2,000 mg/kg in 6 of 63 oil line and transformer soil samples. Samples exceeding screening levels were generally associated with the oil conveyance lines (RYAOC-TP-PL-13 and RYAOC-TP-PL-19), one of the transformers (RYAOC-TP-TR-16), and the area of soil staining discovered during the RI field investigation north of the harmonic filter (RYAOC-TP-PLS-01).
- Soil samples collected from the historical soil excavation/soil staining area along the northernmost former oil line segment (refer to Figure 1-1) did not exceed MTCA Method A and C Industrial screening levels, like historical (PGG 2012b) confirmation sample results (refer to Figure 1-1 and Volume 5, Appendix F-1).

The RI results for the oil lines are like historical soil results that showed low levels of PCBs below applicable screening levels. PAHs and diesel-range organics exceeded MTCA soil screening levels for groundwater protection in some locations for both the RI and pre-RI data sets (Figure 1-1).

1.3.3 Rectifier Building Transformer Bays and Basement

The Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) included sampling of the Rectifier Building transformer bays as well as three borings in the Rectifier Building Basement. Consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b), total cyanide and fluoride were not included in the analytical program for these samples as they were not COPCs in this area.

Table 1-2 summarizes the RI soil results for the Rectifier Building transformer bays and basement. Figure 1-2 shows the RI sampling stations and results exceeding screening levels for the Rectifier Building Transformer Bays and Basement.

The transformer bays were reportedly backfilled to an unknown depth with a coarse-sandy gravel backfill containing a small percentage of silt and clay. The backfill likely occurred around the time of construction of the bays.

The basement soil samples (RYAOC-SB1, RYAOC-SB2, and RYAOC-SB3) were collected after the basement concrete floor was cored to allow for access. The samples were collected using a hand-auger due to the access difficulties for a conventional drill rig. Refusal was encountered at all three auger locations at a shallow depth of 1.0 ft below the base of the slab in the dense and gravelly soil. No soil staining or chemical odor were observed in the hand auger borings, and the adjacent lined trenches and sumps were found to be in good condition at the time of inspection.

Table 1-2
Rectifier Yard AOC - Rectifier Building Transformer Bays and Basement RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Spring and Fall 2016, Fall 2017
(Page 1 of 2)

				Ecological Indicator				Analytical Results										
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone^a	Selected Screening Level	Natural Background	RYAOC-SB01-1.0 11/16/2017	RYAOC-SB02-1.0 11/3/2016	RYAOC-SB03-1.0 11/3/2016	RYAOC-SB40-1.0 (Duplicate of RYAOC-SB03-1.0) 11/3/2016	RYAOC-TP-TR-01-1.0 4/20/2016	RYAOC-TP-TR-46-1.0 (Duplicate of RYAOC-TP-TR-01-1.0) 4/20/2016	RYAOC-TP-TR-02-1.0 4/20/2016	RYAOC-TP-TR-03-1.0 4/20/2016	RYAOC-TP-TR-04-1.0 4/20/2016	RYAOC-TP-TR-45-1.0 (Duplicate of RYAOC-TP-TR-3.0-1.0) 4/20/2016	RYAOC-TP-TR-05-1.0 4/20/2016
Polycyclic Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.00072 U	0.00099 J	0.00073 U	0.0014 J	0.0032 J	0.0086 J	0.0048 J	0.014	0.0014 J	0.002 J	0.0036 J
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.00051 U	0.0022 B	0.0006 B	0.0015 B	0.0046 J	0.0097 J	0.0069	0.02	0.0021 J	0.0029 J	0.0049 J
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.00068 U	0.00062 U	0.0007 U	0.0018 J	0.033 J	0.07 J	0.05	0.18	0.014	0.015	0.033
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00057 U	0.00052 U	0.00058 U	0.0014 J	0.00062 J	0.0011 J	0.0012 J	0.0033 J	0.00054 U	0.00047 U	0.00052 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.00068 U	0.00062 U	0.0007 U	0.0015 J	0.042 J	0.095 J	0.064	0.21	0.025	0.023	0.047
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.00092 J	0.00086 B	0.0019 B	0.0029 B	0.33 J	0.73 J	0.58	1.6	0.17	0.16	0.4
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.00054 J	0.00042 U	0.0017 J	0.0023 J	0.42 J	0.81 J	0.65	2	0.22	0.21	0.49
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0056 J	0.00061 U	0.0038 J	0.0031 J	0.65 J	1.3 J	1.1	3.1	0.32	0.3	0.69
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00093 J	0.00052 U	0.002 J	0.0024 J	0.39	0.56	0.71	2	0.19	0.18	0.47
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0012 J	0.00062 U	0.0012 J	0.0023 J	0.21 J	0.44 J	0.34	0.93	0.11	0.11	0.26
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.004 J	0.0016 U	0.0034 J	0.0034 J	0.43 J	0.85 J	0.77	2.2	0.23	0.22	0.54
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.00082 U	0.00075 U	0.00084 U	0.0017 J	0.052 J	0.13 J	0.11	0.31	0.023	0.021	0.049
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.0025 J	0.0015 U	0.0037 J	0.0055	0.55 J	1.2 J	1.4	3	0.28	0.27	0.79
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.00057 U	0.00052 U	0.00058 U	0.0013 J	0.015 J	0.042 J	0.022	0.076	0.0066	0.0068	0.013
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0011 J	0.00062 U	0.0024 J	0.0023 J	0.41 J	0.67 J	0.73	2	0.2	0.18	0.48
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.00091 U	0.0018 B	0.00094 B	0.0019 B	0.0081 J	0.016 J	0.012	0.034	0.0036 J	0.0043 J	0.007
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0013 J	0.002 B	0.0016 B	0.0025 B	0.21 J	0.5 J	0.32	1.1	0.11	0.11	0.26
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.0016 J	0.0011 J	0.0025 J	0.0046 J	0.49 J	1 J	1.2	2.7	0.26	0.25	0.69
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.001503	0.000434	0.002706	0.003564	0.5895	1.1455	0.9437	2.816	0.3046	0.2893	0.6833
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.0038	0.00699	0.00684	0.0188	0.86652	1.9424	1.8809	4.6373	0.4427	0.434	1.1585
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	0.01589	0.00196	0.0189	0.025	**3.382**	**6.49**	**6.19**	**16.84**	**1.723**	**1.631**	**4.069**
Polychlorinated Biphenyls (PCBs)																		
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.0088 UJ	0.0068 U	0.0071 U	0.0079 UJ	0.0055 U	0.0075 U	0.0071 U	0.0064 U	0.007 U	0.0075 U	0.0066 U
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.005 U	0.0038 U	0.004 U	0.0045 UJ	0.0031 U	0.0042 U	0.004 U	0.0037 U	0.004 U	0.0043 U	0.0038 U
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.0059 U	0.0045 U	0.0047 U	0.0052 UJ	0.0037 U	0.0049 U	0.0047 U	0.0043 U	0.0047 U	0.005 U	0.0044 U
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.0019 U	0.0015 U	0.0015 U	0.0017 UJ	0.0012 U	0.0016 U	0.0015 U	0.0014 U	0.0015 U	0.0021 J	0.0014 U
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.0035 U	0.0027 U	0.0028 U	0.0031 UJ	0.0022 U	0.0029 U	0.0028 U	0.0025 U	0.0045 J	0.003 U	0.15 J
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	0.71	NE	0.0028 J	0.0014 U	0.0014 U	0.0016 UJ	0.0011 U	0.0015 U	0.0014 U	0.0013 U	0.0014 UJ	0.0015 U	0.14 J
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	0.0023 U	0.0017 U	0.0018 U	0.002 UJ	0.013 J	0.006 J	0.021 J	0.091 J	0.0064 J	0.0046 J	0.047 J
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	0.0006 U	0.00046 U	0.00048 U	0.00054 UJ	0.00037 U	0.0005 U	0.00048 U	0.00044 U	0.00048 U	0.00051 U	0.00045 U
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	0.0011 U	0.00082 U	0.00087 U	0.00096 UJ	0.00067 U	0.0055 J	0.00086 U	0.00078 U	0.00086 U	0.00092 U	0.00081 U
Total PCB Aroclor (calc)	mg/Kg	10	66	0.65	NE	0.65	NE	0.0028	0.00046 U	0.00048 U	0.00054 UJ	0.013	0.0115	0.021	0.091	0.0109	0.0067	0.337
Metals																		
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	8,700	6,100 J	6,700 J	7,100 J	3,100 J	3,700	7,700 J	9,100 J	9,100 J	8,500 J	7,400 J
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	2.8	1.8	4.6	4.5	0.96 J	1.1 J	6 J	4.6 J	2.9 J	2.5 J	4.3 J
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.12	0.21	0.3	0.43	0.17 J	0.3 J	**0.87 J**	**1.8 J**	0.27 J	0.2 J	0.64 J
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	16	4.8 J	9.8 J	10 J	4.8 J	5.3 J	13 J	19 J	9.5 J	8 J	15 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	17	20 J	30 J	18 J	8.6 J	11 J	22 J	80 J	18 J	16 J	23 J
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	5	4.7	5.5	6.7	4.8 J	5.1 J	9.7 J	55 J	7 J	5.9 J	7.4 J
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.015 J	0.012 B	0.014 B	0.013 B	0.014 J	0.0069 J	0.059 J	0.14 J	0.0088 J	0.0099 J	0.24 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	9.3	6 J	12 J	14 J	4.9 J	6 J	14 J	73 J	8.4 J	7.2 J	14 J
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**1.2**	**0.99**	**0.66**	**0.8**	**0.45**	**0.49**	**0.57**	**0.51**	**0.85**	**0.81**	**0.48 J**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	47	42 J	47 J	58 J	39 J	62 J	**970 J**	**1,200 J**	69 J	56 J	180 J
Total Petroleum Hydrocarbons (TPHs)																		
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NE	2,000	NE	22 J	9.9 U	13 U	12 U	17 J	14 J	31	51	10 U	9.7 U	16 J
Residual Range Organics	mg/Kg	2,000	NE	2,000	NE	2,000	NE	65	19 J	11 U	9.7 U	74 J	49 J	95	250	26 J	22 J	87

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

mg/Kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NA = Not Applicable

NE = Not Established

PAHs = Polycyclic Aromatic Hydrocarbon

PCB = Polychlorinated Biphenyls

SSL = Soil Screening Level

Total TEC = Total Toxicity Equivalent Concentration

TPH = Total Petroleum Hydrocarbons

Table 1-2
Rectifier Yard AOC - Rectifier Building Transformer Bays and Basement RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Spring and Fall 2016, Fall 2017
(Page 2 of 2)

				Ecological Indicator				Analytical Results									
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	RYAOC-TP-TR-06-1.0 4/20/2016	RYAOC-TP-TR-44-1.0 (Duplicate of RYAOC-TP-TR-06-1.0) 4/20/2016	RYAOC-TP-TR-07-1.0 4/20/2016	RYAOC-TP-TR-47-1.0 (Duplicate of RYAOC-TP-TR-07-1.0) 4/20/2016	RYAOC-TP-TR-08-1.0 4/20/2016	RYAOC-TP-TR-09-1.0 4/20/2016	RYAOC-TP-TR-10-1.0 4/20/2016	RYAOC-TP-TR-11-1.0 4/20/2016	RYAOC-TP-TR-12-1.0 4/20/2016	RYAOC-TP-TR-13-1.0 4/19/2016
Polycyclic Aromatic Hydrocarbons (PAHs)																	
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.00047 U	0.0058 U	0.016	0.019	0.0028 J	0.00096 J	0.0087	0.0014 J	0.013	0.0063
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.00034 U	0.0067 J	0.023	0.027	0.0043 J	0.0019 J	0.013	0.0022 J	0.019	0.0068
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.0011 J	0.02 J	0.18	0.21	0.03	0.0084	0.076	0.016	0.17	0.059
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00037 U	0.0046 U	0.0005 U	0.00048 U	0.0005 U	0.00043 U	0.0005 U	0.00037 U	0.0031 J	0.0011 J
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.00075 B	0.03 J	0.2	0.22	0.038	0.011	0.08	0.022	0.17	0.059
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0071 B	0.23 J	1.8	2.1	0.31	0.081	0.99	0.19	1.6	0.65
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.0087 B	0.27 J	2	2.2	0.37	0.094	1.2	0.24	1.8	0.88
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.014 B	0.43 J	3	3.4	0.58	0.16	2	0.42	2.7	1.5
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0079 B	0.23 J	1.8	1.9	0.33	0.089	1.7	0.24	1.7	0.62
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0044 B	0.11 J	0.84	0.89	0.2	0.048	0.57	0.14	1	0.44
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0091 B	0.3 J	2.3	2.8	0.39	0.11	1.3	0.25	2	0.91
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0021 B	0.067 J	0.29	0.35	0.046	0.014	0.25	0.035	0.28	0.15
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.011 B	0.33 J	2.8	3.2	0.48	0.13	1.6	0.29	2.6	1.1
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.0005 J	0.01 J	0.075	0.092	0.014	0.0036 J	0.035	0.0072	0.067	0.03
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0098 B	0.3 J	1.9	2.1	0.36	0.1	1.7	0.27	1.8	0.83
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.0006 U	0.0074 U	0.041	0.048	0.0073	0.0031 J	0.027	0.0041	0.036	0.012
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0043 B	0.13 J	1.1	1.2	0.18	0.051	0.58	0.11	0.95	0.4
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.0094 B	0.29 J	2.5	2.9	0.42	0.11	1.4	0.26	2.3	0.91
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.012531	0.3867	2.806	3.112	0.5235	0.1354	1.764	0.348	2.558	1.2461
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.01765	0.5267	4.435	5.016	0.7564	0.20996	2.4197	0.4529	4.0281	1.6742
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	0.0725	**2.227**	**16.43**	**18.64**	**3.006**	0.806	**11.11**	**2.045**	**15.18**	**6.89**
Polychlorinated Biphenyls (PCBs)																	
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.0073 U	0.0057 U	0.0062 U	0.0067 U	0.0069 U	0.0076 U	0.0073 U	0.0073 U	0.0072 U	0.0064 U
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.0041 U	0.0033 U	0.0035 U	0.0038 U	0.0039 U	0.0043 U	0.0042 U	0.0042 U	0.0041 U	0.0036 U
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.0048 U	0.0038 U	0.0041 U	0.0045 U	0.0045 U	0.005 U	0.0049 U	0.0049 U	0.0048 U	0.0042 U
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.0016 U	0.0012 U	0.0013 U	0.0015 U	0.0015 U	0.0016 U	0.0016 U	0.0016 U	0.0016 U	0.0014 U
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.0042 J	0.22 J	0.0024 U	0.0026 U	0.0027 U	0.003 U	0.0029 U	0.0029 U	0.0028 U	0.0025 U
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	0.71	NE	0.0015 UJ	0.0012 UJ	0.0013 U	0.0014 U	0.0014 U	0.046 J	0.0015 U	0.0015 U	0.0015 U	0.034
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	0.0019 U	0.0094 J	0.026 J	0.033 J	0.014 J	0.032 J	0.27 J	0.017 J	0.042 J	0.01 J
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	0.00049 U	0.00039 U	0.00042 U	0.00046 U	0.00046 U	0.00051 U	0.00049 U	0.0005 U	0.00049 U	0.00043 U
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	0.00088 U	0.0007 U	0.00075 U	0.00082 U	0.00084 U	0.00092 U	0.00089 U	0.00089 U	0.00088 U	0.00078 U
Total PCB Aroclor (calc)	mg/Kg	10	66	0.65	NE	0.65	NE	0.0042	0.2294	0.026	0.033	0.014	0.078	0.27	0.017	0.042	0.034
Metals																	
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	2,600 J	4,700 J	6,900 J	8,300 J	3,600 J	4,700 J	9,600 J	3,700 J	5,400 J	5,200 J
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	1.3 J	2.4 J	3.8 J	5.5 J	2.5 J	3.1 J	**8.6 J**	2.3 J	2.7 J	2.6
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.17 J	0.51 J	**1.4 J**	**2 J**	0.42 J	0.28 J	**3.1 J**	0.42 J	**1.2 J**	0.34
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	4.4 J	7.6 J	16 J	32 J	7.2 J	8.7 J	34 J	9.2 J	14 J	9.3 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	14 J	18 J	40 J	65 J	20 J	17 J	52 J	21 J	49 J	15
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	2.5 J	5.9 J	17 J	100 J	6.9 J	3.7 J	110 J	11 J	17 J	6.7
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.082 J	0.042 J	0.099 J	0.065 J	0.014 J	0.2 J	0.1 J	0.051 J	0.071 J	0.093 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	4.9 J	7.9 J	16 J	26 J	6.6 J	8.2 J	26 J	10 J	19 J	8.4
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.36 J**	**0.42 J**	**0.49**	**0.49**	**0.38 J**	**0.34 J**	**0.57**	**0.36 J**	**0.43 J**	**0.44 J**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	83 J	82 J	270 J	**440 J**	**380 J**	330 J	**650 J**	150 J	**580 J**	84
Total Petroleum Hydrocarbons (TPHs)																	
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NE	2,000	NE	11 UJ	60 J	61 J	96 J	140	42	1,300	28	78	30
Residual Range Organics	mg/Kg	2,000	NE	2,000	NE	2,000	NE	9.2 UJ	1,100 J	170 J	240 J	80	51	430	58	270	160

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established

PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
TPH = Total Petroleum Hydrocarbons

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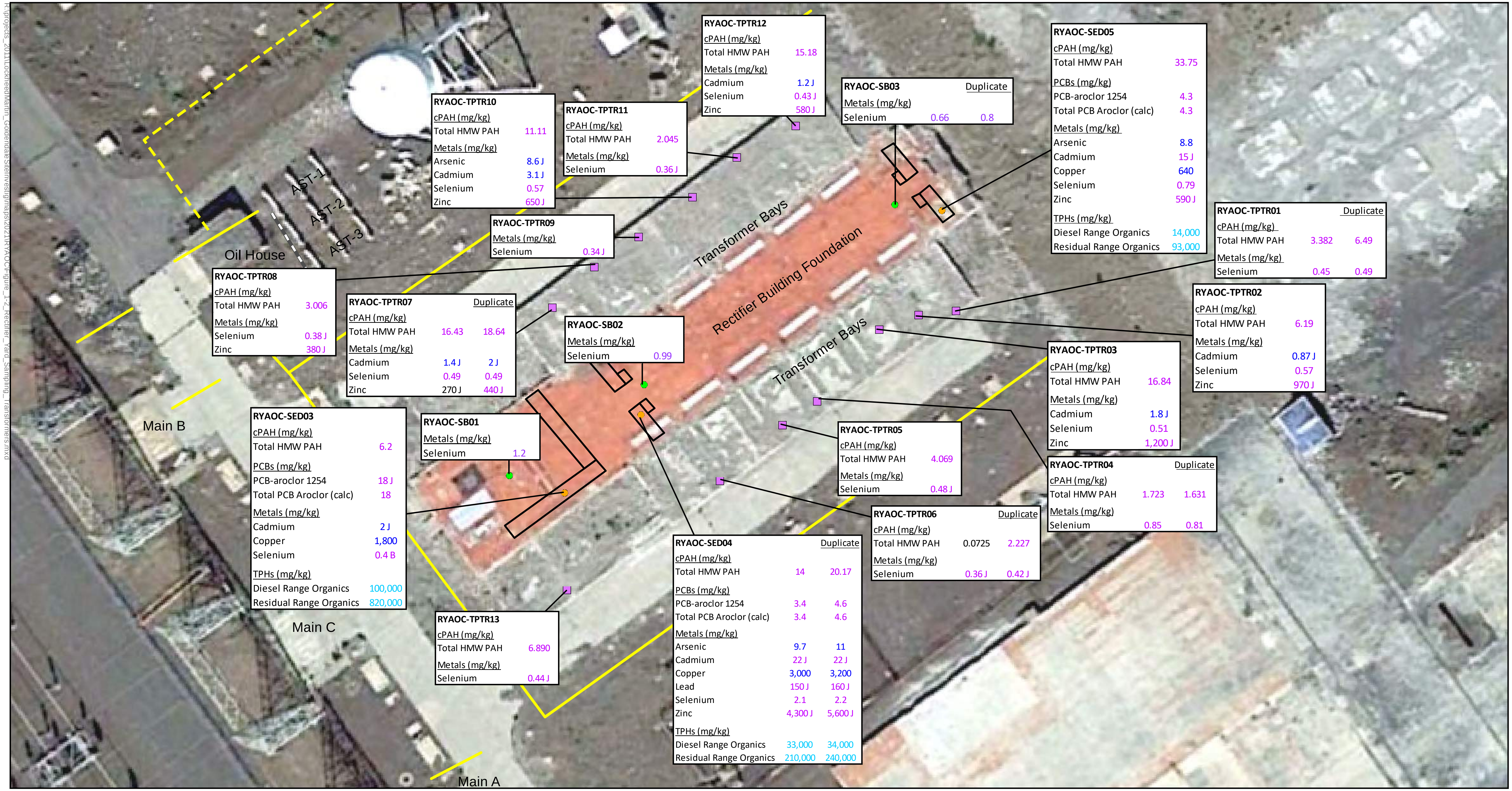


Legend

Remedial Investigation

- ■ Test Pit Location
- ● Shallow Boring
- ● Catch Basin Sediment Sample Location
- - - Former Oil Line Alignment
- — Oil Line Present
- Trench Location
- ☐ Basement Trenches

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
TPH = Total Petroleum Hydrocarbons
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N
W E
S

0 10 20 40
Feet

Figure 1-2
Rectifier Yard AOC
Rectifier Building Transformer Bays and Basement
RI Soil Sample Locations and
Results Above Screening Levels

Rectifier Yard Area of Concern
Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Soil analytical results for the transformer bays and basement are summarized as follows:

- cPAH concentrations did not exceed the MTCA Method C Industrial screening level of 130 mg/kg TTEC or the soil screening level for protection groundwater of 3.9 mg/kg TTEC. Seven of the soil sample results (maximum of 18.64 mg/kg as total HMW PAH in RYAOC-TP-TR-47-1.0, the field duplicate of TR-07-1.0) exceed the soil screening level for wildlife protection of 1.1 mg/kg as total HMW PAH.

- PCBs were not detected above MTCA C Industrial screening levels. Aroclors 1248, 1254, 1260, and 1268 were detected at low concentrations below the total PCB terrestrial ecological soil screening levels for wildlife protection of 0.65 mg/kg.

- For metals, arsenic (maximum of 8.6 mg/kg), cadmium (maximum of 3.1 J mg/kg), and zinc (maximum of 1,200 J mg/kg) were detected in soils above MTCA-derived soil screening levels for protection of groundwater and/or terrestrial ecological soil screening levels for wildlife protection as well as background concentrations. Arsenic exceeded screening levels in one of 21 samples; cadmium and zinc exceeded screening levels in 6 of 21 samples. Selenium (maximum of 1.2 mg/kg) exceed terrestrial ecologic screening level for wildlife protection and background concentrations in all 21 samples.

- Diesel-range organic and/or residual-range organics were not detected above the MTCA Method A Industrial soil screening level of 2,000 mg/kg, which is based on groundwater protection, in any of the 21 soil samples.

- Screening levels were not exceeded in the soil samples collected from the basement soil borings collected from beneath the basement concrete floor.

The RI results for the Rectifier Building Transformer Bays are similar to historical soil results collected from this area that showed concentrations of PCBs, PAHs, and diesel-range petroleum hydrocarbons generally below MTCA Method A Industrial screening levels (refer to Figure 1-2).

1.3.4 Northwest Area of the Rectifier Yard

This area was included in the RI because of previous storage of plant demolition debris. During the RI field investigation, the area contained scattered metal debris and concrete rubble which appeared to be partially re-graded during plant demolition activities, as evidenced by the presence of a concrete and gravel aggregate layer. Samples from this area were analyzed for total cyanide, fluoride, PAHs, PCBs, metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn), and TPH-Dx in accordance with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). RI sample results are summarized in Table 1-3 and Figure 1-3.

Table 1-3
Rectifier Yard AOC - Northwest Area of Rectifier Yard RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Spring 2016

				Ecological Indicator				Analytical Results									
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	RYAOC-TP-G-01-0.5 4/18/2016	RYAOC-TP-G-02-0.5 4/18/2016	RYAOC-TP-G-03-0.5 4/18/2016	RYAOC-TP-G-04-0.5 4/18/2016	RYAOC-TP-G-05-0.5 4/18/2016	RYAOC-TP-G-06-0.5 4/18/2016	RYAOC-TP-G-07-0.5 4/18/2016	RYAOC-TP-G-08-0.5 4/18/2016	RYAOC-TP-G-09-0.5 4/18/2016	RYAOC-TP-G-10-0.5 4/18/2016
Aluminum Smelter																	
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U	2 U	2 U	2.1 U	2 U	2.1 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	13 J	4 B	8 J	9.3 J	14 J	2.9 B	11 J	6.3 J	15 J	3.2 B
Polycyclic Aromatic Hydrocarbons (PAHs)																	
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.00062 U	0.0006 U	0.00063 U	0.00059 U	0.0011 J	0.00057 U	0.0018 J	0.0006 U	0.0007 U	0.00065 U
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.00045 U	0.00043 U	0.00045 U	0.00042 U	0.0013 J	0.0004 U	0.0021 J	0.00043 U	0.0005 U	0.00047 U
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.0014 J	0.00057 U	0.0006 U	0.0014 J	0.012	0.00054 U	0.014	0.001 J	0.0011 J	0.00062 U
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00094 J	0.00047 U	0.0005 U	0.0014 J	0.00076 J	0.00045 U	0.0018 J	0.00048 U	0.00055 U	0.00052 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.0038 J	0.0015 J	0.0006 U	0.0021 J	0.014	0.00054 U	0.026	0.0011 J	0.0017 J	0.00062 U
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.028	0.0027 J	0.00076 U	0.012	0.16	0.00068 U	0.17	0.0066	0.012	0.00079 U
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.028	0.003 J	0.0026 J	0.011	0.2	0.00036 U	0.16	0.0073	0.015	0.00059 J
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.042 J	0.0063	0.00059 U	0.016	0.25	0.00053 U	0.17	0.01	0.021	0.00061 U
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.028	0.0048	0.0019 J	0.013	0.17	0.00045 U	0.12	0.0054	0.013	0.00052 U
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.015	0.0028 J	0.0006 U	0.0068	0.11	0.00054 U	0.089	0.0032 J	0.0069	0.00062 U
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.035 J	0.0051	0.0015 U	0.017	0.2	0.0013 U	0.22	0.0079	0.016	0.0016 U
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0046 J	0.00083 J	0.00072 U	0.0023 J	0.027	0.00065 U	0.02	0.001 J	0.0023 J	0.00074 U
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.035	0.0053	0.0014 U	0.019	0.23	0.0014 J	0.28	0.012	0.02	0.0014 U
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.0012 J	0.0012 J	0.0005 U	0.0016 J	0.0052	0.00045 U	0.0081	0.00048 U	0.00055 U	0.00052 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.026	0.0041 J	0.0023 J	0.012	0.17	0.00054 U	0.12	0.0058	0.014	0.00062 U
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.00095 J	0.00076 U	0.0008 U	0.0012 J	0.0021 J	0.00072 U	0.0043 J	0.00077 U	0.00088 U	0.00083 U
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0091	0.0029 J	0.00073 J	0.01	0.079	0.0008 J	0.12	0.0064	0.0075	0.00071 U
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.04	0.0069	0.0056	0.02	0.21	0.0033 J	0.27	0.014	0.022	0.0039 J
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.03991	0.004724	0.002971	0.01608	0.2737	0.0003335	0.2191	0.010039	0.02078	0.000767
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.05239	0.0109	0.00073	0.0367	0.34546	0.0022	0.4581	0.0205	0.0303	0.00047 U
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	0.2466	0.03653	0.0124	0.1101	**1.497**	0.0033	**1.339**	0.0612	0.1222	0.00449
Polychlorinated Biphenyls (PCBs)																	
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.0067 U	0.0066 U	0.0071 U	0.0069 U	0.0074 U	0.0068 U	0.0074 U	0.0072 U	0.0072 U	0.0071 U
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.0038 U	0.0038 U	0.0041 U	0.0039 U	0.0042 U	0.0039 U	0.0042 U	0.0041 U	0.0041 U	0.0041 U
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.0044 U	0.0044 U	0.0047 U	0.0046 U	0.0049 U	0.0045 U	0.0049 U	0.0048 U	0.0047 U	0.0047 U
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.0014 U	0.0014 U	0.0015 U	0.0015 U	0.0016 U	0.0015 U	0.0016 U	0.0016 U	0.0015 U	0.0015 U
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.0026 UJ	0.0026 UJ	0.0028 UJ	0.0027 UJ	0.0029 UJ	0.0027 UJ	0.0029 UJ	0.0028 UJ	0.0028 UJ	0.0028 UJ
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	0.71	NE	0.0013 U	0.0013 U	0.0014 U	0.0014 U	0.0015 U	0.0014 U	0.0015 U	0.0015 U	0.0015 U	0.0014 U
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	0.0017 U	0.0017 U	0.0018 U	0.0018 U	0.0019 U	0.0018 U	0.0019 U	0.0019 U	0.0018 U	0.0018 U
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	0.00045 U	0.00045 U	0.00048 U	0.00047 U	0.0005 U	0.00046 U	0.0005 U	0.00049 U	0.00048 U	0.00048 U
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	0.00081 U	0.00081 U	0.00087 U	0.00084 U	0.0009 U	0.00083 U	0.0009 U	0.00088 U	0.00087 U	0.00087 U
Total PCB Aroclor (calc)	mg/Kg	10	66	0.65	NE	0.65	NE	0.00045 U	0.00045 U	0.00048 U	0.00047 U	0.0005 U	0.00046 U	0.0005 U	0.00049 U	0.00048 U	0.00048 U
Metals																	
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	7,900	7,600	7,200	7,200	10,000	5,800	8,600	6,700	8,500	5,400
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	2.4	3.3	3.2	2.6	4	3.4	2.2	1.5	2.4	1 J
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.16 J	0.15 J	0.1 J	0.17 J	0.25 J	0.14 J	0.25 J	0.13 J	0.15 J	0.16 J
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	5.9 J	11 J	10 J	7.1 J	8.9 J	7.7 J	11 J	14 J	6.3 J	15 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	14	10	11	13	18	14	17	14	16	17 J
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	4.3	4.3	4.1	4.6	6.9	4.7	5.9	3	4.9	2.1
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.026	0.0061 U	0.0055 U	0.0079 J	0.0076 J	0.011 J	0.015 J	0.0063 U	0.0079 J	0.0057 U
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	6 J	10 J	9.3 J	6.6 J	9.4 J	8.9 J	8.6 J	6.8 J	6.8 J	4.6 J
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**1.5**	**0.99**	**0.99**	**1.6**	**1.6**	**1.3**	**1.7**	**1.6**	**1.5**	**1.6 J**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	51	39	38	46	57	42	69	48	48	43 J
Total Petroleum Hydrocarbons (TPHs)																	
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NE	2,000	NE	26	11 U	10 U	11 U	10 U	8.9 U	18 J	9.7 U	11 U	8.9 U
Residual Range Organics	mg/Kg	2,000	NE	2,000	NE	2,000	NE	430 J	60	8.5 U	21 J	29 J	7.4 U	77	8.1 U	18 J	7.4 U

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

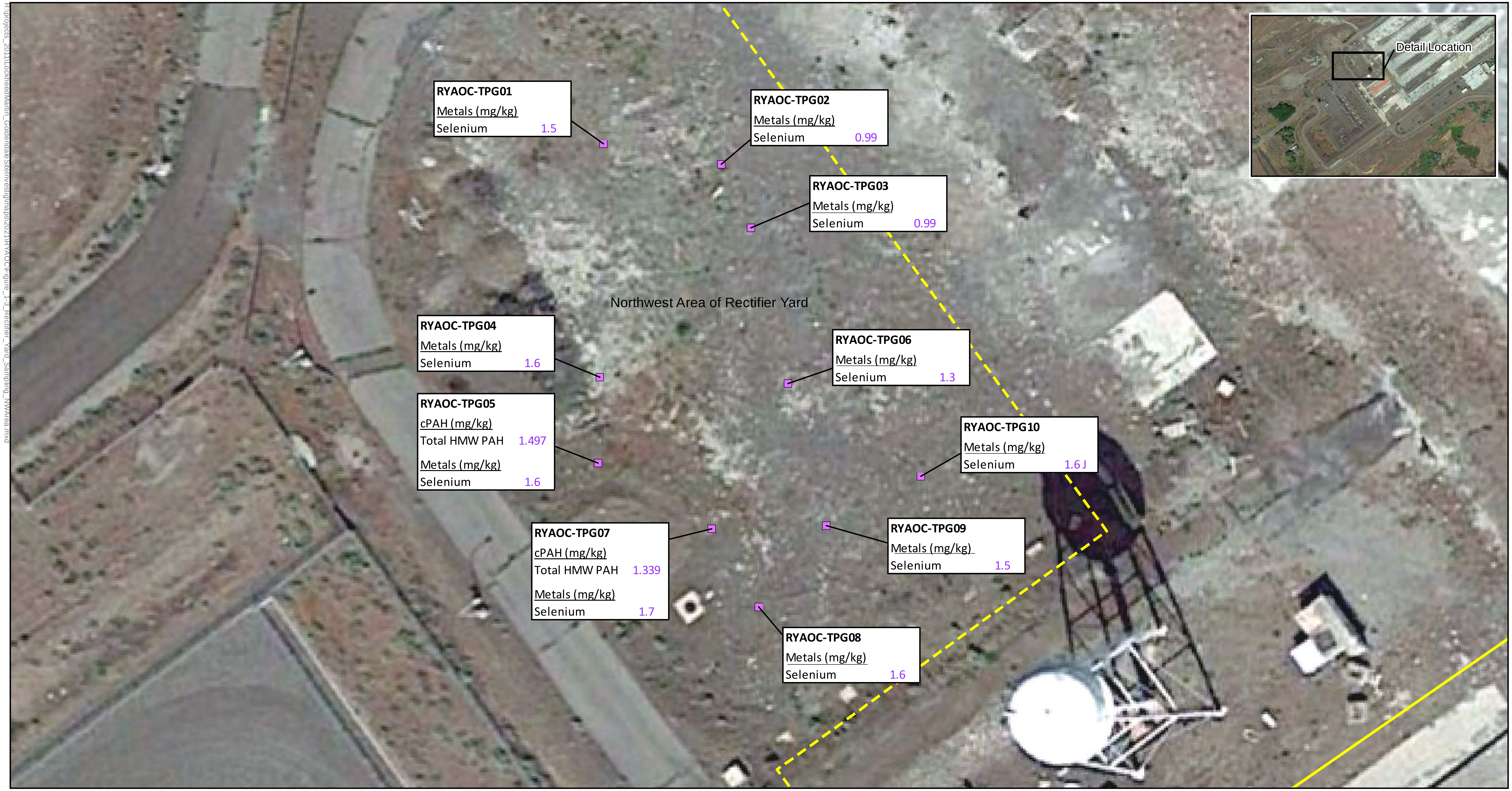
J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable

NE = Not Established
PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
TPH = Total Petroleum Hydrocarbons

R:\projects_2011\LockheedMartin_GoldendaleSite\Investig\maps\2021\RYAOC\Figure_1-3_Rectifier_Yard_Sampling_NWArea.mxd



Legend

Remedial Investigation

🟪 Test Pit Location

Only discrete surface soil samples were collected in this area.

- - Former Oil Line Alignment

— Oil Line Present

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight

N
W E
S

0 10 20 40
Feet

Figure 1-3
Rectifier Yard AOC
Northwest Area of Rectifier Yard
RI Soil Sample Locations and
Results Above Screening Levels

Rectifier Yard Area of Concern
Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Analytical results for the Northwest Area of the Rectifier Yard are summarized as follows:

- Total cyanide was not detected in any of the 10 soil samples.
- Fluoride was detected at low estimated concentrations (2.9 B to 15 J mg/kg) below soil screening levels.
- None of the cPAH sample results exceeded the MTCA Method C Industrial screening levels of 130 mg/kg and soil screening level for protection of groundwater of 3.9 mg/kg cPAH TTEC, respectively. Two samples (maximum of 1.497 mg/kg at total HMW PAHs) exceeded the terrestrial ecologic soil screening level for wildlife protection of 1.1 mg/kg total HMW PAHs.
- PCBs were not detected in any of the 10 soil samples collected and analyzed.
- Metals, where detected, were reported at concentrations below screening levels in all 10 soil samples except for selenium (maximum of 1.7 mg/kg), which was detected above the terrestrial ecologic screening level for wildlife protection of 0.3 mg/kg and background concentrations in all 10 collected samples.
- Diesel-range organics and/or residual-range organics were detected at concentrations below MTCA Method A Industrial soil screening level of 2,000 mg/kg in the 10 soil samples.

1.3.5 Plant Interior Transformer Substations

This summary presents the soil results for the individual transformer locations found at various locations in the Production Building foundation(s) A through D in the main plant area footprint. These transformers are included in the Rectifier Yard AOC consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) even though they are generally not physically located in the area of the Rectifier Yard. There is a total of 27 transformer substations located throughout the site, including two in the vicinity of the Rectifier Yard. Previous soil sampling at interior transformer substations included a total of 37 composite soil samples representing 18 of the 27 substations (PGG 2012b) for PAHs, PCBs, and TPH-Dx. Results showed the widespread presence of PAHs and TPH-Dx in above screening levels shallow soils in this area. During the RI field investigation, some of the previously inaccessible substations were sampled, and some of the previously sampled substations were re-sampled for an expanded analytical suite. The RI analytical program for interior transformer substations included total cyanide, fluoride, PAHs, PCBs, TPH-Dx, and metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn).

RI soil sample results are summarized in Table 1-4. RI soil sample results and historical (PGG 2012b) sample results for the western and eastern portion of the plant area footprint are shown in Figures 1-4 and 1-5, respectively.

RI analytical results are summarized as follows:

- Total cyanide was not detected in any of the 68 soil samples.
- Fluoride (maximum of 520 J mg/kg in sample RYAOC-TP-T9-0.5) exceeded the MTCA-derived soils screening level for protection of groundwater of 147.6 mg/kg in 12 of 68 samples.
- PAH soil contamination is widespread in the vicinity of the plant interior transformer stations. PAH soil concentrations for the plant interior transformer substations are generally higher than was found in the Rectifier Yard vicinity. Eleven of the 68 samples exceeded the MTCA Method C screening levels of 130 mg/kg TTEC. One of the PAH samples (Transformer RYAOC-TP18A-0.5) exceeded the Washington State Dangerous Waste Designation criteria of 10,000 mg/kg (1 percent). It is unlikely that these elevated PAH concentrations are related to the transformers because the PAH concentrations are significantly higher than those observed in soil at the Rectifier Yard and because of the historical use of carbon in plant operations in the plant area footprint.

  Forty-three of 68 samples exceeded the soil screening level for protection of groundwater of 3.9 mg/kg TTEC cPAH. Sixty-three of 68 samples exceeded the terrestrial ecologic soil screening level for protection wildlife of 1.1 mg/kg total HMW PAH and 43 of 68 samples exceeded the soil screening level for protection of wildlife of 100 mg/kg total LMW PAH. Soil screening levels for protection of groundwater were exceeded for non-carcinogenic PAHs including 1-methylnaphthalene (maximum of 15 mg/kg), 2-methylnaphthalene (maximum of 22 mg/kg), naphthalene (maximum of 38 mg/kg), fluoranthene (maximum of 18,000 mg/kg), and pyrene (maximum of 16,000 mg/kg) at a few soil sample stations.

  Three stations were sampled (RYAOC-TP-18A, RYAOC-TP-18B, and RYAOC-TP-18C) from the suspected area of Transformer 18. For this transformer, an area of soil staining near concrete pad(s) and electrical conduit was targeted because these features commonly correspond to the former transformer locations. After the samples had been collected and shipped, the project team learned that Transformer 18 is an underground transformer that is still present. Historical documentation did not indicate that this transformer was underground. NSC Smelter, LLC (NSC) personnel (Tetra Tech, personal communication, September 19, 2016) stated that Transformer 18 did not contain PCB transformer oils. High concentration of PAHs above MTCA Method C Industrial Screening Levels were detected at these sample stations. PCBs were detected at low concentrations below applicable screening levels at these sample stations.

Table 1-4
Rectifier Yard AOC - Plant Interior Transformer Substations RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
September 2016
(Page 1 of 5)

				Ecological Indicator				Analytical Results														
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	RYAOC-TP-T1A-0.5 9/19/2016	RYAOC-TP-T1A-2.0 9/19/2016	RYAOC-TP-T1B-0.5 9/19/2016	RYAOC-TP-T1B-2.0 9/19/2016	RYAOC-TP-T4A-0.5 9/19/2016	RYAOC-TP-T4A-2.0 9/19/2016	RYAOC-TP-T5-01-0.5 9/19/2016	RYAOC-TP-T5-01-3.0 9/19/2016	RYAOC-TP-T5-02-0.5 9/19/2016	RYAOC-TP-T5-02-3.0 9/19/2016	RYAOC-TP-T5-03-0.5 9/19/2016	RYAOC-TP-T5-03-3.0 9/19/2016	RYAOC-TP-T7A-0.5 9/20/2016	RYAOC-TP-T45-0.5 (Duplicate of RYAOC-TP-T7A-0.5) 9/20/2016	RYAOC-TP-T7A-2.0 9/20/2016
Aluminum Smelter																						
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	2 U	2.1 U	2 U	2.2 U	2.1 U	2.2 U	2 U	2 U	1.9 U	2.1 U	2 U	2.4 U	2 U	1.8 U	1.8 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	140 J	**190 J**	**280 J**	45 J	140	140	7.8	15	140	77	60	63	5.3	5.9	4.3
Polycyclic Aromatic Hydrocarbons (PAHs)																						
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.055	**0.098**	0.082	0.0026 J	**1.1**	**0.21**	**0.11**	0.023 J	**1.6**	0.066	**0.096**	0.068	0.005	0.0022 J	0.0019 J
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.083	0.1	0.11	0.0037 J	1.7	0.28	0.16	0.033	**2.3**	0.081	0.12	0.086	0.0069	0.002 J	0.0024 J
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.7	0.37	1.2	0.012	20	3.4	1.6	0.36	28	0.89	1.4	0.76	0.068 J	0.02 J	0.022
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.023 J	0.0085 J	0.027	0.00054 U	0.26	0.051 J	0.017 J	0.0025 U	0.26	0.012 J	0.024	0.013 J	0.00049 U	0.00048 U	0.00051 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2300	NE	0.89	0.49	1.5	0.025	29	5.7	2.5	0.48	37	1.2	2.6	1.3	0.11 J	0.029 J	0.034
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	5.9	4	13	0.17	280	45	17	4.4	280	10	20	10	0.76 J	0.22 J	0.28
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	7.8	4.6	14	0.2	410	74	21	5.9	430	14	23	12	1.1 J	0.31 J	0.38
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	17	8.2	37	0.36	640	110	34	7.3	590	20	36	16	1.6 J	0.48 J	0.48
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	12	4.7	14	0.21	330	46	17	4.9	330	11	18	8.9	0.78 J	0.23 J	0.25
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	4.4	2.1	9.5	0.13	160	25	8.4	2.8	170	5.1	9.7	4.2	0.57 J	0.15 J	0.19
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	10	5.3	22	0.23	300	48	17	4.4	290	10	20	10	0.96 J	0.27 J	0.3
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	1.7	0.73	2.6	0.032	65	9.5	3.6	0.92	66	2.3	3.6	1.9	0.15 J	0.062 J	0.047
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	9.9	6.5	22	0.27	480	77	31	7.2	500	17	34	15	1.4 J	0.4 J	0.46
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.23	0.12	0.42	0.0052 J	8.8	1.7	0.75	0.15	12	0.4	0.82	0.34	0.032 J	0.0085 J	0.0098
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	14	5.6	16	0.25	390	82	20	6.4	380	14	21	12	1.1 J	0.31 J	0.32
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.24	0.085	0.2	0.0033 J	3.3	0.58	0.34	0.066	**4.6**	0.18	0.27	0.19	0.012 J	0.00077 UJ	0.004 J
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	4.2	2.2	7.4	0.089	150	25	11	2.3	160	5.5	11	5.1	0.51 J	0.14 J	0.16
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	9.1	6	21	0.24	520	76	30	6.4	490	17	33	12	1.3 J	0.36 J	0.43
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	**12.2**	**6.716**	**22.03**	0.2965	**567**	**102**	**29.47**	**8.126**	**582**	**19.24**	**32.23**	**16.51**	1.5276	0.4349	0.5147
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	16.321	9.9715	32.939	0.4108	**694**	**114**	47.477	10.612	**746**	25.329	50.33	22.857	2.1439	0.6017	0.6941
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**81.9**	**41.23**	**149**	**1.822**	**3,095**	**516**	**168**	**43.42**	**3,026**	**103**	**184**	**87**	**8.32**	**2.392**	**2.677**
Polychlorinated Biphenyls (PCBs)																						
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.0065 U	0.0077 U	0.0072 U	0.008 U	0.0081 UJ	0.0084 UJ	0.007 UJ	0.0077 UJ	0.0071 UJ	0.0073 UJ	0.0076 UJ	0.0089 UJ	0.0069 U	0.0073 U	0.0072 U
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.0037 U	0.0044 U	0.0041 U	0.0045 U	0.0046 UJ	0.0048 U	0.0039 U	0.0044 U	0.004 U	0.0041 U	0.0043 U	0.005 U	0.0039 U	0.0042 U	0.0041 U
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.0043 U	0.0051 U	0.0048 U	0.0053 U	0.0054 UJ	0.0056 UJ	0.0046 UJ	0.0051 UJ	0.0047 UJ	0.0048 UJ	0.005 UJ	0.0059 UJ	0.0046 U	0.0049 U	0.0048 U
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.0014 U	0.0017 U	0.0016 U	0.0017 U	0.0018 UJ	0.0018 U	0.0015 U	0.0017 U	0.0015 U	0.0016 U	0.0016 U	0.0019 U	0.0015 U	0.0016 U	0.0016 U
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.0026 U	0.003 U	0.0028 U	0.0031 U	0.0032 UJ	0.0033 UJ	0.0027 UJ	0.003 UJ	0.0028 UJ	0.0029 UJ	0.003 UJ	0.0035 UJ	0.0027 U	0.0029 U	0.0028 U
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	0.71	NE	0.0013 U	0.0016 U	0.0015 U	0.0016 U	0.0016 UJ	0.0017 UJ	0.0014 UJ	0.0016 UJ	0.0014 UJ	0.0015 UJ	0.0015 UJ	0.0018 UJ	0.0014 U	0.0015 U	0.0015 U
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	1	0.13	0.08 J	0.0088 J	0.0021 UJ	0.0022 UJ	0.0018 UJ	0.018 J	0.17 J	0.0019 UJ	0.14 J	0.0023 UJ	0.03 J	0.013 J	0.0019 U
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	0.00044 U	0.00052 U	0.00049 U	0.00054 U	0.048 J	0.00057 U	0.078	0.00052 U	0.00048 U	0.032	0.00051 U	0.15	0.00047 U	0.0005 U	0.00049 U
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	0.00079 U	0.00093 U	0.068 J	0.00097 U	0.00099 UJ	0.011 J	0.00085 UJ	0.007 J	0.076 J	0.00089 UJ	0.069 J	0.0011 UJ	0.00084 U	0.00089 U	0.00088 U
Total PCB Aroclor (calc)	mg/Kg	10	66	0.65	NE	0.65	NE	**1**	0.13	0.068	0.0088	0.048	0.011	0.078	0.007	0.076	0.032	0.069	0.15	0.03	0.013	NE
Metals																						
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	4,600 J	14,000 J	15,000 J	9,100 J	51,000 J	14,000 J	11,000 J	8,600 J	44,000 J	9,700 J	19,000 J	12,000 J	6,500	6,100	6,700
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	1 J	2.6 J	3.5 J	1.9 J	5.4	4.3	2	2.1	3	2.6	3.5	5.1	3.6	3.3	4.1
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	**1.2**	**0.84**	**2**	0.55	**4.1 J**	**1 J**	**0.89 J**	0.4 J	**14 J**	**1.3 J**	**4.9 J**	**1.5 J**	0.38	0.34 J	0.26
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	3.4 J	9.9 J	16 J	6.5 J	**120 J**	32 J	7.2 J	5.6 J	19 J	5.8 J	13 J	7.8 J	7.5	7	8.3
Copper	mg/Kg	NA	140,000	217	280	217	28.4	19 J	22 J	73 J	18 J	69	27	19	**330**	100	22	29	31	21	18	16
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	9.6 J	7.5 J	12 J	5 J	34 J	9.1 J	5.3 J	4.3 J	17 J	5.8 J	13 J	8 J	7.2	8.1 J	5.5
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	**4.7**	0.046	0.027	0.0063 U	0.15	0.066	0.0056 U	0.0065 U	0.017 J	0.0065 U	0.013 J	0.0071 U	0.0084 J	0.0081 J	0.007 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	10 J	14 J	35 J	9.4 J	120 J	22 J	9.6 J	6.3 J	41 J	15 J	60 J	21 J	11	11	10
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.62**	**0.73**	**0.85**	**0.75**	**0.53 J**	**0.82 J**	**0.64 J**	**0.73 J**	**0.51 J**	**0.84 J**	**0.76 J**	**1.5 J**	**0.88**	**0.82 B**	**0.81**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	220 J	100 J	210 J	120 J	**1,700 J**	360 J	67 J	51 J	**430 J**	74 J	200 J	110 J	88	81	46
Total Petroleum Hydrocarbons (TPHs)																						
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NE	2,000	NE	660	210	190	13 U	**3,100 J**	600	260	14 J	**2,800 J**	220	740	1,600	16 J	11 U	11 U
Residual Range Organics	mg/Kg	2,000	NE	2,000	NE	2,000	NE	350	930	760	33 J	**8,300 J**	2,000	670	46 J	**12,000 J**	330	1,100	830	57	21 J	24 J

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NE = Not Established

PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
TPH = Total Petroleum Hydrocarbons

Table 1-4
Rectifier Yard AOC - Plant Interior Transformer Substations RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
September 2016
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				Ecological Indicator				Analytical Results													
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	RYAOC-TP-T7B-0.5 9/20/2016	RYAOC-TP-T7B-2.0 9/20/2016	RYAOC-TP-T8A-0.5 9/19/2016	RYAOC-TP-T8A-2.0 9/19/2016	RYAOC-TP-T40-2.0 (Duplicate of RYAOC-TP-T8A-2.0) 9/19/2016	RYAOC-TP-T8B-0.5 9/19/2016	RYAOC-TP-T8B-2.0 9/19/2016	RYAOC-TP-T9B-0.5 9/21/2016	RYAOC-TP-T9C-0.5 9/21/2016	RYAOC-TP-T10A-0.5 9/19/2016	RYAOC-TP-T10A-2.0 9/19/2016	RYAOC-TP-T13B-0.5 9/19/2016	RYAOC-TP-T13B-2.0 9/19/2016	RYAOC-TP-T42-2.0 (Duplicate of RYAOC-TP-T13B-2.0) 9/19/2016
Aluminum Smelter																					
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	1.9 U	1.9 U	2 U	2 U	1.9 U	2 U	2.1 U	2 U	1.8 U	1.9 U	2.1 U	2 U	1.9 U	2 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	13	2.7	**390 J**	**290 J**	**430 J**	47 J	65 J	**520 J**	**460 J**	**430 J**	**240 J**	81	89	76
Polycyclic Aromatic Hydrocarbons (PAHs)																					
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.016 J	0.00064 U	0.0056	0.0017 J	0.0021 J	0.032	0.0038 J	**0.66**	**0.19**	**0.18**	0.045	**5.4**	**6.7**	**5.8**
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.017 J	0.00045 U	0.0083	0.0028 J	0.0032 J	0.033	0.0044 J	0.61	0.27	0.25	0.061	**8.2**	**9.7**	**8.2**
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.15	0.0039 J	0.053	0.017	0.019	0.54	0.045 J	8.2	2.9	2.3	0.38	53	56	42
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0045 U	0.0005 U	0.0053	0.0022 J	0.0026 J	0.0069	0.0026 J	0.025 U	0.1	0.061	0.015 J	0.4	2 J	3.2 J
Anthracene	mg/Kg	NA	NE	NL	2,300	2300	NE	0.22	0.0073	0.15	0.078	0.099	1.2	0.072 J	19	7.2	3.4	0.64	74	81	54
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	1.4	0.039	0.97	0.37	0.48	2.3	0.62 J	170	51	24	4.6	460	600 J	350 J
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	2	0.056	0.99	0.44	0.55	2	0.78 J	190	63	24	5.1	670	710 J	390 J
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	2.5	0.077	3.7	1.1	1.2	3.3	1.8 J	380	130	46	8.7	820	960	670
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	1.3	0.043	2.1	0.89	0.97	1.8	1 J	160	40	29	6.5	380	410	280
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	1.2	0.031	0.82	0.34	0.42	1.2	0.59 J	110	27	13	3.1	230	260 J	160 J
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	1.7	0.046	2.4	0.7	0.86	2.8	1 J	190	68	35	6.1	450	600 J	380 J
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.38	0.011	0.34	0.1	0.12	0.28	0.15	40	9.1	4.8	0.95	85	91	70
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	2.6	0.066	1.8	0.68	0.91	7.8	1.1 J	330	93	46	7.9	**900**	**1,000**	**700**
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.064	0.0005 U	0.025	0.0092	0.012	0.42	0.018	5.2	1.9	1	0.17	30	33	25
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	1.8	0.049	2.5	0.96	1.1	2.1	1.2 J	220	72	33	7.1	460	700 J	340 J
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.032 J	0.00081 U	0.014	0.0053	0.007	0.14	0.0079	1.1	0.49	0.4	0.078	**13**	**17**	**14**
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.9	0.025	0.38	0.18	0.25	4.5	0.33 J	85	28	15	2.4	330	370	280
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	2.4	0.062	1.8	0.6	0.84	6.2	0.99 J	300	86	40	7	**830**	**930**	650
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	2.745	0.07716	1.847	0.734	0.8906	2.946	1.226	**284**	**92.59**	**36.43**	**7.606**	**880**	**977**	**553**
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	3.999	0.1022	2.4412	0.9762	1.3049	14.6719	1.5837	**450**	**134**	68.591	11.689	**1,414**	**1,575**	**1,132**
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**14.68**	0.414	**15.62**	**5.5**	**6.54**	**21.98**	**8.13**	**1,760**	**546**	**249**	**49.15**	**4,385**	**5,261**	**3,290**
Polychlorinated Biphenyls (PCBs)																					
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.007 U	0.007 U	0.0075 U	0.0074 U	0.0071 U	0.0073 U	0.0073 U	0.027 J	0.00049 U	0.0069 U	0.0073 U	0.0073 UJ	0.0079 UJ	0.0079 UJ
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.004 U	0.0039 U	0.0043 U	0.0042 U	0.004 U	0.0041 U	0.0041 U	0.0034 U	0.0034 U	0.0039 U	0.0041 U	0.0042 U	0.0045 U	0.0045 U
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.0046 U	0.0046 U	0.005 U	0.0049 U	0.0047 U	0.0048 U	0.0048 U	0.0022 U	0.0022 U	0.0046 U	0.0048 U	0.0049 UJ	0.0053 UJ	0.0052 UJ
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.0015 U	0.0015 U	0.0016 U	0.0016 U	0.0015 U	0.0016 U	0.0016 U	0.0021 UJ	0.0021 U	0.0015 U	0.0016 U	0.0016 U	0.0017 U	0.0017 U
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.0027 U	0.0027 U	0.0029 U	0.0029 U	0.0028 U	0.0028 U	0.0028 U	0.0016 UJ	0.0016 U	0.0027 U	0.0029 U	0.0029 UJ	0.0031 UJ	0.0031 UJ
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	0.71	NE	0.0014 U	0.0014 U	0.0015 U	0.0015 U	0.0014 U	0.0015 U	0.0015 U	0.00091 UJ	0.00089 U	0.0014 U	0.0015 U	0.0015 UJ	0.0016 UJ	0.0016 UJ
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	0.2	0.0078 J	0.18	0.0019 UJ	0.43 J	0.016	0.17	0.2 J	0.0013 U	3.1	0.59	0.48 J	0.54 J	0.26 J
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	0.00047 U	0.00047 U	0.00051 U	0.39 J	0.00048 UJ	0.00049 U	0.00049 U	0.0019 UJ	0.0019 U	0.00047 U	0.00049 U	0.0005 U	0.00054 U	0.00053 U
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	0.00085 U	0.00085 U	0.00091 U	0.0009 U	0.00086 U	0.0061 J	0.00088 U	0.0021 UJ	0.0021 UJ	0.00084 U	0.00089 U	0.00089 UJ	0.00097 UJ	0.00096 UJ
Total PCB Aroclor (calc)	mg/Kg	10	66	0.65	NE	0.65	NE	0.2	0.0078	0.18	0.39	0.43	0.0061	0.17	0.027	0.00049 U	**3.1**	0.59	0.48	0.54	0.26
Metals																					
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	6,900	6,500	8,100 J	8,700 J	10,000 J	5,800 J	11,000 J	85,000	47,000	49,000 J	16,000 J	18,000 J	17,000 J	12,000 J
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	3.9	3.8	3.7 J	5.1 J	4.6 J	1 J	4.1 J	**22**	**9.6**	**12 J**	5 J	0.8	1.2 J	0.95 J
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.79 J	0.24 J	**2.6**	**2.4**	**2.4**	**2.6**	**4.5**	**20 J**	**3.2 J**	**5.8**	**1**	0.53 J	**1.4 J**	0.51 J
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	8.3	7.3	9.9 J	11 J	11 J	5.2 J	11 J	**170**	**72**	58 J	12 J	5.9 J	7.7 J	5 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	17	15	28 J	26 J	25 J	22 J	36 J	150	**480**	64 J	63 J	17	20 J	13 J
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	10	5.1 J	8.9 J	6.7 J	8.7 J	2.8 J	11 J	69 J	34 J	**180 J**	14 J	9.2 J	12 J	7.8 J
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.01 J	0.0068 J	0.01 J	0.013 J	0.068 J	0.0056 U	0.018 J	0.097	0.056	0.51	0.044	0.026	0.018 J	0.0086 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	13	10	24 J	24 J	21 J	10 J	21 J	**260**	82	**140 J**	31 J	6.9 J	7.8 J	5.7 J
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.74 B**	**0.8 B**	**0.77**	**0.72**	**0.78**	**0.71**	**0.9**	**2.9**	**1.3**	**1.1**	**0.98**	**0.5 J**	**0.57 J**	**0.42 J**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	90	43	**410 J**	**490 J**	**430 J**	130 J	330 J	**1,200 J**	**670 J**	**710 J**	190 J	140 J	150 J	140 J
Total Petroleum Hydrocarbons (TPHs)																					
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NE	2,000	NE	23 J	10 U	35	15 J	160 J	11 U	32	**2,900**	1,000	1,400	130	**4,400 J**	**4,800 J**	**6,100 J**
Residual Range Organics	mg/Kg	2,000	NE	2,000	NE	2,000	NE	56	11 J	120	100 J	310 J	12 B	120	**11,000**	**4,000**	**2,900**	300	**4,600 J**	**14,000 J**	**8,800 J**

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

mg/Kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NE = Not Established

PAHs = Polycyclic Aromatic Hydrocarbon

PCB = Polychlorinated Biphenyls

SSL = Soil Screening Level

Total TEC = Total Toxicity Equivalent Concentration

TPH = Total Petroleum Hydrocarbons

Table 1-4
Rectifier Yard AOC - Plant Interior Transformer Substations RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
September 2016
(Page 3 of 5)

				Ecological Indicator				Analytical Results															
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	RYAOC-TP-T14A-0.5 9/19/2016	RYAOC-TP-T14A-2.0 9/19/2016	RYAOC-TP-T17A-0.5 9/20/2016	RYAOC-TP-T17A-2.0 9/20/2016	RYAOC-TP-T17B-0.5 9/20/2016	RYAOC-TP-T17B-2.0 9/20/2016	RYAOC-TP-T18A-0.5 9/19/2016	RYAOC-TP-T18B-0.5 9/19/2016	RYAOC-TP-T18C-0.5 9/19/2016	RYAOC-TP-T18C-2.0 9/19/2016	RYAOC-TP-T21A-0.5 9/19/2016	RYAOC-TP-T21A-2.0 9/19/2016	RYAOC-TP-T21B-0.5 9/19/2016	RYAOC-TP-T21B-2.0 9/19/2016	RYAOC-TP-T22A-0.5 9/19/2016	RYAOC-TP-T22A-2.0 9/19/2016
Aluminum Smelter																							
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	2.3 U	2.1 U	1.9 U	1.8 U	1.9 U	2 U	2 U	1.9 U	2 U	2.1 U	1.9 U	2 U	2.1 U	2 U	2 U	2 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	35	37	65	47	67	78	9.7	36	22	5	**150 J**	19 J	80 J	81 J	110 J	110 J
Polycyclic Aromatic Hydrocarbons (PAHs)																							
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.0072 U	0.007 U	**0.1**	0.035	**0.14**	**0.16**	**3.7**	**15**	**1.8**	0.0068 U	0.0026 J	0.0011 J	0.0054 J	0.0019 J	0.0081 J	0.00059 U
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.0052 U	0.0054 J	0.14	0.059	0.2	0.24	**4.7**	**22**	**2.6**	0.0049 U	0.0037 J	0.0014 J	0.0054 J	0.0034 J	0.01 J	0.00042 U
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.0069 U	0.02 J	1.5	0.35	2.2	2.5	78	11	28	0.038 J	0.022	0.0048 J	0.074	0.018	0.087	0.0048
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0058 U	0.0055 U	0.019	0.00053 U	0.031	0.035	3.6	0.76	0.44 J	0.0054 U	0.0015 J	0.00049 U	0.014 J	0.0029 J	0.02 J	0.00046 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2300	NE	0.034 J	0.032 J	1.4	0.44	2.2	3.1	430	270	53	0.076	0.021	0.0069	0.31	0.04	0.33	0.012
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.18	0.19	13	3.3	20	27	3,100	220	290	1	0.18	0.036	1.3	0.36	5.6	0.079
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.2	0.24	15	4.5	26	34	1,300	100	370	0.96	0.23	0.034	1	0.35	2.1	0.07
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.28	0.29	25	9	39	47	2,500	240	430	2.8	0.54	0.075	3.3	1.4	17	0.26
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.13	0.19	14	4.2	24	31	430	72	250	0.95	0.36	0.039	1.8	0.79	4	0.11
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.1	0.14	6.6	1.8	12	15	870	80	170	0.98	0.22	0.03	1.1	0.52	5.1	0.093
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.21	0.21	17	4.9	28	37	2,400	490	280	3	0.51	0.061	3.3	1.1	17	0.26
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.023 J	0.049 J	2.8	0.79	3.8	4.8	100	19	51	0.21	0.061	0.0058	0.24	0.13	0.94	0.017
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.44	0.35	22	7.3	35	44	**18,000**	**1,200**	520	5.3	0.35	0.071	3.2	0.77	11	0.19
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.0058 U	0.012 J	0.53	0.14	0.84	1.1	37	34	13	0.015 J	0.0069	0.0025 J	0.05	0.0077	0.037	0.0023 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.15	0.24	15	4.7	27	34	770	99	320	1.4	0.39	0.043	1.8	0.91	4.8	0.12
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.0092 U	0.0089 U	0.23	0.13	0.36	0.43	**8.8**	**38**	**6.4**	0.0087 U	0.0047	0.0044 J	0.011 J	0.0034 J	0.017 J	0.0014 J
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.1 B	0.11	7.6	2.2	13	16	890	500	190	0.36	0.1	0.034	1	0.16	1.9	0.04
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.5	0.38	20	6.6	32	40	**16,000**	**870**	540	3.3	0.33	0.063	2.8	0.7	8.6	0.16
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	**0.2754**	0.333	**21.41**	**6.508**	**36.46**	**47.15**	**2,058**	**171**	**499**	1.629	0.3742	0.05359	1.807	0.693	**5.614**	0.1295
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.574	0.5294	33.519	10.654	53.971	67.565	**19,456**	**2,091**	**815**	5.789	0.5124	0.1261	4.6698	1.0073	13.4091	0.2505
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**1.773**	**1.929**	**128**	**39.79**	**212**	**270**	**27,470**	**2,190**	**2,701**	**14.6**	**2.821**	0.3868	**16.64**	**6.26**	**65.14**	**1.169**
Polychlorinated Biphenyls (PCBs)																							
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.0086 U	0.0084 U	0.0073 U	0.0075 U	0.0077 U	0.0076 U	0.007 U	0.0068 U	0.0068 UJ	0.0083 U	0.0071 U	0.0069 U	0.0081 U	0.0075 U	0.0065 U	0.0077 UJ
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.0049 UJ	0.0048 UJ	0.0041 UJ	0.0043 UJ	0.0043 UJ	0.0043 UJ	0.004 UJ	0.0039 UJ	0.0038 U	0.0047 UJ	0.004 U	0.0039 U	0.0046 U	0.0042 U	0.0037 U	0.0044 U
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.0057 U	0.0056 U	0.0048 U	0.005 U	0.0051 U	0.005 U	0.0047 U	0.0045 U	0.0045 UJ	0.0055 U	0.0047 U	0.0046 U	0.0053 U	0.0049 U	0.0043 U	0.0051 UJ
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.0019 U	0.0018 U	0.0016 U	0.0016 U	0.0017 U	0.0016 U	0.0015 U	0.0015 U	0.0015 U	0.1	0.0015 U	0.0015 U	0.0017 U	0.0016 U	0.0014 U	0.0017 U
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.0034 U	0.0033 U	0.0029 U	0.003 U	0.003 U	0.003 U	0.0028 U	0.0027 U	0.2 J	0.0033 U	0.0028 U	0.0027 U	0.0032 U	0.0029 U	0.0025 U	0.003 UJ
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	0.71	NE	0.0017 U	0.0017 U	0.0015 U	0.0015 U	0.0016 U	0.0015 U	0.0014 U	0.25	0.0014 UJ	0.0017 U	0.0014 U	0.0014 U	0.0016 U	0.0015 U	0.0013 U	0.0016 UJ
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	0.0022 U	0.0022 U	0.0019 U	0.0019 U	0.002 U	0.0019 U	0.0018 U	0.0018 U	0.08 J	0.0021 U	0.0018 U	0.0018 U	0.0021 U	0.0019 U	0.0017 U	0.002 UJ
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	0.00058 U	0.00057 U	0.00049 U	0.00051 U	0.00052 U	0.00051 U	0.00047 U	0.00046 U	0.00046 U	0.00056 U	0.00048 U	0.00047 U	0.00055 U	0.0005 U	0.00044 U	0.00052 U
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	0.001 U	0.0017 J	0.00089 U	0.00092 U	0.00093 U	0.00092 U	0.099 J	0.093	0.25 J	0.001 U	0.00086 U	0.00084 U	0.00098 U	0.00091 U	0.00079 U	0.00094 UJ
Total PCB Aroclor (calc)	mg/Kg	10	66	0.65	NE	0.65	NE	NE	0.0017	NE	NE	NE	NE	0.099	0.093	0.25	0.1	NE	NE	NE	NE	NE	NE
Metals																							
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	5,900	5,500	11,000 J	8,200 J	11,000 J	18,000 J	11,000	14,000 J	11,000 J	11,000 J	9,300 J	6,000 J	13,000 J	9,100 J	22,000 J	5,600 J
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	0.64	0.63	4	2.3	3.1	5.8	**8**	5.8	7.1	4.6	1.6 J	1.2 J	2.6 J	1.6 J	3.4 J	1.1 J
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.23	0.31	**3.1 J**	0.57 J	**1.3 J**	**2.5 J**	**3.5**	**2.8 J**	**2 J**	0.41 J	0.58	0.29	**4.7**	**0.83**	**2.5**	0.23
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	4.5	3.8	36 J	8.8 J	15 J	23 J	**150**	43 J	50 J	17 J	15 J	9 J	14 J	13 J	24 J	8.9 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	25	23	25 J	20 J	38 J	160 J	87	**320**	51	25	28 J	21 J	31 J	31 J	80 J	16 J
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	1.9	1.9	11	32	8.2	13	53	35 J	17 J	4.2 J	6.9 J	3 J	14 J	6.9 J	13 J	2.6 J
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.0054 UJ	0.0065 UJ	0.12 J	0.062 J	0.088 J	0.088 J	0.25 J	0.12	0.057	0.0065 U	0.0064 U	0.0061 U	0.036	0.0059 U	0.013 J	0.0056 U
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	6.9	6.2	22 J	10 J	16 J	31 J	19	32 J	19 J	11 J	9.5 J	5.7 J	23 J	12 J	33 J	5.3 J
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.92**	**0.73**	**0.82**	**0.89**	**0.83**	**0.83**	**0.43 J**	**0.48 J**	**0.49 J**	**0.48 J**	**0.64**	**0.63**	**0.61**	**0.67**	**0.73**	**0.63**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	340	120	**380 J**	180 J	**380 J**	**690 J**	**630**	**1,800 J**	**840 J**	110 J	120 J	59 J	**790 J**	**760 J**	**760 J**	57 J
Total Petroleum Hydrocarbons (TPHs)																							
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NE	2,000	NE	10 U	19 J	99	69	43	290	**44,000**	**14,000 J**	**2,500**	560	13 J	9.5 U	33	21 J	50	25 J
Residual Range Organics	mg/Kg	2,000	NE	2,000	NE	2,000	NE	30 J	170	280	120	110	800	**43,000**	**22,000 J**	**6,400**	**3,000**	56	14 J	160	53	170	130

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NE = Not Established

PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
TPH = Total Petroleum Hydrocarbons

Table 1-4
Rectifier Yard AOC - Plant Interior Transformer Substations RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
September 2016
(Page 4 of 5)

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results													
				Eco-SSL Wildlife				RYAOC-TP-T22B-0.5 9/19/2016	RYAOC-TP-T41-0.5 (Duplicate of RYAOC-TP-T22B-0.5) 9/19/2016	RYAOC-TP-T22B-2.0 9/19/2016	RYAOC-TP-T25A-0.5 9/20/2016	RYAOC-TP-T25A-2.0 9/20/2016	RYAOC-TP-T25B-0.5 9/20/2016	RYAOC-TP-T25B-2.0 9/20/2016	RYAOC-TP-T44-2.0 (Duplicate of RYAOC-TP-T25B-2.0) 9/20/2016	RYAOC-TP-T26A-0.5 9/20/2016	RYAOC-TP-T26A-2.0 9/20/2016	RYAOC-TP-T26B-0.5 9/20/2016	RYAOC-TP-T26B-2.0 9/20/2016	RYAOC-TP-T27A-0.5 9/20/2016	RYAOC-TP-T27A-2.0 9/20/2016
Aluminum Smelter																					
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	2.3 U	2 U	2 U	2 U	1.9 U	1.8 U	2.1 U	2.1 U	2 U	1.9 U	1.9 U	1.9 U	1.8 U	1.8 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	**280 J**	**250**	99 J	5.4	3.6	5.2	3.5	3.2	41	47	48	34	100	85
Polycyclic Aromatic Hydrocarbons (PAHs)																					
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.058	0.044	0.003 J	0.0033 U	0.0034 U	0.0032 U	0.0007 U	0.00069 U	0.064	0.06	0.024	0.065	**0.41**	**0.094**
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.066	0.052	0.0046 J	0.0024 U	0.0024 U	0.0023 U	0.0005 U	0.00049 U	0.086	0.087	0.032	0.09	0.59	0.13
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.49	0.41	0.025	0.025 J	0.0032 U	0.0031 U	0.00066 U	0.0023 J	0.96	0.85	0.31	0.74	2.8	0.92
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.069 J	0.039 J	0.0052	0.0026 U	0.0027 U	0.0026 U	0.00055 U	0.00055 U	0.016	0.015	0.0064	0.013	0.037	0.015
Anthracene	mg/Kg	NA	NE	NL	2,300	2300	NE	1	0.74	0.064	0.038	0.046	0.016 J	0.00066 U	0.0051 J	0.88	0.76	0.3	0.69	3	0.94
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	8	6.2	0.57	0.3	0.18	0.081	0.012 J	0.023 J	8.3	6.7	2.5	7.3	21	8.9
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	6.9	5.6	0.39	0.5	0.27	0.14	0.016	0.031	10	8.6	3.1	9.1	23	11
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	21	17	1.6	0.68	0.29	0.16	0.027	0.039	17	13	4.9	13	35	15
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	10	7.8	0.6	0.37	0.17	0.093	0.012 J	0.021 J	10	4.9	2.4	4.5	19	4
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	8 J	4.5 J	0.5	0.28	0.16	0.087	0.01	0.025	4.1	3.9	1.6	3.7	9.4	4.4
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	24	18	2	0.41	0.24	0.14	0.018 J	0.033 J	11	9.2	3.2	9.9	28	12
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	1.8	1.4	0.1	0.07	0.033	0.018 J	0.0029 J	0.0037 J	1.4	1.2	0.54	1.2	3.2	1.1
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	19	14	1.3	0.53	0.34	0.16	0.022 J	0.047 J	15	12	4.4	13	41	16
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.24	0.19	0.013	0.0026 U	0.0027 U	0.0026 U	0.00055 U	0.00055 U	0.32	0.28	0.11	0.27	1.4	0.4
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	13	9.4	0.74	0.45	0.19	0.11	0.014 J	0.027 J	12	9.2	2.9	10	22	10
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.11	0.075	0.007	0.0042 U	0.0043 U	0.0041 U	0.00089 U	0.00088 U	0.14	0.14	0.045	0.14	0.59	0.16
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	4.7	3.5	0.22	0.16	0.14	0.057	0.0095 J	0.017 J	4.7	3.9	1.5	3.7	17	5.9
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	16	12	1.1	0.51	0.34	0.17	0.022 J	0.045 J	14	11	3.8	11	35	14
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	**12.32**	**9.63**	0.761	0.6821	0.3577	0.187	0.02277	0.0431	**14.39**	**12.092**	**4.376**	**12.719**	**32.34**	**15.06**
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	25.733	19.05	1.6418	0.753	0.526	0.233	0.0315	0.0714	22.166	18.092	6.7274	18.708	66.827	24.559
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**109**	**81.9**	**7.6**	**3.57**	**1.873**	0.999	0.1339	0.2477	**87.8**	**67.7**	**24.94**	**69.7**	**196**	**80.4**
Polychlorinated Biphenyls (PCBs)																					
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.008 UJ	0.0073 UJ	0.0074 UJ	0.0071 U	0.0074 U	0.0077 U	0.0085 U	0.0084 UJ	0.0076 U	0.0062 U	0.0076 U	0.0076 U	0.0069 U	0.007 U
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.0045 U	0.0041 U	0.0042 U	0.004 U	0.0042 U	0.0044 U	0.0048 U	0.0048 U	0.0043 UJ	0.0035 UJ	0.0043 UJ	0.0043 UJ	0.0039 UJ	0.004 UJ
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.0053 UJ	0.0048 UJ	0.0049 UJ	0.0047 U	0.0049 U	0.0051 U	0.0056 U	0.0056 UJ	0.005 U	0.0041 U	0.005 U	0.005 U	0.0046 U	0.0047 U
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.0017 U	0.0016 U	0.0016 U	0.0015 U	0.0016 U	0.0017 U	0.0018 U	0.0018 UJ	0.0016 U	0.0013 U	0.0016 U	0.0016 U	0.0015 U	0.0015 U
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.0031 UJ	0.0029 UJ	0.0029 UJ	0.0028 U	0.0029 U	0.003 U	0.0033 U	0.0033 UJ	0.003 U	0.0024 U	0.003 U	0.003 U	0.0027 U	0.0028 U
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	0.71	NE	0.0016 UJ	0.0015 UJ	0.0015 UJ	0.0014 U	0.0015 U	0.0016 U	0.0017 U	0.0017 UJ	0.0015 U	0.0013 U	0.0015 U	0.0015 U	0.0014 U	0.0014 U
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	0.002 UJ	0.0019 UJ	0.0019 UJ	0.0018 U	0.0019 U	0.002 U	0.0022 U	0.0022 UJ	0.0019 U	0.0016 U	0.0019 U	0.002 U	0.0018 U	0.0018 U
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	0.00054 U	0.00049 U	0.0005 U	0.00048 U	0.0005 U	0.00052 U	0.00057 U	0.00057 UJ	0.00051 U	0.00042 U	0.00051 U	0.00051 U	0.00047 U	0.00047 U
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	0.0041 J	0.0018 J	0.0016 J	0.00086 U	0.00089 U	0.00093 U	0.001 U	0.001 UJ	0.00092 U	0.00075 U	0.00092 U	0.00092 U	0.00084 U	0.00085 U
Total PCB Aroclor (calc)	mg/Kg	10	66	0.65	NE	0.65	NE	0.0041	0.0018	0.0016	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Metals																					
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	54,000 J	45,000 J	7,500 J	4,300 J	3,800 J	3,600 J	8,600 J	7,600 J	12,000 J	8,200 J	6,700 J	6,500 J	14,000 J	7,500 J
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	**8.6 J**	5.4 J	1.8	0.72	0.83	0.58	1.9	1.9	3.7	2.7	2.1	2.2	3.8	3.2
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	**3.8 J**	**5.6 J**	0.67 J	**2 J**	0.21 J	0.43 J	0.34 J	0.35 J	**6.1 J**	**2.1 J**	**1.8 J**	**2.3 J**	**1.2 J**	0.59 J
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	59 J	42 J	13 J	7.7 J	3.2 J	3.5 J	6.5 J	5.5 J	25 J	18 J	9.5 J	14 J	13 J	6.2 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	**280 J**	**220 J**	21	20 J	13 J	19 J	20 J	19 J	29 J	25 J	19 J	19 J	28 J	16 J
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	34 J	28 J	4.3 J	8.4 J	2.4 J	1.9 J	4.3 J	3.6 J	12	8.4	5.4	8.4 J	9.5 J	4.7 J
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.057 J	0.034 J	0.006 U	0.0052 U	0.0055 J	0.0056 U	0.0092 J	0.0077 J	0.094 J	0.11 J	0.048 J	0.073 J	0.041 J	0.011 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	88 J	67 J	10 J	6 J	4.6 J	5 J	7.6 J	6.4 J	21 J	15 J	12 J	11 J	21 J	13 J
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.79 J**	**0.71 J**	**0.62 J**	**0.93**	**0.61**	**0.84**	**1**	**0.85**	**0.97**	**0.84**	**0.84**	**0.74**	**0.82**	**0.74**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	**1,300 J**	**910 J**	99 J	**450 J**	40 J	110 J	56 J	46 J	**1,100 J**	**1,100 J**	**1,100 J**	**1,400 J**	240 J	97 J
Total Petroleum Hydrocarbons (TPHs)																					
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NE	2,000	NE	150	170	16 J	27	11 U	12 J	11 U	13 U	92	38	140	100	270	150
Residual Range Organics	mg/Kg	2,000	NE	2,000	NE	2,000	NE	720	950	68	370	55	97	8.9 U	10 U	240	100	440	440	780	430

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NE = Not Established

PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
TPH = Total Petroleum Hydrocarbons

Table 1-4
Rectifier Yard AOC - Plant Interior Transformer Substations RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
September 2016
(Page 5 of 5)

				Ecological Indicator				Analytical Results								
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	RYAOC-TP-T27B-0.5 9/20/2016	RYAOC-TP-T27B-2.0 9/20/2016	RYAOC-TP-T27C-0.5 9/20/2016	RYAOC-TP-T27C-2.0 9/20/2016	RYAOC-TP-T50-0.5 9/20/2016	RYAOC-TP-T50-2.0 9/20/2016	RYAOC-TP-T51-0.5 9/20/2016	RYAOC-TP-T43-0.5 (Duplicate of RYAOC-TP-T51-0.5) 9/20/2016	RYAOC-TP-T51-2.0 9/20/2016
Aluminum Smelter																
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	2 U	2 U	1.9 U	2 U	2 U	1.9 U	1.8 U	1.8 U	1.9 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	80	43	25	42	28	33	20	22	42
Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.045	0.017	0.061	0.035	0.024	0.069	**0.99**	**0.79**	0.039
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.053	0.022	0.086 J	0.035	0.029	0.089	1.4	1.1	0.048
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.47	0.19	0.72 J	0.26	0.33	0.68	15	13	0.5
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.012	0.0032 J	0.007	0.017 J	0.0024 U	0.0025 U	0.13	0.13	0.0024 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2300	NE	0.76	0.26	0.76 J	0.52	0.62	1.3	15	13	0.78
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	6.6	2.5	6.7	2.9	4.4	8.2	110	90	5.1
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	8.7	3	8.3	4.8	6.6	11	180	160	7
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	15	4.5	11	6.5	9.5	16	250	220	9.9
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	8.1	1.8	3.7 J	4.2	4.4	7.8	150	140	5.3
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	3.2	1.3	2.8 J	2.4	3.1	5.2	84	73	3.3
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	12	3	8.5	3.9	5.2	9.1	130	110	5.6
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	1.1	0.43	0.95 J	0.64	0.91	1.6	23	22	0.98
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	14	3.8	12	5.8	7.4	14	210	180	8.6
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.23	0.1	0.31 J	0.14	0.15	0.34	6.4	5.3	0.23
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	9.4	2.4	4.5	5.1	6.3	11	200	180	7.3
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.067	0.031	0.13 J	0.056	0.053	0.16	2.4	1.8	0.085
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	3.6	1.3	3.9	2.1	2.6	5.1	73	60	3.1
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	12	3.4	10	5.3	6.8	13	190	170	7.8
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	**12.35**	**4.143**	**10.98**	**6.593**	**9.073**	**15.291**	**248**	**220**	**9.714**
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	19.237	5.7232	17.974	8.963	11.206	21.738	**324**	**275**	13.382
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**76.1**	**22.33**	**56.45**	**35.74**	**47.21**	**82.9**	**1,317**	**1,165**	**52.28**
Polychlorinated Biphenyls (PCBs)																
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.0071 U	0.0074 U	0.0064 U	0.0069 U	0.007 U	0.0067 U	0.007 U	0.0073 U	0.0078 U
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.004 UJ	0.0042 UJ	0.0036 UJ	0.0039 UJ	0.004 UJ	0.0038 UJ	0.004 UJ	0.0041 UJ	0.0044 UJ
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.0047 U	0.0049 U	0.0042 U	0.0046 U	0.0046 U	0.0044 U	0.0046 U	0.0048 U	0.0051 U
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.0015 U	0.0016 U	0.0014 U	0.0015 U	0.0015 U	0.0014 U	0.0015 U	0.0016 U	0.0017 U
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.0028 U	0.0029 U	0.0025 U	0.0027 U	0.0027 U	0.0026 U	0.0027 U	0.0028 U	0.003 U
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	0.71	NE	0.0014 U	0.0015 U	0.0013 UJ	0.0014 UJ	0.0014 UJ	0.0014 UJ	0.0014 UJ	0.0015 UJ	0.0016 UJ
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	0.0018 U	0.0019 U	0.0016 UJ	0.0018 UJ	0.0018 UJ	0.013 J	0.68 J	0.56 J	0.061 J
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	0.00048 U	0.0005 U	0.00043 UJ	0.00047 UJ	0.00047 UJ	0.00045 UJ	0.00047 UJ	0.00049 UJ	0.00052 UJ
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	0.00086 U	0.00089 U	0.00078 UJ	0.00084 UJ	0.00085 UJ	0.00081 UJ	0.00085 UJ	0.00088 UJ	0.00094 UJ
Total PCB Aroclor (calc)	mg/Kg	10	66	0.65	NE	0.65	NE	NE	NE	NE	NE	NE	0.013	**0.68**	0.56	0.061
Metals																
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	9,300 J	4,400 J	6,900 J	7,200 J	16,000 J	7,900 J	42,000 J	38,000 J	9,000 J
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	3.3	1.9	2.3	2.6	2.3	1.4	2.5	2.7	2.4
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.81 J	0.23 J	0.52 J	0.61 J	**1.5 J**	**0.84 J**	**3 J**	**7.5 J**	0.5 J
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	9.2 J	5 J	9.3 J	9.1 J	16 J	7.4 J	33 J	28 J	10 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	37 J	14 J	16 J	18 J	44 J	28 J	49 J	61 J	19 J
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	5.8 J	3.3 J	4.6 J	5.8 J	17 J	7.6 J	57 J	49 J	12 J
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.13 J	0.018 J	0.093 J	0.14 J	0.035	0.038	0.052 J	0.061 J	0.037 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	25 J	7.8 J	12 J	12 J	18 J	8.9 J	34 J	34 J	9.5 J
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.86**	**0.73**	**0.71**	**0.78**	**0.9**	**0.75**	**0.52**	**0.57**	**0.63**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	330 J	40 J	100 J	99 J	210 J	97 J	**510 J**	**500 J**	99 J
Total Petroleum Hydrocarbons (TPHs)																
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NE	2,000	NE	98	50	85	140	110	50	1,400	1,700	39
Residual Range Organics	mg/Kg	2,000	NE	2,000	NE	2,000	NE	320	150	270	350	330	160 J	**5,000**	**5,800**	110

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

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CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NE = Not Established

PAHs = Polycyclic Aromatic Hydrocarbon
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SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
TPH = Total Petroleum Hydrocarbons

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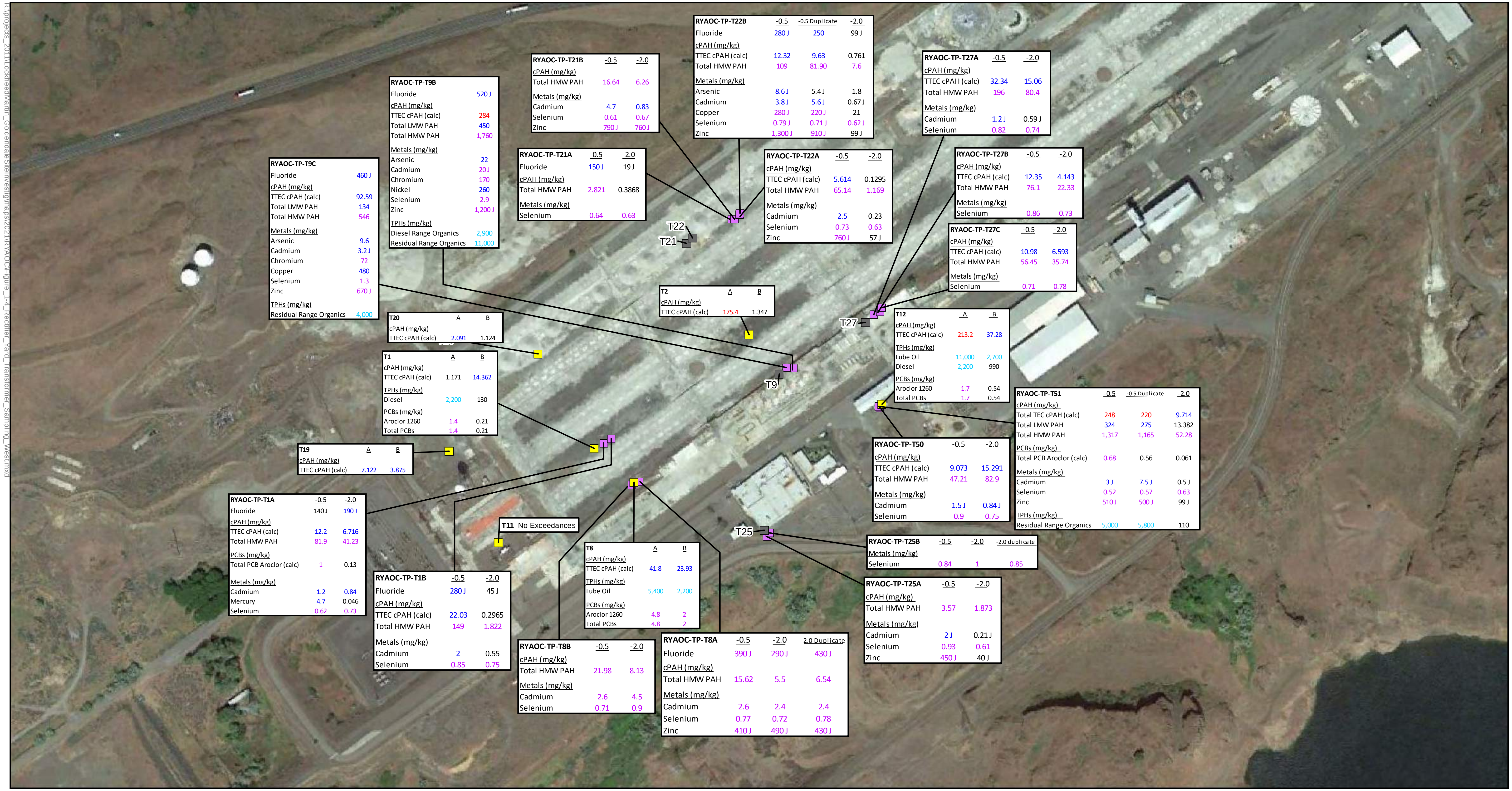

RYAOC-TP-T9C	
Fluoride	460 J
cPAH (mg/kg)	
TTEC cPAH (calc)	92.59
Total LMW PAH	134
Total HMW PAH	546
Metals (mg/kg)	
Arsenic	9.6
Cadmium	3.2 J
Chromium	72
Copper	480
Selenium	1.3
Zinc	670 J
TPHs (mg/kg)	
Residual Range Organics	4,000

RYAOC-TP-T9B	
Fluoride	520 J
cPAH (mg/kg)	
TTEC cPAH (calc)	284
Total LMW PAH	450
Total HMW PAH	1,760
Metals (mg/kg)	
Arsenic	22
Cadmium	20 J
Chromium	170
Nickel	260
Selenium	2.9
Zinc	1,200 J
TPHs (mg/kg)	
Diesel Range Organics	2,900
Residual Range Organics	11,000

RYAOC-TP-T21B	-0.5	-2.0
cPAH (mg/kg)		
Total HMW PAH	16.64	6.26
Metals (mg/kg)		
Cadmium	4.7	0.83
Selenium	0.61	0.67
Zinc	790 J	760 J

RYAOC-TP-T21A	-0.5	-2.0
Fluoride	150 J	19 J
cPAH (mg/kg)		
Total HMW PAH	2.821	0.3868
Metals (mg/kg)		
Selenium	0.64	0.63

RYAOC-TP-T22B	-0.5	-0.5 Duplicate	-2.0
Fluoride	280 J	250	99 J
cPAH (mg/kg)			
TTEC cPAH (calc)	12.32	9.63	0.761
Total HMW PAH	109	81.90	7.6
Metals (mg/kg)			
Arsenic	8.6 J	5.4 J	1.8
Cadmium	3.8 J	5.6 J	0.67 J
Copper	280 J	220 J	21
Selenium	0.79 J	0.71 J	0.62 J
Zinc	1,300 J	910 J	99 J

RYAOC-TP-T22A	-0.5	-2.0
cPAH (mg/kg)		
TTEC cPAH (calc)	5.614	0.1295
Total HMW PAH	65.14	1.169
Metals (mg/kg)		
Cadmium	2.5	0.23
Selenium	0.73	0.63
Zinc	760 J	57 J

RYAOC-TP-T27A	-0.5	-2.0
cPAH (mg/kg)		
TTEC cPAH (calc)	32.34	15.06
Total HMW PAH	196	80.4
Metals (mg/kg)		
Cadmium	1.2 J	0.59 J
Selenium	0.82	0.74

RYAOC-TP-T27B	-0.5	-2.0
cPAH (mg/kg)		
TTEC cPAH (calc)	12.35	4.143
Total HMW PAH	76.1	22.33
Metals (mg/kg)		
Selenium	0.86	0.73

RYAOC-TP-T27C	-0.5	-2.0
cPAH (mg/kg)		
TTEC cPAH (calc)	10.98	6.593
Total HMW PAH	56.45	35.74
Metals (mg/kg)		
Selenium	0.71	0.78

T2	A	B
cPAH (mg/kg)		
TTEC cPAH (calc)	175.4	1.347

T20	A	B
cPAH (mg/kg)		
TTEC cPAH (calc)	2.091	1.124

T1	A	B
cPAH (mg/kg)		
TTEC cPAH (calc)	1.171	14.362
TPHs (mg/kg)		
Diesel	2,200	130
PCBs (mg/kg)		
Aroclor 1260	1.4	0.21
Total PCBs	1.4	0.21

T12	A	B
cPAH (mg/kg)		
TTEC cPAH (calc)	213.2	37.28
TPHs (mg/kg)		
Lube Oil	11,000	2,700
Diesel	2,200	990
PCBs (mg/kg)		
Aroclor 1260	1.7	0.54
Total PCBs	1.7	0.54

RYAOC-TP-T51	-0.5	-0.5 Duplicate	-2.0
cPAH (mg/kg)			
Total TEC cPAH (calc)	248	220	9.714
Total LMW PAH	324	275	13.382
Total HMW PAH	1,317	1,165	52.28
PCBs (mg/kg)			
Total PCB Aroclor (calc)	0.68	0.56	0.061
Metals (mg/kg)			
Cadmium	3 J	7.5 J	0.5 J
Selenium	0.52	0.57	0.63
Zinc	510 J	500 J	99 J
TPHs (mg/kg)			
Residual Range Organics	5,000	5,800	110

T19	A	B
cPAH (mg/kg)		
TTEC cPAH (calc)	7.122	3.875

RYAOC-TP-T50	-0.5	-2.0
cPAH (mg/kg)		
TTEC cPAH (calc)	9.073	15.291
Total HMW PAH	47.21	82.9
Metals (mg/kg)		
Cadmium	1.5 J	0.84 J
Selenium	0.9	0.75

RYAOC-TP-T1A	-0.5	-2.0
Fluoride	140 J	190 J
cPAH (mg/kg)		
TTEC cPAH (calc)	12.2	6.716
Total HMW PAH	81.9	41.23
PCBs (mg/kg)		
Total PCB Aroclor (calc)	1	0.13
Metals (mg/kg)		
Cadmium	1.2	0.84
Mercury	4.7	0.046
Selenium	0.62	0.73

RYAOC-TP-T25B	-0.5	-2.0	-2.0 duplicate
Metals (mg/kg)			
Selenium	0.84	1	0.85

T8	A	B
cPAH (mg/kg)		
TTEC cPAH (calc)	41.8	23.93
TPHs (mg/kg)		
Lube Oil	5,400	2,200
PCBs (mg/kg)		
Aroclor 1260	4.8	2
Total PCBs	4.8	2

RYAOC-TP-T1B	-0.5	-2.0
Fluoride	280 J	45 J
cPAH (mg/kg)		
TTEC cPAH (calc)	22.03	0.2965
Total HMW PAH	149	1.822
Metals (mg/kg)		
Cadmium	2	0.55
Selenium	0.85	0.75

RYAOC-TP-T25A	-0.5	-2.0
cPAH (mg/kg)		
Total HMW PAH	3.57	1.873
Metals (mg/kg)		
Cadmium	2 J	0.21 J
Selenium	0.93	0.61
Zinc	450 J	40 J

RYAOC-TP-T8B	-0.5	-2.0
cPAH (mg/kg)		
Total HMW PAH	21.98	8.13
Metals (mg/kg)		
Cadmium	2.6	4.5
Selenium	0.71	0.9

RYAOC-TP-T8A	-0.5	-2.0	-2.0 Duplicate
Fluoride	390 J	290 J	430 J
cPAH (mg/kg)			
Total HMW PAH	15.62	5.5	6.54
Metals (mg/kg)			
Cadmium	2.6	2.4	2.4
Selenium	0.77	0.72	0.78
Zinc	410 J	490 J	430 J

Legend

Remedial Investigation

🟪 Test Pit Location

Previous Investigation Soil Samples (PGG 2012b)

🟨 Sampled

⬛ Not Sampled (Inaccessible or No Soil)

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
TPH = Total Petroleum Hydrocarbons
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N
W E
S

0 100 200 400
Feet

Figure 1-4
Rectifier Yard AOC
Plant Interior Transformer Substations
RI and Historical Soil Sample Locations and Results Above Screening Levels, Western Area

Rectifier Yard Area of Concern
Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

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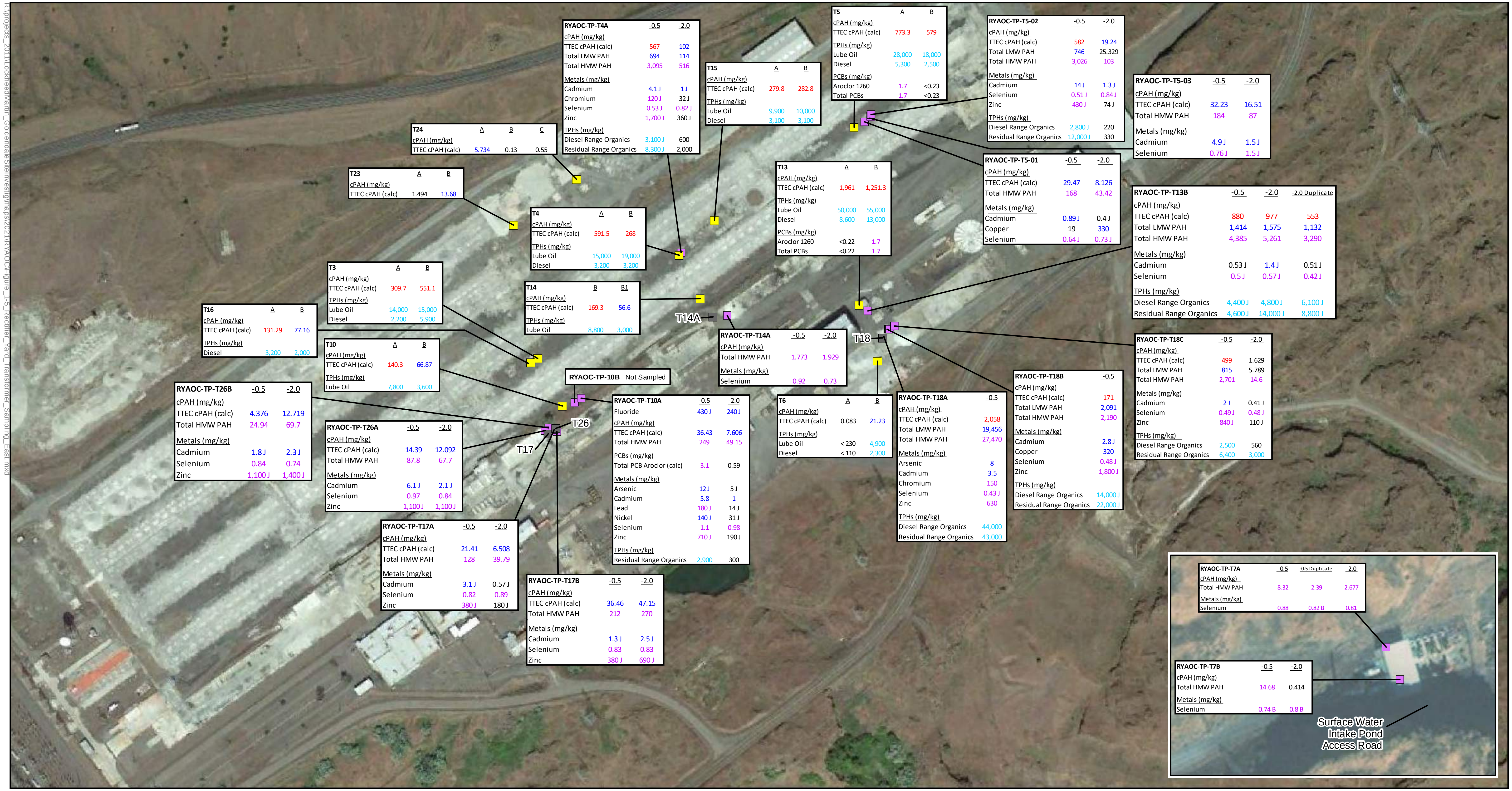


RYAOC-TP-T4A	-0.5	-2.0
cPAH (mg/kg)		
TTEC cPAH (calc)	567	102
Total LMW PAH	694	114
Total HMW PAH	3,095	516
Metals (mg/kg)		
Cadmium	4.1 J	1 J
Chromium	120 J	32 J
Selenium	0.53 J	0.82 J
Zinc	1,700 J	360 J
TPHs (mg/kg)		
Diesel Range Organics	3,100 J	600
Residual Range Organics	8,300 J	2,000

T24	A	B	C
cPAH (mg/kg)			
TTEC cPAH (calc)	5.734	0.13	0.55

T23	A	B
cPAH (mg/kg)		
TTEC cPAH (calc)	1.494	13.68

T4	A	B
cPAH (mg/kg)		
TTEC cPAH (calc)	591.5	268
TPHs (mg/kg)		
Lube Oil	15,000	19,000
Diesel	3,200	3,200

T3	A	B
cPAH (mg/kg)		
TTEC cPAH (calc)	309.7	551.1
TPHs (mg/kg)		
Lube Oil	14,000	15,000
Diesel	2,200	5,900

T16	A	B
cPAH (mg/kg)		
TTEC cPAH (calc)	131.29	77.16
TPHs (mg/kg)		
Diesel	3,200	2,000

T14	B	B1
cPAH (mg/kg)		
TTEC cPAH (calc)	169.3	56.6
TPHs (mg/kg)		
Lube Oil	8,800	3,000

T10	A	B
cPAH (mg/kg)		
TTEC cPAH (calc)	140.3	66.87
TPHs (mg/kg)		
Lube Oil	7,800	3,600

T15	A	B
cPAH (mg/kg)		
TTEC cPAH (calc)	279.8	282.8
TPHs (mg/kg)		
Lube Oil	9,900	10,000
Diesel	3,100	3,100

T5	A	B
cPAH (mg/kg)		
TTEC cPAH (calc)	773.3	579
TPHs (mg/kg)		
Lube Oil	28,000	18,000
Diesel	5,300	2,500
PCBs (mg/kg)		
Aroclor 1260	1.7	<0.23
Total PCBs	1.7	<0.23

T13	A	B
cPAH (mg/kg)		
TTEC cPAH (calc)	1,961	1,251.3
TPHs (mg/kg)		
Lube Oil	50,000	55,000
Diesel	8,600	13,000
PCBs (mg/kg)		
Aroclor 1260	<0.22	1.7
Total PCBs	<0.22	1.7

RYAOC-TP-T5-02	-0.5	-2.0
cPAH (mg/kg)		
TTEC cPAH (calc)	582	19.24
Total LMW PAH	746	25.329
Total HMW PAH	3,026	103
Metals (mg/kg)		
Cadmium	14 J	1.3 J
Selenium	0.51 J	0.84 J
Zinc	430 J	74 J
TPHs (mg/kg)		
Diesel Range Organics	2,800 J	220
Residual Range Organics	12,000 J	330

RYAOC-TP-T5-01	-0.5	-2.0
cPAH (mg/kg)		
TTEC cPAH (calc)	29.47	8.126
Total HMW PAH	168	43.42
Metals (mg/kg)		
Cadmium	0.89 J	0.4 J
Copper	19	330
Selenium	0.64 J	0.73 J

RYAOC-TP-T5-03	-0.5	-2.0
cPAH (mg/kg)		
TTEC cPAH (calc)	32.23	16.51
Total HMW PAH	184	87
Metals (mg/kg)		
Cadmium	4.9 J	1.5 J
Selenium	0.76 J	1.5 J

RYAOC-TP-T13B	-0.5	-2.0	-2.0 Duplicate
cPAH (mg/kg)			
TTEC cPAH (calc)	880	977	553
Total LMW PAH	1,414	1,575	1,132
Total HMW PAH	4,385	5,261	3,290
Metals (mg/kg)			
Cadmium	0.53 J	1.4 J	0.51 J
Selenium	0.5 J	0.57 J	0.42 J
TPHs (mg/kg)			
Diesel Range Organics	4,400 J	4,800 J	6,100 J
Residual Range Organics	4,600 J	14,000 J	8,800 J

RYAOC-TP-10B Not Sampled

RYAOC-TP-T26B	-0.5	-2.0
cPAH (mg/kg)		
TTEC cPAH (calc)	4.376	12.719
Total HMW PAH	24.94	69.7
Metals (mg/kg)		
Cadmium	1.8 J	2.3 J
Selenium	0.84	0.74
Zinc	1,100 J	1,400 J

RYAOC-TP-T26A	-0.5	-2.0
cPAH (mg/kg)		
TTEC cPAH (calc)	14.39	12.092
Total HMW PAH	87.8	67.7
Metals (mg/kg)		
Cadmium	6.1 J	2.1 J
Selenium	0.97	0.84
Zinc	1,100 J	1,100 J

RYAOC-TP-T17A	-0.5	-2.0
cPAH (mg/kg)		
TTEC cPAH (calc)	21.41	6.508
Total HMW PAH	128	39.79
Metals (mg/kg)		
Cadmium	3.1 J	0.57 J
Selenium	0.82	0.89
Zinc	380 J	180 J

RYAOC-TP-T17B	-0.5	-2.0
cPAH (mg/kg)		
TTEC cPAH (calc)	36.46	47.15
Total HMW PAH	212	270
Metals (mg/kg)		
Cadmium	1.3 J	2.5 J
Selenium	0.83	0.83
Zinc	380 J	690 J

RYAOC-TP-T10A	-0.5	-2.0
Fluoride	430 J	240 J
cPAH (mg/kg)		
TTEC cPAH (calc)	36.43	7.606
Total HMW PAH	249	49.15
PCBs (mg/kg)		
Total PCB Aroclor (calc)	3.1	0.59
Metals (mg/kg)		
Arsenic	12 J	5 J
Cadmium	5.8	1
Lead	180 J	14 J
Nickel	140 J	31 J
Selenium	1.1	0.98
Zinc	710 J	190 J
TPHs (mg/kg)		
Residual Range Organics	2,900	300

RYAOC-TP-T14A	-0.5	-2.0
cPAH (mg/kg)		
Total HMW PAH	1.773	1.929
Metals (mg/kg)		
Selenium	0.92	0.73

T6	A	B
cPAH (mg/kg)		
TTEC cPAH (calc)	0.083	21.23
TPHs (mg/kg)		
Lube Oil	< 230	4,900
Diesel	< 110	2,300

RYAOC-TP-T18A	-0.5
cPAH (mg/kg)	
TTEC cPAH (calc)	2,058
Total LMW PAH	19,456
Total HMW PAH	27,470
Metals (mg/kg)	
Arsenic	8
Cadmium	3.5
Chromium	150
Selenium	0.43 J
Zinc	630
TPHs (mg/kg)	
Diesel Range Organics	44,000
Residual Range Organics	43,000

RYAOC-TP-T18B	-0.5
cPAH (mg/kg)	
TTEC cPAH (calc)	171
Total LMW PAH	2,091
Total HMW PAH	2,190
Metals (mg/kg)	
Cadmium	2.8 J
Copper	320
Selenium	0.48 J
Zinc	1,800 J
TPHs (mg/kg)	
Diesel Range Organics	14,000 J
Residual Range Organics	22,000 J

RYAOC-TP-T18C	-0.5	-2.0
cPAH (mg/kg)		
TTEC cPAH (calc)	499	1.629
Total LMW PAH	815	5.789
Total HMW PAH	2,701	14.6
Metals (mg/kg)		
Cadmium	2 J	0.41 J
Selenium	0.49 J	0.48 J
Zinc	840 J	110 J
TPHs (mg/kg)		
Diesel Range Organics	2,500	560
Residual Range Organics	6,400	3,000

RYAOC-TP-T7A	-0.5	-0.5 Duplicate	-2.0
cPAH (mg/kg)			
Total HMW PAH	8.32	2.39	2.677
Metals (mg/kg)			
Selenium	0.88	0.82 B	0.81

RYAOC-TP-T7B	-0.5	-2.0
cPAH (mg/kg)		
Total HMW PAH	14.68	0.414
Metals (mg/kg)		
Selenium	0.74 B	0.8 B

Legend

Remedial Investigation

🟪 Test Pit Location

Previous Investigation Soil Samples (PGG 2012b)

🟨 Sampled

■ Not Sampled (Inaccessible or No Soil)

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
TPH = Total Petroleum Hydrocarbons
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N
W E
S

0 100 200 400
Feet

Figure 1-5
Rectifier Yard AOC
Plant Interior Transformer Substations
RI and Historical Soil Sample Locations and
Results Above Screening Levels, Eastern Area

Rectifier Yard Area of Concern
Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

- Total PCBs did not exceed the MTCA Method C Industrial screening level of 66 mg/kg. or the MTCA Method A Industrial soil screening level of 10 mg/kg. Total PCBs (maximum of 3.1 mg/kg in RYAOC-TP-T10A-0.5) exceeded the MTCA terrestrial ecologic soil screening level for protection of wildlife of 0.65 mg/kg in three of 68 samples.

- For metals, arsenic (maximum of 22 mg/kg), cadmium (maximum of 20 J mg/kg), chromium (320 mg/kg), copper (maximum of 480 mg/kg), mercury (maximum of 4.7 mg/kg), nickel (maximum of 260 mg/kg), and zinc (maximum of 1,800 J mg/kg) were detected in soils above screening levels for protection of groundwater and/or terrestrial ecological screening levels for wildlife protection as well as background concentrations. Selenium (maximum of 2.9 mg/kg) slightly exceeded the terrestrial ecologic soil screening level for wildlife protection of 0.3 mg/kg and background concentrations in all 68 samples.

- Diesel-range organics and/or residual-range organics were detected above the MTCA Method A industrial soil screening level of 2,000 mg/kg in 14 of 68 samples. Further investigation of the lateral and vertical extent of petroleum hydrocarbon contamination in soils was performed as part of the WPA Courtyards investigation and is summarized in Section 2.3.

- Soil samples collected near Transformer 5 (the site of a spill and small-scale removal action during plant demolition activities, see Figure 1-5) contained elevated levels of PAHs above MTCA Method C Industrial screening levels. PCB concentrations were below MTCA Method A and C Industrial screening levels. One of the Transformer 5 soil samples (RYAOC-TP-T5-02-0.5) also contained diesel-range organics (2,800 J mg/kg) and residual-range organics (12,000 mg/kg) above MTCA Method A Industrial screening level of 2,000 mg/kg. Additional samples were collected in this area as part of the WPA Courtyards investigation and the results are summarized in Section 2.3.

1.3.6 Catch Basin and Basement Trench Sump

Solids sampled from two catch basins and three trench sumps were collected as specified in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The catch basin on the south side of the Oil House (RYAOC-SD02) and one of the trenches in the Rectifier Building basement (RYAOC-SD03) contained water. All of these structures appeared to be lined with concrete and contained 2- to 10-inches accumulation of solids/sludge. The Rectifier Building Basement trenches were reportedly located beneath large fans used for cooling of air in the Rectifier Building. It is currently unclear how these catch basins and trench sumps specifically connect with the industrial line and/or stormwater system at the site, but it appears likely that they are routed to the pump station located southeast of the Rectifier Building (Figures 1-1 and 1-3).

A strong chemical odor was noted at the catch basin south of the Oil House (RYAOC-SD02) and an elevated total organic vapor reading of 719 ppm was detected within the catch basin using a photoionization detector (PID) instrument.

The solids analytical results are summarized in Table 1-5. Sample locations and exceedances of associated soil screening levels are shown on Figures 1-1 and 1-3.

Analytical results for the solids samples are summarized as follows:

- None of the sample results exceeded the MTCA Method C Industrial screening level of 130 mg/kg TTEC. Results for three of the 6 samples (maximum of 14.152 mg/kg TTEC) exceeded the 3.9 mg/kg MTCA-derived soil screening level for protection of groundwater express as cPAH TTEC. All 6 of the samples also exceeded terrestrial ecologic soil screening levels for wildlife protection of 1.1 mg/kg expressed as total HMW PAH.
- The maximum detected concentration of PCBs (18 J mg/kg, Aroclor 1254, RYAOC-SD-03) represents the highest PCB concentration detected at the site. The MTCA Method C Industrial screening level of 66 mg/kg was not exceeded, but the detected concentration exceeds the MTCA Method A Industrial screening level of 10 mg/kg, and the terrestrial ecological soil screening level for protection of wildlife of 0.65 mg/kg.
- For metals, aluminum (maximum of 42,000 mg/kg), arsenic (maximum of 15 mg/kg), cadmium (maximum of 22 J mg/kg), copper (maximum of 3,200 mg/kg), chromium (170 mg/kg), mercury (maximum of 4.7 mg/kg), nickel (maximum of 260 mg/kg), selenium (maximum of 2.9 mg/kg), and zinc (maximum of 5,600 J mg/kg) were detected in solids/sludge at concentrations above MTCA-derived screening levels for protection of groundwater and/or terrestrial ecologic screening levels for groundwater protection.
- Diesel-range organics and/or residual-range organics were detected above the MTCA Method A Industrial soil screening level of 2,000 mg/kg that is based on groundwater protection in all six samples.

1.4 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are made with respect to the Rectifier Yard AOC:

- The Rectifier Yard AOC will be further evaluated in the Feasibility Study (FS) based on the occurrence of TPH-Dx, cPAHs, PCBs, and metals (As, Cd, Cu, Hg, Ni, Se, and Zn) above soil screening levels for protection of groundwater and/or terrestrial ecological soil screening levels for wildlife protection.
- PCBs were generally detected in soil below MTCA Method A and C Industrial levels and do not represent the main chemical of concern at the Rectifier Yard AOC.

Table 1-5
Rectifier Yard AOC - Catch Basin Solids RI Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Fall 2016

				Ecological Indicator				Analytical Results					
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	RYAOC-SD01 9/21/2016	RYAOC-SD02 9/21/2016	RYAOC-SD03 9/21/2016	RYAOC-SD04 9/21/2016	RYAOC-SD46 (Duplicate of RYAOC-SD04) 9/21/2016	RYAOC-SD05 9/21/2016
Aluminum Smelter													
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	NA	NA	NA	NA	NA	NA
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	NA	NA	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons (PAHs)													
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.017 U	**0.36**	0.016 U	0.0032 U	0.016 U	0.016 U
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.031 U	0.63	0.03 U	0.0058 U	0.03 U	0.029 U
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.48	0.0091 U	0.039 U	0.021 J	0.039 U	0.16 J
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.025 U	0.49	0.025 U	0.0049 U	0.025 U	0.024 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	1.2	0.0087 U	0.037 U	0.15	0.18 J	0.4
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	6.1	2.9	0.021 U	0.85	0.95	0.92
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	9.4	3.7	0.047 U	1.3 J	0.47 J	1.2
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	19	13	0.024 U	0.0047 UJ	3.6 J	8.9
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	12	7.1	0.076 U	0.51 J	0.82 J	1.6
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	5.6	3.5	0.04 U	0.0078 UJ	0.83 J	1.5
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	8.2	5.7	0.045 U	4.4	5.1	9.6
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	2	1.5	0.046 U	0.0089 U	0.046 U	0.33
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	12	5.9	4.1	13	14	13
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.26	0.0074 U	0.032 U	0.041 J	0.032 U	0.031 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	14	9.4	0.047 U	0.74	1.1	2.1
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.078 J	0.43	0.024 U	0.01 J	0.025 U	0.071 J
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	3.7	5.4	0.076 U	2.6	2.2	1.9
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	11	4.2	6.2	6.2	7.3	7.6
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	**14.152**	**6.787**	0.032625	1.50407	1.1713	2.671
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	17.718	13.21	4.1	15.822	16.38	15.531
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**87.3**	**51**	**6.2**	**14**	**20.17**	**33.75**
Polychlorinated Biphenyls (PCBs)													
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.00051 U	0.0059 U	0.0012 UJ	0.00049 UJ	0.00049 UJ	0.00047 UJ
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.0034 U	0.04 U	0.0085 UJ	0.0033 UJ	0.0033 UJ	0.0032 UJ
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.0022 U	0.026 U	0.0055 UJ	0.0021 UJ	0.0022 UJ	0.0021 UJ
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.0021 U	0.025 U	0.0052 UJ	0.002 UJ	0.0021 UJ	0.002 UJ
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.49 J	0.54	0.004 UJ	0.0016 UJ	0.0016 UJ	0.0015 UJ
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	0.71	NE	0.00091 U	0.011 U	**18 J**	**3.4**	**4.6**	**4.3**
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	0.32	0.78	0.0032 UJ	0.0013 UJ	0.0013 UJ	0.0012 UJ
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	0.0019 U	0.022 U	0.0047 UJ	0.0018 UJ	0.0019 UJ	0.0018 UJ
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	0.0021 UJ	0.025 UJ	0.0052 UJ	0.002 UJ	0.0021 UJ	0.002 UJ
Total PCB Aroclor (calc)	mg/Kg	10	66	0.65	NE	0.65	NE	0.32	**0.78**	**18**	**3.4**	**4.6**	**4.3**
Metals													
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	18,000	12,000	2,000	11,000	12,000	42,000
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	**11**	**15**	0.73	**9.7**	**11**	**8.8**
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	**4 J**	**2.6 J**	**2 J**	**22 J**	**22 J**	**15 J**
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	47	19	14	52	61	25
Copper	mg/Kg	NA	140,000	217	280	217	28.4	**260**	140	**1,800**	**3,000**	**3,200**	**640**
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	100 J	69 J	50 J	**150 J**	**160 J**	33 J
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.36	**4.7**	0.064	0.65	0.64	0.13
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	94	36	5	43	46	34
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**1**	**0.87 J**	**0.4 B**	**2.1**	**2.2**	**0.79**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	**3,400 J**	**1,400 J**	230 J	**4,300 J**	**5,600 J**	**590 J**
Total Petroleum Hydrocarbons (TPHs)													
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NE	2,000	NE	1,600	**130,000**	**100,000**	**33,000**	**34,000**	**14,000**
Residual Range Organics	mg/Kg	2,000	NE	2,000	NE	2,000	NE	**2,800**	**19,000**	**820,000**	**210,000**	**240,000**	**93,000**

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established

PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
TPH = Total Petroleum Hydrocarbons

- Oil lines remain in place north and south of the Rectifier Building. The lines (where exposed) appeared to be empty and in adequate condition with no observed cracks or holes. Petroleum hydrocarbons and PAHs have been detected above screening levels in proximity of the lines in some locations where the lines are still present. Soils in the areas where the lines have been previously removed on the north side of the Rectifier Building and Oil House are generally below soil screening levels. Contaminated soil and oil line removal will be further evaluated in the FS.

- Sampled soils for borings beneath Rectifier Building were below Method C Industrial screening levels, soil screening levels for groundwater, and terrestrial ecological screening levels for wildlife protection, and accordingly, this area is not recommended for inclusion in the FS.

- Sampled solids/sludges from catch basins and sumps near the Oil House and in the Rectifier Building basement contained elevated concentration of PAHs, diesel-range petroleum hydrocarbons, PCBs, and metals (As, Cd, Cu, Hg, and Zn). The catch basin and sumps were lined with concrete, were in adequate condition, and appeared to be connected to the industrial line sump located south of the Rectifier Yard. The catch basins and sumps will be further evaluated in the FS.

- Elevated concentrations of cPAHs and diesel-range petroleum hydrocarbons were consistently detected in soils at most of the interior plant transformer substations. It appears that the cPAH contamination may be related to historical plant operations, rather than transformer operations. The interior plant transformers will be further evaluated in the FS.

- Concentrations for soil in the northwest portion of the Rectifier Yard generally did not exceed screening levels, and accordingly, this area is not recommended for inclusion in the FS.

Section 2

Plant Area

This section summarizes the RI results for the Plant Area AOC. The investigation of the Plant Area AOC was not originally included in the Agreed Order (Ecology 2014). The Plant Area AOC was jointly identified by the Potentially Liable Persons (PLPs) named in the Agreed Order, NSC Smelter, LLC and Lockheed Martin on October 6, 2014. A subsequent Supplemental Remedial Investigation Work Plan for the Plant Area AOC (PGG 2017) was also approved by Ecology as a revised scope of investigation.

The initial investigation of the site was conducted between 2015 and 2018 and the results were summarized in a draft RI Report dated January 24, 2019. Ecology reviewed the draft RI Report and provided review comments by letter dated June 26, 2019, which identified some data gaps and directed the parties to prepare a follow up RI WPA to address the identified data gaps. The final WPA dated September 18, 2020, was submitted to Ecology, and was approved on September 23, 2020. The WPA included a decision tree approach that would allow field-based decision making for investigation step-outs to achieve characterization of nature and extent of contamination (RI Volume 1, Section 3.2.1.3, Figure 3-1). The primary scope objective of the WPA for the Plant Area AOC was to identify potential soil sources of contamination to shallow groundwater and to identify previous areas that exceeded surface soil screening levels.

Section 2.1 is intended to provide an overview of the completed RI field investigation program including the initial RI and WPA phases of investigation. Section 2.1 is organized as follows:

- *Section 2.1, Background Summary of RI Field Investigation Program* provides a description of the Plant Area AOC and the features and structures that were the focus of the site investigation.
- *Section 2.1.1, Initial RI Field Investigation Program Summary* describes the initial RI investigation identified data gaps as stated in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b), scope of investigation, overview of results, and additional data gaps identified based on a comprehensive data gaps assessment and Ecology comments on the draft RI Report. The additional identified data gaps were discussed, and an investigation approach proposed in the Final WPA (Tetra Tech et al. 2020b).

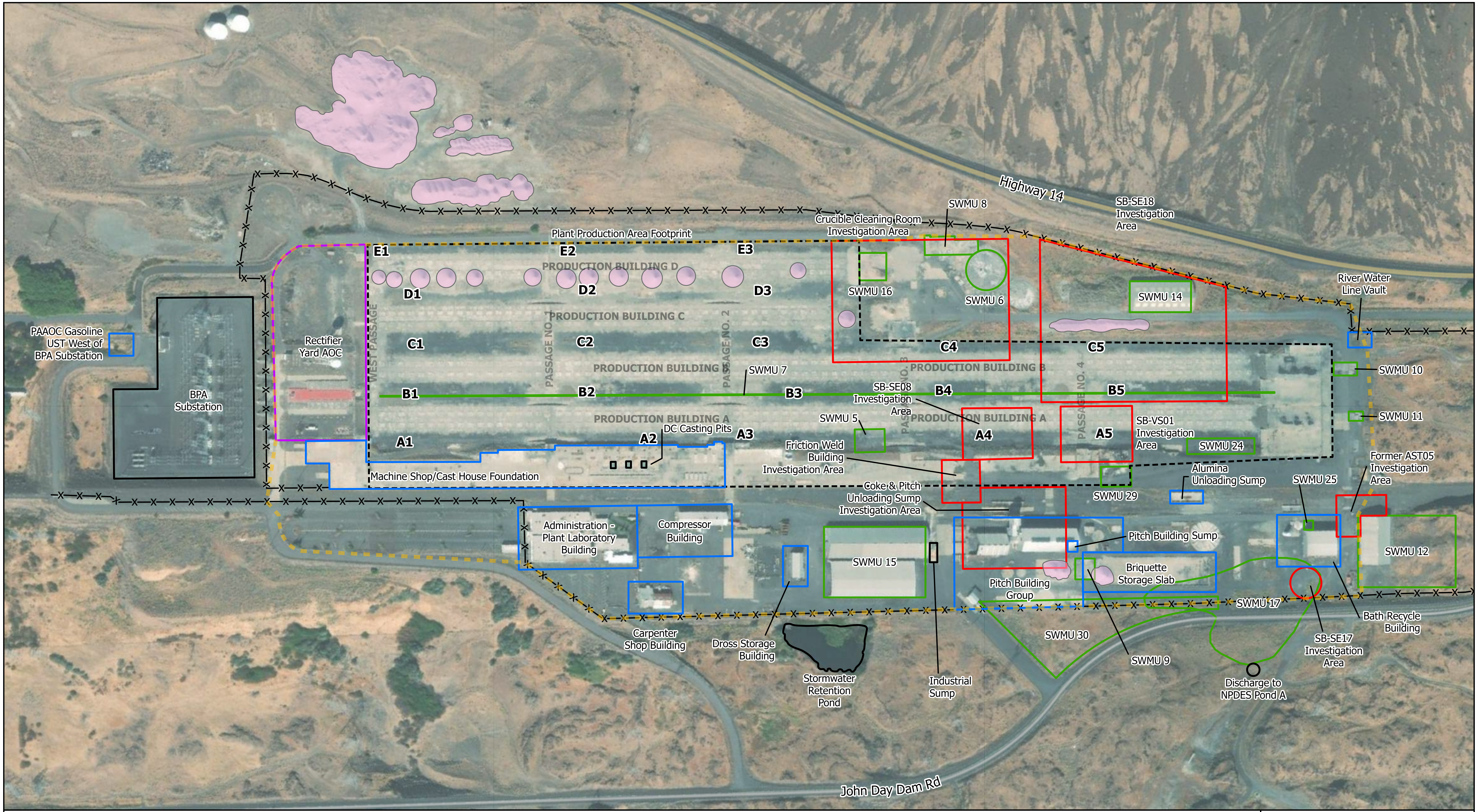
- *Section 2.1.2, Follow-on WPA Field Investigation Program Summary* presents the goals and objectives of the WPA follow-on investigation and how the RI and WPA investigation results will be evaluated and discussed in subsequent Sections 2.2 through 2.5. In portions of the site where follow-on WPA phase investigation was conducted, the initial RI and WPA investigation results will be addressed simultaneously. In other portions of the site where no data gaps or follow-on WPA phase investigation was conducted, only the initial RI investigation results will be discussed. These areas are identified in Section 2.1.2.

2.1 BACKGROUND SUMMARY OF RI FIELD INVESTIGATION PROGRAM

The Plant Area AOC consists of approximately 140-acres that includes the main production area at the base of the hillside to the south of Washington State Highway 14 (Figure 2.1.2-1). The main production area extends eastward from the eastern end of the Rectifier Yard AOC to the John Day Dam Road, and north to south from the access road north of production building D to the fenced margin of the plant parking and overall plant area. The hillside includes the area north of the main production area (Courtyard E) and east of the water towers to Highway 14. The hillside area is not included in the investigation of the Plant Area AOC because it contains individual Solid Waste Management Units (SWMUs) that were investigated separately.

Historical operations within the main plant production area footprint had a potential to create fugitive emissions and/or dust not captured by the air pollution control systems, and potential other releases, which may have been deposited on the ground in the unpaved courtyards soil between and adjacent to production buildings. Additionally, plant operations required practices using mobile units within the Plant Area AOC, such as transport trucks and temporary material storage facilities. These temporary storage and handling operations and associated locations, some of which are difficult to clearly define, could have potentially contributed to contamination of the soil within the Plant Area AOC.

Many of the buildings and structures in the former production area were demolished during 2010 through 2012. Foundations, concrete slabs, and crushed concrete piles remain in many locations. The major focus of investigation in the Plant Area AOC is surface and subsurface soil, and for certain other structures such as waste lines and sumps, their potential to impact surface soil and shallow groundwater. Shallow groundwater is specifically addressed in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC.



⬚ Plant Production Area Footprint
🟪 Rectifier Yard AOC
🟦 South Plant Areas
⬛ DC Casting Pits
☁ Crushed Concrete Stockpiles
🟨 Plant Area AOC Boundary

🟩 SWMU Area Extents
🟥 WPA Investigation Areas
A1 PAAOC Courtyard Segments
—x— Plant Area AOC Fence Lines

SWMU	Description
5	Line A Secondary Scrubber Recycle Station
6	Line B, C, D Secondary Scrubber Recycle Stations
7	Decommissioned Air Pollution Control Equipment
8	Tertiary Treatment Plant
9	Paste Plant Recycle Water System
10	North Pot Liner Soaking Station
11	South Pot Liner Soaking Station
12	East SPL Storage Area
14	North SPL Storage Containment Building
15	South SPL Storage Building
16	SPL Handling Containment Building
17	East End Landfill
24	Carbon Waste Roll-off Area
25	Solid Waste Collection Bin and Dumpsters
29	Caustic Spill
30	Paste Plant Spill

N E S W

0 125 250 500
Feet

Figure 2.1.2-1

Plant Area AOC
RI Report Volume 3 Index Map

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

2.1.1 Initial RI Field Investigation Program Summary

Structures and features within the Plant Area AOC include the Production Building Foundations A through D, associated Courtyards A through E, the Machine Shop, maintenance, Cast House, and Shipping Area building foundation, and associated ancillary features and buildings south of the production area where materials containing site COPCs were used, routinely handled, and temporarily stored.

Four SWMUs are also located in the Plant Area AOC and are included in the investigation of the Plant Area AOC according to the approved Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a). These SWMUs include the Decommissioned Air-Pollution Control Equipment (SWMU 7), the Carbon Waste Roll-Off Areas (SWMU 24), the Solid Waste Collection Bin and Dumpsters (SWMU 25), and the High Efficiency Air Filtration (HEAF) Filter Roll-Off Bin (SWMU 26). Locations of these SWMUs are not well documented, and/or may have changed through time. Where locations for some of these SWMUs were documented, those locations were sampled. Otherwise, evaluation of these SWMUs relies upon data collected for other area structures or features. Descriptions of these SWMUs are presented in the Volume 2, RI SWMU Summary.

The initial phase of the remedial investigation (initial RI) of the Plant Area AOC was completed to address data needs and data gaps which are summarized in Table 3-4 of the approved Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and described in the approved Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a). In addition, a Supplemental Remedial Investigation Work Plan approved by Ecology for the Plant Area AOC (PGG 2017) is included as a revised scope of investigation for the Plant Area AOC.

The following investigation objectives are based on the identified data needs and data gaps for the Plant Area AOC as stated in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The WPA was implemented to address data gaps that included the interaction between subsurface soil and shallow groundwater and to identify potential soil sources of contamination to shallow groundwater. A full discussion of hydraulic interaction between soil and shallow groundwater will be addressed in the Groundwater in the Uppermost Aquifer AOC, Volume 4, Section 2:

- Characterize the nature and extent of COPCs that exceed relevant screening levels in surface and subsurface soil for structures and features identified for the Plant Area AOC.

- Determine the extent of COPCs, particularly PAHs, in soil in courtyards that exceed MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife screening levels.

- Inspect the construction of the Coke and Pitch Unloading Structure and associated sump. The hydrologic interaction of this feature with shallow groundwater is be evaluated in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC.

- Evaluate hydrologic interaction with shallow groundwater of low-lying features such as direct chill (DC) casting pits associated with the machine shop/maintenance/cast house, friction weld, production buildings foundations, and industrial sump, and their impact on shallow groundwater. The hydrologic interaction of these features with shallow groundwater will be evaluated in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC.

- Determine volume of contaminated sediment in the Industrial Sump.

- Confirm construction and layout of the southeast portion of the groundwater collection system and its tie-in with other area water and waste conveyance lines.

- Determine the status of pre-RI cleanup for the scrubber effluent (SE) line system.

- Determine whether the industrial and monitoring (I&M) line system should be forwarded to the FS for consideration of remedial action.

- Evaluate the hydrologic interaction of the industrial and maintenance lines, scrubber effluent lines, and southeast segment of the groundwater collection system in connection with the stormwater pond and the potential impact on shallow groundwater. The hydrologic interaction of this feature with shallow groundwater will be evaluated in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC.

- Determine source of water discharging to National Pollutant Discharge Elimination System (NPDES) Pond A from the pipe near the head of the pond and characterize COPCs in surface soil at the discharge point (characterization of surface soil is addressed in Volume 2, SWMU 1 NPDES Ponds).

- Evaluate the hydrologic interactions with shallow groundwater of gasoline, diesel, and heating oil USTs and ASTs, and their impact on shallow groundwater. The hydrologic interaction of these features with shallow groundwater will be evaluated in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC.

- Characterize surface and subsurface soil at the cryolite and bath storage handling structures to identify soil sources of contamination to shallow groundwater where fluoride is of concern.

- Characterize surface and subsurface soil at the Paste Plant and other carbon handling, storage, and manufacturing structures to identify soil sources of contamination to shallow groundwater.
- Investigate surface soil in Courtyards B, D, and E through a series of discrete soil samples collected from 0 to 12 inches in depth at the locations of 30 soil borings completed in 2010.
- Limited additional sampling of up to 10 visually stained (black) surface soil areas in Courtyards A through E to determine whether apparent visual indicator of contamination is valid.
- Use previously collected data from 2010 and 2011 to characterize subsurface soil in Courtyards A through E, supplemented by five soil borings co-located with selected 2010 borings to address the COPC data gap.
- Collect up to six wood samples from the interior of Scrubber Effluent System horizontal lines.
- As per the Supplemental Remedial Investigation Work Plan, modify the sampling and analysis protocol for other sources in the southern portion of the Plant Area AOC, such as carbon manufacturing and cryolite handling, by reducing the depth of borings and using a two-step decision approach for collection of the deepest subsurface soil sample analyses.

The initial RI phase investigation was conducted between 2015 and 2018 and addressed the identified investigation objectives listed above. The overall scope was to collect surface and subsurface soil samples, sediment and water in sumps, and sediment, water, and wood fragments (Scrubber Effluent lines only) from the system lines within the Plant Area AOC to assist in fully characterizing the nature and extent of COPCs. Surface and subsurface soil sampling was performed using air-rotary drilling, and sonic drilling equipment, and a backhoe. All sample collection, management, and handling were performed in accordance with the Quality Assurance Project Plan (QAPP), Sampling and Analysis Plan (SAP), and the Final RI Phase 2 Work Plan Volume 1 (Tetra Tech et al. 2015b).

The scope of the initial RI is summarized in Table 2.1.1-1. Investigation of the Plant Area AOC consisted of completion of 104 soil borings, excavation of 45 test pits, and collection of one water and one sediment sample from the Coke and Pitch Unloading Sump. Investigation of the Plant Area AOC and the five water and waste conveyance systems in the plant area were conducted simultaneously and consisted of completion of 20 soil borings, collection of 14 water and

Table 2.1.1-1
PAAOC Site Features and Structures RI Investigation Summary
Columbia Gorge Aluminum Smelter, Goldendale, Washington

REMEDIAL INVESTIGATION: FOCUS FEATURES AND OTHER PLANT OPERATIONAL FEATURES	TOTAL NUMBER OF SAMPLE LOCATIONS				
	BORINGS	TEST PITS	WATER	SEDIMENT	WOOD
Plant Area AOC					
SWMU 7 WESPs	Not directly sampled: overhead line in Courtyard B with no ground location				
SWMU 24 Carbon Waste Bins	2				
SWMU 25 Solid Waste Bins		5			
SWMU 26 HEAF Filter Bins	1				
Pitch, Hard Pitch Storage, Paste Plant, and Paste Plant Maintenance Buildings	16				
Coke and Pitch Unloading Structure and Sump	3		1	1	
Petroleum Coke, Metalurgical Coke, and Anthracite Coal Silos (4)	4				
Briquette Storage Slab	5				
East and West Briquette Silos (2)	3				
Vitamin Silos and Stud Hole Paste Drying Area	2				
Aluminum Fluoride and treated Alumina Silos (4)	4				
Bath Crusher	1				
Battery Storage Area	1				
Cast House and DC Casting Pits	6				
Cast House Machine Shop and Maintenance Areas	8				
Cast House Stud Repair and Friction Weld Area	3				
Production Building Foundations	8				
Courtyard Soil (2010 Soil boring locations, surface impacted soil)	5	34			
Stud Cleaning and Repair (2)	1	1			
Bag Houses (5 of 8 locations identified)	5				
Crane Repair Areas (2)	2				
Crucible Cleaning Room	1				
Gasoline USTs (2) at BPA Substation	2				
Diesel ASTs (8)	8				
Heating Oil AST near Administration Building	Not sampled: specific location unknown and area inaccessible				
Compressor Building and USTs (3)	6				
Plant Laboratory Building	3				
Carpenter Shop	2				
Dross Storage	2				
Bath Recycle Building and Cryolite Silo		5			
Total Sample Locations	104	45	1	1	
Plant Area AOC and SWMU 32 Lines					
Stormwater Collection Lines			4	6	
Groundwater Collection Lines			6		
Industrial and Monitoring Lines	2			4	
Industrial Sump			2		
Scrubber Effluent Lines	18				5
Sanitary Sewer Lines	Not sampled: no RI data needs identified				
Sanitary Sewer Treatment Plant Sump	Not sampled: no high solid sediment present				
Pond A Discharge			1		
Total Sample Locations	20		14	10	5

10 sediment samples from four of the five site conveyance systems (the Sanitary system was not sampled), and collection of wood core samples from inside five selected Scrubber Effluent System manholes. Draft RI Report Figures 5-2 through 5-11 show the locations of the initial RI soil borings, test pits, sump water and sediment samples (Tetra Tech et al. 2019a). Analytical data for all media sampled were summarized in Draft RI Report Tables 5-2 through 5-35 (Tetra Tech et al. 2019a). Based on the results of Ecology's review of the Draft RI Report (Ecology and Yakama Nation 2019), and the additional investigations that were conducted, the initial RI investigation results are not discussed in detail in this section but are incorporated and addressed in Sections 2.2 through 2.5.

Ecology's review of the draft RI (dated January 24, 2019) resulted in a significant number of comments and identification of data gaps for the Plant Area AOC, most of which were focused on potential interaction between soil contamination and shallow groundwater. Ecology's review also resulted in the requirement to develop an RI WPA to address these potential data gaps.

As part of the WPA development, the PLPs conducted a comprehensive data gaps assessment of the draft RI Report initial RI investigation results (Volume 5, Appendix A-1). Several data gaps were identified in addition to those identified by Ecology. The following are data gaps that were identified for a follow-on WPA phase investigation of the Plant Area AOC:

- Crucible Cleaning Room (CCR) Area soil and potential impact to shallow groundwater
- Soil Boring SB-VS01 in Courtyard Segment A5 and potential impact to shallow groundwater
- Coke and Pitch Unloading Sump and potential impact to shallow groundwater
- Former AST (AST05) near East Spent Pot Liner (SPL) Storage Area (SWMU 12) and potential impact on shallow groundwater
- Friction Weld Building and potential impact on shallow groundwater
- Soil Boring SB-SE08 in Courtyard Segment A4 and potential impact on shallow groundwater
- Soil Boring SB-SE18 in Courtyard Segment C5 and potential impact on shallow groundwater
- Industrial sump sediment sampling

- Source, chemical characterization, and flow rate of water discharging to NPDES Pond A (source could not be determined in initial RI phase)
- Vertical Extent of Contaminated Soil in All Courtyard Segments

These data gaps, the approach, and scope of the follow-on investigations to address them, as outlined in the WPA, are discussed below in Section 2.1.2. Discussion of WPA investigation results are presented in the Sections 2.2 through 2.6 of Volume 3 of the RI Report.

2.1.2 Follow-on WPA Field Investigation Program Summary

The WPA presented an investigation approach to address the identified Plant Area AOC data gaps identified in Section 2.1.1. These geographic-based data gaps, excluding the source of water discharging to NPDES Pond A and sediment sampling of the Industrial Sump, were established as Investigation Areas that furthered the investigation conducted during the initial RI phase investigation to fully characterize the nature and extent of contamination and address potential interaction of soil contamination with shallow groundwater for portions of the Plant Area AOC (Figure 2.1.2-1). The investigation approach included a decision-tree process to allow field decisions for investigation step-outs during one field mobilization based on rapid turnaround soil and water analytical results Volume 1, Section 3.2.1.3, Figure 3-1.

The WPA phase investigation was conducted between September 2020 and May 2021 and addressed the identified investigation objectives listed above. The overall scope was to collect surface and subsurface soil samples, sediment and water in sumps, and shallow groundwater in identified Investigation Areas to identify potential sources of soil contamination to shallow groundwater. Additional samples collected during the WPA phase of investigation included water samples collected from sumps not previously identified, including the Alumina conveyor sump and the Paste Plant sump. Surface and subsurface soil sampling was performed using air-rotary drilling equipment, and a backhoe. All sample collection, management, and handling were performed in accordance with the QAPP and SAP, and the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b).

The scope of the WPA phase of investigation is summarized in Table 2.1.1-2. Investigation of the Plant Area AOC consisted of completion of 39 soil borings, excavation of 74 test pits, installation of 8 permanent shallow groundwater monitoring wells, collection of 2 samples from soil stockpiles,

Table 2.1.1-2
PAAOC Site Features and Structures WPA Investigation Summary
Columbia Gorge Aluminum Smelter, Goldendale, Washington

	TOTAL NUMBER OF SAMPLE LOCATIONS						
REMEDIAL INVESTIGATION: WPA INVESTIGATION	**BORINGS**	**WELLS**	**TEST PITS**	**SOIL**	**WATER**	**SEDIMENT**	**CRUST**
Plant Area AOC							
Vertical Extent of Contamination in Courtyard Soil Investigation Area			63				
Crucible Cleaning Room Investigation Area	11	3	9		5		
Soil Boring SB-VS01 Investigation Area	3	1			1		
Coke and Pitch Unloading Sump Investigation Area	2	1			2		
Former AST (AST05) Near Bath Recycle Building Investigation Area	4						
Friction Weld Building Investigation Area	2				1		
Soil Boring SB-SE08 Investigation Area	3	1			3		
Soil Boring SB-SE18 Investigation Area	12	1	2		6		
Soil Boring SB-SE17 Investigation Area	2	1			1		
Paste Plant and Alumina Conveyor Sumps (2)					2		
Large Clarifier (center outflow pipe)						1	
River Water Vault					1		
Soil Stockpiles (adjacent to SWMU 14 Building)				2			
Total Sample Locations	39	8	74	2	22	1	
Plant Area AOC and SWMU 32 Lines							
Stormwater Collection Lines	Not sampled: no WPA data need identified						
Groundwater Collection Lines					2		
Industrial and Monitoring Lines	Not sampled: no WPA data need identified						
Industrial Sump						1	
Scrubber Effluent Lines	2				2	4	1
Sanitary Sewer Lines	Not sampled: no WPA data needs identified						
Sanitary Sewer Treatment Plant Sump	Not sampled: no WPA data needs identified						
Pond A Discharge					1		
Total Sample Locations	2				6	5	1

collection of 22 water samples from temporary well screen installations and permanent wells, and collection of 3 water samples from three sumps. These borings, test pits, and analytical results for collected soil and water samples will be discussed in detail in Sections 2.2 through 2.5, and recommendations for the FS in Section 2.6.

Soil encountered in soil borings and test pits was characterized, logged, and sampled and the logs for WPA phase investigations are included in Volume 5, Appendix G-2. Laboratory analytical reports for all Plant Area AOC environmental media samples are included in Volume 5, Appendix H-4. Data validation reports for WPA phase investigation results are included in Volume 5, Appendix I-4. The RI data quality objectives for the Plant Area AOC were met with data qualifiers assigned as appropriate in the data tables. A discussion of data quality objectives is presented in Volume 1 of the RI Report.

Initial RI and WPA phases of investigation results will be addressed simultaneously for areas of the Plant Area AOC where both phases of investigation were conducted, and only initial RI phase investigation results will be addressed in areas of the Plant Area AOC where no further work was proposed in the WPA. The index map of Figure 2.1.2-1 shows the location of each of the following Plant Area AOC WPA investigations. The organization of discussion of RI investigation results in Section 2.2 through 2.6 is as follows:

- **Section 2.2 RI Work Plan Addendum (WPA) Investigation Areas** includes a detailed evaluation and discussion of all initial RI and WPA phase investigation results for the Investigation Areas. The Investigation Areas are discussed in Sections 2.2.1 through 2.2.8.

- **Section 2.3 Courtyard Segments Soil Contamination Summary** presents a comprehensive evaluation of analytical results for all soil samples collected in each of the 21 courtyard segments during the initial RI and WPA phases of investigation. This includes samples collected at transformer substations that are part of the Rectifier Yard AOC, at SWMUs located in courtyard segments (SWMU 5), and courtyard soil investigations for the Plant Area AOC. The courtyard segments are discussed individually because their areas are large, they contain differing contaminant and extent profiles, they are bounded on four sides by continuous and thick building foundations and in some cases steep slopes, and there will likely be differing remedial considerations evaluated in the FS. Courtyard segments are discussed in Sections 2.3.1 through 2.3.21.

- **Section 2.4 Areas Outside the Plant Production Footprint** includes other areas south of the main production area and west of the Plant Area AOC, except for production building foundations. No additional work was proposed in the WPA for these areas therefore the evaluation of analytical results only includes initial RI phase investigation results. These areas include the gasoline USTs west of the BPA Substation, Administration/Plant Laboratory Building, Carpenter Shop Building, Compressor Building, Dross Storage Building, Pitch Building Group, Briquette Storage Slab, Bath Recycle Building, Production Building Foundations, Pitch Alumina and Paste Plant Sumps, and crushed concrete stockpiles resulting from plant demolition. These other investigation areas are discussed in Sections 2.4.1 through 2.4.11.

- **Section 2.5 SWMU 32 and Plant Area AOC Water and Waste Conveyance Line Systems** presents a comprehensive evaluation and discussion of each of the site's five water and waste conveyance systems, including stormwater collection, groundwater collection, I&M, scrubber effluent, and sanitary sewer. Identifying the source of water discharging to NPDES Pond A is included in the scrubber effluent system discussion. Evaluation of each water and waste system includes discussions of previous investigations prior to the Agreed Order (if applicable), the initial RI phase of investigation, the WPA phase of investigation, and conclusions and recommendations for the FS. The five systems are discussed in Sections 2.5.1 through 2.5.5.

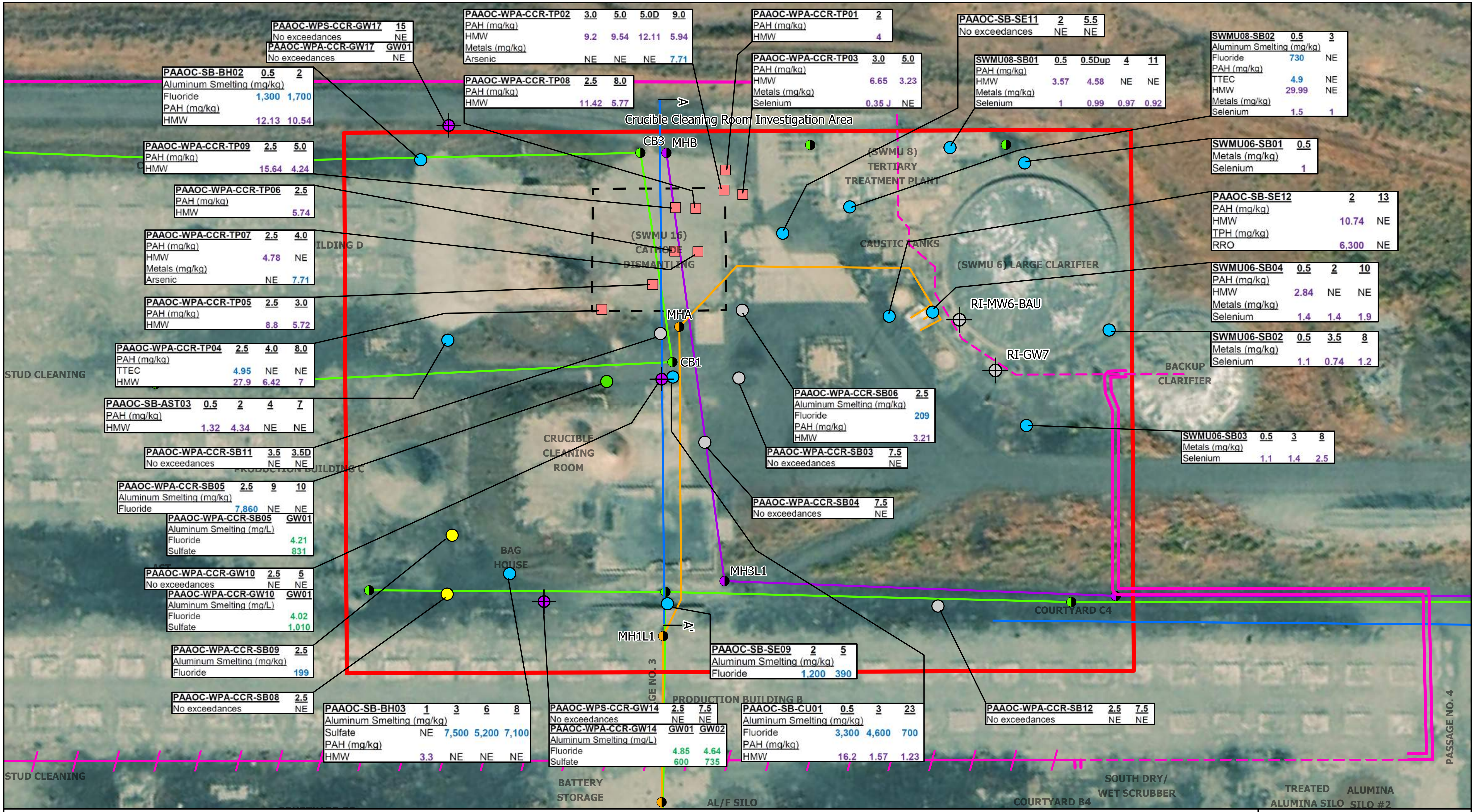
- **Section 2.6 Major Findings and Recommendations for the FS** presents the major findings of the RI for each of the areas investigated, and whether the areas investigated are recommended for evaluation in the FS (Table 2.6-1, Summary of Major Findings and Recommendations).

2.2 RI WORK PLAN ADDENDUM INVESTIGATION AREAS

Below is a discussion of the WPA investigation areas.

2.2.1 Crucible Cleaning Room Investigation Area

The Crucible Cleaning Room Investigation Area includes the portion of the plant area east of production buildings C and D, to the east side of the large clarifier (SWMU 6), and north of Production Building B (Figure 2.2.1-1). This Investigation Area includes the Crucible Cleaning Room at the east end of Production Building C, SWMU 6 Line B, C, D Secondary Scrubber Recycle Station (large and backup clarifiers), SWMU 8 Tertiary Treatment Plant, SWMU 16 SPL Handling Containment Building at the east end of Production Building D, the north end of Passage No. 3, and portions of Courtyard Segments C3, C4, D3, and E3. The Crucible Cleaning Room Investigation Area was designated an Investigation Area based on concentrations of fluoride detected in soil in initial RI boring SB-CU01, and sulfate detected in soil in initial RI boring SB-BH03, that exceed



🟥 CCR Investigation Area
— Cross Section A-A'
⊕ WPA Monitor Well
⊕ RI Monitor Well
🟥 WPA Test Pit

Plant SO2 Purge Lines (See Figure 2.2.1-5)
— Existing SO2 Lines w/spare
— Existing SO2 Lines
- - Elevated SO2 Line
+ Abandoned SO2 Line

SOIL BORINGS
● WPA Boring, Dry
● WPA Boring, Wet, no temp screen
● WPA Boring, Dry
● RI Boring

PLANT SYSTEM LINES
◐ Groundwater Collection Line Manhole
— Groundwater Collection Line
◐ Stormwater Line Catch Basin
— Stormwater Line
◐ Industrial and Monitoring Line Manhole
— Industrial and Monitoring Line

Soil Screening Levels
blue: Exceeds Protection of Groundwater
purple: Exceeds Ecological Wildlife and for TPH diesel and residual range organics also exceeds MTCA Method A

NE: No exceedances
D: Duplicate sample
2: Sample depths in feet

Water Screening Levels
green: Exceeds WA MCL

All groundwater results have been screened using Table 5-2, Volume 1, Screening Levels, and are discussed in GWAOC, Volume 4

W N S E

0 37.5 75 150
Feet

Figure 2.2.1-1

Plant Area AOC

Crucible Cleaning Room Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Maxar, Microsoft

protection of groundwater screening levels to the total depths of the borings at 23 and 8 ft bgs, respectively. This area of the site is at the upgradient edge of a sitewide fluoride plume in shallow groundwater. Sulfate is also identified as a site COPC that has impacted shallow groundwater and appears to occur in some areas with fluoride in soil and groundwater (refer to Volume 4, Section 2, Groundwater AOC for sulfate and fluoride plumes in the shallow groundwater).

The objective for the Crucible Cleaning Room Investigation Area was to investigate soil to determine whether a soil source of fluoride and/or sulfate contamination to shallow groundwater is present. Soil borings SB-CU01 and SB-BH03 are the basis for designating the Crucible Cleaning Room Investigation Area. Evaluation of several nearby borings identified other locations where fluoride and sulfate were present in soil at concentrations that exceed the protection of groundwater screening level.

The nearby borings that were evaluated were part of several specific initial RI investigations that have occurred in the Crucible Cleaning Room Area (Figure 2.2.1-1). Initial RI analytical results are summarized on Table 2.2.1-1:

- *Scrubber Effluent System alignment from Passage No. 3 to the Tertiary Treatment Plant*. Borings SB-SE09, SB-SE11, and SB-SE12 with soil samples collected in shallow soil, at above and below the projected invert for the Scrubber Effluent line in this area. Detected concentration of fluoride in soil up to 87 mg/kg at 5 ft bgs in SB-SE09. Other WPA investigations (video survey, Section 2.5.4) determined the Scrubber Effluent line could not be traced north of Passage No. 3 and therefore does not appear to be present in the Crucible Cleaning Room Investigation Area.

- *Crucible Cleaning Room*. Boring SB-CU01 (additional samples at depth to investigate the Scrubber Effluent line previously thought to be located in this area) with samples in shallow soil. Detected concentrations of fluoride exceeding the protection of groundwater screening level in all samples up to 4,600 mg/kg.

- *Courtyard Segments Plant Operational Features*. Borings SB-BH02 and SB-BH03 investigated bag houses that were previously located at the east ends of Courtyard Segments C3 and E3. Boring SB-AST03 investigated a diesel AST at the east end of Courtyard Segment D3. Boring SB-COPC02 investigated soil in Courtyard Segment C4. Detected concentrations of fluoride ranged from 240 mg/kg (SB-COPC02, 2 ft bgs) to 1,800 mg/kg (SB-BH02, 2 ft bgs). Detected concentrations of sulfate ranged from 140 mg/kg at 9 ft bgs in SB-COPC02 to 7,100 mg/kg in SB-BH03 at 8 ft bgs.

Table 2.2.1-1
CCR Investigation Area Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

		Screening Levels				Ecological Screening Levels	Initial RI Analytical Results																	
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-AST03-0.5	PAAOC-SB-AST03-2	PAAOC-SB-AST03-4	PAAOC-SB-AST03-7	PAAOC-SB-BH02-0.5	PAAOC-SB-BH02-2	PAAOC-SB-BH03-1	PAAOC-SB-BH03-3	PAAOC-SB-BH03-6	PAAOC-SB-BH03-8	PAAOC-SB-CU01-0.5	PAAOC-SB-CU01-3	PAAOC-SB-CU01-23	PAAOC-SB-SE09-3	PAAOC-SB-SE09-5	PAAOC-SB-SE11-2	PAAOC-SB-SE11-5.5	PAAOC-SB-SE12-2
Aluminum Smelting																								
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	NA	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.062	0.05 U	0.05 U	0.17	0.05 UJ	0.05 UJ	0.05 U	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	NA	NA	NA	NA	**1,300**	**1,700**	30	14	7.7	7.6	**3,300**	**4,600**	**700**	**1,200**	**390**	30 J	21	140
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	NA	NA	NA	30	46	1,800	**7,500**	**5,200**	**7,100**	22	160	260	75	87	10 U	21	26
Polynuclear Aromatic Hydrocarbons (PAHs)																								
1-Methylnaphthalene	mg/kg	NL	4,500	0.082	NE	NL	0.078 U	0.03 U	0.009 U	0.0093 U	0.041 U	0.069 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.73 U	0.0074 U	0.017 U	0.018 U	0.0081 U	0.0071 U	0.007 U	0.072 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	NA	NA	NA	NA	0.041 U	0.069 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.73 U	0.0074 U	0.017 U	0.018 U	0.0081 U	0.0071 U	0.007 U	0.072 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.078 U	0.03 U	0.009 U	0.0093 U	0.041 U	0.069 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.73 U	0.0074 U	0.017 U	0.018 U	0.0081 U	0.0071 U	0.007 U	0.072 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	NA	NA	NA	NA	0.041 U	0.069 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.73 U	0.0074 U	0.017 U	0.018 U	0.0081 U	0.0071 U	0.007 U	0.072 U
Anthracene	mg/kg	NL	NE	2,300	NE	NL	0.078 U	0.054	0.009 U	0.0093 U	0.11	0.077	0.039 U	0.01 U	0.0087 U	0.0097 U	0.73 U	0.0074 U	0.017 U	0.018 U	0.0081 U	0.0071 U	0.007 U	0.11
Benzo(a)anthracene	mg/kg	NL	NL	NL	NE	NL	0.16	0.46	0.009 U	0.0093 U	1.1	0.8	0.25	0.01 U	0.0087 U	0.0097 U	1.6	0.11	0.08	0.023	0.0081 U	0.014	0.0081	0.96
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.19	0.56	0.009 U	0.0093 U	1.5	1.3	0.33	0.01 U	0.0087 U	0.0097 U	2.2	0.15	0.13	0.048	0.0081 U	0.018	0.011	1.4
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.29	1	0.009 U	0.0093 U	2.6	2.3	0.79	0.01 U	0.0087 U	0.0097 U	3.3	0.36	0.29	0.082	0.0081 U	0.025	0.016	2.1
Benzo(g,h,i)perylene	mg/kg	NL	NE	NE	NE	NL	NA	NA	NA	NA	1.4	1.2	0.6	0.01 U	0.0087 U	0.0097 U	1.9	0.24	0.19	0.018 U	0.0081 U	0.015	0.011	1.4
Benzo(k)fluoranthene	mg/kg	NL	NL	NL	NE	NL	NA	NA	NA	NA	0.72	0.75	0.19	0.01 U	0.0087 U	0.0097 U	1	0.072	0.058	0.029	0.0081 U	0.01	0.007 U	0.59
Chrysene	mg/kg	NL	NL	NL	NE	NL	0.2	0.72	0.009 U	0.0093 U	1.5	1.2	0.4	0.01 U	0.0087 U	0.0097 U	2	0.26	0.18	0.038	0.0081 U	0.016	0.0097	1.3
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.078 U	0.15	0.009 U	0.0093 U	0.31	0.29	0.091	0.01 U	0.0087 U	0.0097 U	0.73 U	0.039	0.03	0.018 U	0.0081 U	0.0071 U	0.007 U	0.29
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.34	0.87	0.009 U	0.0093 U	1.9	1.5	0.3	0.01 U	0.0087 U	0.0097 U	2.4	0.17	0.14	0.037	0.0081 U	0.022	0.014	1.6
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.078 U	0.03 U	0.009 U	0.0093 U	0.041 U	0.069 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.73 U	0.0074 U	0.017 U	0.018 U	0.0081 U	0.0071 U	0.007 U	0.072 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.17	0.61	0.009 U	0.0093 U	1.2	1.3	0.36	0.01 U	0.0087 U	0.0097 U	1.9	0.18	0.14	0.069	0.0081 U	0.015	0.0096	1.3
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.078 U	0.03 U	0.009 U	0.0093 U	0.041 U	0.069 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.73 U	0.001 U	0.017 U	0.018 U	0.0081 U	0.0071 U	0.007 U	0.072 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	NA	NA	NA	NA	0.49	0.31	0.082	0.01 U	0.0087 U	0.0097 U	0.98	0.011	0.017 U	0.018 U	0.0081 U	0.0071 U	0.007 U	0.66
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.31	0.84	0.009 U	0.0093 U	1.8	1.4	0.29	0.01 U	0.0087 U	0.0097 U	2.3	0.16	0.13	0.036	0.0081 U	0.022	0.014	1.4
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.25	0.79	0.009	0.0093	2.11	2	0.5	0.01	0.0087	0.0097	3	0.23	0.2	0.07	0.0081	0.03	0.15	1.94
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.34	0.92	0.009	0.0093	2.5	1.89	0.38	0.01	0.0087	0.0097	3.38	0.18	0.14	0.04	0.0081	0.02	0.01	2.37
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**1.32**	**4.34**	0.009	0.0093	**12.13**	**10.54**	**3.3**	0.01	0.0087	0.0097	**16.2**	**1.57**	**1.23**	0.33	0.0081	0.14	0.08	**10.74**
Polychlorinated Biphenyls (PCBs)																								
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	NA	0.062 U	0.052 U	0.059 U	0.075 U	0.065 U	0.065 U	0.055 U	0.056 U	0.05 U	0.068 U	0.06 U	0.053 U	0.053 U	0.054 UJ
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	0.062 U	0.052 U	0.059 U	0.075 U	0.065 U	0.065 U	0.055 U	0.056 U	0.05 U	0.068 U	0.06 U	0.053 U	0.053 U	0.054 UJ
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	0.062 U	0.052 U	0.059 U	0.075 U	0.065 U	0.065 U	0.055 U	0.056 U	0.05 U	0.068 U	0.06 U	0.053 U	0.053 U	0.054 UJ
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	0.062 U	0.052 U	0.059 U	0.075 U	0.065 U	0.065 U	0.055 U	0.056 U	0.05 U	0.068 U	0.06 U	0.053 U	0.053 U	0.054 UJ
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	0.062 U	0.052 U	0.059 U	0.075 U	0.065 U	0.065 U	0.055 U	0.056 U	0.05 U	0.068 U	0.06 U	0.053 U	0.053 U	0.054 UJ
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	NA	NA	0.062 U	0.052 U	0.059 U	0.075 U	0.065 U	0.065 U	0.055 U	0.056 U	0.05 U	0.068 U	0.06 U	0.053 U	0.053 U	0.054 UJ
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	NA	NA	0.062 U	0.052 U	0.059 U	0.075 U	0.065 U	0.065 U	0.055 U	0.056 U	0.05 U	0.068 U	0.06 U	0.053 U	0.053 U	0.054 UJ
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	NA	NA	0.062	0.052	0.059	0.075	0.065	0.065	0.055	0.056	0.05	0.068	0.06	0.053	0.053	0.054
Metals																								
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	NA	NA	9,900	NA	8,400	3,300	9,500	14,000	11,000	19,000	17,000	8,600	16,000	12,000	6,700	3,500	2,100	6,100 J
Arsenic	mg/kg	20	88	2.9	7.61	132	NA	NA	14 U	NA	12 U	10 U	12 U	15 U	13 U	15 U	11 U	11 U	13 U	14 U	12 U	11 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	NA	NA	0.68 U	NA	0.64	0.52 U	0.59 U	0.75 U	0.65 U	0.73 U	0.55 U	0.56 U	0.65 U	0.68 U	0.6 U	0.53 U	0.53 U	0.54 U
Chromium	mg/kg	2000	5,300,000	490,000	31.88	67	NA	NA	2.70	NA	14	11	1.9	7.9	5	3	38	12	10	6	4	4	2	7
Copper	mg/kg	NA	140,000	280	28.4	217	NA	NA	16.0	NA	16	16	11	21	16	18	18	10	22	24	91	12	12	18
Lead	mg/kg	1000	NE	3,000	13.1	118	NA	NA	6.8 U	NA	6.9	5.2 U	5.9 U	7.5 U	6.5 U	7.3 U	5.5 U	5.6 U	6.5 U	6.8 U	6 U	5.3 U	5.3 U	5.4 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	NA	NA	0.34 U	NA	0.31 U	0.26 U	0.29 U	0.37 U	0.32 U	0.36 U	0.27 U	0.28 U	0.33 U	0.34 U	0.3 U	0.27 U	0.26 U	0.27 U
Nickel	mg/kg	NA	70,000	130	24.54	980	NA	NA	5.70	NA	20	12	2.9 U	12	5	9.7	21	10	5.9	5.5	8.3	4.6	3.2	11
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	NA	NA	14 U	NA	12 U	10 U	12 U	15 U	13 U	15 U	11 U	11 U	13 U	14 U	12 U	11 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	NA	NA	36.0	NA	99	81	29	72	46	56	64	37	56	39	140	30	30	52
Volatile Organic Compounds (VOCs)																								
Benzene	mg/kg	0.03	2,400	0.027	NE	0.26	NA	NA	NA	NA	0.011 U	0.00096 U	0.011 U	0.0017 U	0.0014 U	0.0017 U	0.001 U	0.001 U	0.0013 U	0.0014 U	0.0013 U	0.00096 U	0.00099 U	0.0011 U
Toluene	mg/kg	7	280,000	4.5	NE	5.45	NA	NA	NA	NA	0.0057 U	0.0048 U	0.0056 U	0.0083 U	0.0072 U	0.0084 U	0.005 U	0.0052 U	0.0063 U	0.007 U	0.0064 U	0.0048 U	0.005 U	0.0053 U
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	NA	NA	NA	NA	0.011 U	0.00096 U	0.011 U	0.0017 U	0.0014 U	0.0017 U	0.001 U	0.001 U	0.0013 U	0.0014 U	0.0013 U	0.00096 U	0.00099 U	0.0011 U
m,p-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	0.0023 U	0.0019	0.0022 U	0.0033 U	0.0029 U	0.0033 U	0.002 U	0.0021 U	0.0025 U	0.0028 U	0.0026 U	0.0019 U	0.002 U	0.0021 U
o-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	0.011 U	0.00096 U	0.011 U	0.0017 U	0.0014 U	0.0017 U	0.001 U	0.001 U	0.0013 U	0.0014 U	0.0013 U	0.00096 U	0.00099 U	0.0011 U
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	NA	NA	NA	NA	0.011 U	0.00096 U	0.011 U	0.0017 U	0.0014 U	0.0017 U	0.001 U	0.001 U	0.0013 U	0.0014 U	0.0013 U	0.00096 U	0.00099 U	0.0011 U
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	NA	NA	NA	NA	0.011 U	0.00096 U	0.011 U	0.0017 U	0.0014 U	0.0017 U	0.001 U	0.001 U	0.0013 U	0.0014 U	0.0013 U	0.00096 U	0.00099 U	0.0011 U
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	NA	NA	NA	NA	0.011 U	0.00096 U	0.011 U	0.0017 U	0.0014 U	0.0017 U	0.001 U	0.001 U	0.0013 U	0.0014 U	0.0013 U	0.00096 U	0.00099 U	0.0011 U
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	NA	NA	NA	NA	0.011 U	0.00096 U	0.011 U	0.0017 U	0.0014 U	0.0017 U	0.001 U	0.001 U	0.0013 U	0.0014 U	0.0013 U	0.00096 U	0.00099 U	0.0011 U
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	NA	NA	NA	NA	0.011 U	0.00096 U	0.011 U	0.0017 U	0.0014 U	0.0017 U	0.001 U	0.001 U	0.0013 U	0.0014 U	0.0013 U	0.00096 U	0.00099 U	0.0011 U
Total Petroleum Hydrocarbons (TPHs)																								
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	29 U	140 U	34 U	35 U	52 U	26 U	29 U	38 U	33 U	36 U	280 U	28 U	33 U	34 U	30 U	27 U	26 U	270 U
Residual Range Organics	mg/kg	2,000	NE	NE	NE	2,000	59 U	770	68 U	70 U	280	52 U	95	75 U	65 U	73 U	1,200	56 U	65 U	68 U	60 U	53 U	53 U	**6,300**

Notes:

J	Estimated Concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method reporting limit.
Z	Chromatographic fingerprint does not resemble a petroleum product.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.2.1-1
CCR Investigation Area Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
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	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results																
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-SE12-13**	**SWMU06-SB01-0.5**	**SWMU06-SB02-0.5**	**SWMU06-SB02-3.5**	**SWMU06-SB02-8.0**	**SWMU06-SB03-0.5**	**SWMU06-SB03-3.0**	**SWMU06-SB03-8.0**	**SWMU06-SB04-0.5**	**SWMU06-SB04-2**	**SWMU06-SB04-10**	**SWMU08-SB01-0.5**	**SWMU08-SB40-0.5 (Duplicate of SB01-0.5)**	**SWMU08-SB01-4.0**	**SWMU08-SB01-11.0**	**SWMU08-SB02-0.5**	**SWMU08-SB02-3.0**
Aluminum Smelting																							
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 UJ	1.9 U	1.9 U	2.7 U	2.2 U	1.9 U	2.2 U	2.1 U	1.9 U	2 U	1.9 U	2 U	2 U	2.2 U	2.4 U	1.9 U	2.2 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	5 U	11 J	17 J	1.3 J	6.8 J	18 J	33 J	68 J	44	7.8	16	25 J	12 J	48 J	3 J	**730**	140
Sulfate	mg/kg	NA	NE	2,150	NE	NE	12	3.9 U	13	150	41	7 J	5.3 J	7.1 J	19	8.2 J	6.1 J	120 J	170 J	24	830	33	22
Polynuclear Aromatic Hydrocarbons (PAHs)																							
1-Methylnaphthalene	mg/kg	NL	4,500	0.082	NE	NL	0.0081 U	0.0016 U	0.0016 U	0.0021 U	0.0089 U	0.082 U	0.0019 U	0.017 U	0.033 J	0.0017 U	0.0016 U	0.017 J	0.016 U	0.0019 U	0.0018 U	0.04 J	0.0017 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0081 U	0.0021 U	0.0022 J	0.0027 U	0.013	0.11 U	0.0025 U	0.0023 U	0.044 J	0.0022 U	0.0021 U	0.021 U	0.021 U	0.0025 U	0.0045 J	0.065	0.0022 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0081 U	0.000064 U	0.011	0.00082 U	0.012	0.033 U	0.00076 U	0.0008 J	0.031 J	0.00067 U	0.0062 U	0.0063 U	0.0062 U	0.00076 U	0.00074 U	0.31	0.0099
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0081 U	0.00053 U	0.00054 U	0.00069 U	0.0074	0.027 U	0.00063 U	0.00058 U	0.0054 U	0.00056 U	0.00052 U	0.0053 U	0.0052 U	0.00064 U	0.00061 U	0.013 J	0.00097 J
Anthracene	mg/kg	NL	NE	2,300	NE	NL	0.0081 U	0.00093 J	0.011	0.00082 U	0.03	0.033 U	0.00076 U	0.0016 J	0.029 J	0.00067 U	0.00062 U	0.038 J	0.044 J	0.00076 U	0.00074 U	0.35	0.0095
Benzo(a)anthracene	mg/kg	NL	NL	NL	NE	NL	0.0081 U	0.0068 J	0.097	0.0021 U	0.017	0.082 U	0.0019 U	0.019	0.3	0.0017 U	0.0016 U	0.21 J	0.3 J	0.0019 U	0.0018 U	3.3	0.1
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.0081 U	0.012	0.13	0.00055 U	0.012	0.099 J	0.0016 J	0.023	0.37	0.00044 U	0.00041 U	0.34 J	0.43 J	0.00051 U	0.00049 U	3.5	0.11
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.01	0.02	0.2	0.0021 U	0.036	0.22 J	0.0025 J	0.057	0.5	0.0017 U	0.0016 U	0.76 J	0.85 J	0.0019 U	0.006 J	5.4	0.18
Benzo(g,h,i)perylene	mg/kg	NL	NE	NE	NE	NL	0.0081 U	0.016	0.12	0.00069 U	0.017	0.13 J	0.0017 J	0.029	0.32	0.00056 U	0.00052 U	0.55 J	0.69 J	0.00064 U	0.00061 U	3.2	0.11
Benzo(k)fluoranthene	mg/kg	NL	NL	NL	NE	NL	0.0081 U	0.0078	0.053	0.0082 U	0.012	0.083 J	0.001 J	0.016	0.18	0.00067 U	0.00062 U	0.26 J	0.26 J	0.00076 U	0.00074 U	1.5	0.05
Chrysene	mg/kg	NL	NL	NL	NE	NL	0.0081 U	0.014	0.12	0.0021 U	0.025	0.082 U	0.0019 U	0.038	0.37	0.0017 U	0.0016 U	0.54 J	0.7 J	0.0019 U	0.0018 U	3.9	0.12
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0081 U	0.00021 U	0.025	0.0027 U	0.0045 J	0.011 U	0.00025 U	0.0064	0.084	0.00022 U	0.00021 U	0.092 J	0.12 J	0.00025 U	0.00025 U	0.69	0.023
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.0089	0.014 J	0.16	0.0067 U	0.036	0.27 U	0.0062 U	0.041	0.48	0.0054 U	0.0051 U	0.43 J	0.71 J	0.0062 U	0.006 U	6.4	0.2
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0081 U	0.00053 U	0.0043 J	0.00069 U	0.026	0.027 U	0.00063 U	0.00071 J	0.015 J	0.00056 U	0.00052 U	0.0053 U	0.0052 U	0.00064 U	0.00061 U	0.21	0.0049 J
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.0081 U	0.012	0.1	0.00082 U	0.015	0.087 U	0.0014 J	0.029	0.27	0.00067 U	0.00062 U	0.39 J	0.52 J	0.00076 U	0.00074 U	2.9	0.1
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0081 U	0.00085 U	0.0031 J	0.0011 U	0.0034 J	0.044 U	0.001 U	0.00093 U	0.0086 U	0.00089 U	0.00083 U	0.0091 J	0.0083 U	0.001 U	0.00098 U	0.074	0.0018 J
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.0081 U	0.0054 J	0.055	0.0021 U	0.037	0.095 J	0.0019 U	0.012	0.19	0.0017 U	0.0016 U	0.12 J	0.22 J	0.0019 U	0.0059 J	2.1	0.064
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.0084	0.012 J	0.15	0.006 U	0.034	0.24 U	0.0056 U	0.034	0.45	0.0049 U	0.0046 U	0.43 J	0.71 J	0.0056 U	0.0054 U	5.6	0.18
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.001	0.0168	0.18	0.0006	0.02	0.14	0.002	0.04	0.51	0.00056	0.00021	0.52	0.64	0.0003	0.0006	**4.9**	0.16
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.009	0.073	0.24	0.0007	0.11	0.1	0.04	0.06	0.75	0.00056	0.00052	0.6	0.97	0.0006	0.006	9.46	0.29
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.018	0.1	1	0.0006	0.17	0.63	0.009	0.25	**2.84**	0.00056	0.00021	**3.57**	**4.58**	0.0003	0.0003	**29.99**	0.97
Polychlorinated Biphenyls (PCBs)																							
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.061 U	NA	NA	NA	NA	NA	NA	NA	0.0081 U	0.0083 U	0.008 U	NA	NA	NA	NA	NA	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.061 U	NA	NA	NA	NA	NA	NA	NA	0.0046 U	0.0047 U	0.0045 U	NA	NA	NA	NA	NA	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.061 U	NA	NA	NA	NA	NA	NA	NA	0.0054 U	0.0055 U	0.0053 U	NA	NA	NA	NA	NA	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.061 U	NA	NA	NA	NA	NA	NA	NA	0.0017 U	0.0018 U	0.0017 U	NA	NA	NA	NA	NA	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.061 U	NA	NA	NA	NA	NA	NA	NA	0.0032 U	0.0032 U	0.0031 U	NA	NA	NA	NA	NA	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.061 U	NA	NA	NA	NA	NA	NA	NA	0.0016 U	0.0017 U	0.0016 U	NA	NA	NA	NA	NA	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.061 U	NA	NA	NA	NA	NA	NA	NA	0.0021 U	0.0021 U	0.002 U	NA	NA	NA	NA	NA	NA
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.061	NA	NA	NA	NA	NA	NA	NA	0.0021	0.0021	0.002	NA	NA	NA	NA	NA	NA
Metals																							
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	9,600 J	3200.0	4,800	16,000	7,300	2,900	10,000	6,000	5,900	7,800	6,600	5,600	5,100	10,000	11,000	10,000	4,800
Arsenic	mg/kg	20	88	2.9	7.61	132	12 U	0.5	4	7.1	1.9	1.1	6.2	4.4	1.5	2.3	2.2	2.3	1.9	3.7	2.5	4	1.7
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.61 U	0.1	0.16	0.18	0.15	0.12	0.34	0.16	0.17	0.15	0.15	0.28	0.24	0.24	0.24	**1.3**	0.15
Chromium	mg/kg	2000	5,300,000	490,000	31.88	67	4.00	2.3 J	17 J	8.6 J	16 J	3.7 J	15 J	7.8 J	55	4.3	3.4	19 J	14 J	2.4 J	1.7 J	21 J	7.1 J
Copper	mg/kg	NA	140,000	280	28.4	217	17.0	9.6	19	32	23	12	20	12	16	21	21	30	36	19	12	19	12
Lead	mg/kg	1000	NE	3,000	13.1	118	6.1 U	1.5	5.2	2.7	2.1	1.6	13.00	3.7	3.1	2.1	1.4	3.3	2.9	3.3	2.2	7.2	2.9
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.3 U	0.0058 U	0.006 U	0.019 J	0.0063 U	0.0062 U	0.0075 U	0.0063 U	0.0062 U	0.0067 U	0.0063 U	0.0059 U	0.0062 U	0.007 U	0.0083 J	0.0086 J	0.006 U
Nickel	mg/kg	NA	70,000	130	24.54	980	3.60	2	12	3.5	11	5.4	17	4.8	45	4.6	4.4	16	16	4.3	4.7	90 J	5.5 J
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	12 U	**1**	**1.1**	**0.74**	**1.2**	**1.1**	**1.4**	**2.5**	**1.4**	**1.4**	**1.9**	**1**	**0.99**	**0.97**	**0.92**	**1.5**	**1**
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	48	28	64	40	38	33	59	47	42	44	46	59	50	44	21	81	31
Benzene	mg/kg	0.03	2,400	0.027	NE	0.26	0.0012 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.006 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.0012 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.0024 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	0.0012 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.0012 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.0012 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.0012 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.0012 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	0.0012 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (TPHs)																							
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	30 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	61 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

J	Estimated Concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method reporting limit.
Z	Chromatographic fingerprint does not resemble a petroleum product.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

- *SWMU 6*. Four Soil borings SWMU06-SB01 to SWMU06-SB04 and two monitoring wells RI-GW7 and RI-MW6-BAU that investigated the large clarifier. Fluoride was not detected at concentrations that exceeded the protection of groundwater screening level. Detected concentrations of sulfate up to 150 mg/kg at 3.5 ft bgs in SWMU06-SB02.

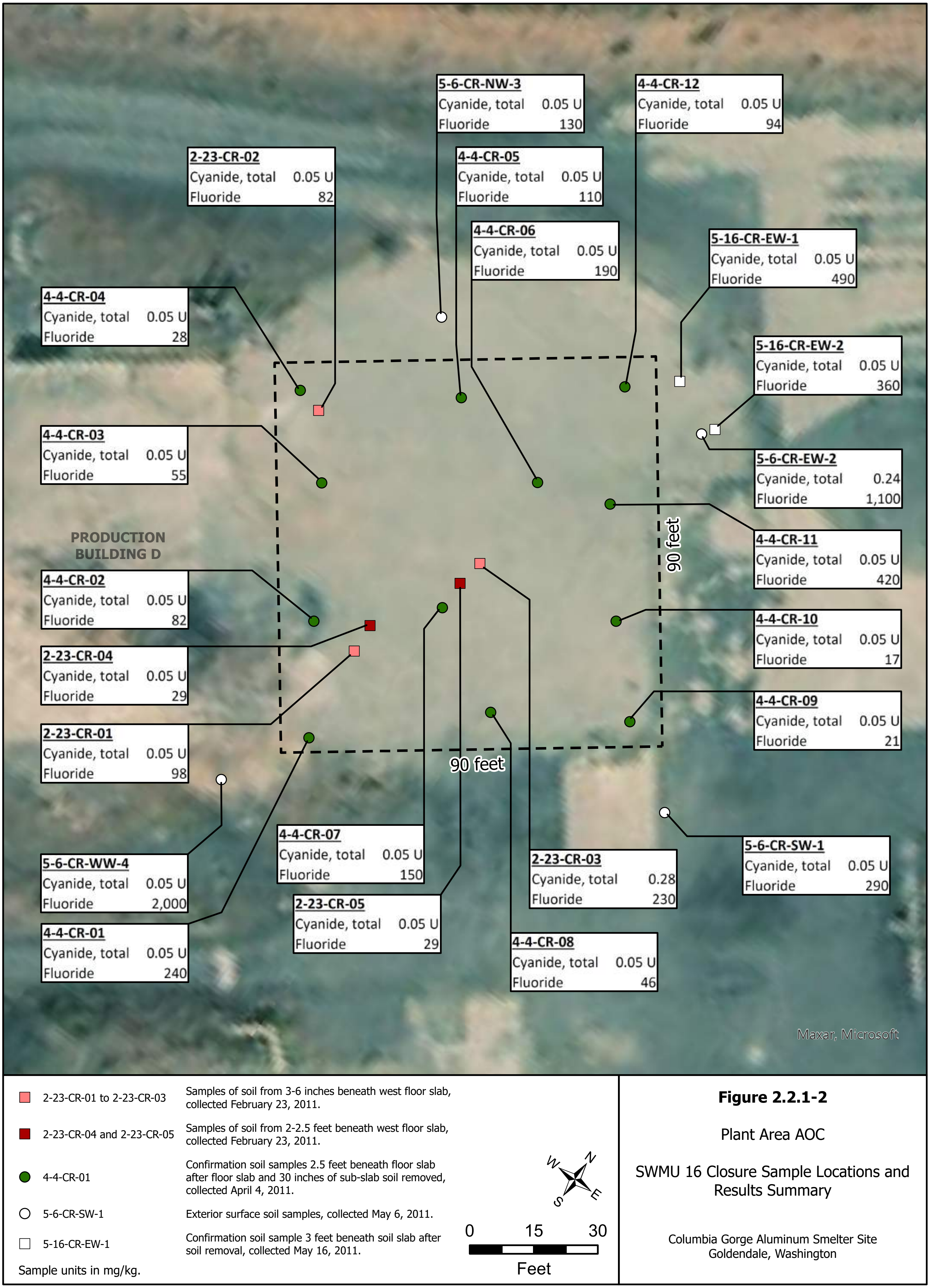
- *SWMU 8*. Two soil borings SWMU08-SB01 and SWMU08-SB02 that investigated the Tertiary Treatment Plant. Detected concentration of fluoride of 730 mg/kg at 0.5 ft bgs in SWMU08-SB02, and sulfate at up to 830 mg/kg at 11 ft bgs in SWMU08-SB01.

- *SWMU 16*. A series of Pre-RI sub-slab and surface soil samples that supported closure of the RCRA facility (Figure 2.2.1-2) detected concentrations of fluoride of up to 2,000 mg/kg at approximately 2.5 ft beneath the floor slab, and in shallow soil at approximately 2.5 ft bgs at the northeast corner of the SWMU 16 building. A 2011 removal excavated up to 3 ft below the building floor slab and at the northeast corner of the building.

- *Groundwater monitoring wells downgradient from SWMU 6 and SWMU 8*. Groundwater analytical results indicate detection of fluoride at up to 17 milligrams per liter (mg/L) in well RI-GW7 [Unconsolidated Aquifer (UA)], and up to 130 mg/L in well RI-MW6 [Basalt Aquifer – Upper Zone (BAU)] during the 2017 quarterly groundwater monitoring program (Groundwater AOC, Volume 4, Section 2).

Soil boring SB-CU01 is the location where fluoride has been detected in soil at the highest concentrations that exceeds the protection of groundwater screening level and at the deepest depth. Soil boring SB-BH03 is the location where sulfate has been detected in soil at the highest concentrations that exceed the protection of groundwater screening level at the deepest depth in the boring. In boring SB-BH02, the vertical extent of fluoride concentrations that exceed the protection of groundwater screening level has not been defined.

The Crucible Cleaning Room Investigation Area may be a potential source of fluoride and sulfate soil contamination contributing to the interpreted area-wide fluoride plume and elevated concentrations of sulfate in shallow groundwater. Groundwater (UA and BAU) investigation during the initial RI has identified a sitewide fluoride plume with concentrations up to approximately 15 mg/L in the UA aquifer in the investigation area and with the northern edge of the plume north of the Tertiary Treatment Plant and large clarifier. An area wide sulfate plume was not identified during the initial RI, but sulfate has been detected in the UA aquifer in and near the investigation area at concentrations that are elevated but below the 250 mg/L secondary MCL screening level (Groundwater AOC, Volume 4, Section 2). Groundwater flow gradients are interpreted to be radially southward from the clarifier area for both the UA and BAU aquifers.



🟥	2-23-CR-01 to 2-23-CR-03	Samples of soil from 3-6 inches beneath west floor slab, collected February 23, 2011.
🟥	2-23-CR-04 and 2-23-CR-05	Samples of soil from 2-2.5 feet beneath west floor slab, collected February 23, 2011.
●	4-4-CR-01	Confirmation soil samples 2.5 feet beneath floor slab after floor slab and 30 inches of sub-slab soil removed, collected April 4, 2011.
○	5-6-CR-SW-1	Exterior surface soil samples, collected May 6, 2011.
☐	5-16-CR-EW-1	Confirmation soil sample 3 feet beneath soil slab after soil removal, collected May 16, 2011.

Sample units in mg/kg.

Figure 2.2.1-2

Plant Area AOC

SWMU 16 Closure Sample Locations and Results Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Other potential sources of fluoride and sulfate contamination impacting shallow groundwater include the Tertiary Treatment Plant and associated tanks and piping (SWMU 8), the large clarifier and associated tanks and piping (SWMU 6), and the SPL containment building at the end of Production Building D (SWMU 16). Potential pipe or tank leaks would allow fluoride- and sulfate-containing liquids to contact soil at depth. Sulfur was introduced into the aluminum production process by sulfur-bearing coke used in the anode paste. The air pollution control process removed sulfur dioxide with dry/wet scrubbers and then routed wastewater to the Tertiary Treatment Plant for further treatment.

The focus of the WPA phase of investigation was to identify potential soil sources of fluoride and sulfate contamination to shallow groundwater.

2.2.1.1 Investigation Scope

The Crucible Cleaning Room Investigation Area has been investigated during the WPA phase with 11 soil borings, installation of three shallow groundwater monitoring wells (in three of the soil borings), one grab groundwater sample collected from a temporary well screen installed in one boring, one round of groundwater samples from the three monitoring wells, and nine test pits. The WPA investigation also included evaluation of all soil and groundwater data collected during the initial RI in the Crucible Cleaning Room Investigation Area. Logs of borings and test pits are included in Volume 5, Appendices G-1 and G-2. The results of the initial RI phase of investigation are discussed together with the WPA phase in Section 2.2.1.2.

The objectives for the WPA phase of investigation included defining vertical and horizontal extent of fluoride and sulfate in subsurface soil, collection of grab groundwater samples if shallow groundwater is encountered in borings, installation of three shallow groundwater monitoring wells, and conduct one round of groundwater sampling from the three wells. The WPA investigation was conducted in stages using the decision tree approach to guide field decisions regarding the need for additional step-out borings and wells during one field mobilization (Volume 1, Section 3.2.1.3, Figure 3-1). Implementing the iterative approach included rapid turnaround time for laboratory analysis of fluoride and sulfate in soil and groundwater. The following summarizes investigation activities in successive stages of the WPA investigation of the Crucible Cleaning Room Investigation Area:

- 10 initial soil borings were completed with three shallow groundwater monitoring wells installed in three of the soil borings and include CCR-GW10, CCR-GW14, CCR-GW17, CCR-SB03 through CCR-SB06, CCR-SB08, CCR-SB09, CCR-SB11, and CCR-SB12 (Figure 2.2.1-1).
    - ❖ The borings were completed to variable depths planned to extend into basalt bedrock and up to 10 ft below shallow groundwater if encountered.
    - ❖ Soil samples were planned to be collected at a minimum 2.5 ft intervals and analyzed for cyanide, fluoride, sulfate, PAHs, and TPH-Dx.
    - ❖ If encountered, grab samples of groundwater were to be collected through temporary well screen installations. One grab groundwater sample was collected from CCR-SB05 and analyzed for cyanide, fluoride, sulfate, PAHs, and TPH-Dx.
    - ❖ One round of groundwater samples was collected from the three installed monitoring wells and were analyzed for cyanide, fluoride, sulfate, PAHs, and TPH-Dx.
- Based on rapid turnaround analytical results for fluoride and sulfate, one additional soil boring (bringing to total number of borings to 11), CCR-SB12, was completed in the southeastern portion of the investigation area in Courtyard Segment C4, with plans to install a fourth shallow groundwater monitoring well. The boring was completed to a depth of 15 ft bgs, five ft into hard fine-grained dry basalt, and no groundwater was encountered therefore a monitoring well was not installed.
    - ❖ Soil samples were collected at 2.5 and 7.5 ft bgs and analyzed for cyanide, fluoride, sulfate, PAHs, and TPH-Dx.
- Rapid turnaround analytical results for soil and groundwater samples did not provide data to support identification of significant areas of fluoride and sulfate soil contamination. Additional step-out borings north of SB-CU01 in the former SWMU 16 footprint were attempted but could not be completed because of numerous non-metal and non-concrete piping in the subsurface to a depth of approximately 8 ft bgs (piping was encountered in CCR-SB06 and CCR-GW20, requiring the borings move 5 ft from the first locations). The investigation was paused to change from air rotary drilling to a test pit investigation and resumed in a later second field mobilization.
    - ❖ Nine test pits were excavated below the SWMU 16 2011 soil removal depth beneath the floor slab and at the northwest corner of the building. The test pits were excavated to variable depths based upon encountering basalt bedrock or building footings.
    - ❖ Soil samples were collected from each observed soil type and analyzed for cyanide, fluoride, sulfate, PAHs, and metals.

At the conclusion of the second field mobilization, rapid turnaround analytical results did not indicate a fluoride or sulfate soil source of contamination for shallow groundwater and the field investigation for the Crucible Cleaning Room Investigation Area was completed.

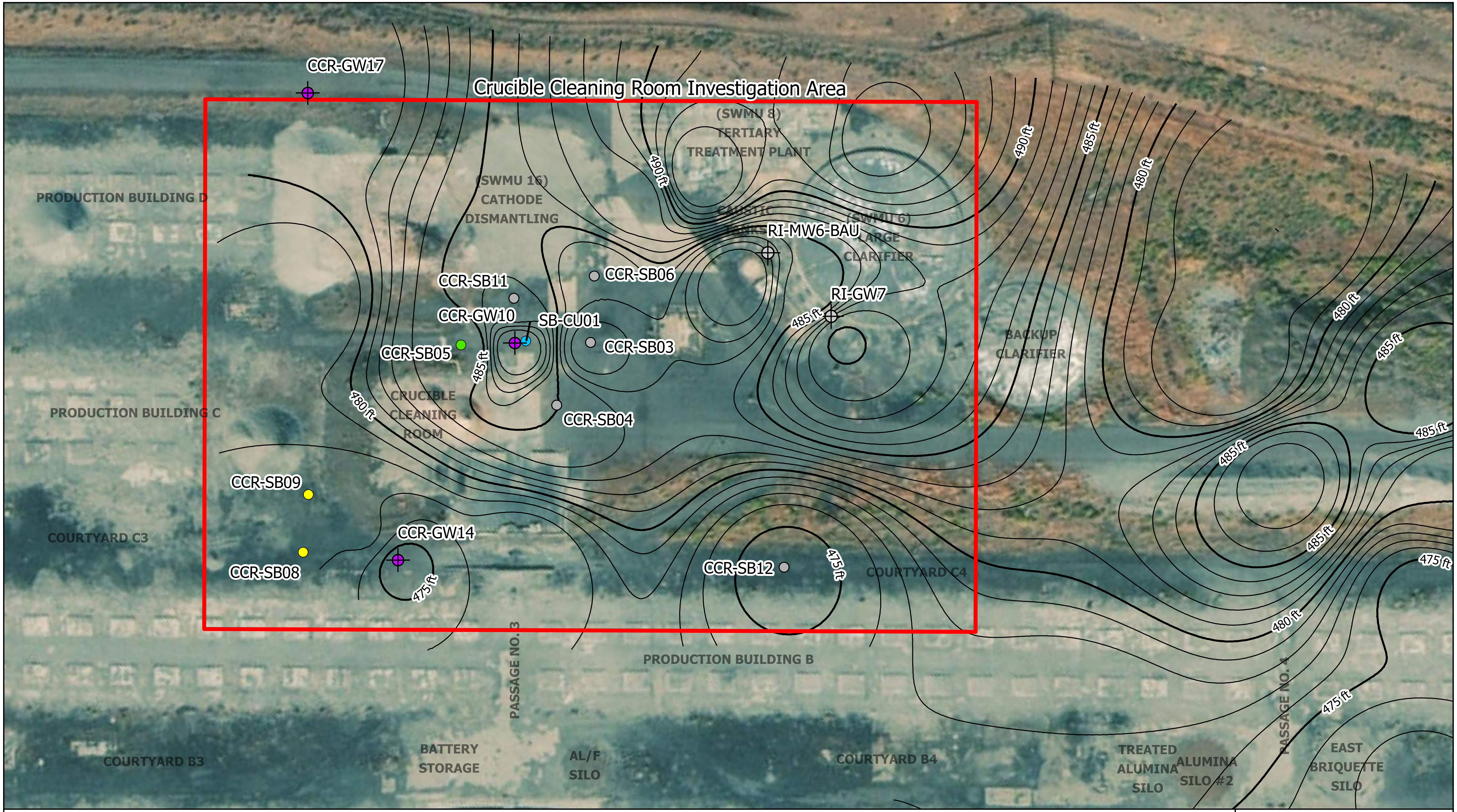
2.2.1.2 Investigation Results

The Crucible Cleaning Room Investigation Area was investigated during the WPA phase with a total of 11 soil borings, installation of three shallow groundwater monitoring wells, collection of one grab groundwater sample, one round of samples from the three monitoring wells, and nine test pits. In addition, initial RI investigation results for 13 soil borings and 2 groundwater monitoring wells have been incorporated into the evaluation of investigation results.

The 11 WPA soil borings were completed around the initial RI boring SB-CU01, around the initial RI boring SB-BH03, and near initial RI boring SB-BH02. All 11 soil borings encountered basalt as either flow top or hard fine-grained basalt. The depth to the basalt surface varied with depths of 5 to 10 ft bgs at the SB-CU01 location area which is at an elevation of approximately 493 ft, and depths of 6 to 15 ft bgs in Courtyard Segments C3, C4, and E3 which are at elevations of approximately 484 to 492 ft. The surface of the basalt underlying the Crucible Cleaning Room Investigation Area was encountered at variable depths and is portrayed on Figure 2.2.1-3, Crucible Cleaning Room Investigation Area Contour Map of Basalt Surface. Based on boring and test pit observations, the soil column in this area ranges from 5 to 10 ft thick and thins to the north and northeast at the Tertiary Treatment Plant as basalt bedrock becomes shallower then is exposed at ground surface. A profile view of the basalt surface is presented in Cross-Section A-A' Figure 2.2.1-4. As seen in the cross-section, the depth to the surface of the basalt is variable, with highest points below the SWMU 16 building and at well CCR-GW20. Hard fine-grained basalt was encountered in WPA borings CCR-GW20, CCR-SB05 and CCR-SB04. The basalt surface slopes away to the west, south and east, as can be seen in Figure 2.2.1-3.

Water levels measured in CCR-SB05, CCR-GW10, CCR-GW14, and CCR-GW17 were 18.25 ft bgs, 21.37 ft bgs, 11.4 ft bgs, and 20.63 ft bgs, respectively, which is approximately 470 to 475 ft elevation. Spring activity is visible as seepage at ground surface at the northwest corner of the Tertiary Treatment Plant during wetter portions of the year.

Soil analytical results are summarized in Table 2.2.1-1 (CCR Investigation Area RI Soil Results Summary), Table 2.2.1-2 (CCR Investigation Area WPA Soil Results Summary), and Table 2.2.1-3 (CCR Investigation Area WPA Test Pit Soil Results Summary). Groundwater analytical results are summarized in Table 2.2.1-4 (CCR Investigation Area WPA Groundwater Results Summary). Soil



🟥 CCR Investigation Area
● WPA Boring, Temp screen
● WPA Boring, Wet, no temp screen
● WPA Boring, Dry
● RI Boring
⊕ WPA Monitor Well

Contours at 1-ft intervals with 5-ft majors, calculated using Inverse Distance Weighted interpolation from subsurface basalt elevations.

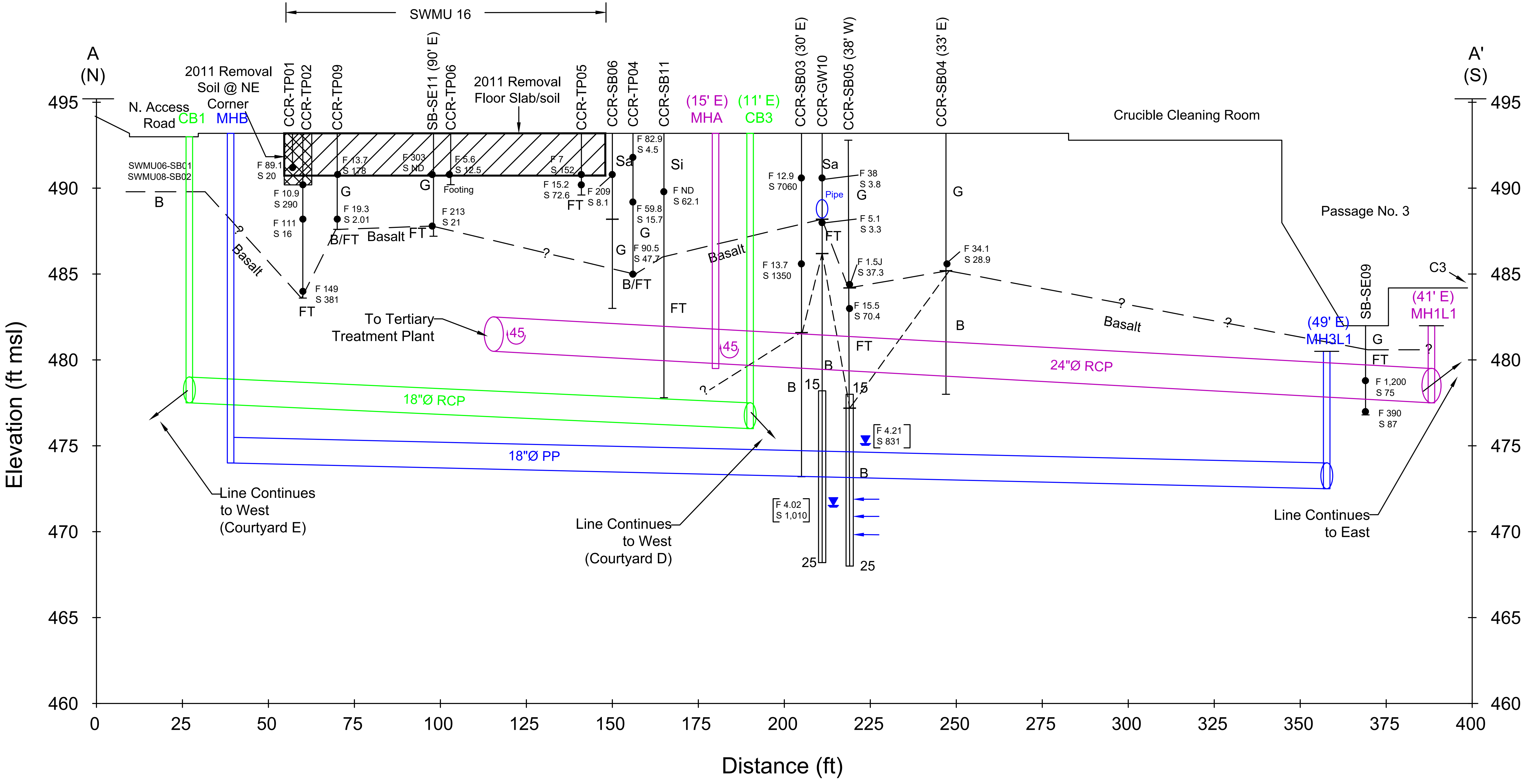
Figure 2.2.1-3

Plant Area AOC

Crucible Cleaning Room Area Investigation
Contour Map of Basalt Surface

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Maxar, Microsoft



Source: Plateau Geoscience Group

Legend

Si	Silt
Cl	Clay
Sa	Sand
G	Gravel
FT	Basalt Flowtop
B	Basalt, fine-grained, hard
GF	Gravel, poorly sorted
GW	Gravel, well sorted
ML	Silt, low plasticity
FT	Flow top
45	Projected distance in direction shown
⬭	14"Ø HDPE Pipe, Purpose Unknown

Wet soil

Water inflow

15 Well screen, depth, ft

25

Water level, ft bgs

F 215
S 21

Soil sample:

F	Fluoride, mg/kg
S	Sulfate, mg/kg
ND	Not detected

Water sample:

F 4.21
S 831

F	Fluoride, mg/L
S	Sulfate, mg/L
▼	Water level measurement

PP RCP	Perforated Pipe Reinforced Concrete Pipe
🟩 CB1	Stormwater System Catch Basin
🟪 MHA MH1L1	Industrial Monitoring System Manhole
🟦 MHB MH3L1	Groundwater System Manhole

Figure 2.2.1-4

CCR Investigation Area
Cross Section A-A'

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Table 2.2.1-2
CCR Investigation Area WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 1 of 2

		Screening Levels				Ecological Screening Level	WPA Analytical Results								
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-WPA-CCR-SB03-7.5**	**PAAOC-WPA-CCR-SB04-7.5**	**PAAOC-WPA-CCR-SB05-2.5**	**PAAOC-WPA-CCR-SB05-9**	**PAAOC-WPA-CCR-SB05-10**	**PAAOC-WPA-CCR-SB06-2.5**	**PAAOC-WPA-CCR-SB08-2.5**	**PAAOC-WPA-CCR-SB09-2.5**	**PAAOC-WPA-CCR-SB11-3.5**
Aluminum Smelting															
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.24 U	0.3 U	0.2 U	0.32 U	0.31 U	0.19 U	0.18 U	0.2 U	0.22
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	13.7	34.1	12.9	1.5 J	15.5	**209**	67.9	**199**	5.1 UJ
Sulfate	mg/kg	NA	NE	2,150	NE	NE	1,350 J	28.9 J	**7,860**	37.3 J	70.4 J	8.1 J	9.6 J	23.1 J	32.1 J
Polynuclear Aromatic Hydrocarbons (PAHs)															
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.001 JB	0.00096 JB	0.0011 JB	0.00093 JB	0.0011 JB	0.005 J	0.00072 JB	0.00077 JB	0.0007 J
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0064 U	0.00058 JB	0.0011 JB	0.0088 U	0.0084 U	0.032	0.0051 U	0.001 JB	0.0063 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0064 U	0.0082 U	0.0057 U	0.0088 U	0.0084 U	0.0004 J	0.0051 U	0.0057 U	0.0063 U
Anthracene	mg/kg	NL	NE	2,300	NE	NL	0.0064 U	0.00087 JB	0.0018 JB	0.0088 U	0.0084 U	0.032	0.00089 JB	0.0015 JB	0.0063 U
Benzo(a)anthracene	mg/kg	NL	NL	NL	NE	NL	0.0014 JB	0.0049 J	0.014	0.0088 U	0.0084 U	0.31	0.0044 J	0.008	0.0051 JB
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.00078 J	0.0062 J	0.019	0.0088 U	0.0084 U	0.4	0.0041 J	0.0098	0.0063 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0018 J	0.012	0.033	0.0088 U	0.0084 U	0.59	0.0065	0.015	0.0063 U
Benzo(g,h,i)perylene	mg/kg	NL	NE	NE	NE	NL	0.00078 J	0.0086	0.022	0.0088 U	0.0084 U	0.31	0.0035 J	0.0089	0.0063 U
Benzo(k)fluoranthene	mg/kg	NL	NL	NL	NE	NL	0.00082 J	0.0043 J	0.012	0.0088 U	0.0084 U	0.2	0.0029 J	0.0056 J	0.0063 U
Chrysene	mg/kg	NL	NL	NL	NE	NL	0.0012 J	0.0054 J	0.02	0.0088 U	0.0084 U	0.4	0.005 J	0.0083	0.0063 U
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0064 U	0.0016 J	0.0034 J	0.0088 U	0.0084 U	0.071	0.0054 J	0.0016 J	0.0063 U
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	0.0064 U	0.0082 U	0.00083 JB	0.0012 JB	0.0084 U	0.011	0.0051 U	0.0014 JB	0.0063 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.0016 JB	0.0062 JB	0.019	0.004 JB	0.0016 JB	0.42	0.0064 B	0.015	0.0063 U
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0064 U	0.0082 U	0.00094 JB	0.0088 U	0.0084 U	0.018	0.0051 U	0.0016 JB	0.0063 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.00077 J	0.0075 J	0.02	0.0088 U	0.0084 U	0.32	0.003 J	0.0082	0.0063 UJ
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0017 JB	0.0017 JB	0.0017 JB	0.0018 JB	0.0021 JB	0.0084	0.0011 JB	0.0014 JB	0.001 JB
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.0015 JB	0.0037 JB	0.0096 B	0.0071 JB	0.0031 JB	0.2	0.0032 JB	0.013 B	0.0063 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.0015 JB	0.0064 J	0.02	0.0027 JB	0.00099 JB	0.42	0.0067	0.014	0.0063 U
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.001	0.01	0.03	0.0088 U	0.0084 U	0.55	0.009	0.01	0.0005
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.01	0.01	0.03	0.01	0.007	0.71	0.02	0.03	0.001
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.01	0.06	0.16	0.003	0.001	**3.21**	0.04	0.08	0.005
Total Petroleum Hydrocarbons (TPHs)															
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	49 U	83 U	4.6 J	7.9 J	3.9 J	9 J	12 J	16 J	32 U
Residual Range Organics	mg/kg	2,000	NE	NE	NE	2,000	8.8 J	19 J	14 J	15 J	200 U	28 J	49 J	43 J	130 U

Notes:

B	The sample result is less than five times the blank contamoination and cross-contamination is suspected.
J	Estimated Concentration.
NA	Not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method reporting limit.
X	Chromatogram indicated the presence of non-target components. Matrix interference may have resulted in a slight high bias.
Z	Chromatographic fingerprint does not resemble a petroleum product.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.2.1-2
CCR Investigation Area WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
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	Screening Levels					Ecological Screening Level	WPA Analytical Results							
Parameter Name	**Units**	**MTCA Method A Industrial**	**Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-WPA-CCR-SB11-3.5D**	**PAAOC-WPA-CCR-SB12-2.5**	**PAAOC-WPA-CCR-SB12-7.5**	**PAAOC-WPA-CCR-GW10-2.5**	**PAAOC-WPA-CCR-GW10-5**	**PAAOC-WPA-CCR-GW14-2.5**	**PAAOC-WPA-CCR-GW14-7.5**	**PAAOC-WPA-CCR-GW17-15**
Aluminum Smelting														
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.23 U	0.19 U	0.19 U	0.19 U	0.23 U	0.2 U	0.2 U	0.24 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	3.3 J	19.3	4.4 U	38 J	5.1 J	2.4 J	4.5 U	1.9 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	8 J	160	66.5	3.8	13.3	5.5 JB	198 J	5.7
Polynuclear Aromatic Hydrocarbons (PAHs)														
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.00081 J	0.0005 J	0.00059 J	0.00061 J	0.00074 J	0.0015 JB	0.00075 JB	0.0065 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0062 U	0.0054 U	0.00087 JB	0.00059 J	0.0062 U	0.00082 JB	0.0055 U	0.0065 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0062 U	0.0054 U	0.0055 U	0.0053 U	0.0062 U	0.00051 J	0.0055 U	0.0065 U
Anthracene	mg/kg	NL	NE	2,300	NE	NL	0.0062 U	0.00032 J	0.00063 JB	0.00089 J	0.0062 U	0.00096 JB	0.0055 U	0.0065 U
Benzo(a)anthracene	mg/kg	NL	NL	NL	NE	NL	0.00053 JB	0.001 J	0.0015 JB	0.0029 J	0.002 J	0.0055 U	0.00094 J	0.0017 J
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.0062 U	0.00051 J	0.0013 JB	0.0034 J	0.0019 J	0.0055 U	0.0055 U	0.001 J
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0062 U	0.0014 J	0.0022 JB	0.0041 J	0.0039 J	0.0055 U	0.0012 J	0.0029 J
Benzo(g,h,i)perylene	mg/kg	NL	NE	NE	NE	NL	0.0062 U	0.00063 J	0.0013 JB	0.0021 J	0.0024 J	0.0055 U	0.00045 J	0.0015 J
Benzo(k)fluoranthene	mg/kg	NL	NL	NL	NE	NL	0.0062 U	0.00059 J	0.0059 B	0.0018 J	0.0015 J	0.0055 U	0.0055 U	0.001 J
Chrysene	mg/kg	NL	NL	NL	NE	NL	0.0062 U	0.00088 J	0.0014 JB	0.0031 J	0.003 J	0.0055 U	0.00051 J	0.0014 J
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0062 U	0.0054 U	0.0055 U	0.0053 U	0.0004 J	0.0055 U	0.0055 U	0.0065 U
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	0.0062 U	0.0054 U	0.001 J	0.0007 J	0.0062 U	0.0018 JB	0.0011 JB	0.0065 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.00085 J	0.0013 J	0.0041 JB	0.0062	0.003 J	0.0042 JB	0.0014 JB	0.002 J
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0062 U	0.0054 U	0.001 JB	0.0008 J	0.0062 U	0.0022 JB	0.0055 U	0.0065 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.0062 UJ	0.007 J	0.0011 JB	0.0021 J	0.0021 J	0.0055 U	0.0055 U	0.0013 J
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0012 JB	0.00089 JX	0.086 JB	0.0011 JB	0.0013 JB	0.0018 JB	0.0013 JB	0.00064 J
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.0019 J	0.0011 JB	0.0072 B	0.006	0.0015 J	0.012 B	0.002 JB	0.0019 J
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.00063 J	0.0013 JXB	0.0032 JXB	0.0057	0.0026 J	0.0028 JB	0.0011 JB	0.0023 JX
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.00053	0.002	0.002	0.005	0.003	0.006	0.0002	0.002
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.004	0.004	0.1	0.02	0.006	0.02	0.005	0.005
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.001	0.01	0.01	0.03	0.02	0.003	0.004	0.01
Total Petroleum Hydrocarbons (TPHs)														
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	31 U	NA	NA	27 U	4.2 J	7.6 J	64 Z	25 J
Residual Range Organics	mg/kg	2,000	NE	NE	NE	2,000	130 U	NA	NA	5 J	6.7 J	27 J	56 J	46 J

Notes:

B	The sample result is less than five times the blank contamoination and cross-contamination is suspected.
J	Estimated Concentration.
NA	Not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method reporting limit.
X	Chromatogram indicated the presence of non-target components. Matrix interference may have resulted in a slight high bias.
Z	Chromatographic fingerprint does not resemble a petroleum product.

TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.2.1-3
CCR Investigation Area WPA Test Pit Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 1 of 2

		Screening Levels				Ecological Screening Level	WPA Analytical Results									
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-WPA-CCR-TP01-2.0**	**PAAOC-WPA-CCR-TP02-3.0**	**PAAOC-WPA-CCR-TP02-5.0**	**PAAOC-WPA-CCR-TP02-5.0D**	**PAAOC-WPA-CCR-TP02-9.0**	**PAAOC-WPA-CCR-TP03-3.0**	**PAA0C-WPA-CCR-TP03-5.0**	**PAAOC-WPA-CCR-TP04-2.5**	**PAAOC-WPA-CCR-TP04-4.0**	**PAAOC-WPA-CCR-TP04-8.0**
Aluminum Smelting																
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	89.1	10.9	111	99.6	14.9	11.5	44.4	82.9	59.8	90.5
Sulfate	mg/kg	NA	NE	2,150	NE	NE	20	290	16	39.8	381	484	69.3	4.5	15.7	47.7
Polynuclear Aromatic Hydrocarbons (PAHs)																
2-Methylnaphthalene	mg/kg	NL	4,500	0.082	NE	NL	0.0023 J	0.0025 J	0.0036 J	0.0074	0.0021 J	0.0019 J	0.0012 J	0.13	0.0023 J	0.011
Acenaphthene	mg/kg	NA	14,000	1.7	NE	NL	0.019	0.013	0.046	0.081	0.014	0.0097	0.0072	0.44	0.016	0.076
Acenaphthylene	mg/kg	NA	210,000	98	NE	NL	0.001 J	0.00053 J	0.0034 J	0.0027 J	0.00055 J	0.00038 J	0.00094 J	0.0051 J	0.00038 J	0.0008 J
Anthracene	mg/kg	NA	NE	NE	NE	NL	0.023	0.019	0.058	0.085	0.025	0.016	0.011	0.33	0.014	0.068
Benzo(a)anthracene	mg/kg	NL	NE	2,300	NE	NL	0.34	0.61	0.08	0.96	0.41	0.44	0.12	3.2	0.13	0.72
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.44	0.45	1.1	1.4	0.39	0.36	0.16	3.6	0.18	0.87
Benzo(b)fluoranthene	mg/kg	NL	NL	NL	NE	NL	0.79	2.2	2.1	2.3	1.3	1.6	0.33	5.1	0.29	1.4
Benzo(g,h,i)perylene	mg/kg	NA	NL	NL	NE	NL	0.5	0.64	1.5	1.9	0.56	0.51	1.9	2	0.15	0.61
Benzo(k)fluoranthene	mg/kg	NL	NE	NE	NE	NL	0.25	0.47	0.65	0.66	0.37	0.41	0.1	1.8	0.1	0.47
Chrysene	mg/kg	NL	NL	NL	NE	NL	0.56	2.1	1.3	1.4	1.2	1.5	0.22	4	0.19	1
Dibenzo(a,h)anthracene	mg/kg	NL	NL	NL	NE	NL	0.09	0.16	0.21	0.29	0.12	0.11	0.038	0.57	0.033	0.15
Dibenzofuran	mg/kg	NA	NL	NL	NE	NL	0.0069	0.0072	0.013	0.024	0.006	0.0045 J	0.0027 J	0.13	0.0048 J	0.027
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.57	2.1	1.2	1.4	1.2	1.3	0.2	5.9	0.23	1.1
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.01	0.0072	0.022	0.035	0.0074	0.0052 J	0.0038 J	0.24	0.0081	0.04
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.45	0.77	1.3	1.7	0.61	0.62	0.17	2.4	0.15	0.68
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0042 J	0.0032 J	0.007	0.017	0.0041 J	0.0028 J	0.0024 J	0.18	0.0039 J	0.017
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.18	0.3	0.38	0.49	0.16	0.12	0.06	2.6	0.092	0.48
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.58	1.8	1.3	1.5	0.98	1.1	0.19	5.2	0.21	1.1
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.64	0.89	1.42	2	0.67	0.69	0.24	**4.95**	0.25	1.22
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.62	2.44	1.72	2.11	1.44	1.45	0.29	9.7	0.36	1.78
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**4**	**9.2**	**9.54**	**12.11**	**5.94**	**6.65**	**3.23**	**27.9**	**6.42**	**7**
Metals																
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	10,700	11,200	12,800	12,700	13,000	11,600	12,000	7,750	6,770	8,780
Arsenic	mg/kg	20	88	2.9	7.61	132	4.4	4.93	3.27	2.86	**7.71**	4.21	3.42	2.06	1.7	1.79
Cadmium	mg/kg	2	3,500	0.7	0.81	14	0.404	0.18	**1.05**	0.766	0.325	0.194	0.345	0.756	0.249	0.509
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	11.1	22.2	17.5	12	16.8	17.3	13.7	10.1	4.57	11.5
Copper	mg/kg	NA	140,000	280	28.4	217	34.8	33.2	21.1	22.7	30.7	26.1	20	14.5	16.7	19.7
Lead	mg/kg	1,000	NE	3,000	13.1	118	9.41	5.01	4.87	4.62	6.59	4.35	4.64	4.36	3.79	5.94
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.096 U	0.022 U	0.02 U	0.023 U	0.024 U	0.019 U	0.021 U	0.022 U	0.021 U	0.004 J
Nickel	mg/kg	NA	70,000	130	24.54	980	11	12.8	15.9	14.3	12.1	11.1	12.3	9.85	6.45	7.76
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	0.28 J	0.1 J	0.2 J	0.3 J	0.2 J	**0.35 J**	0.2 J	0.09 J	0.1 J	.01 J
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	96.7	109	73.4	74.3	79.8	71.7	69.3	112	71.7	117

Notes:

B	The sample result is less than five times the blank contamination and cross-contamination is suspected.
J	Estimated Concentration.
NA	Not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method reporting limit.
X	Chromatogram indicated the presence of non-target components. Matrix interference may have resulted in a slight high bias.
Z	Chromatographic fingerprint does not resemble a petroleum product.

TTEC	Total Toxicity Equivalent Concentrattion for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.2.1-3
CCR Investigation Area WPA Test Pit Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 2 of 2

Parameter Name	Units	Screening Levels				Ecological Screening Level	WPA Analytical Results								
		MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-WPA-CCR-TP05-2.5	PAAOC-WPA-CR-TP05-3.0	PAAOC-WPA-CCR-TP06-2.5	PAAOC-WPA-CCR-TP07-2.5	PAAOC-WPA-CCR-TP07-4.0	PAAOC-WPA-CCR-TP08-2.5	PAAOC-WPA-CCR-TP08-5.0	PAAOC-WPA-CCR-TP09-2.5	PAAOC-WPA-CCR-TP09-5.0
Aluminum Smelting															
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.02 U	0.02 U	0.02 U	0.09 J	0.02 U	0.02 U	0.08 J	0.02 U	0.02 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	7	15.2	5.6	17.4	4.8 U	7.9	22.8	13.7	19.3
Sulfate	mg/kg	NA	NE	2,150	NE	NE	152	72.6	125	174	294	248	200	178	201
Polynuclear Aromatic Hydrocarbons (PAHs)															
2-Methylnaphthalene	mg/kg	NL	4,500	0.082	NE	NL	0.0023 J	0.0029 J	0.0032 J	0.0029 J	0.006 U	0.0019 J	0.002 J	0.0034 J	0.0023 J
Acenaphthene	mg/kg	NA	14,000	1.7	NE	NL	0.016	0.021	0.022	0.02	0.006 U	0.01	0.0091	0.017	0.013
Acenaphthylene	mg/kg	NA	210,000	98	NE	NL	0.00092 J	0.00048 J	0.00064 J	0.00082 J	0.006 U	0.00094 J	0.00068 J	0.0011 J	0.00053 J
Anthracene	mg/kg	NA	NE	NE	NE	NL	0.02	0.024	0.024	0.024	0.006 U	0.022	0.014	0.034	0.02
Benzo(a)anthracene	mg/kg	NL	NE	2,300	NE	NL	0.55	0.51	0.44	0.42	0.00095 J	0.93	0.46	1.2	0.35
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.39	0.35	0.39	0.42	0.006 U	0.49	0.29	0.64	0.26
Benzo(b)fluoranthene	mg/kg	NL	NL	NL	NE	NL	2.1	1.2	1.3	0.97	0.0013 J	2.6	1.3	3.6	0.95
Benzo(g,h,i)perylene	mg/kg	NA	NL	NL	NE	NL	0.58	0.36	0.44	0.46	0.00055 J	0.59	0.37	0.8	0.29
Benzo(k)fluoranthene	mg/kg	NL	NE	NE	NE	NL	0.48	0.32	0.36	0.35	0.0003 J	0.6	0.35	0.79	0.26
Chrysene	mg/kg	NL	NL	NL	NE	NL	2.1	1.4	1.3	0.97	0.00098 J	3.3	1.4	4.3	1
Dibenzo(a,h)anthracene	mg/kg	NL	NL	NL	NE	NL	0.15	0.089	0.11	0.011	0.006 U	0.15	0.097	0.22	0.072
Dibenzofuran	mg/kg	NA	NL	NL	NE	NL	0.0091	0.0075	0.0092	0.0076	0.006 U	0.0044 J	0.004 J	0.0088	0.007
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	2.8	1.2	1.2	0.65	0.0014 J	2.8	1.4	3.9	0.94
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0076	0.012	0.011	0.011	0.006 U	0.0054 J	0.0045 J	0.0073	0.008
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.73	0.39	0.5	0.5	0.00067 J	0.66	0.4	0.89	0.32
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0044 J	0.004 J	0.0061	0.0051 J	0.00091 J	0.0029 J	0.0029 J	0.0044 J	0.0047 J
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.22	0.14	0.18	0.16	0.006 U	0.14	0.11	0.24	0.15
Pyrene	mg/kg	NA	110,000	650	NE	NL	1.8	1.1	0.9	0.68	0.00087 J	2.1	1.1	3.2	0.74
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.92	0.62	0.67	0.66	0.00093	1.01	0.57	1.35	0.47
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	3.07	1.4	1.44	0.87	0.002	2.98	1.54	4.11	1.14
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**8.8**	**5.72**	**5.74**	**4.78**	0.01	**11.42**	**5.77**	**15.64**	**4.24**
Metals															
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	10,800	8,660	8,980	8,580	9,350	11,900	12,100	12,900	11,800
Arsenic	mg/kg	20	88	2.9	7.61	132	4.44	3.46	4.46	2.7	**7.71**	3.4	3.52	3.39	3.95
Cadmium	mg/kg	2	3,500	0.7	0.81	14	0.268	0.424	0.325	0.424	0.124	0.432	0.459	0.521	0.282
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	19	6.54	26.2	9	12.5	23	13.9	21.6	12
Copper	mg/kg	NA	140,000	280	28.4	217	33.1	24.4	43.3	16	17.3	34.9	29.9	36.4	36.9
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.59	5.67	5.25	5.25	12.3	14.1	10.2	21.8	12.4
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.02 U	0.022 U	0.021 U	0.022 U	0.023 U	0.023 U	0.023 U	0.02 U	0.021 U
Nickel	mg/kg	NA	70,000	130	24.54	980	12.1	7.9	17.3	8.54	9.99	12.9	12.4	15.6	10.5
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	0.1 J	.02 J	0.12 J	0.1 J	0.1 J	.017 J	0.2 J	0.17 J	.02 J
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	137	75.8	109	95.8	59.1	231	134	246	90.7

Notes:

B	The sample result is less than five times the blank contamination and cross-contamination is suspected.
J	Estimated Concentration.
NA	Not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method reporting limit.
X	Chromatogram indicated the presence of non-target components. Matrix interference may have resulted in a slight high bias.
Z	Chromatographic fingerprint does not resemble a petroleum product.

TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.2.1-4
CCR Investigation Area WPA Groundwater Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels						WPA Analytical Results				
Parameter Name	**Units**	**MTCA Method A**	**MTCA Method B**	**MTCA Method C**	**WA MCL**	**Natural Background**	**PAAOC-WPA-CCR-SB05-GW01**	**PAAOC-WPA-CCR-GW10-GW01**	**PAAOC-WPA-CCR-GW14-GW01**	**PAAOC-WPA-CCR-GW14-GW02**	**PAAOC-WPA-CCR-GW17-GW01**
Aluminum Smelting											
Cyanide, Free	mg/L	NE	0.01	0.022	0.2	ND	0.002 U	0.002 U	0.00195	0.002 U	0.002
Fluoride	mg/L	NE	0.96	2.1	4	0.72	**4.21**	**4.02**	**4.85**	**4.64**	1.05
Sulfate	mg/L	NE	NE	NE	250	32	**831**	**1,010**	**600**	**735**	80.4
Polynuclear Aromatic Hydrocarbons (PAHs)											
2-Methylnaphthalene	ug/L	NL	32	70	NE	NE	0.044	0.0065 JB	0.036	0.0044 JB	0.019 JB
Acenaphthene	ug/L	NA	960	2,100	NE	NE	0.0024 JB	0.0065 J	0.0035 JB	0.0044 JB	0.0052 JB
Acenaphthylene	ug/L	NA	NE	NE	NE	NE	0.02 U	0.0035 JB	0.0019 JB	0.02 U	0.02 U
Anthracene	ug/L	NA	4,800	11,000	NE	NE	0.02 U	0.02 U	0.0016 JB	0.02 U	0.02 U
Benzo(a)anthracene	ug/L	NL	NL	NL	NE	NE	0.0027 JB	0.0024 JB	0.0098 JB	0.0085 JB	0.0049 JB
Benzo(a)pyrene	ug/L	0.1	0.023	1	0.2	NE	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Benzo(b)fluoranthene	ug/L	NL	NL	NL	NE	NE	0.02 U	0.02 U	0.0016 JB	0.02 U	0.0012 JB
Benzo(g,h,i)perylene	ug/L	NA	NE	NE	NE	NE	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Benzo(k)fluoranthene	ug/L	NL	NL	NL	NE	NE	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Chrysene	ug/L	NL	NL	NL	NE	NE	0.00089 JB	0.0012 JB	0.0024 JB	0.0011 JB	0.003 JB
Dibenzo(a,h)anthracene	ug/L	NL	NL	NL	NE	NE	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Dibenzofuran	ug/L	NL	NL	NE	NE	NE	0.0024 JB	0.001 JB	0.0074 JB	0.0024 JB	0.02 U
Fluoranthene	ug/L	NA	640	1,400	NE	NE	0.003 JB	0.0032 JB	0.006 JB	0.0019 JB	0.008 JB
Fluorene	ug/L	NA	640	1,400	NE	NE	0.003 JB	0.0013 JB	0.011 JB	0.0049 JB	0.02 U
Indeno(1,2,3-cd)pyrene	ug/L	NL	NL	NL	NE	NE	0.02 U	0.02 UJ	0.02 U	0.02 UJ	0.02 UJ
Naphthalene	ug/L	160	160	350	NE	NE	0.01 JB	0.0071 JB	0.034 B	0.0074 JB	0.016 JB
Phenanthrene	ug/L	NA	NE	NE	NE	NE	0.016 JB	0.0022 JB	0.014 JB	0.0012 JB	0.02 U
Pyrene	ug/L	NA	480	1,100	NE	NE	0.0023 JB	0.0034 JB	0.016 JB	0.0014 JB	0.0064 JB
TTEC cPAH (calc)	ug/L	0.1	0.2	0.2	NE	NE	0.0003	0.0003	0.0011	0.0009	0.0006
Total Petroleum Hydrocarbons (TPHs)											
Diesel Range Organics	mg/L	0.5	NE	NE	NE	NE	0.087 J	0.047 JB	0.045 JB	0.036 JB	0.039 JB
Residual Range Organics	mg/L	0.5	NE	NE	NE	NE	0.048 J	0.073 JB	0.026 JB	0.042 JB	0.045 JB

Notes:

B	The sample result is less than five times the blank contamination and cross-contamination is suspected.
J	Estimated concentration.
MCL	Maximum Contaminant Level.
NA	Not analyzed or not applicable.
ND	Not detected.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by summation process.
TTEC	Total Toxicity Equivalent Concentration.
U	Chemical was not detected. The associated value represents the method reporting limit.
UJ	Chemical was not detected. The associated limit is estimated.

Detected concentrations shown in **bold** exceed one or more site groundwater screening level.

results are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. Groundwater results are compared to MTCA Method A, MTCA Method B, MTCA Method C, and the Washington State Maximum Contaminant Level (WA MCL) screening levels. Natural background concentrations for the site have been used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech. et al. 2015b) and WPA (Tetra Tech et al. 2020b). Soil reporting limits for arsenic exceed the protection of groundwater screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels for half of the initial RI samples analyzed. WPA soil and groundwater reporting limit objectives have been met.

Soil and water analytical results that exceed Plant Area AOC soil and water screening levels are compiled and presented on Figure 2.2.1-1, CCR Investigation Area Sampling Location and Exceedance Summary. For WPA soil samples, analytical results indicate that sulfate, fluoride, PAH as TTEC and calculated total HMW, and two metals (arsenic and selenium) were detected at concentrations that exceed soil screening levels.

Sulfate was detected at a concentration of 7,860 mg/kg in CCR-SB05 at 2.5 ft bgs but not in deeper depth samples at 9 and 10 ft bgs in boring CCR-SB05 located approximately 50 ft west of SB-CU01. Sulfate was not detected in any other WPA soil samples at concentrations that exceed the protection of groundwater screening level.

Fluoride was detected in two WPA soil borings at concentrations that exceed the protection of groundwater screening level. The detections include 209 mg/kg at 2.5 ft bgs in boring CCR-SB06 (pipe obstruction caused first boring abandonment at 5 ft bgs) approximately 50 ft east of SB-CU01, and 199 mg/kg at 2.5 ft bgs in boring CCR-SB09 approximately 200 ft southwest of SB-CU01. Fluoride was not detected at concentrations that exceed the protection of groundwater screening level in soil samples from eight out of 11 WPA soil borings, and nine WPA test pits. The concentrations of fluoride detected in WPA borings and test pits that ranged in concentration from below the protection of groundwater screening level up to 209 mg/kg do not represent a significant source of soil contamination to shallow groundwater.

PAH as TTEC was detected at a concentration of 4.95 mg/kg in test pit CCR-TP04 at 2.5 ft bgs exceeding MTCA Method C. PAHs did not exceed screening levels in any deeper depth samples, and not in any other WPA boring or test pit. PAH as total HMW was detected at calculated concentrations ranging from 3.23 to 15.64 mg/kg at all depths sampled in the WPA test pits and was not detected at concentrations that exceed screening levels in any of the WPA borings. Arsenic was detected at concentrations that exceed the protection of groundwater screening level in two test pits including 7.71 mg/kg in CCR-TP02 at 9 ft bgs, and at 7.71 mg/kg in CCR-TP07 at 4 ft bgs. Arsenic was not detected at concentrations that exceed the protection of groundwater screening level in any of the WPA soil borings. Selenium was detected at a low concentration of 0.35 J mg/kg that exceeds the ecological wildlife screening level in one test pit CCR-TP03 at 3 ft bgs but not in deeper depths sampled, and not in the other eight test pits or WPA soil borings.

For groundwater, fluoride and sulfate were the only two COPCs that were detected at concentrations that exceed water screening levels in the grab groundwater sample and two of the three monitoring well samples. Fluoride was detected at concentrations that range from 4.02 to 4.85 mg/L that exceed both the MTCA Method C and WA MCL screening levels. Fluoride was not detected at concentrations that exceed water screening levels in CCR-GW17 which may be located at the northern margin of the fluoride plume in shallow groundwater.

Sulfate was detected at concentrations that exceed the WA MCL in the grab groundwater sample and two of the three monitoring well samples. Sulfate was detected at concentrations that range from 600 to 1,010 mg/L, with the highest concentration in well CCR-GW10 located adjacent to SB-CU01. Sulfate also was not detected at concentrations that exceed water screening levels in CCR-GW17.

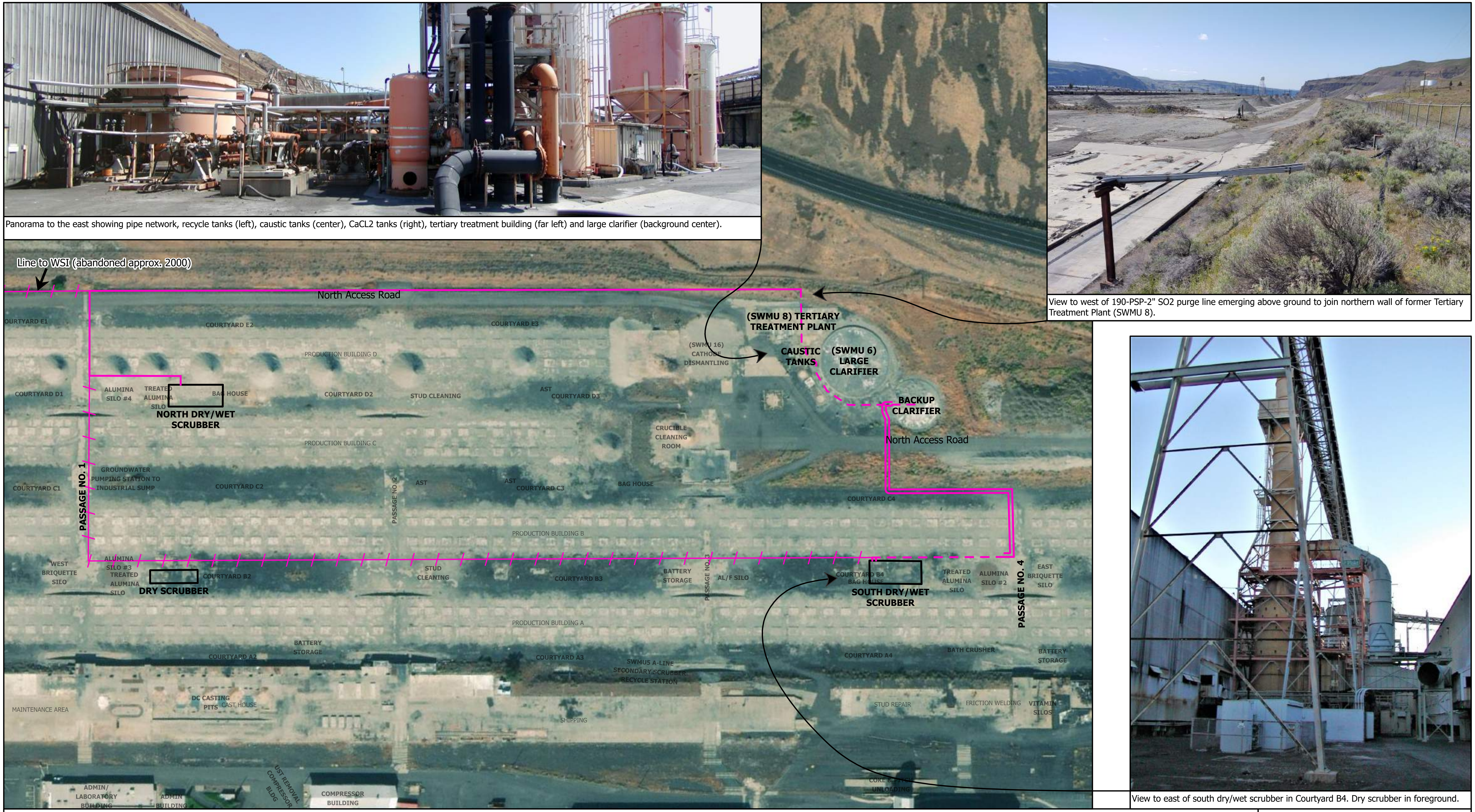
No other COPCs were detected in groundwater at concentrations that exceed water screening levels.

Cross-Section A-A’ Figure 2.2.1-4 shows a sectional view of the Crucible Cleaning Room area, north to south, through the SB-CU01/CCR-GW10 location (Figure 2.2.1-1). The subsurface profile in this area consists of an upper layer of soil at 10 ft or less thick, underlain by basalt. The surface of the basalt is variable with the highest points beneath the SWMU 16 building and at boring CCR-GW10. Hard fine-grained basalt was encountered in WPA borings in the southern portion of the investigation area. Concentrations of fluoride and sulfate that exceed the protection of groundwater screening levels and that were detected in WPA boring and test pit soil samples are shown along the line of the cross-section.

Other potential sources of fluoride and sulfate contamination include piping underlying the Crucible Cleaning Room area including site system water and wastewater lines, and piping associated with the Tertiary Treatment Plant and large clarifier (Plant drawing W806-11-011, Appendix G-3). Three system water and wastewater lines present beneath this area are shown on Cross-Section A-A‘, and include the Stormwater Collection, I&M, and Groundwater Collection lines. Stormwater catch basins were sampled in 2011 (Section 2.5.1) and then were cleaned in 2011. The I&M line contains flowing water during portions of the year that appears to be groundwater that flows into the line at a crushed manhole near the Tertiary Treatment Plant (video survey, Section 2.5.3). The Groundwater Collection line receives groundwater during portions of the year and does not appear to contain significant sediment in catch basins or lines in this area. There is no evidence to indicate breaches or past leakage from these lines during plant operation, and none of the lines contained waters with the concentrations of fluoride and sulfate that would be necessary to serve as the driver to create sitewide plumes in shallow groundwater. In addition, considering the range of COPCs and their concentrations in sediment in the stormwater catch basins (Section 2.5.1), and the past function of the I&M lines to convey process wastewater, there is no corresponding detection of the range of COPCs that were present in these lines in soil or groundwater in the Crucible Cleaning Room Investigation Area if these lines had leaked during plant operations.

The air pollution control system for the plant included dry and wet scrubbers for removal of fluoride and sulfate, respectively, from the gas and particulate waste stream that was captured in cell buildings during aluminum production. Two new dry scrubbers were installed in 1979 for production buildings A and B, and one new dry scrubber was installed in 1981 for production buildings C and D. By 1983 wet sulfate scrubbers were installed at two of the three dry scrubbers. Figure 2.2.1-5 shows the layout of the dry/wet scrubber units and associated piping.

The north dry/wet scrubber unit servicing production buildings C and D was in Courtyard Segment D2, and the south dry/wet scrubber unit servicing production buildings A and B was in Courtyard Segment B4. The third dry scrubber servicing production buildings A and B was in Courtyard Segment B2. Prior to 2000, a 1.5-inch chemical and corrosion resistant piping connected the south and north scrubber units and the dry scrubber unit via Courtyard B and Passage No. 1, with scrubber discharge conveyed to the West Surface Impoundment (WSI; SWMU 4). In 2000, plans were prepared to abandon in place the 1.5-inch purge lines, including the line to SWMU 4, and install new 2-inch purge lines that would directly and independently connect the north and south



Panorama to the east showing pipe network, recycle tanks (left), caustic tanks (center), $CaCL_2$ tanks (right), tertiary treatment building (far left) and large clarifier (background center).

View to west of 190-PSP-2" SO_2 purge line emerging above ground to join northern wall of former Tertiary Treatment Plant (SWMU 8).

View to east of south dry/wet scrubber in Courtyard B4. Dry scrubber in foreground.

Plant SO_2 Lines

- ━ SO_2 2in Purge Line (Buried [190-PSP-2"])
- ╌ SO_2 2in Purge Lines (Elevated [163-PSP-2" and 190-PSP-2"])
- ═ SO_2 2in Purge Line (Entrenched 24" bgs w/spare line [163-PSP-2"])
- ┼ SO_2 1.5in Line (Abandoned in place)

Plant Area Buildings

- ▭ Dry and Wet Scrubber Units

Reference Plant Drawings: A14840, A14851, A14857, A14900, A14901

W N S E

0 100 200 400
Feet

Figure 2.2.1-5

Plant Area AOC

SO_2 Scrubber Purge Line Locations and Details

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Maxar, Microsoft

dry/wet scrubber units to the secondary treatment system (90-ft clarifier). The 2-inch line from the north dry/wet scrubber unit may have been mostly above ground but did pass through the Tertiary Treatment Plant (SWMU 8) from north to south and was constructed above ground along the west and southwest side of the 120-ft clarifier (SWMU 6) to the 90-ft clarifier. The line from the south dry/wet scrubber unit was constructed above ground between the unit and Passage No. 4 to the east, then was laid along with a spare 2-inch line, in a minimum 2-ft deep and 2.5-ft wide trench beneath the concrete floor of Passage No. 4 and passing beneath the access road north of production building B and the North Access Road to the 90-ft clarifier. Scrubber wastewater was pumped via the 90-ft clarifier underdrain system in underground piping to the Tertiary Treatment Plant for further treatment then combined in the pool of treated water that was sent back to the production buildings for use as makeup water.

Anecdotal information from plant personnel indicates that in the Tertiary Treatment Plant area the piping had to be repaired in the past, which suggests leakage of wastewater may have occurred. The purge lines from the north and south wet/dry scrubber units conveyed wastewater that may have contained dissolved fluoride and sulfate at concentrations of 200 and 30,000 mg/L, respectively. Leakage from pipes to the ground or from underground piping could be a significant source of fluoride and sulfate contamination for shallow groundwater in the Tertiary Treatment Plant area where basalt bedrock is shallow.

2.2.1.3 Conclusions and Recommendations

The Crucible Cleaning Room Investigation Area was designated based on elevated concentrations of fluoride detected in soil in initial RI boring SB-CU01 to a depth of 23 ft bgs, and of sulfate detected in soil in initial RI boring SB-BH03 to depths of 8 ft bgs. This area is in the upgradient portion of a sitewide fluoride plume in shallow groundwater with local concentrations of up to 15 mg/L that exceeds site water screening levels, and concentrations of sulfate that are elevated but below water screening levels in other area monitoring wells. The objective for this investigation area was to identify potential sources of fluoride and sulfate soil contamination to shallow groundwater. The following are conclusions based on results of the Crucible Cleaning Room Investigation Area:

- Fluoride was detected in initial RI boring soil samples at concentrations that exceed the protection of groundwater screening level. The highest concentrations of fluoride of 3,300 and 4,600 mg/kg at depths of 0.5 and 3 ft bgs in SB-CU01. The concentration of fluoride decreases to 700 mg/kg at 23 ft bgs in SB-CU01, which was collected from within the basalt in the apparent UA aquifer zone.

- Soil analytical results did not identify a significant fluoride soil source of contamination to groundwater. Fluoride was detected at concentrations that exceeds the protection of groundwater screening level of 147.6 mg/kg in two samples at 2.5 ft bgs in boring CCR-SB06 and CCR-SB09 at 209 and 199 mg/kg, respectively. These concentrations would not be expected to result in fluoride concentrations of approximately 4 mg/L in groundwater beneath the Crucible Cleaning Room Investigation Area.

- Sulfate was detected in initial RI boring SB-BH03 at 8 ft bgs at a maximum concentration of 7,500 mg/kg that exceeds the protection of groundwater screening level.

- Soil analytical results did not identify a significant sulfate soil source of contamination to groundwater. Sulfate was detected in only one WPA soil boring CCR-SB05 at 2.5 ft bgs at concentrations that exceed the protection of groundwater screening level. The exceedance of sulfate in soil boring CCR-SB05 is located side-gradient or down-gradient from the highest concentrations of sulfate detected in groundwater in CCR-GW10.

- WPA phase investigation included 11 soil borings, three shallow groundwater monitoring wells, and nine test pits. The surface of basalt is relatively shallow, at 6 to 10 ft bgs.

- Groundwater sample analytical results indicate fluoride and sulfate were detected at concentrations that exceed MTCA Method C and WA MCL water screening levels.

- Concentrations of fluoride in groundwater were consistent with the interpreted sitewide fluoride plume in shallow groundwater ranging from 4 to 15 mg/L.

- The Stormwater Collection, I&M, and Groundwater Collection lines in this area do not appear to be a current source of fluoride and sulfate contamination to shallow groundwater because there is no corresponding soil or groundwater contamination reflecting the range of COPCs conveyed by these systems if they had leaked during plant operations.

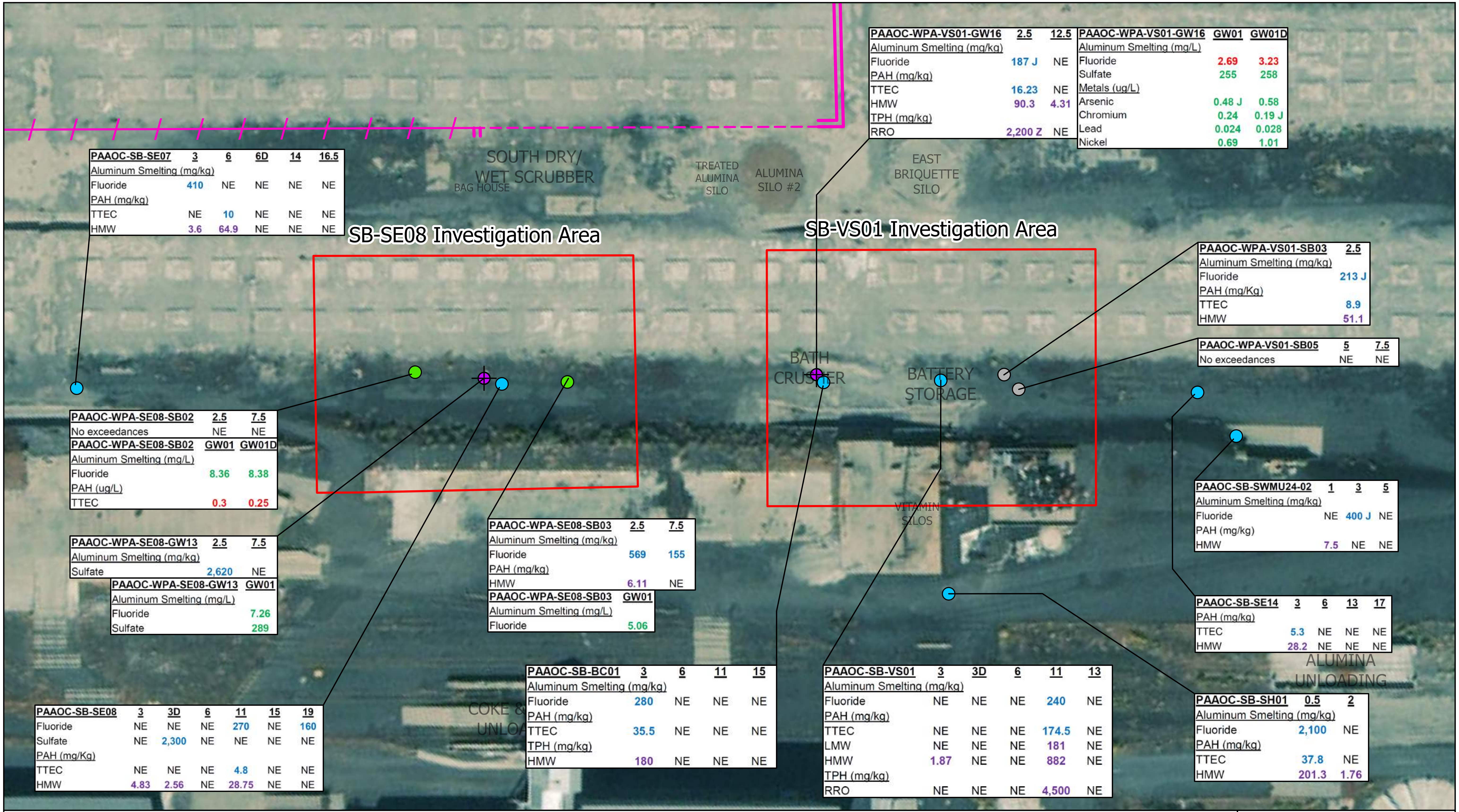
- Underground piping associated with the Tertiary Treatment Plant (SWMU 8) and Clarifiers (SWMU 6) are more likely source of fluoride and sulfate contamination since the pipes conveyed air pollution control wastewater with high concentrations of fluoride and sulfate for treatment at the Tertiary Treatment Plant. The piping conveyed water from air pollution control systems in the production buildings to the treatment plant, and then returned treated water to the production buildings for reuse.

The Crucible Cleaning Room Investigation Area is recommended for further evaluation in the FS for soil contamination at depth associated with fluoride and sulfate, but it does not appear to be a soil source of fluoride or sulfate contamination for shallow groundwater. SWMU 6 and 8 are recommended for further evaluation in the FS, and in addition, the SO_2 dry/wet scrubber purge line may have leaked and could potentially be the source of contamination for shallow groundwater. Contamination present in shallow groundwater and resulting conclusions and recommendations will be addressed in the Groundwater AOC (Volume 4, Section 2). Soil contamination in the Courtyard Segments, and resulting conclusions and recommendations, are addressed in the following Courtyard Segment Soil Contamination (Section 2.3.4). Soil contaminated with fluoride, sulfate, and PAHs that exceed soil screening levels are recommended for further evaluation in the FS.

2.2.2 Soil Boring SB-VS01 in Courtyard Segment A5

Soil boring SB-VS01 was completed during the initial RI phase of investigation and is in the western portion of Courtyard Segment A5, south of Production Building A (Figure 2.1.2-1). This boring was completed to investigate the vitamin silos located at the southwest corner of segment A5. The vitamin silos have been demolished but were used for storage of wet and dry anode paste briquettes and constructed on concrete pads. SB-VS01 was designated an Investigation Area based on elevated concentrations of PAHs, and TPH-Dx as residual range organics at a depth of 11 ft bgs in SB-VS01 and the potential contribution of contamination to shallow groundwater.

Initial RI results for SB-VS01 indicate that concentrations of fluoride and PAHs as TTEC exceed protection of groundwater soil screening levels, PAH as total calculated LMW and HMW exceeds ecological wildlife soil screening levels, and TPH-Dx exceeds MTCA Method A Industrial and ecological wildlife soil screening levels (Figure 2.2.2-1). These COPCs exceeded soil screening levels only at a depth of 11 ft bgs but not in samples above 11 ft bgs or deeper depth samples. Evaluation of nearby RI soil borings SB-BC01, SB-SH01, SB-SE14, and SB-SWMU24-02 indicates that PAHs and TPH-Dx were not detected at concentrations that exceed soil screening levels, at depths comparable to samples in boring SB-VS01 and provide a horizontal bounding to the SB-VS01 contamination.



PAAOC-SB-SE07	3	6	6D	14	16.5
Aluminum Smelting (mg/kg)					
Fluoride	410	NE	NE	NE	NE
PAH (mg/kg)					
TTEC	NE	10	NE	NE	NE
HMW	3.6	64.9	NE	NE	NE

PAAOC-WPA-VS01-GW16	2.5	12.5
Aluminum Smelting (mg/kg)		
Fluoride	187 J	NE
PAH (mg/kg)		
TTEC	16.23	NE
HMW	90.3	4.31
TPH (mg/kg)		
RRO	2,200 Z	NE

PAAOC-WPA-VS01-GW16	GW01	GW01D
Aluminum Smelting (mg/L)		
Fluoride	2.69	3.23
Sulfate	255	258
Metals (ug/L)		
Arsenic	0.48 J	0.58
Chromium	0.24	0.19 J
Lead	0.024	0.028
Nickel	0.69	1.01

PAAOC-WPA-VS01-SB03	2.5
Aluminum Smelting (mg/kg)	
Fluoride	213 J
PAH (mg/Kg)	
TTEC	8.9
HMW	51.1

PAAOC-WPA-VS01-SB05	5	7.5
No exceedances	NE	NE

PAAOC-WPA-SE08-SB02	2.5	7.5
No exceedances	NE	NE

PAAOC-WPA-SE08-SB02	GW01	GW01D
Aluminum Smelting (mg/L)		
Fluoride	8.36	8.38
PAH (ug/L)		
TTEC	0.3	0.25

PAAOC-WPA-SE08-GW13	2.5	7.5
Aluminum Smelting (mg/kg)		
Sulfate	2,620	NE

PAAOC-WPA-SE08-GW13	GW01
Aluminum Smelting (mg/L)	
Fluoride	7.26
Sulfate	289

PAAOC-WPA-SE08-SB03	2.5	7.5
Aluminum Smelting (mg/kg)		
Fluoride	569	155
PAH (mg/kg)		
HMW	6.11	NE

PAAOC-WPA-SE08-SB03	GW01
Aluminum Smelting (mg/L)	
Fluoride	5.06

PAAOC-SB-SWMU24-02	1	3	5
Aluminum Smelting (mg/kg)			
Fluoride	NE	400 J	NE
PAH (mg/kg)			
HMW	7.5	NE	NE

PAAOC-SB-SE14	3	6	13	17
PAH (mg/kg)				
TTEC	5.3	NE	NE	NE
HMW	28.2	NE	NE	NE

PAAOC-SB-SE08	3	3D	6	11	15	19
Fluoride	NE	NE	NE	270	NE	160
Sulfate	NE	2,300	NE	NE	NE	NE
PAH (mg/Kg)						
TTEC	NE	NE	NE	4.8	NE	NE
HMW	4.83	2.56	NE	28.75	NE	NE

PAAOC-SB-BC01	3	6	11	15
Aluminum Smelting (mg/kg)				
Fluoride	280	NE	NE	NE
PAH (mg/kg)				
TTEC	35.5	NE	NE	NE
TPH (mg/kg)				
HMW	180	NE	NE	NE

PAAOC-SB-VS01	3	3D	6	11	13
Aluminum Smelting (mg/kg)					
Fluoride	NE	NE	NE	240	NE
PAH (mg/kg)					
TTEC	NE	NE	NE	174.5	NE
LMW	NE	NE	NE	181	NE
HMW	1.87	NE	NE	882	NE
TPH (mg/kg)					
RRO	NE	NE	NE	4,500	NE

PAAOC-SB-SH01	0.5	2
Aluminum Smelting (mg/kg)		
Fluoride	2,100	NE
PAH (mg/kg)		
TTEC	37.8	NE
HMW	201.3	1.76

▭ Investigation Areas
● WPA Boring, temp screen
● WPA Boring, dry
⊕ WPA Monitor Well
● RI Boring

Plant SO2 Purge Lines (See Figure 2.2.1-5)
═ Existing SO2 Lines w/spare
– – Elevated SO2 Line
+ Abandoned SO2 Line

Soil Screening Levels
blue: Exceeds Protection of Groundwater
purple: Exceeds Protection of Wildlife and for TPH diesel and residual range organics also exceeds MTCA Method A

Z: Chromatographic fingerprint does not resemble a petroleum product
D: Duplicate sample
RRO: Residual Range Organics

Water Screening Levels
red: Exceeds MTCA Method C
green: Exceeds WA MCL

All groundwater results have been screened using Table 5-2, Volume 1, screening levels, and are discussed in GWAOC, Volume 4.

Figure 2.2.2-1

Plant Area AOC

SB-VS01 Investigation Area Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Maxar, Microsoft

The closest downgradient shallow groundwater monitoring well MW-E1A (UA aquifer) is located approximately 150 ft to the southeast. PAHs were not detected in MW-E1A above reporting limits in first quarter 2017 groundwater monitoring and not analytes thereafter. There are no nearby downgradient UA or BAU monitoring wells to provide data on presence of TPH-Dx in shallow groundwater (Groundwater AOC, Volume 4, Section 2).

2.2.2.1 Investigation Scope

The SB-VS01 Investigation Area was investigated with a total of four soil borings, one of which was completed during the initial RI phase, and the other three completed during the WPA phase. One WPA soil boring was completed as shallow groundwater monitoring well VS01-GW16. Grab samples of shallow groundwater were planned to be collected from temporary well screen installations in the WPA borings, if shallow groundwater were encountered. Logs of borings are included in Volume 5, Appendices G-1 and G-2. Initial RI soil samples were analyzed for cyanide, fluoride, sulfate, PAHs, PCBs, metals, VOCs, and TPH-Dx. The results of the initial RI phase of investigation are discussed together with the WPA phase below in the Section 2.2.2.2.

WPA investigation of SB-VS01 incorporated an iterative approach (Volume 1, Section 3.2.1.3, Figure 3-1) to guide field decisions during a single field mobilization to determine whether PAH and TPH-Dx detected in soil at 11 ft bgs has impacted shallow groundwater, and the need for additional step-out borings. Implementation of the iterative approach included rapid turnaround time for laboratory analysis of PAH and TPH-Dx in soil.

WPA soil boring VS01-SB03 was completed east of initial RI soil boring SB-VS01. As a result of obstructions in the subsurface and the casing being compromised, a second boring VS01-SB05 was completed approximately 10 ft to the east and was drilled to a depth of 13.5 ft bgs, below the contact with basalt. A minimum of four samples were planned to be collected including one sample above or near the water table if encountered. Hard fine-grained basalt was encountered at 11 ft bgs, and soil samples were collected at 5 and 7.5 ft bgs. No groundwater was encountered and therefore a grab groundwater sample was not collected.

A third WPA soil boring was completed west of SB-VS01, at the east end of segment A4, and installed as shallow groundwater monitoring well VS01-GW16 with a screened interval of 10 to 20 ft bgs and a pre-development water level measured at 14 ft bgs. Basalt flow top was encountered in the boring at 12 ft bgs, and a saturated zone encountered at 15 ft bgs. Soil samples were collected at 2.5 and 12.5 ft bgs, with no recovery at 8 ft bgs, and one groundwater sample was collected from the monitoring well. A shallow groundwater monitoring well was installed in this well, versus collection of a grab groundwater sample through a temporary well screen installation, based on discovery of a significant breach in the nearby Scrubber Effluent Line 4 (Section 2.5.4, Scrubber Effluent System).

Soil samples were analyzed for cyanide, fluoride, sulfate, PAHs, metals, and TPH-Dx. The groundwater sample was analyzed for free cyanide, fluoride, sulfate, PAHs, metals, VOCs, and TPH-Dx. PAH and TPH-Dx analyses for soil was completed on an expedited turnaround time.

One objective for the WPA phase of investigation was to use video survey to further evaluate the presence of breaches in Scrubber Effluent Line 4 in Courtyard Segment A5. The purpose of this evaluation for the SB-VS01 investigation was to determine whether Scrubber Effluent Line 4 could be the source of PAHs and TPH-Dx detected in SB-VS01, if a line breach exists. The video survey of the Scrubber Effluent System is discussed in Section 2.5.4.5.5, but the survey did discover a significant horizontal breach in the eastern portion courtyard A4, approximately halfway between VS01-GW16 and SB-VS01, and potentially upgradient from SB-VS01. The breach appears to be 1 to 2 feet (ft) below the local water level measured in VS01-GW16 resulting in groundwater inflow to the Scrubber Effluent pipe at that location (into a mostly empty pipe) and no other breaches were observed in the vicinity of SB-VS01 for outflow.

2.2.2.2 Investigation Results

Soil boring SB-VS01 was investigated with a total of three soil borings, with a shallow monitoring well VS01-GW16 installed in one of the borings, and collection of one groundwater sample from monitoring well VS01-GW16. Soil boring VS01-SB05 was drilled to 13.5 with hard fine-grained dry basalt encountered at 11 ft bgs to the east of SB-VS01, and VS01-GW16 was drilled 20 ft bgs with saturated basalt flow top encountered at 13 ft bgs to the west of SB-VS01. The water level measured in VS01-GW16 prior to development (10/29/2020) was 14 ft bgs, or approximately 471 ft elevation.

Soil analytical results are summarized in Table 2.2.2-1 (VS01 Investigation Area WPA and RI soil Results Summary), and groundwater results are summarized in Table 2.2.2-2 (VS01 Investigation Area WPA Groundwater Results Summary). Soil results are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. Groundwater results are compared to MTCA Method A, MTCA Method B, MTCA Method C, and WA MCL water screening levels. Natural background concentrations for the site have been used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Soil reporting limits for arsenic exceed the protection of groundwater screening level, and for selenium exceed the protection of groundwater and ecological wildlife screening level, for most samples analyzed. Water reporting limits for mercury exceed the WA MCL screening level, and for selenium exceed the MTCA Method C and WA MCL screening level for all samples analyzed.

Soil and water analytical results that exceed Plant Area AOC soil and water screening levels are compiled and presented on Figure 2.2.2-1. Analytical results indicate that fluoride, PAH as TTEC and calculated total LMW and HMW, and TPH-Dx as residual range organics are detected in soil at concentrations that exceed soil screening levels to a depth of 3 ft bgs, but not in deeper depths sampled. The exception is PAH as total calculated HMW which is detected at a concentration of 4.31 mg/kg at 12.5 ft bgs in VS01-GW16. Five of six detected concentrations of fluoride range from 187 J to 400 J mg/kg. The sixth sample was detected at the highest concentration of fluoride at 2,100 mg/kg in SB-SH01, which is downgradient from SB-VS01. No other COPCs exceed soil screening levels at depths greater than 3 ft bgs, other than the COPCs that exceed soil screening levels at only 11 ft bgs in initial RI boring SB-VS01 and the exception of PAH as HMW at 12.5 in VS01-GW16.

Water analytical results indicate that fluoride and sulfate are detected in monitoring well VS01-GW16 at concentrations that exceed the MTCA Method C screening level for fluoride and the WA MCL screening level for sulfate. Several metals were also detected at concentrations that exceed water screening levels including arsenic, chromium, lead, and selenium. Arsenic was detected at

Table 2.2.2-1
VS01 Investigation Area WPA and Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
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	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results												
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-VS01-3	PAAOC-SB-VS01-3D	PAAOC-SB-VS01-6	PAAOC-SB-VS01-11	PAAOC-SB-VS01-13	PAAOC-SB-BC01-3	PAAOC-SB-BC01-6	PAAOC-SB-BC01-11	PAAOC-SB-BC01-15	PAAOC-SB-SE14-3	PAAOC-SB-SE14-6	PAAOC-SB-SE14-13	PAAOC-SB-SE14-17
Aluminum Smelting																			
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	45	59	5 U	**240**	7.4	**280**	76	80	32	130	46	16	14
Sulfate	mg/kg	NA	NE	2,150	NE	NE	25	26	280	350	180	61	35	46	140	28 J	10 UJ	14 J	160 J
Polynuclear Aromatic Hydrocarbons (PAHs)																			
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.015 U	0.016 U	0.0087 U	15 U	0.0078 U	16 U	0.0084 U	0.0073 U	0.0077 U	0.3 U	0.0077 U	0.0073 U	0.0075 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.015 U	0.016 U	0.0087 U	15 U	0.0078 U	16 U	0.0084 U	0.0073 U	0.0077 U	0.3 U	0.0077 U	0.0073 U	0.0075 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.015 U	0.016 U	0.0087 U	15 U	0.0078 U	16 U	0.0084 U	0.0073 U	0.0077 U	0.3 U	0.0077 U	0.0073 U	0.0075 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.015 U	0.016 U	0.0087 U	15 U	0.0078 U	16 U	0.0084 U	0.0073 U	0.0077 U	0.3 U	0.0077 U	0.0073 U	0.0075 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.024	0.016 U	0.0087 U	15 U	0.0078 U	16 U	0.0084 U	0.0073 U	0.0077 U	0.34	0.0077 U	0.0073 U	0.0075 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.14	0.096	0.0087 U	83	0.014	21	0.0084 U	0.011	0.036	2.9	0.0096	0.014	0.0075 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.28	0.14	0.0087 U	130	0.027	28	0.0084 U	0.016	0.053	3.9	0.012	0.02	0.0075 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.36	0.18	0.0087 U	170	0.036	32	0.012	0.023	0.069	5.5	0.02	0.033	0.0095
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.2	0.1	0.0087 U	98	0.021	18	0.0084 U	0.014	0.039	3.4	0.015	0.022	0.0075 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.13	0.059	0.0087 U	60	0.012	16 U	0.0084 U	0.0073 U	0.024	1.7	0.0088	0.015	0.0075 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.22	0.11	0.0087 U	110	0.023	25	0.0093	0.013	0.042	3.1	0.014	0.027	0.0081
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.047	0.023	0.0087 U	21	0.0078 U	16 U	0.0084 U	0.0073 U	0.0082	0.78	0.0077 U	0.0073 U	0.0075 U
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.31	0.16	0.0087 U	130	0.029	36	0.018	0.016	0.054	4.5	0.017	0.029	0.01
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.015 U	0.016 U	0.0087 U	15 U	0.0078 U	16 U	0.0084 U	0.0073 U	0.0077 U	0.3 U	0.0077 U	0.0073 U	0.0075 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.21	0.11	0.0087 U	100	0.022	19	0.0084 U	0.011	0.04	2.8	0.011	0.017	0.0075 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.015 U	0.016 U	0.0087 U	15 U	0.0078 U	16 U	0.0084 U	0.0073 U	0.0077 U	0.3 U	0.0077 U	0.0073 U	0.0075 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.13	0.062	0.0087 U	51	0.012	18	0.0084 U	0.0073 U	0.021	1.6	0.0077 U	0.0098	0.0075 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.28	0.14	0.0087 U	110	0.028	37	0.017	0.015	0.051	4.1	0.017	0.029	0.01
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.38	0.19	0.0087	**174.5**	0.036	**35.5**	0.0013	0.02	0.07	**5.3**	0.02	0.03	0.001
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.46	0.22	0.0087	**181**	0.04	54	0.018	0.02	0.08	6.44	0.02	0.04	0.04
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**1.87**	0.96	0.0087	**882**	0.18	**180**	0.03	0.02	0.32	**28.2**	0.11	0.2	0.03
Polychlorinated Biphenyls (PCBs)																			
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U	0.06 U	0.063 U	0.055 U	0.058 U	0.056 U	0.058 U	0.055 U	0.056 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U	0.06 U	0.063 U	0.055 U	0.058 U	0.056 U	0.058 U	0.055 U	0.056 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U	0.06 U	0.063 U	0.055 U	0.058 U	0.056 U	0.058 U	0.055 U	0.056 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U	0.06 U	0.063 U	0.055 U	0.058 U	0.056 U	0.058 U	0.055 U	0.056 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U	0.06 U	0.063 U	0.055 U	0.058 U	0.056 U	0.058 U	0.055 U	0.056 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U	0.06 U	0.063 U	0.055 U	0.058 U	0.056 U	0.058 U	0.055 U	0.056 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U	0.06 U	0.063 U	0.055 U	0.058 U	0.056 U	0.058 U	0.055 U	0.056 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.7	0.056	0.059	0.065	0.055	0.059	0.06	0.063	0.055	0.058	0.056	0.058	0.055	0.056
Metals																			
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	6,800	8,400	15,000	8,200	5,800	17,000	13,000	4,300	3,800	7,900	7,700	6,700	6,000
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	12 U	13 U	11 U	12 U	12 U	13 U	11 U	12 U	11 U	12 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.56 U	0.59 U	0.65 U	0.55 U	0.59 U	0.6 U	0.63 U	0.55 U	0.58 U	0.56 U	0.58 U	0.55 U	0.56 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	4	5.7	5.1	13	6	6	2	2	2	7	5	6	4
Copper	mg/kg	NA	140,000	280	28.4	217	11	14	15	15	22	17	18	12	14	14	11	12	21
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.6 U	5.9 U	6.5 U	5.5 U	5.9 U	6 U	6.3 U	5.5 U	5.8 U	5.6 U	5.8 U	5.5 U	5.6 U
Mercury	mg/kg	2	NE	2.1	0.04	5.50	0.28 U	0.29 U	0.33 U	0.27 U	0.29 U	0.3 U	0.31 U	0.27 U	0.29 U	0.28 U	0.29 U	0.28 U	0.28 U
Nickel	mg/kg	NA	70,000	130	24.54	980	3.5	5.1	6.3	8.7	3.1	12.0	3.6	2.7 U	2.9	6.0	4.3	6.6	4.3
Selenium	mg/kg	NA	18,000	5.2	0.29	0.30	11 U	12 U	13 U	11 U	12 U	12 U	13 U	11 U	12 U	11 U	12 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	43	46	54	58	36	3	33	32	34	54	40	36	41
Volatile Organic Compounds (VOCs)																			
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.0012 U	0.00097 U	0.00093 U	0.00079 U
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.005 U	0.006 U	0.0055 U	0.0054 U	0.0048 U	0.0066 U	0.007 U	0.0038 U	0.0051 U	0.0061 U	0.0048 U	0.0047 U	0.004 U
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.0012 U	0.00097 U	0.00093 U	0.00079 U
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.002 U	0.0024 U	0.0022 U	0.0021 U	0.001 U	0.0026 U	0.0028 U	0.0015 U	0.0012 U	0.0024 U	0.0019 U	0.0019 U	0.0016 U
o-Xylene	mg/kg	9	700,000	14	NE	10	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.0012 U	0.00097 U	0.00093 U	0.00079 U
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.0012 U	0.00097 U	0.00093 U	0.00079 U
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.0012 U	0.00097 U	0.00093 U	0.00079 U
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.0012 U	0.00097 U	0.00093 U	0.00079 U
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.0012 U	0.00097 U	0.00093 U	0.00079 U
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.0012 U	0.00097 U	0.00093 U	0.00079 U
Total Petroleum Hydrocarbons (TPHs)																			
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	28 U	29 U	33 U	460 U	29 U	210 U	32 U	28 U	29 U	28 U	29 U	28 U	28 U
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	57 U	59 U	65 U	**4,500**	59 U	1,400	63 U	55 U	58 U	110	58 U	55 U	56 U

Notes:

J	Estimated Concentration.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
NA	Not applicable or not analyzed.	LMW PAH	Low molecular weight PAH.
NE	Not established in lookup tables.	HMW PAH	High molecular weight PAH.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.	B	The sample result is five times less than blank contamination and cross-contamination is suspected.
U	Chemical was not detected. The associated value represents the method reporting limit.	Detected concentrations shown in bold exceed one or more site soil screening leels.	
Z	Chromatographic fingerprint does not resemble a petroleum product.		

Table 2.2.2-1
VS01 Investigation Area WPA and Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
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Parameter Name	Units	Screening Levels				Ecological Screening Levels	Initial RI Analytical Results					WPA Analytical Results				
		MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-SH01-0.5	PAAOC-SB-SH01-2	PAAOC-SWMU24-02-1	PAAOC-SWMU24-02-3	PAAOC-SWMU24-02-5	PAAOC-WPA-VS01-SB03-2.5	PAAOC-WPA-VS01-SB05-5	PAAOC-WPA-VS01-SB05-7.5	PAAOC-WPA-VS01-GW16-2.5	PAAOC-WPA-VS01-GW16-12.5
Aluminum Smelting																
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.05 U	0.051	0.05 U	0.2 UJ	0.20 U	0.21 U	0.2 UJ	0.22 UJ
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**2,100**	84	41 U	**400 J**	110	**213 J**	37	45	**187 J**	74.6 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	11	130	18 U	84	17 U	63.9 J	24.8	52	210 J	192 J
Polynuclear Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.37 U	0.015 U	0.28 U	0.015 U	0.0073 U	NA	NA	NA	NA	NA
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.37 U	0.015 U	0.28 U	0.015 U	0.0073 U	0.096	0.0008 J	0.00066 J	0.16	0.002 J
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	2.1	0.015 U	0.28 U	0.015 U	0.0073 U	0.56	0.00057 J	0.00067 J	1.3	0.017
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.37 U	0.015 U	0.28 U	0.015 U	0.0073 U	0.055 U	0.0055 U	0.0056 U	0.0095 J	0.00068 J
Anthracene	mg/kg	NA	NE	2,300	NE	NL	4	0.03	0.28 U	0.015 U	0.0073 U	0.83	0.00096 J	0.0006 J	2.4	0.025
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	22	0.21	0.68	0.04	0.0085	6	0.0051 J	0.0076	11	0.41
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	28	0.3	1.1	0.057	0.012	6.3	0.0034 J	0.011	12	0.47
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	35	0.37	1.5	0.082	0.019	9.8	0.0057	0.018	15	0.95
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	20	0.22	0.93	0.05	0.012	4	0.0026 J	0.011	6.2	0.39
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	12	0.11	0.49	0.026	0.0073 U	3.2	0.0025 J	0.0077	5.6	0.31
Chrysene	mg/kg	NA	NL	NL	NE	NL	24	0.21	0.88	0.047	0.01	7.6	0.0057	0.012	12	0.65
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	5.3	0.044	0.28 U	0.015 U	0.0073 U	1.1	0.0055 U	0.0017 J	1.8	0.11
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	NA	NA	NA	NA	NA	0.21	0.00085 J	0.0056 U	0.34	0.0058
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	35	0.32	1	0.057	0.012	10	0.0096	0.012	22	0.5
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.85	0.015 U	0.28 U	0.015 U	0.0073 U	0.36	0.0055 U	0.0056 U	0.68	0.0089
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	21	0.19	0.92	0.041	0.0088	4.7	0.0024 J	0.01 J	7.7	0.45
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.37 U	0.015 U	0.28 U	0.015 U	0.0073 U	0.13	0.0011 J	0.0011 J	0.25	0.0032 B
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	14	0.12	0.43	0.027	0.0073 U	4.7	0.0068	0.0046 J	10	0.17
Pyrene	mg/kg	NA	110,000	650	NE	NL	34	0.3	0.96	0.052	0.011	8.4	0.0092	0.012	19	0.57
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**37.8**	0.4	1.6	0.08	0.02	**8.9**	0.005	0.03	**16.23**	0.7
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	55.95	0.47	1.43	0.08	0.01	16.58	0.02	0.02	36.64	0.73
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**201.3**	**1.76**	**7.5**	0.4	0.08	**51.1**	0.04	0.09	**90.3**	**4.31**
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.055 U	0.055 U	0.053 U	0.057 U	0.055 U	NA	NA	NA	NA	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.055 U	0.053 U	0.057 U	0.055 U	NA	NA	NA	NA	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.055 U	0.053 U	0.057 U	0.055 U	NA	NA	NA	NA	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.055 U	0.053 U	0.057 U	0.055 U	NA	NA	NA	NA	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.055 U	0.053 U	0.057 U	0.055 U	NA	NA	NA	NA	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.055 U	0.055 U	0.053 U	0.057 U	0.055 U	NA	NA	NA	NA	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.055 U	0.055 U	0.053 U	0.057 U	0.055 U	NA	NA	NA	NA	NA
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.055	0.055	0.053	0.057	0.055	NA	NA	NA	NA	NA
Metals																
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	21,000	7,300	4,100	9,400	6,900	10,800	7,350	6,730	16,300	7,800
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	11 U	11 U	11 U	2.62	1.78	1.44	2.35	1.05
Cadmium	mg/kg	2	3,500.00	0.69	0.81	14	0.55 U	0.56 U	0.53 U	0.57 U	0.55 U	0.27	0.11	0.10	0.65	0.07
Chromium	mg/kg	2,000	5,300,000	490,000	32	67	6.4	6.3	2	5	4	9	4	5	9	2
Copper	mg/kg	NA	140,000	280	28	217	12	8.7	18	11	12	20	17	16	20	21
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.5 U	5.6 U	5.3 U	6.70	5.5 U	6.66	4.89 J	4.96 J	10.60	3.11
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.28 U	0.26 U	0.28 U	0.27 U	0.02 U	0.004 J	0.003 J	0.021 U	0.023 U
Nickel	mg/kg	NA	70,000	130	24.5	980	3.3	5.3	15.0	8.6	3.8	10.2	5.2	4.7	11.8	2.8
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	11 U	11 U	0.2 J	0.1 J	0.1 J	0.2 J	0.4 J
Zinc	mg/kg	NA	1,100,000	6,000	81	360	72	43	18	49	45	90	51	40	103	49
Volatile Organic Compounds (VOCs)																
Benzene	mg/kg	0.03	2,400	0.03	NE	0.255	0.0011 U	0.00096 U	0.00099 U	0.0011 U	0.0011 U	NA	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0055 U	0.0048 U	0.005 U	0.0055 U	0.0054 U	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.0011 U	0.00096 U	0.00099 U	0.0011 U	0.0011 U	NA	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.0022 U	0.0019 U	0.002 U	0.0022 U	0.0022 U	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	0.0011 U	0.00096 U	0.00099 U	0.0011 U	0.0011 U	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.0011 U	0.00096 U	0.00099 U	0.0011 U	0.0011 U	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.08	NE	30.2	0.0011 U	0.00096 U	0.00099 U	0.0011 U	0.0011 U	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.0011 U	0.00096 U	0.00099 U	0.0011 U	0.0011 U	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.03	NE	12.4	0.0011 U	0.00096 U	0.00099 U	0.0011 U	0.0011 U	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	0.0011 U	0.00096 U	0.00099 U	0.0011 U	0.0011 U	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (TPHs)																
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	NA	NA	29 U	28 U	27 U	260 J	12 J	14 J	510 Z	13 J
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	NA	NA	210	57 U	55 U	970 J	45 J	57 J	**2,200 Z**	49 J

Notes:

J	Estimated Concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method reporting limit.
Z	Chromatographic fingerprint does not resemble a petroleum product.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.
B	The sample result is five times less than blank contamination and cross-contamination is suspected.

Detected concentrations shown in bold exceed one or more site soil screening leels.

Table 2.2.2-2
VS01 Investigation Area WPA Groundwater Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels						WPA Analytical Results	
Parameter Name	Units	MTCA Method A	MTCA Method B	MTCA Method C	WA MCL	Natural Background	PAAOC-WPA-VS01-GW16-GW01	PAAOC-WPA-VS01-GW16-GW01D
Aluminum Smelting								
Cyanide, Free	mg/L	NE	0.01	0.022	0.2	ND	0.002 U	0.002 U
Fluoride	mg/L	NE	0.96	2.1	4	0.72	**2.69**	**3.23**
Sulfate	mg/L	NE	NE	NE	250	32	**255**	**258**
Polynuclear Aromatic Hydrocarbons (PAHs)								
2-Methylnaphthalene	ug/L	NL	32	70	NE	NE	0.0026 JB	0.0053 JB
Acenaphthene	ug/L	NA	960	2,100	NE	NE	0.02 U	0.0028 J
Acenaphthylene	ug/L	NA	NE	NE	NE	NE	0.02 U	0.02 U
Anthracene	ug/L	NA	4,800	11,000	NE	NE	0.02 U	0.02 U
Benzo(a)anthracene	ug/L	NL	NL	NL	NE	NE	0.0016 JB	0.0018 JB
Benzo(a)pyrene	ug/L	0.1	0.023	0.88	0.2	NE	0.02 U	0.02 U
Benzo(b)fluoranthene	ug/L	NL	NL	NL	NE	NE	0.02 U	0.02 U
Benzo(g,h,i)perylene	ug/L	NA	NE	NE	NE	NE	0.02 U	0.02 U
Benzo(k)fluoranthene	ug/L	NL	NL	NL	NE	NE	0.02 U	0.02 U
Chrysene	ug/L	NL	NL	NL	NE	NE	0.02 U	0.02 U
Dibenzo(a,h)anthracene	ug/L	NL	NL	NL	NE	NE	0.02 U	0.02 U
Dibenzofuran	ug/L	NL	NL	NE	NE	NE	0.0018 JB	0.0018 JB
Fluoranthene	ug/L	NA	640	1,400	NE	NE	0.02 U	0.0014 J
Fluorene	ug/L	NA	640	1,400	NE	NE	0.0012 JB	0.0016 JB
Indeno(1,2,3-cd)pyrene	ug/L	NL	NL	NL	NE	NE	0.02 U	0.02 U
Naphthalene	ug/L	160	160	350	NE	NE	0.0036 JB	0.0076 JB
Phenanthrene	ug/L	NA	NE	NE	NE	NE	0.0032 JB	0.0028 JB
Pyrene	ug/L	NA	480	1,100	NE	NE	0.02 U	0.0017 J
TTEC cPAH (calc)	ug/L	0.1	0.2	0.2	0.2	NE	0.00016	0.00018
Metals								
Aluminum	ug/L	NE	16	35	NE	1.14	6.6	6.8
Arsenic	ug/L	0.005	0.000058	0.000583	0.01	0.0069	**0.48 J**	**0.58**
Cadmium	ug/L	0.005	0.008	0.018	0.005	NE	**0.014 J**	**0.009 J**
Chromium	ug/L	0.05	24	53	0.1	0.03	**0.24**	**0.19 J**
Copper	ug/L	NE	0.64	1.4	1.3	NE	**0.67 J**	0.17 J
Lead	ug/L	0.015	NE	NE	0.015	0.0004632	**0.024**	**0.028**
Mercury	ug/L	0.002	NE	NE	0.002	NE	0.2 U	0.2 U
Nickel	ug/L	NA	0.000096	0.001	0.1	0.0651	**0.69**	**1.01**
Selenium	ug/L	NA	0.08	0.18	0.05	NE	1 U	1 U
Zinc	ug/L	NA	4.8	11	NE	NE	1.2 J	1.5 J
Volatile Organic Compounds (VOCs)								
Benzene	ug/L	5	0.8	8	5	NE	0.5 U	0.5 U
Toluene	ug/L	1,000	640	1,400	1,000	NE	0.07 J	0.07 J
Ethyl Benzene	ug/L	700	800	1,800	700	NE	0.5 U	0.5 U
Xylenes	ug/L	1,000	1,600	3,500	10,000	NE	0.5 U	0.5 U
Tetrachloroethene (PCE)	ug/L	5	21	110	5	NE	0.5 U	0.5 U
Trichloroethene (TCE)	ug/L	5	0.54	8.8	5	NE	0.5 U	0.5 U
1,1,1-Trichloroethane (1,1,1-TCA)	ug/L	200	16,000	35,000	200	NE	0.5 U	0.5 U
1,2-Dichloroethane (1,2-DCA)	ug/L	5	0.48	4.8	5	NE	0.5 U	0.5 U
cis-1,2-Dichloroethene (cis-1,2-DCE)	ug/L	NE	16	35	70	NE	0.5 U	0.5 U
Vinyl chloride	ug/L	0.2	0.029	0.29	2	NE	0.5 U	0.5 U
Total Petroleum Hydrocarbons (TPHs)								
Diesel Range Organics	mg/L	0.5	NE	NE	NE	NE	0.016 J	0.015 J
Residual Range Organics	mg/L	0.5	NE	NE	NE	NE	0.023 JB	0.019 U

Notes:

B	The sample result is less than five times the blank contamination and cross-contamination is suspected.
J	Estimated concentration.
MCL	Maximum Contaminant Level.
NA	Not analyzed or not applicable.
ND	Not detected.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
U	Chemical was not detected. The associated value represents the method reporting limit.

Detected concentrations shown in **bold** exceed one or more site groundwater screening levels.

concentrations of 0.48 J and 0.58 mg/L that exceeds MTCA Method C screening level. Chromium was detected at concentrations of 0.24 and 0.19 J mg/L and lead at 0.024 and 0.028 mg/L that exceed the WA MCL water screening level. Selenium was detected at concentrations of 0.69 and 1.01 mg/L that exceeds both MTCA Method C and WA MCL water screening levels. PAHs, VOCs, and TPH-Dx did not exceed water screening levels indicating no broader impact to shallow groundwater in the vicinity of SB-VS01 for these COPCs.

2.2.2.3 Conclusions and Recommendations

The SB-VS01 Investigation Area, designated based on elevated concentrations of fluoride, PAHs, and TPH-Dx as residual range organics in an isolated soil sample from 11 ft bgs (not exceeding at depths above or below that sample). The purpose of the SB-VS01 Investigation Area field effort was to determine the vertical and horizontal extent of fluoride and sulfate soil contamination in SB-VS01, and whether SB-VS01 could be a soil source of contamination to shallow groundwater. The following are conclusions based on results of the SB-VS01 investigation:

- PAHs do not appear to have impacted shallow groundwater. PAHs were not detected at concentrations that exceed soil screening levels below a maximum depth of 3 ft bgs in initial RI and other WPA borings (aside from SB-VS01), except for total calculated HMW detected at a concentration of 4.31 mg/kg at 12.5 ft bgs in VS01-GW16. The water sample from VS01-GW16 did not detect PAHs above water screening levels.

- TPH-Dx does not appear to have impacted shallow groundwater. TPH-Dx as residual range organics was detected at one location (aside from SB-VS01) at a concentration of 2,200 Z mg/kg at 2.5 ft bgs in VS01-GW16. The water sample from VS01-GW16 did not detect TPH-Dx above water screening levels.

- Metals in soil do not appear to have impacted shallow groundwater. While several metals, including arsenic, chromium, lead, and selenium, were detected in the water sample from VS01-GW16 at concentrations that exceed water screening levels, there is no corresponding exceedance of protection of groundwater soil screening levels in soil in the initial RI and WPA SB-VS01 Investigation Area soil borings.

- Fluoride in soil does not appear to be a potential soil source of contamination to shallow groundwater. Fluoride was detected at concentrations that exceed the protection of groundwater screening level in all the soil borings to a maximum depth of 3 ft bgs, except in SB-VS01 at 11 ft bgs. The highest detected concentration of fluoride is located downgradient from the SB-VS01 Investigation Area. The water sample from VS01-GW16 detected fluoride at concentrations of 2.69 to 3.23 mg/L which is well below interpreted concentrations of fluoride in the areawide plume in shallow groundwater that are between 4 and 10 mg/L (Groundwater AOC, Volume 4, Section 2).

- Sulfate in soil does not appear to be a potential soil source of contamination to shallow groundwater. Sulfate was detected in soil at concentrations well below the protection of groundwater screening level, with the highest concentration detected at 350 mg/kg being less than 20% of the concentration for protection of groundwater at 2,150 mg/kg. The water sample from VS01-GW16 detected concentrations of sulfate that exceed the WA MCL but there is no corresponding exceedance of protection of groundwater soil screening levels in soil in the initial RI or WPA SB-VS01 Investigation Area soil borings.

- The most likely sources of sulfate onsite are from the air pollution control water treatment system and associated piping in this courtyard segment and passage no. 4, and from wet scrubbers that are in series with dry scrubbers specifically to remove sulfur dioxide from wastewater. Sulfur dioxide oxidizes to form sulfate. The SB-VS01 Investigation Area is located side gradient from a dry/wet scrubber located in Courtyard Segment B4. Additionally, it is located east of the SWMU 5 Line A Secondary Scrubber Recycle Station, which is in the east end of Courtyard Segment A3.

- Video survey identified a significant breach in the Scrubber Effluent Line 4 that does not appear to be a current source of PAH and TPH-Dx contamination. The positioning of the breach below the local water table, mere inches off water flow inside the pipe, and no other nearby breach with water outflow, suggests that groundwater that flows into the pipe continues flowing downstream until the Line 4 outfall at the head of Pond A.

- The source of PAH and TPH-Dx in SB-VS01 at 11 ft bgs remains unclear.

The SB-VS01 Investigation Area is recommended for further evaluation in the FS for fluoride, PAHs, metals, and TPH-Dx contamination in two deeper soil samples. Shallow soil contamination in Courtyard Segment A4, and resulting conclusions and recommendations, are addressed in the following Courtyard Segment Soil Contamination (Section 2.3.4). The Scrubber Effluent line system in discussed further in Section 2.5.4 and includes conclusions and recommendations.

2.2.3 Coke and Pitch Unloading Sump

The Coke and Pitch Unloading Sump is a large subterranean “room” beneath the rail-accessible Coke and Pitch Unloading Area (Figure 2.1.2-1). Coke and pitch brought onsite in rail cars were unloaded by gravity into the sump below. The sump is constructed of concrete, with its upper floor at about 21 ft bgs (approximately 468 ft elevation) and near or below the local depth of shallow groundwater in the UA of approximately 475 ft elevation measured during winter quarter 2017 (Groundwater AOC, Volume 4, Section 2). Historically, during prior plant operations, the sump was pumped to remove excess water (BMEC, personal communication, 2019); however, once plant operations ceased, the sump was inundated with standing water at approximately 16 ft bgs. Clearly, the Coke and Pitch Unloading Sump, one or both upper and lower floors, are in communication with shallow groundwater. Based on elevated concentrations of PAHs and TPH-Dx detected in sump sediments samples from the initial RI (Figure 2.2.3-1), and likely communication between the sump and sediments, and shallow groundwater, the Coke and Pitch Unloading Sump was designated as an Investigation Area.

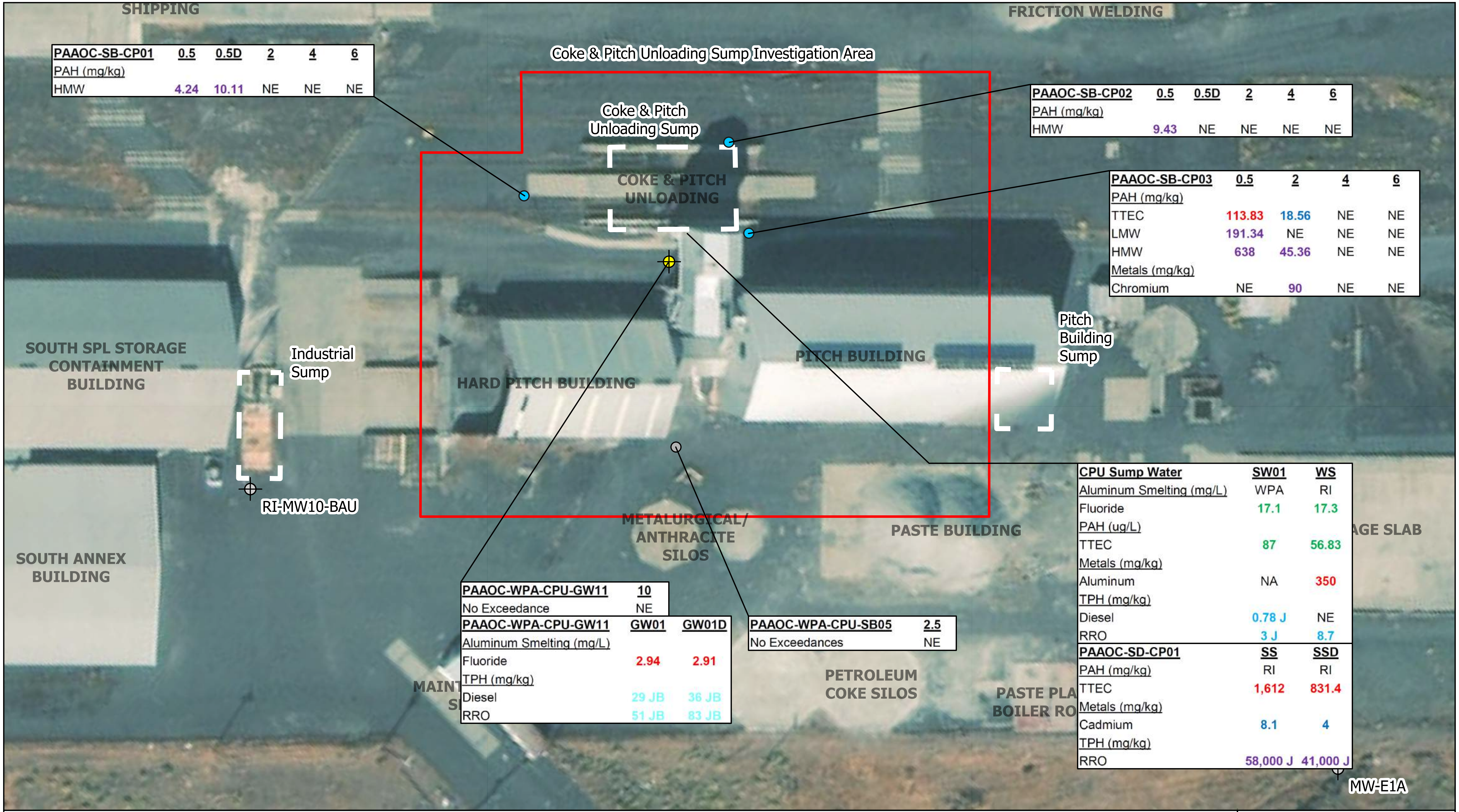
Evaluation of nearby initial RI soil borings SB-CP03 (Figure 2.2.3-1), and SB-PB02, SB-PB05, and SB-HP02 (see Section 2.4.6, Figure 2.4.6-1) located in a downgradient location from the sump indicated that PAHs and TPH-Dx were not detected in soil at concentrations that exceed screening levels below approximately 3 ft bgs, or approximately 13 ft above standing water level in the sump. Based on this evaluation, soil adjacent to the downgradient side of the sump, and above the floor level of the sump, was not expected to contain PAHs or TPH-Dx at concentrations that exceed protection of groundwater screening levels at and below the standing water in the sump.

No downgradient UA/BAU shallow groundwater monitoring wells are located near the Coke and Pitch Unloading Sump.

2.2.3.1 Investigation Scope

The initial RI scope of investigation included three soil borings, SB-CP01 west of the sump, and SB-CP02 and SB-SP03 at the east side of the sump. Soil samples were planned to be collected at 0.5 ft bgs, 2 ft bgs, 4 ft bgs, and 6 ft bgs. Logs of borings are included in Volume 5, Appendices G-1 and G-2. Initial RI soil samples were analyzed for cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. The results of the initial RI phase of investigation are discussed together with the WPA phase below in the Section 2.2.3.2.

The WPA investigation scope for the Coke and Pitch Unloading Sump included completion of one soil boring at the nearest point accessible downgradient from the south sump wall, installation of a shallow monitoring well in the soil boring, collection of one water sample from the shallow monitoring well, and collection of one water sample from the sump. The investigation incorporated an iterative approach (Volume 1, Section 3.2.1.3, Figure 3-1) to guide field decisions during a single field mobilization to determine whether PAH and TPH-Dx detected in sump sediment has impacted shallow groundwater downgradient from the sump, and the need for additional step-out borings.



PAAOC-SB-CP01	0.5	0.5D	2	4	6
PAH (mg/kg)					
HMW	4.24	10.11	NE	NE	NE

PAAOC-SB-CP02	0.5	0.5D	2	4	6
PAH (mg/kg)					
HMW	9.43	NE	NE	NE	NE

PAAOC-SB-CP03	0.5	2	4	6
PAH (mg/kg)				
TTEC	113.83	18.56	NE	NE
LMW	191.34	NE	NE	NE
HMW	638	45.36	NE	NE
Metals (mg/kg)				
Chromium	NE	90	NE	NE

CPU Sump Water	SW01	WS
Aluminum Smelting (mg/L)	WPA	RI
Fluoride	17.1	17.3
PAH (ug/L)		
TTEC	87	56.83
Metals (mg/kg)		
Aluminum	NA	350
TPH (mg/kg)		
Diesel	0.78 J	NE
RRO	3 J	8.7

PAAOC-SD-CP01	SS	SSD
PAH (mg/kg)	RI	RI
TTEC	1,612	831.4
Metals (mg/kg)		
Cadmium	8.1	4
TPH (mg/kg)		
RRO	58,000 J	41,000 J

PAAOC-WPA-CPU-GW11	10
No Exceedance	NE

PAAOC-WPA-CPU-GW11	GW01	GW01D
Aluminum Smelting (mg/L)		
Fluoride	2.94	2.91
TPH (mg/kg)		
Diesel	29 JB	36 JB
RRO	51 JB	83 JB

PAAOC-WPA-CPU-SB05	2.5
No Exceedances	NE

🟥	Coke & Pitch Unloading Sump Investigation Area
●	WPA Boring, dry
⊕	WPA Monitor Well
●	RI Soil Borings
⊕	RI Monitor Well Location

Soil Screening Levels
blue: Exceeds Protection of Groundwater
purple: Exceeds Ecological Wildlife
red: Exceeds MTCA Method C

J: Estimated concentration
D: Duplicate sample
RRO: Residual Range Organics
2: Sample depths in feet

Water Screening Levels
red: Exceeds MTCA Method C
green: Exceeds WA MCL
cyan: Exceeds MTCA Method A

W N S E

0 25 50 100
Feet

Figure 2.2.3-1

Plant Area AOC

Coke and Pitch Unloading Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Maxar, Microsoft

Implementation of the iterative approach included rapid turnaround time for laboratory analysis of PAH and TPH-Dx in soil. The iterative approach proposed one step-out soil boring farther downgradient from the sump if concentrations of PAH and TPH-Dx in the shallow monitoring well exceeded Plant Area AOC water screening levels. One step-out boring to the south would be the furthest downgradient extent of the Coke and Pitch Unloading Sump investigation area because it abuts the northern boundary of the Pitch Building Group Investigation Area (Figure 2.1.2-1).

The WPA soil boring was completed as close as feasible downgradient from the sump and a shallow groundwater monitoring well, CPU-GW11 was installed in the boring. Soil samples were planned to be collected at 5 ft intervals beginning at a depth of 10 ft bgs, above the level of water in the sump, and deeper samples below the lower level of the sump. Basalt flow top was encountered at 10 ft bgs and hard dry basalt at 13 ft bgs, and as a result only one sample was collected from this boring. The step-out soil boring, CPU-SB05, was completed at the downgradient location south of the Hard Pitch Building (Figure 2.2.3-1) when rapid turnaround for PAH and TPH-Dx was delayed. Two soil samples were collected at 2.5 and 7.5 ft bgs. Hard dry basalt was encountered at approximately 12 ft bgs and as a result only two soil samples were collected from the step-out boring.

WPA soil samples were analyzed for cyanide, fluoride, sulfate, PAHs, and TPH-Dx. The initial RI sump water sample was analyzed for cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. The WPA groundwater and sump water samples were analyzed for free cyanide, fluoride, sulfate, PAHs, and TPH-Dx. PAH and TPH-Dx analyses for soil and water were completed on an expedited turnaround time.

2.2.3.2 Investigation Results

The Coke and Pitch Unloading Sump was investigated with a total of four soil borings (three completed during the initial RI phase), installation of one shallow groundwater monitoring well, collection of one groundwater sample, and collection of one sump sediment and water sample. The soil boring for CPU-GW11 was drilled to a total depth of 30 ft bgs with basalt flow top encountered at approximately 10 ft bgs, then hard dry basalt from about 13 ft bgs to the total depth of the boring. A potential fracture zone that was water-bearing was encountered at 23 ft bgs and a shallow groundwater monitoring well CPU-GW11 was installed and screened from 20 to 30 ft bgs. No shallow groundwater was encountered in downgradient soil boring CPU-SB05.

Soil analytical results are summarized in Table 2.2.3-1, Coke and Pitch Unloading Sump Investigation Area Initial RI and WPA Soil Results Summary. Soil and sediment data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. Groundwater and Sump water analytical results are summarized on Table 2.2.3-2, Coke and Pitch Unloading Sump Investigation Area Initial RI and WPA Groundwater and Sump Water Results Summary. Water data are compared to MTCA Method A, MTCA Method B, MTCA Method C, and protection of groundwater screening levels. Sump sediment analytical results are summarized on Table 2.2.3-3, Coke and Pitch Unloading Sump Investigation Area RI Sump Sediment Results Summary. Sediment data are compared to MTCA Method A Industrial, MTCA Method C, and protection of groundwater screening levels. Natural background concentrations for the site have been used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Soil reporting limits for arsenic exceed the protection of groundwater screening level, and for selenium exceed the protection of groundwater and ecological wildlife soil screening levels. Water reporting limits for arsenic and selenium exceed the WA MCL water screening levels.

All soil, sediment and water sample results that exceed Plant Area AOC soil and water screening levels are compiled and presented on Figure 2.2.3-1. Initial RI analytical results indicated that PAHs and metals were detected in soil in the 0.5 and 2 ft bgs samples at concentrations that exceeded protection of groundwater and ecological wildlife screening levels but did not exceed in deeper depth samples. PAH as TTEC exceeded the protection of groundwater screening level, and total calculated LMW and HMW exceeded ecological wildlife screening levels in SB-CP03 east of the sump. Total calculated concentrations of HMW exceeded the ecological wildlife screening level in SB-CP02 east of the sump and in SB-CP01 west of the sump. Chromium exceeded the ecological wildlife screening level in one sample, SB-CP03-2.

Table 2.2.3-1
CPU Investigation Area Initial RI and WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 1 of 2

		Screening Levels				Ecological Screening Levels	WPA Analytical Results		Initial RI Analytical Results						
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-WPA-CPU-GW11-10	PAAOC-WPA-CPU-SB05-2.5	PAAOC-SB-CP01-0.5	PAAOC-SB-CP01-0.5D	PAAOC-SB-CP01-2	PAAOC-SB-CP01-4	PAAOC-SB-CP01-6	PAAOC-SB-CP02-0.5	PAAOC-SB-CP02-0.5D
Aluminum Smelting															
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.19 U	0.2 U	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	NA	NA
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	2.8 J	29.6 J	17 J	7	14 J	6.2 J	15 J	NA	NA
Sulfate	mg/kg	NA	NE	2,150	NE	NE	9.1 J	2.7	10 UJ	10 U	10 UJ	10 UJ	18 J	NA	NA
Polynuclear Aromatic Hydrocarbons (PAHs)															
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.00057 JB	0.0027 J	0.029 U	0.15 U	0.0078 U	0.0075 U	0.007 U	0.15 U	0.015 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0014 U	0.013	0.038	0.15 UJ	0.0078 U	0.0075 U	0.012	0.15 U	0.015 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0014 U	0.00034 J	0.294	0.15 UJ	0.0078 U	0.0075 U	0.007 U	0.15 U	0.015 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0014 U	0.017	0.066 J	0.17 J	0.0078 U	0.0075 U	0.0089	0.15 U	0.015 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.00045 JB	0.083	0.44	1.1 J	0.0078 U	0.0075 U	0.033	0.92 J	0.047 J
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.0014 U	0.11	0.61	1.5 J	0.0078 U	0.0089	0.04	1.4 J	0.063 J
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.00098 J	0.14	0.82	1.9 J	0.0088	0.012	0.054	1.9 J	0.09 J
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.0014 U	0.09	0.51 J	1.2 J	0.0078 U	0.0075 U	0.029	1.2 J	0.055 J
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.00029 J	0.064	0.25 J	0.65 J	0.0078 U	0.0075 U	0.018	0.61	0.027 J
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.00077 JB	0.11	0.48	1.1 J	0.0078 U	0.0085	0.037	1 J	0.045 J
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0014 U	0.019	0.11	0.2 J	0.0078 U	0.0075 U	0.007 U	0.24	0.015 U
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	0.0014 U	0.0059	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.0016 JB	0.16	0.69 J	1.7 J	0.0078 U	0.011	0.059	1.3 J	0.064 J
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0014 U	0.0083	0.029 U	0.15 U	0.0078 U	0.0075 U	0.007 U	0.15 U	0.015 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.0014 U	0.091 J	0.43	0.96 J	0.0078 U	0.0075 U	0.026	0.96 J	0.048 J
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.00079 JB	0.0028 JB	0.029 U	0.15 U	0.0078 U	0.0075 U	0.01	0.15 U	0.015 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.0011 JB	0.09	0.32 J	0.79 J	0.0078 U	0.0075 U	0.038	0.45 J	0.028 J
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.00096 JB	0.15	0.59 J	1.5 J	0.0078 U	0.011	0.051	1.2 J	0.059 J
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.0002	0.160	0.82	1.99	0.0088	0.01	0.05	1.87	0.09
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.0035	0.29	1.41	2.66	0.0078	0.01	0.13	1.75	0.09
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.0035	0.850	**4.24**	**10.11**	0.0088	0.04	0.3	**9.43**	0.43
Polychlorinated Biphenyls (PCBs)															
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	0.55 U	0.055 U	0.059 U	0.056 U	0.052 U	NA	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	0.55 U	0.055 U	0.059 U	0.056 U	0.052 U	NA	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	0.55 U	0.055 U	0.059 U	0.056 U	0.052 U	NA	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	0.55 U	0.055 U	0.059 U	0.056 U	0.052 U	NA	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	0.55 U	0.055 U	0.059 U	0.056 U	0.052 U	NA	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	0.55 U	0.055 U	0.059 U	0.056 U	0.052 U	NA	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	0.55 U	0.055 U	0.059 U	0.056 U	0.052 U	NA	NA
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	0.55	0.055	0.059	0.056	0.052	NA	NA
Metals															
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	NA	NA	7,200	7,200	15,000	8,300	3,500	7,200 J	9,100
Arsenic	mg/kg	20	88	2.9	7.61	132	NA	NA	11 U	11 U	12 U	11 U	10 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	NA	NA	0.55 U	0.55 U	0.59 U	0.56 U	0.52 U	0.56 U	055 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	NA	NA	4.5	5.5	10	5.7	3.9	6.7 J	9.2
Copper	mg/kg	NA	140,000	280	28.4	217	NA	NA	15	17	26	15	11	15	14
Lead	mg/kg	1,000	NE	3,000	13.1	118	NA	NA	5.5 U	5.5 U	6.9	5.6 U	5.2 U	5.6 U	5.5 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	NA	NA	0.28 U	0.28 U	0.29 U	0.28 U	0.26 U	0.28 U	0.28
Nickel	mg/kg	NA	70,000	130	24.54	980	NA	NA	5.2	5.6	11	7.8	2.6 U	7.4	8.3
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	NA	NA	11 U	11 U	12 U	11 U	10 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	NA	NA	39	41	78	47	39	45 J	56
Total Petroleum Hydrocarbons (TPHs)															
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	2.7 J	4 J	56 U	140 U	29 U	28 U	26 U	NA	NA
Residual Range Organics	mg/kg	2,000	NE	NE	NE	2,000	7.3 J	7.9 J	56 U	430	59 U	56 U	52 U	NA	NA

Notes:

J	Estimated Concentration.	U	Chemical was not detected. The associated value represents the method reporting limit.
NA	Not applicable or not analyzed.	UJ	Chemical was not detected. The associated limit is estimated.
NE	Not established in lookup tables.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.	LMW PAH	Low molecular weight PAH.
		HMW PAH	High molecular weight PAH.
X	Chromatogram indicated the presence of non-target components. Matrix interference may have resulted in a slight high bias.	Detected concentrations shown in **bold** exceed one or more site soil screening levels.	
		B	The sample result is less than five times the blank contamination and cross-contamination is suspected.
Z	Chromatographic fingerprint does not resemble a petroleum product.		

Table 2.2.3-1
CPU Investigation Area Initial RI and WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
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Parameter Name	Units	Screening Levels: MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Ecological Screening Levels: Wildlife	Initial RI Analytical Results: PAAOC-SB-CP02-2	PAAOC-SB-CP02-4	PAAOC-SB-CP02-6	PAAOC-SB-CP03-0.5	PAAOC-SB-CP03-2	PAAOC-SB-CP03-4	PAAOC-SB-CP03-6
Aluminum Smelting													
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	NA	NA	NA	NA	NA	NA	NA
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	NA	NA	NA	NA	NA	NA	NA
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	NA	NA	NA	NA	NA	NA
Polynuclear Aromatic Hydrocarbons (PAHs)													
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0072 U	0.0074 U	0.0075 U	7.2 U	0.15 U	0.0076 U	0.0074 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0072 U	0.0074 U	0.0075 U	7.2	0.6	0.0076 U	0.0074 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0072 U	0.0074 U	0.0075 U	7.44	0.15 U	0.0076 U	0.0074 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0072 U	0.0074 U	0.0075 U	8.7	1.4	0.0076 U	0.0074 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.028	0.020	0.034	72	4.9	0.013	0.0074 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.035	0.03	0.05	89	7.2	0.018	0.0096
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.047	0.04	0.07	120	8.4	0.02	0.011
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.280	0.02	0.041	63	5.2	0.013	0.0074 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.013	0.011	0.016	41	2.5	0.02	0.00744
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.029	0.02	0.038	85	4.6	0.012	0.0074 U
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0072 U	0.0074 U	0.0075 U	14	0.96	0.0076 U	0.0074 U
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.046	0.03	0.051	120	8.6	0.02	0.012
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0072 U	0.0074 U	0.0075 U	7.2 U	0.53	0.0076 U	0.0074 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.024	0.018	0.034	54	4.4	0.012	0.0074 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0072 U	0.0074 U	0.0075 U	7.2 U	0.15 U	0.0076 U	0.0074 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.023	0.01	0.019	48	4.9	0.011	0.0075
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.042	0.03	0.046	100	7.2	0.018	0.01
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.050	0.040	0.07	**113.83**	**18.56**	0.03	0.02
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.07	0.04	0.07	**191.34**	16.03	0.03	0.02
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.5	0.2	0.33	**638**	**45.36**	0.13	0.04
Polychlorinated Biphenyls (PCBs)													
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	NA	NA	NA	NA	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	NA	NA	NA	NA	NA
Metals													
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	4,700 J	6,300 J	6,100 J	5,100	7,900	8,000	6,400
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	11 U	11 U	11 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.54 U	0.56 U	0.56 U	0.54 U	0.57 U	0.57 U	0.55 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	6	3.4	2.8	8.9	**90**	5.2	3.4
Copper	mg/kg	NA	140,000	280	28.4	217	10	9.1	12	15	49	17	15
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.4 U	5.6 U	5.6 U	7.6	34	5.7 U	5.5 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.27 U	0.28 U	0.28 U	0.27 U	0.28 U	0.29 U	0.28 U
Nickel	mg/kg	NA	70,000	130	24.54	980	6	4.2	4	16	16	5.1	3.8
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	11 U	11 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	37	34.0	36	43	230	51	41
Total Petroleum Hydrocarbons (TPHs)													
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	NA	NA	NA	NA	NA	NA	NA
Residual Range Organics	mg/kg	2,000	NE	NE	NE	2,000	NA	NA	NA	NA	NA	NA	NA

Notes:

J	Estimated Concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
X	Chromatogram indicated the presence of non-target components. Matrix interference may have resulted in a slight high bias.
Z	Chromatographic fingerprint does not resemble a petroleum product.

U	Chemical was not detected. The associated value represents the method reporting limit.
UJ	Chemical was not detected. The associated limit is estimated.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

B	The sample result is five times less than the blank contamination and cross-contamination is suspected.

Table 2.2.3-2
CPU Investigation Area Initial RI and WPA Groundwater and Sump Water Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels						WPA Analytical Results			Initial RI Analytical Results
Parameter Name	**Units**	**MTCA Method A**	**MTCA Method B**	**MTCA Method C**	**WA MCL**	**Natural Background**	**PAAOC-WPA-CPU-GW11-GW01**	**PAAOC-WPA-CPU-GW11-GW01D**	**PAAOC-WPA-CPU-SW01**	**PAAOC-SW-CP01 WS**
Aluminum Smelting										
Cyanide, Free	mg/L	NE	0.01	0.022	0.2	ND	0.002 U	0.002 U	0.002 U	0.05 UJ
Fluoride	mg/L	NE	0.96	2.1	4	0.72	**2.94**	**2.91**	**17.1**	**17.3**
Sulfate	mg/L	NE	NE	NE	250	32	50	49	26.2	51.2 J
Polynuclear Aromatic Hydrocarbons (PAHs)										
2-Methylnaphthalene	ug/L	NL	32	70	NE	NE	0.012 J	0.012 J	0.19	1.9 U
Acenaphthene	ug/L	NA	960	2,100	NE	NE	0.0031 JXB	0.0032 JXB	2.9	1.9 U
Acenaphthylene	ug/L	NA	NE	NE	NE	NE	0.02 U	0.02 U	0.014 J	1.9 U
Anthracene	ug/L	NA	4,800	11,000	NE	NE	0.02 U	0.02 U	5.7	2.6
Benzo(a)anthracene	ug/L	NL	NL	NL	NE	NE	0.0028 JB	0.0026 JB	49	24
Benzo(a)pyrene	ug/L	0.1	0.023	0.88	0.2	NE	0.02 U	0.02 U	64	36
Benzo(b)fluoranthene	ug/L	NL	NL	NL	NE	NE	0.02 U	0.02 U	86	45
Benzo(g,h,i)perylene	ug/L	NA	NE	NE	NE	NE	0.02 U	0.02 U	40	25
Benzo(k)fluoranthene	ug/L	NL	NL	NL	NE	NE	0.02 U	0.02 U	32	15
Chrysene	ug/L	NL	NL	NL	NE	NE	0.0012 JB	0.0014 JB	57	26
Dibenzo(a,h)anthracene	ug/L	NL	NL	NL	NE	NE	0.02 U	0.02 U	9.7	6.1
Dibenzofuran	ug/L	NL	NL	NE	NE	NE	0.0015 J	0.0013 J	1	NA
Fluoranthene	ug/L	NL	640	1,400	NE	NE	0.0036 JB	0.0032 JXB	80	35
Fluorene	ug/L	NL	640	1,400	NE	NE	0.0012 J	0.0012 J	1.8	1.9 U
Indeno(1,2,3-cd)pyrene	ug/L	NL	NL	NL	NE	NE	0.02 U	0.02 U	45.0	28
Naphthalene	ug/L	160	160	350	NE	NE	0.0052 JB	0.0047 JB	0.28	1.9 U
Phenanthrene	ug/L	NL	NL	NE	NE	NE	0.0025 JB	0.0026 JB	31	13
Pyrene	ug/L	NL	480	1,100	NE	NE	0.0031 JB	0.0034 JB	74	31
TTEC cPAH (calc)	ug/L	0.1	0.2	0.2	0.2	NE	0.0003	0.0003	**87**	**56.83**
Polychlorinated Biphenyls (PCBs)										
Aroclor 1016	ug/L	NA	1.1	2.5	NE	ND	NA	NA	NA	0.047 U
Aroclor 1221	ug/L	NA	NE	NE	NE	ND	NA	NA	NA	0.047 U
Aroclor 1232	ug/L	NA	NE	NE	NE	ND	NA	NA	NA	0.047 U
Aroclor 1242	ug/L	NA	NE	NE	NE	ND	NA	NA	NA	0.047 U
Aroclor 1248	ug/L	NA	NE	NE	NE	ND	NA	NA	NA	0.047 U
Aroclor 1254	ug/L	NA	0.044	0.44	NE	ND	NA	NA	NA	0.047 U
Aroclor 1260	ug/L	NA	0.044	0.44	NE	ND	NA	NA	NA	0.047 U
Total PCBs (calc)	ug/L	0.1	0.044	0.44	0.5	ND	NA	NA	NA	**0.047**
Metals										
Aluminum	ug/L	NE	16	35	NE	1.14	NA	NA	NA	**350**
Arsenic	ug/L	0.005	0.000058	0.00058	0.01	0.0069	NA	NA	NA	3.3 U
Cadmium	ug/L	0.005	0.008	0.018	0.005	NE	NA	NA	NA	4.4 U
Chromium	ug/L	0.05	24	53	0.1	0.03	NA	NA	NA	11 U
Copper	ug/L	NE	0.64	1.4	1.3	NE	NA	NA	NA	11 U
Lead	ug/L	0.015	NE	NE	0.015	0.0004632	NA	NA	NA	1.1 U
Mercury	ug/L	0.002	NE	NE	0.002	NE	NA	NA	NA	0.5 U
Nickel	ug/L	NA	0.000096	0.18	0.1	0.0651	NA	NA	NA	22 U
Selenium	ug/L	NA	0.08	0.18	0.05	NE	NA	NA	NA	5.6 U
Zinc	ug/L	NA	4.8	11	NE	NE	NA	NA	NA	28 U
Total Petroleum Hydrocarbons (TPHs)										
Diesel Range Organics	mg/L	0.5	NE	NE	NE	NE	0.029 JB	0.036 JB	**0.780 J**	0.96 U
Residual Range Organics	mg/L	0.5	NE	NE	NE	NE	0.051 JB	0.083 JB	**3 J**	**8.7**

Notes:

B	The sample result is less than five times the blank contamination and cross-contamination is suspected.
J	Estimated concentration.
MCL	Maximum Contaminant Level (Secondary MCL for sulfate).
NA	Not analyzed or not applicable.
ND	Not detected.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by summation process.
TTEC	Total Toxicity Equivalent Concentration.
U	Chemical was not detected. The associated value represents the method reporting limit.
UJ	Chemical was not detected. The associated limit is estimated.
X	Chromatogram indicated the presence of non-target components. Matrix interference may have resulted in a slight high bias.

Detected concentrations shown in **bold** exceed one or more site groundwater screening levels.

Table 2.2.3-3
CPU Investigation Area Initial RI Sump Sediment Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results	
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SD-CP01-SS**	**PAAOC-SD-CP01-SSD**
Aluminum Smelting								
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.52 J	0.11 J
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	69 J	50 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	10 UJ	26 J
Polynuclear Aromatic Hydrocarbons (PAHs)								
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NL	NL	22 U	24 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NL	NL	22 U	24 U
Acenaphthene	mg/kg	NA	210,000	98	NL	NL	55	31
Acenaphthylene	mg/kg	NA	NE	NE	NL	NL	22 U	24 U
Anthracene	mg/kg	NA	NE	2,300	NL	NL	92	48
Benzo(a)anthracene	mg/kg	NA	NL	NL	NL	NL	830 J	450 J
Benzo(a)pyrene	mg/kg	2	NL	NL	NL	NL	1,200 J	640 J
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NL	NL	1,500 J	790 J
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NL	NL	840	430
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NL	NL	550	24 J
Chrysene	mg/kg	NA	NL	NL	NL	NL	910 J	500 J
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NL	NL	210 J	110 J
Fluoranthene	mg/kg	NA	140,000	630	NL	NL	1,200 J	650
Fluorene	mg/kg	NL	140,000	100	NL	NL	31	24 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NL	NL	940 J	480 J
Naphthalene	mg/kg	5	70	4.5	NL	NL	22 U	24 U
Phenanthrene	mg/kg	NA	NE	NE	NL	NL	430	260
Pyrene	mg/kg	NA	110,000	650	NL	NL	1,000 J	590
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**1,612**	**831.4**
Polychlorinated Biphenyls (PCBs)								
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.081 UJ	0.089 UJ
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.081 UJ	0.089 UJ
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.081 UJ	0.089 UJ
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.081 UJ	0.089 UJ
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.081 UJ	0.089 UJ
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.081 UJ	0.089 UJ
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.081 UJ	0.089 UJ
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.081	0.089
Metals								
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	24,000	28,000
Arsenic	mg/kg	20	88	2.9	7.61	132	16 U	18 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	**8.1**	**4**
Chromium	mg/kg	2,000	5,300,000	490,000	32	67	41	80
Copper	mg/kg	NA	140,000	280	28.4	217	16	24
Lead	mg/kg	1,000	NE	3,000	13	118	39	56
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.41 U	0.45 U
Nickel	mg/kg	NA	70,000	130	24.54	980	35	53
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	16 U	18 U
Zinc	mg/kg	NA	1,100,000	6,000	81	360	240	300
Total Petroleum Hydrocarbons (TPHs)								
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	6,200 U	4,600 U
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	**58,000 J**	**41,000 J**

Notes:

J	Estimated Concentration.
NL	Not listed or not shown for this chemical but detected concentration is accounted for in the summation process.
NE	Not established.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

One sump sediment sample and a duplicate (SD-CP01-SS/D) collected during the initial RI phase detected PAHs, cadmium, and TPH-Dx at concentrations that exceeded protection of groundwater and MTCA Method C soil screening levels. PAH as TTEC was detected at calculated concentrations of 1,612 and 831.4 mg/kg. Cadmium was detected at concentrations of 8.1 mg/kg and 4 mg/kg. TPH-Dx as residual range organics at 58,000 J and 41,000 J mg/kg.

One sump water sample collected during the initial RI detected fluoride at a concentration of 17.3 mg/L and PAH as TTEC at 56.83 micrograms per liter (µg/L). In addition, diesel range organics were detected at 0.780 J mg/L and residual range organics were detected at 3 J mg/L that exceed MTCA Method A screening levels. A second sump water sample collected during the WPA detected fluoride at a concentration of 17.1 mg/L, PAH as TTEC at 87 µg/L, aluminum at 350 mg/L, and residual range organics at 8.7 exceeding MTCA Method A and/or MTCA Method B screening levels.

Since the concentration of fluoride detected in the sump sediment samples were below the protection of groundwater screening level (Table 2.2.3-3) the concentration of fluoride detected in sump water, 17.1 and 17.3 mg/L, is presumed to represent groundwater that has flowed into the sump (during previous operations at the site, the sump was regularly pumped keep the sump dry) and is in contact with sump sediment for long periods of time. Detected concentrations of PAH as TTEC at 56.83 µg/L, and TPH-Dx as residual range organics at 3,000 J mg/L in the sump water sample may result from contact with contaminated sump sediment.

WPA boring soil sample analytical results indicate that detected concentrations of cyanide, fluoride, sulfate, PAHs and TPH-Dx do not exceed Plant Area AOC soil screening levels. WPA water analytical results for CPU-GW11 and one sump water sample CPU-SW01, indicate that fluoride, PAH as TTEC, and TPH-Dx as diesel and residual range organics exceed water screening levels. Fluoride was detected in groundwater samples CPU-GW11-GW01 and CPU-GW11-GW01D at concentrations of 2.94 and 2.91 mg/L, respectively, that exceeds the MTCA Method C screening level; but cyanide, sulfate, PAHs, and TPH-Dx did not exceed Plant Area AOC water screening levels at the downgradient side of the Coke and Pitch Unloading Sump. PAH as TTEC and TPH-Dx as diesel and residual range organics were detected in sump water sample CPU-SW01 at concentrations that exceed the MTCA Method A screening level and is consistent with the concentrations detected in the initial RI sump water sample.

2.2.3.3 Conclusions and Recommendations

The Coke and Pitch Unloading Sump was investigated with a total of five soil borings, one sump sediment sample, two sump water samples, and one groundwater sample. The following conclusions are based on the soil and water analytical results:

- Initial RI soil analytical results indicate PAHs and chromium were detected at concentrations that exceed soil screening levels in samples to 2 ft bgs but not in deeper samples.
- WPA boring soil analytical results indicate no exceedance of soil screening levels.
- Sump sediment contains elevated concentrations of PAHs, cadmium, and TPH-Dx as residual range organics at concentrations that exceed MTCA Method C and protection of groundwater screening levels.
- Sump water contains elevated concentrations of fluoride, PAH as TTEC, aluminum, and TPH-Dx as diesel and residual range organics that exceeds Method A and WA MCL screening levels. TTEC concentrations in sump water are considered representative of sump sediment contamination. Based on potential minimal seasonal fluctuations in the water table (Groundwater AOC, Volume 4, Section 2), water likely does not flow out of the sump in any appreciable volume.
- WPA groundwater sample analytical results indicate only fluoride was detected at concentrations that exceed screening levels and are consistent with a site wide fluoride plume in shallow groundwater (Groundwater AOC, Volume 4, Section 2).
- Coke and Pitch Sump sediment PAH and TPH-Dx contamination has impacted standing water within the sump but does not appear to have impacted shallow groundwater immediately downgradient from the sump.

The Coke and Pitch Unloading Sump is recommended for evaluation in the FS for contaminated sediments that remain in the sump from former plant operations.

2.2.4 Soil Boring SB-AST05 Near the East SPL Storage Area

An above-ground storage tank (AST05) was previously located near the northwest corner of the Bath Storage Building (SWMU 12, East SPL Storage Area), south of the east end of Production Building A (Figure 2.1.2-1). Soil boring SB-AST05 was identified in the WPA as an Investigation Area (Tetra Tech et al. 2020b) to address a data gap of vertical extent of TPH-Dx in soil and potential interaction with shallow groundwater.

During the initial RI, AST05 was investigated with one soil boring (SB-AST05). Initial RI results indicated that PAHs and TPH-Dx were detected at concentrations that exceed Plant Area AOC soil screening levels to the total depth of the boring at 4 ft bgs (see Figure 2.2.4-1 and Table 2.2.4-1). PAHs as TTEC exceeded protection of groundwater screening levels, and total calculated LMW and HMW, and TPH-Dx as residual range organics, exceeded ecological wildlife screening levels.

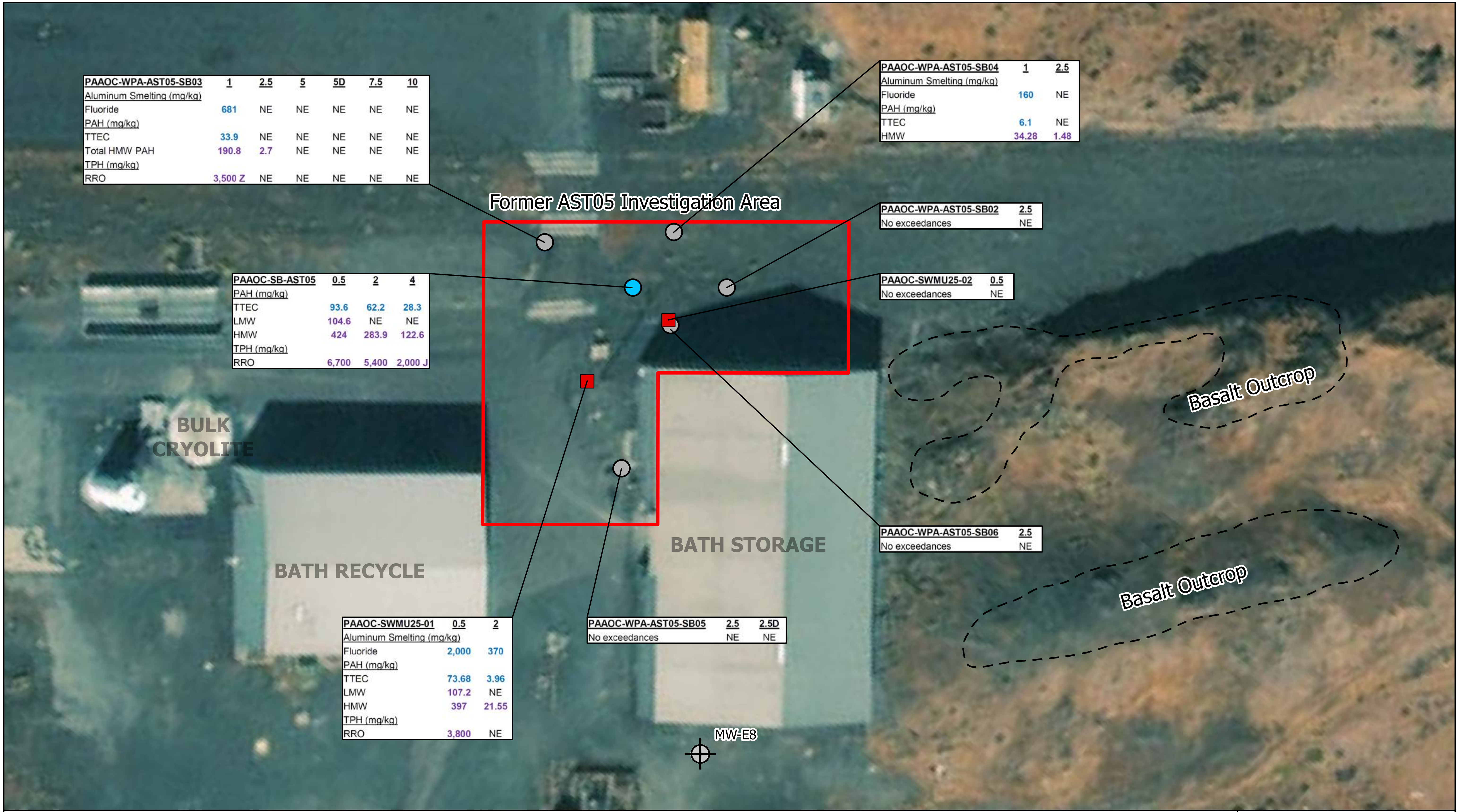
Evaluation of nearby initial RI test pits TP-SWMU25-01 and TP-SWMU25-02 indicate that PAHs and TPH-Dx exceed Plant Area AOC soil screening levels to the west of SB-AST05 in TP-SWMU25-01, but not to the east in TP-SWMU25-02 where surface soil thins exposing basalt bedrock at ground surface.

One shallow groundwater monitoring well MW-E8 (UA zone) is located approximately 160 ft downgradient from AST05, and on the south side of the Bath Storage Building (Figure 2.2.4-1). This well was dry during the 2017 quarterly groundwater monitoring program, which is consistent with an increasingly shallow depth to bedrock at and east of the Bath Storage Building (SWMU 12).

2.2.4.1 Investigation Scope

The proposed WPA scope for the soil boring SB-AST05 Investigation Area consisted of four soil borings, installation of one shallow groundwater monitoring well at the initial RI SB-AST05 location, and potential collection of one grab groundwater sample if shallow groundwater was encountered in any of the soil borings. The investigation incorporated an iterative approach (Volume 1, Section 3.2.1.3, Figure 3-1) to guide field decisions during a single field mobilization to define the vertical and horizontal extent of TPH-Dx in soil and the need for additional step-out borings. Implementation of the iterative approach included rapid turnaround time for laboratory analysis of TPH-Dx in soil.

Four soil borings (AST05-SB02, AST05-SB03, AST05-SB04, and AST05-SB06) were completed to the north, east, south, and west of SB-AST05. A fifth soil boring, AST05-SB05, was completed farther to the south of SB-AST05 in the downgradient location when rapid turnaround for TPH-Dx analysis was delayed. All five soil borings were drilled to basalt bedrock and soil samples were collected at approximate 2.5 ft intervals. No shallow groundwater was encountered in any of the WPA phase soil borings, which were drilled to deeper depths than the initial RI boring SB-AST05. Therefore, a shallow monitoring well was not installed at the SB-AST05 location. Logs of borings and test pits are included in Volume 5, Appendices G-1 and G-2.



PAAOC-WPA-AST05-SB03	1	2.5	5	5D	7.5	10
Aluminum Smelting (mg/kg)						
Fluoride	681	NE	NE	NE	NE	NE
PAH (mg/kg)						
TTEC	33.9	NE	NE	NE	NE	NE
Total HMW PAH	190.8	2.7	NE	NE	NE	NE
TPH (mg/kg)						
RRO	3,500 Z	NE	NE	NE	NE	NE

PAAOC-WPA-AST05-SB04	1	2.5
Aluminum Smelting (mg/kg)		
Fluoride	160	NE
PAH (mg/kg)		
TTEC	6.1	NE
HMW	34.28	1.48

PAAOC-WPA-AST05-SB02	2.5
No exceedances	NE

PAAOC-SB-AST05	0.5	2	4
PAH (mg/kg)			
TTEC	93.6	62.2	28.3
LMW	104.6	NE	NE
HMW	424	283.9	122.6
TPH (mg/kg)			
RRO	6,700	5,400	2,000 J

PAAOC-SWMU25-02	0.5
No exceedances	NE

PAAOC-WPA-AST05-SB06	2.5
No exceedances	NE

PAAOC-SWMU25-01	0.5	2
Aluminum Smelting (mg/kg)		
Fluoride	2,000	370
PAH (mg/kg)		
TTEC	73.68	3.96
LMW	107.2	NE
HMW	397	21.55
TPH (mg/kg)		
RRO	3,800	NE

PAAOC-WPA-AST05-SB05	2.5	2.5D
No exceedances	NE	NE

🟥	Former AST05 Investigation Area
●	WPA Boring, dry
●	RI Boring
⌖	RI Monitor Well
■	RI Test Pits
◌	Basalt Outcrop (Volume 2, Figure 12-1)

Soil Screening Levels
blue: Exceeds Protection of Groundwater
purple: Exceeds Protection of Wildlife and for TPH diesel and residual range organics exceeds MTCA Method A

J: Estimated concentration
Z: Chromatographic fingerprint does not resemble a petroleum product
NE: No exceedance
RRO: Residual Range Organics
D: Duplicate sample

Figure 2.2.4-1

Plant Area AOC

SB-AST05 Near East SPL Storage Area Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Maxar, Microsoft

Table 2.2.4-1
AST05 Investigation Area Initial RI and WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 1 of 2

		Screening Levels				Ecological Screening Levels	WPA Analytical Results								
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-WPA-AST05-SB02-2.5	PAAOC-WPA-AST05-SB03-1	PAAOC-WPA-AST05-SB03-2.5	PAAOC-WPA-AST05-SB03-5	PAAOC-WPA-AST05-SB03-5D	PAAOC-WPA-AST05-SB03-7.5	PAAOC-WPA-AST05-SB03-10	PAAOC-WPA-AST05-SB04-1	PAAOC-WPA-AST05-SB04-2.5
Aluminum Smelting															
Cyanide, Total	mg/kg	NA	2,200	1.9	NE	5	0.2 U	1.72	0.02 U	0.19 U	0.19 U	0.2 U	0.19 U	0.09 J	0.19 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	40.2 J	**681 J**	111 J	46.9 J	37.8 J	26.3 J	28.5 J	**160 J**	45.8 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	3.1 JB	15.5 J	3.6 JB	3.3 JB	3.4 JB	3.2 JB	2.8 JB	9.4 J	3 JB
Polynuclear Aromatic Hydrocarbons (PAHs)															
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0057 U	0.53	0.005 J	0.0054 U	0.0054 U	0.0056 U	0.0007 J	0.07	0.0014 J
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.00059 JB	3.3	0.04	0.0054 U	0.0054 U	0.0056 U	0.00035 JB	0.41	0.011
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0057 U	0.062	0.00047 J	0.0054 U	0.0054 U	0.0056 U	0.005 U	0.0062 J	0.0054 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0057 U	3.9	0.033	0.0054 U	0.0054 U	0.0056 U	0.005 U	0.45	0.011
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0022 JB	20	0.28	0.0019 JB	0.0019 JB	0.00044 JB	0.00066 JB	3.8	0.14
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.0021 JB	25	0.36	0.0025 JB	0.0029 JB	0.0056 U	0.005 U	4.4	0.19
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0038 JB	35	0.49	0.0041 JB	0.0034 JB	0.0056 U	0.005 U	6.1	0.29
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.0021 JB	14	0.26	0.003 JB	0.0025 JB	0.0056 U	0.005 U	3	0.17
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0017 JB	11	0.2	0.0013 JB	0.0014 JB	0.0056 U	0.005 U	2.4	0.1
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.0023 JB	28	0.35	0.0021 JB	0.0018 JB	0.0056 U	0.005 U	4.8	0.19
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.00038 J	3.8	0.063	0.00048 J	0.0054 U	0.0056 U	0.005 U	0.78	0.035
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	0.0057 U	1.2	0.01	0.0054 U	0.0054 U	0.0056 U	0.005 U	0.12	0.0026 J
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.0038 JB	44	0.41	0.0025 J	0.0028 JB	0.0056 U	0.00092 JB	6.2	0.21
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0057 U	1.6	0.015	0.0054 U	0.0054 U	0.0056 U	0.005 U	0.21	0.0058
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.002 JB	16	0.28	0.0027 JB	0.0023 JB	0.0056 U	0.005 U	3.3	0.16
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.00089 JB	0.77	0.01	0.0055 J	0.00063 JB	0.00056 JB	0.001 JB	0.1	0.002 JB
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.0032 JB	24	0.2	0.0009 JB	0.0022 JB	0.0056 U	0.0016 JB	2.9	0.076
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.0035 JXB	38	0.41	0.0024 JXB	0.0025 JXB	0.0056 U	0.0009 JB	5.7	0.2
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.003	**33.9**	0.5	0.004	0.004	0.00004	0.0007	**6.1**	0.3
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.009	77.63	0.71	0.009	0.006	0.0006	0.004	10.3	0.32
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.02	**190.8**	**2.7**	0.04	0.02	0.0004	0.002	**34.28**	**1.48**
Metals															
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	mg/kg	20	88	2.9	7.61	132	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	mg/kg	2	3,500	0.69	0.81	14	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	mg/kg	2,000	5,300,000	490,000	32	67	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	mg/kg	NA	140,000	280	28	217	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	mg/kg	1,000	NE	3,000	13	118	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	mg/kg	2	NE	2.1	0.04	5.5	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	mg/kg	NA	70,000	130	25	980	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	mg/kg	NA	1,100,000	6,000	81	360	NA	NA	NA	NA	NA	NA	NA	NA	NA
Volatile Organic Compounds (VOCs)															
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.5	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.2	NA	NA	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.9	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.5	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (TPHs)															
Gasoline Range Organics	mg/kg	100	NE	NA	NA	1,000	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	7 J	950 Z	8.3 J	27 U	27 U	27 U	27 U	60 Z	7.1 J
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	14 JB	**3,500 Z**	29 JB	11 JB	10 JB	7.9 JB	8.8 JB	250 Z	29 JB

Notes:

B	The sample result is less than five times the bland contamination and cross-contamination is suspected.
J	Estimated Concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method reporting limit.
UJ	Chemical was not detected. The associated limit is estimated.
X	Chromatogram indicated the presence of non-target components. Matrix interference may have resulted in a slight high bias.
Z	Chromatographic fingerprint does not resemble a petroleum product.

TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.2.4-1
AST05 Investigation Area Initial RI and WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 2 of 2

		Screening Levels				Ecological Screening Levels	WPA Analytical Results			Initial RI Analytical Results					
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-WPA-AST05-SB05-2.5	PAAOC-WPA-AST05-SB05-2.5D	PAAOC-WPA-AST05-SB06-2.5	PAAOC-SB-AST05-0.5	PAAOC-SB-AST05-2	PAAOC-SB-AST05-4	PAAOC-TP-SWMU25-01-0.5	PAAOC-TP-SWMU25-01-2	PAAOC-TP-SWMU25-02-0.5
Aluminum Smelting															
Cyanide, Total	mg/kg	NA	2,200	1.9	NE	5	0.2 U	0.2 U	0.24 U	NA	NA	NA	0.48	0.05 U	0.054
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	20.1 J	19.3 J	97.3 J	NA	NA	NA	**2,000**	**370**	110
Sulfate	mg/kg	NA	NE	2,150	NE	NE	27.3 J	32.2 J	2.9 JB	NA	NA	NA	NA	NA	NA
Polynuclear Aromatic Hydrocarbons (PAHs)															
1-Methylnaphthalene	mg/kg	NA	4,500	0	NE	NL	NA	NA	NA	1.6 U	0.75 U	0.27	0.75 U	0.16 U	0.0076 U
2-Methylnaphthalene	mg/kg	NA	14,000	2	NE	NL	0.00056 J	0.0007 J	0.00057 J	NA	NA	NA	0.75 U	0.16 U	0.0076 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.00038 JB	0.0074 JB	0.0068 U	6.2	4.1	2.2	4.7	0.18	0.0076 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0056 U	0.0054 U	0.0068 U	NA	NA	NA	0.75 U	0.164	0.0076 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.00036 JB	0.00053 JB	0.00044 JB	7.8	4.9	2.1	4.9	0.2	0.0076 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0056 U	0.0054 U	0.0029 JB	52	35	14	43	2.1	0.018
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.0056 U	0.0054 U	0.004 J	68	45	21	54	2.9	0.026
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0056 U	0.0054 U	0.0054 JB	99	66	27	73	4	0.038
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.0056 U	0.0054 U	0.0039 JB	NA	NA	NA	47	2.4	0.021
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0056 U	0.0054 U	0.0018 JB	NA	NA	NA	27	1.3	0.012
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.0056 U	0.0054 U	0.0032 JB	63	42	17	48	2.5	0.026
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0056 U	0.0054 U	0.0068 U	13	8.9	3.6	11	0.55	0.0076 U
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	0.00075 J	0.00095 J	0.0068 U	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.0021 JB	0.0026 JB	0.005 JB	87	58	26	64	3.3	0.033
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.00081 JB	0.00087 JB	0.0068 U	3.6	2.1	0.9	2.7	0.16 U	0.0076 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.0056 U	0.0054 U	0.003 JB	54	36	17	38	2.4	0.02
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.00079 JB	0.00095 JB	0.001 J	1.6 U	0.75 U	0.48	0.92	0.16 U	0.0076 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.0046 JB	0.0069 B	0.0046 JB	NA	NA	NA	30	1.3	0.015
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.0014 JB	0.0017 JB	0.005 JXB	75	51	23	56	3	0.032
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.006	0.0054	0.005	**93.6**	**62.2**	**28.3**	**73.68**	**3.96**	0.035
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.009	0.02	0.005	**104.6**	69.1	31.68	**107.22**	5.14	0.048
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.002	0.0017	0.03	**424**	**283.9**	**122.6**	**397**	**21.55**	0.19
Metals															
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	NA	NA	NA	NA	NA	NA	50,000	11,000	10,000
Arsenic	mg/kg	20	88	2.9	7.61	132	NA	NA	NA	NA	NA	NA	11 U	12 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	NA	NA	NA	NA	NA	NA	0.56 U	0.58 U	0.57 U
Chromium	mg/kg	2,000	5,300,000	490,000	32	67	NA	NA	NA	NA	NA	NA	17 J	9.2 J	8 J
Copper	mg/kg	NA	140,000	280	28	217	NA	NA	NA	NA	NA	NA	28	14	16
Lead	mg/kg	1,000	NE	3,000	13	118	NA	NA	NA	NA	NA	NA	21	8.4	5.7 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	NA	NA	NA	NA	NA	NA	0.28 U	0.29 U	0.28 U
Nickel	mg/kg	NA	70,000	130	25	980	NA	NA	NA	NA	NA	NA	55	8	8.8
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	NA	NA	NA	NA	NA	NA	11 U	12 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	81	360	NA	NA	NA	NA	NA	NA	83 J	62 J	49 J
Volatile Organic Compounds (VOCs)															
Benzene	mg/kg	0.03	2,400	0.027	NE	0.3	NA	NA	NA	0.02 U	0.02 U	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.5	NA	NA	NA	0.063 U	0.056 U	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.2	NA	NA	NA	0.063 U	0.056 U	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10.0	NA	NA	NA	0.063 U	0.056 U	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10.0	NA	NA	NA	0.063 U	0.056 U	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.9	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.5	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (TPHs)															
Gasoline Range Organics	mg/kg	100	NE	NA	NA	1,000	NA	NA	NA	6.3 U	5.6 U	4.1 UJ	NA	NA	NA
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	2.7 J	2.5 J	4.2 J	860 U	630 U	360 UJ	440	64	28 U
Residual Range Organics	mg/kg	2,000	NE	NE	NE	2,000	12 JB	12 JB	12 JB	**6,700**	**5,400**	**2,000 J**	**3,800**	210	57 U

Notes:

B	The sample result is less than five times the bland contamination and cross-contamination is suspected.
J	Estimated Concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method reporting limit.
UJ	Chemical was not detected. The associated limit is estimated.
X	Chromatogram indicated the presence of non-target components. Matrix interference may have resulted in a slight high bias.
Z	Chromatographic fingerprint does not resemble a petroleum product.

TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Initial RI SB-AST05 soil samples were analyzed for cyanide, fluoride, sulfate, PAHs, total petroleum hydrocarbons – gasoline-extended range (TPH-Gx), TPH-Dx, and fuel-related VOCs. Initial RI soil samples from TP-SWMU25-01 and TP-SWMU25-02 were analyzed for cyanide, fluoride, sulfate, PAHs, metals, and TPH-Dx. WPA soil samples were analyzed for cyanide, fluoride, sulfate, PAHs, and TPH-Dx.

2.2.4.2 Investigation Results

The initial RI boring location SB-AST05 was investigated during the WPA phase with five soil borings drilled to the north, east, south, and west, to depths of 10 ft bgs, 15 ft bgs, and 20 ft bgs, versus the SB-AST05 total depth of 4 ft bgs. Basalt flow top and hard basalt was encountered at shallow depths and no groundwater was encountered in any of the soil borings. Soil analytical results are summarized in Table 2.2.4-1 SB-AST05 Investigation Area Initial RI and WPA Soil Results Summary. Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. Natural background concentrations for the site have been used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater screening level, and for selenium exceed the protection of groundwater and ecological wildlife soil screening levels in all samples analyzed for metals.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels are compiled and presented on Figure 2.2.4-1 SB-AST05 Near East SPL Storage Area Sampling Locations and Exceedance Summary. Initial RI and WPA analytical results indicate that cyanide, sulfate, metals, TPH-Gx, and fuel-related VOCs do not exceed soil screening levels. Fluoride exceeds the protection of groundwater screening level in shallow soil in soil borings and test pits to the north, west, and south of SB-AST05 where surface soil is thicker. Fluoride was not an analyte in initial RI boring SB-AST05.

PAH as TTEC was detected at concentrations that exceed the protection of groundwater screening level in SB-AST05, WPA borings AST05-SB04 and AST05-SB03 to the north and west, and test pit TP-SWMU25-01 to the southwest. PAH as total calculated LMW and HMW exceeded ecological wildlife soil screening levels in these same borings to depths of up to 4 ft bgs.

TPH-Dx as residual range organics were detected at concentrations that exceeds MTCA Method A and ecological wildlife soil screening levels in initial RI boring SB-AST05 to 4 ft bgs, in AST05-SB03 to the west only in the shallowest soil sample, and in test pit TP-SWMU25-01 to the southwest also in the shallowest soil samples but not in deeper depth samples. Groundwater was not encountered in any of the soil borings or test pits in the SB-AST05 Investigation Area, and, with surface soil thinning to the south and east (Figure 2.2.4-1), and the nearest shallow monitoring well MW-E8 consistently dry, it does not appear that TPH-Dx in this area has or may have the potential to impact shallow groundwater.

2.2.4.3 Conclusions and Recommendations

Soil in the SB-AST05 Investigation Area becomes thinner from west to east. Basalt bedrock was encountered in borings at up to 10 ft bgs in the west, and at less than 4 ft bgs in the east. Shallow groundwater was not encountered in any of the soil borings, and a monitoring well was not installed, and no shallow groundwater samples were collected.

TPH-Dx was detected in soil to the west and southwest of SB-AST05 at concentrations that exceed MTCA Method A and ecological wildlife screening levels in shallow soil (<1 ft bgs) and was the basis for designating the SB-AST05 Investigation Area. Other COPCs that exceeded either the protection of groundwater or ecological wildlife soil screening levels include fluoride and PAHs detected in WPA boring AST05-SB03 to the west and initial RI test pit TP-SWMU25-01 to the southwest.

The SB-AST05 Investigation Area is recommended for further evaluation in the FS for TPH-Dx, fluoride, and PAH contamination in shallow soil. The SB-AST05 Investigation Area overlaps with SWMU 12 East SPL Storage Area (Volume 2, Section 12) and will be evaluated jointly with SWMU 12 in the FS.

2.2.5 Friction Weld Building

The Friction Weld Building is located east of the Cast House (Figure 2.1.2-1) and was investigated during the initial RI with three soil borings completed along the south side of the building. The Friction Weld Building was identified in the WPA as an Investigation Area (Tetra Tech et al. 2020b) to address a data gap of vertical extent of fluoride in soil and potential interaction with shallow groundwater (Figure 2.2.5-1).

Initial RI soil sample analytical results indicated that concentrations of fluoride in soil boring SB-FW01 exceeded the protection of groundwater screening level of 147.6 mg/kg to the total boring depth of 10.75 ft and may represent a potential source of contamination to shallow groundwater. Evaluation of nearby initial RI soil borings SB-FW02 (east), and SB-CP01 and SB-CP02 (southwest) indicates that fluoride did not exceed the protection of groundwater screening levels to depths of 6 ft bgs, the maximum depth of these borings.

The closest downgradient shallow groundwater monitoring well is RI-MW10-BAU located approximately 250 ft to the southeast, east of the South SPL Building (SWMU 15) (Figure 2.1.2-1). During the 2017 quarterly groundwater monitoring program fluoride was detected in the well at concentrations of 1.2 mg/L to 1.6 J mg/L (Volume 4, Section 2, Groundwater AOC). Interpreted groundwater monitoring data indicates a shallow groundwater fluoride plume in the BAU encompassing most of the southern portion of the plant area, including the Friction Weld Building, at concentrations that exceed the MTCA Method B screening level of 0.96 mg/L.

2.2.5.1 Investigation Scope

The proposed WPA phase scope for the Friction Weld Building Investigation Area consisted of two soil borings and collection of one groundwater grab sample. The investigation incorporated an iterative approach (Volume 1, Section 3.2.1.3, Figure 3-1) to guide field decisions during a single field mobilization to define the vertical and horizontal extent of fluoride contamination in soil, and the need for and location of additional step-out borings. Implementing the iterative approach included rapid turnaround time for laboratory analysis of fluoride in soil.

PAAOC-SB-FW02	0.5	4
PAH (mg/kg)		
LMW	738.8	NE
HMW	322.8	NE
Metals (mg/kg		
Selenium	1.3	1.3

PAAOC-SB-FW04	0.5	4	6.5
PAH (mg/kg)			
HMW	3.35	NE	NE
Metals (mg/kg)			
Selenium	1.3	1.5	1.7

PAAOC-WPA-FWB-SB06	2.5
No exceedances	NE

PAAOC-WPA-FWB-SB05	2.5	7.5	12.5	17.5	17.5D
PAH (mg/kg)					
TTEC	6.12	NE	NE	NE	NE
HMW	32.5	NE	NE	NE	NE

PAAOC-WPA-FWB-SB05	GW01
Aluminum Smelting (mg/L)	
Fluoride	8.64

PAAOC-SB-FW01	0.5	4	10.5
Aluminum Smelting (mg/kg)			
Fluoride	1,800 J	1,100 J	160 J
PAH (mg/kg)			
TTEC	31.75	NE	NE
HMW	164.6	NE	NE
Metals (mg/kg)			
Arsenic	28	4.5	5.5
Cadmium	0.97	NE	NE
Selenium	NE	1.2	1.6

🟥 Friction Weld Building Investigation Area
● WPA Boring, wet, no temp screen
● WPA Boring, temp screen
● RI Boring

Soil Screening Levels
blue: Exceeds SLV for Protection of Groundwater
purple: Exceeds Protection of Wildlife

J: Estimated concentration
D: Duplicate sample
NE: No exceedance
2: Sample depth in feet

Water Screening Levels
red: Exceeds MTCA Method C

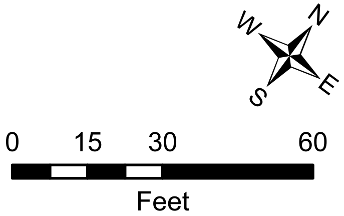


Figure 2.2.5-1

Plant Area AOC

Friction Weld Building Investigation Area Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter

Maxar, Microsoft

Initially, two soil borings (FWB-SB05 and FWB-SB06) were completed at the location of SB-FW01 (Figure 2.2.5-1) to confirm the presence of fluoride in soil at depth, and to determine if this area is a potential source of fluoride contamination to shallow groundwater. Four soil samples were collected from FWB-SB05 and one sample from FWB-SB06. Sufficient groundwater was encountered in boring FWB-SB05 for installation of a temporary well screen, and one grab groundwater sample was collected per the WPA plan. Logs of borings are included in Volume 5, Appendices G-1 and G-2.

Soil samples were analyzed for cyanide, fluoride, sulfate, PAHs, PCBs, Metals, and TPH-Dx. The groundwater sample was analyzed for free cyanide, fluoride, sulfate, PAHs, and TPH-Dx.

2.2.5.2 Investigation Results

The Friction Weld Building was investigated with a total of three soil borings completed during the initial RI phase, and two soil borings and collection of one grab groundwater sample during the WPA phase. Soil analytical results are summarized in Table 2.2.5-1, Friction Weld Building Investigation Area Initial RI and WPA Soil Results Summary, and the groundwater analytical results are summarized in Table 2.2.5-2, Friction Weld Building Investigation Area WPA Groundwater Results Summary. MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. Groundwater results are compared to MTCA Method A, MTCA Method B, MTCA Method C, and WA MCL water screening levels. Natural background concentrations for the site have been used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). The reporting limit objectives have been met.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels are compiled and presented on Figure 2.2.5-1. Initial RI and WPA analytical results indicate that while fluoride exceeded the protection of groundwater screening level in initial RI boring SB-FW01, it did not exceed the screening level in initial RI borings SB-FW02 and SB-FW04, or in WPA borings FWB-SB05 and FWB-SB06. Other COPCs that exceed soil screening levels include PAHs and metals. PAH as TTEC exceeds the protection of groundwater screening level, and concentrations of

Table 2.2.5-1
FWB Investigation Area Initial RI and WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

		Screening Levels				Ecological Screening Level	WPA Analytical Results						Initial RI Analytical Results							
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-WPA-FWB-SB05-2.5	PAAOC-WPA-FWB-SB05-7.5	PAAOC-WPA-FWB-SB05-12.5	PAAOC-WPA-FWB-SB05-17.5	PAAOC-WPA-FWB-SB05-17.5D	PAAOC-WPA-FWB-SB06-2.5	PAAOC-SB-FW01-0.5	PAAOC-SB-FW01-4	PAPAOC-SB-FW01-10.75	PAAOC-SB-FW02-0.5	PAAOC-SB-FW02-4	PAAOC-SB-FW04-0.5	PAAOC-SB-FW04-4	PAAOC-SB-FW04-6.5
Aluminum Smelting																				
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.19 U	0.21 U	0.2 U	0.23 U	0.23 U	0.21 U	2.2 U	2.1 U	2.4 U	2 U	2 U	2.1 U	2 U	2.3 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	37.8	5.1	19.4	32.5 J	23.8 J	28.5	**1,800 J**	**1,100 J**	**160 J**	53 J	9.9 J	16 J	18 J	9.4 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	8.4	5	16.9	60.5	64.8	2.3 U	28 B	70	34 B	6.9 B	6.4 B	4.9 B	8.7 B	6.7 B
Polynuclear Aromatic Hydrocarbons (PAHs)																				
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.035	0.001 J	0.0005 J	0.00079 J	0.0006 J	0.0058 U	0.23	0.0022 U	0.0024 U	22 U	0.0022 U	0.022 U	0.0022 U	0.0023 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.35	0.0016 J	0.0057 U	0.0063 U	0.0063 U	0.0058 U	1.8	0.0059	0.0028 J	16 J	0.00066 U	0.023 J	0.0011 J	0.00069 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0019 J	0.0058 U	0.0057 U	0.0063 U	0.0063 U	0.0058 U	0.046 J	0.00056 U	0.00061 U	5.4 U	0.00055 U	0.0054 U	0.56 U	0.00057 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.4	0.0022 J	0.0057 U	0.0063 U	0.0063 U	0.0058 U	2.6	0.0089	0.0025 J	24 J	0.66	0.023 J	0.0015 J	0.0014 J
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	3.1	0.023	0.0011 JB	0.00099 JB	0.0018 JB	0.00073 JB	18	0.069	0.024	0.31	0.0039 J	0.31	0.017	0.0084 J
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	4.5	0.031	0.00057 J	0.0063 U	0.0012 J	0.0058 U	24	0.088	0.025	0.42	0.0051 J	0.4	0.021	0.0097
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	6.2	0.054	0.0013 J	0.0063 U	0.0025 J	0.00056 J	28	0.11	0.033	0.52	0.0063 J	0.65	0.027	0.013
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	3.6	0.028	0.00073 J	0.0063 U	0.0011 J	0.0058 U	16	0.063	0.018	320	0.0033 J	0.34	0.014	0.0062
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	1.8	0.021	0.00041 J	0.0063 U	0.00081 J	0.0058 U	9.7	0.043	0.014	0.2	0.0026 J	0.22	0.009	0.0044 J
Chrysene	mg/kg	NA	NL	NL	NE	NL	4	0.034	0.00074 J	0.00053 J	0.0016 J	0.00039 J	19	0.076	0.026	0.38	0.0037 J	0.5	0.019	0.0088 J
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.84	0.0048 J	0.0057 U	0.0063 U	0.0063 U	0.0058 U	3.9	0.014	0.0047 J	0.07	0.00097 J	0.077	0.0036 J	0.0017 J
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	5	0.032	0.0011 J	0.0011 J	0.0027 J	0.0058 U	35	0.12	0.04	540	0.0086 J	0.57	0.03	0.016 J
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.16	0.00095 J	0.0057 U	0.0063 U	0.0063 U	0.0058 U	0.86	0.0026 J	0.0014 J	8.8 J	0.00055 U	0.017 J	0.00065 J	0.00057 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	3.9	0.03	0.00049 J	0.0063 U	0.00089 J	0.0058 U	16	0.063	0.018	0.3	0.003 J	0.32	0.013	0.0057
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.079	0.0015 JX	0.00088 JX	0.00093 J	0.00085 JX	0.0006 J	0.44	0.0016 J	0.00098 U	8.7 U	0.00087 U	0.01 J	0.0009 U	0.00091 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	2.2	0.013	0.0011 J	0.0014 J	0.0019 J	0.0058 U	12	0.036	0.016	150	0.0022 J	0.17	0.0087 J	0.0051 J
Pyrene	mg/kg	NA	110,000	650	NE	NL	4.6	0.035	0.0012 JX	0.0012 JX	0.0029 J	0.0005 JX	30	0.1	0.035	510	0.0077 J	0.53	0.027	0.014 J
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**6.12**	0.05	0.001	0.0001	0.002	0.0001	**31.75**	0.12	0.035	0.56	0.007	0.56	0.03	0.0131
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	8.21	0.05	0.003	0.003	0.005	0.006	52.75	0.18	0.06	**738.8**	0.67	0.81	0.04	0.023
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**32.5**	0.3	0.007	0.003	0.01	0.007	**164.6**	0.63	0.2	**322.8**	0.04	**3.35**	0.15	0.07
Polychlorinated Biphenyls (PCBs)																				
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.0085 U	0.008 U	0.0086 U	0.029	0.008 UJ	0.022 J	0.008 U	0.0085 UJ
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.0045 U	0.0046 U	0.0049 U	0.0045 U	0.0046 UJ	0.0044 U	0.0045 U	0.0048 UJ
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.0056 U	0.0053 U	0.0057 U	0.0052 U	0.0053 UJ	0.0052 U	0.0053 U	0.0056 UJ
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.0018 U	0.0017 U	0.0019 U	0.0017 U	0.0017 UJ	0.0017 U	0.0017 U	0.0018 UJ
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.0033 U	0.0031 U	0.0034 U	0.0031 U	0.0032 UJ	0.0031 U	0.0031 U	0.0033 UJ
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	NA	NA	NA	NA	0.0017 U	0.0046 U	0.0017 U	0.0016 U	0.0016 UJ	0.0016 U	0.0016 U	0.0017 UJ
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.0022 U	0.0021 U	0.0022 U	0.002 U	0.0021 UJ	0.002 U	0.002 U	0.0022 UJ
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	NA	NA	NA	NA	0.0022	0.0021	0.0022	0.002	0.0021	0.002	0.002	0.0022
Metals																				
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	NA	NA	NA	NA	NA	NA	48,000	18,000	9,300	5,800	6,000	3,700	5,000	6,600
Arsenic	mg/kg	20	88	2.9	7.61	132	NA	NA	NA	NA	NA	NA	**28**	**4.5**	**5.5**	1.1	1.2	0.8	1	1.2
Cadmium	mg/kg	2	3,500	0.69	0.81	14	NA	NA	NA	NA	NA	NA	**0.97**	0.23	0.22	0.18	0.14	0.13	0.16	0.15
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	NA	NA	NA	NA	NA	NA	7.4 J	7.3 J	13 J	5.5 J	3.8 J	37 J	5.3 J	4.2 J
Copper	mg/kg	NA	140,000	280	28.4	217	NA	NA	NA	NA	NA	NA	16 J	13 J	16 J	15 J	9.4 J	11 J	13 J	12 J
Lead	mg/kg	1,000	NE	3,000	13.1	118	NA	NA	NA	NA	NA	NA	6.2	3	6.4	2.7	3	2.1	2.5	3.1
Mercury	mg/kg	2	NE	2.1	0.04	5.5	NA	NA	NA	NA	NA	NA	0.0067 U	0.0064 U	0.0073 U	0.0062 U	0.0062 U	0.0064 U	0.0063 U	0.0067 U
Nickel	mg/kg	NA	70,000	130	24.5	980	NA	NA	NA	NA	NA	NA	6.2 J	5.1 J	11 J	5.6 J	4 J	5.2 J	3.6 J	4.1 J
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	NA	NA	NA	NA	NA	NA	0.15 J	**1.2**	**1.6**	**1.3**	**1.3**	**1.3**	**1.5**	**1.7**
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	NA	NA	NA	NA	NA	NA	38	39	56	37	39	34	41	46
Total Petroleum Hydrocarbons (TPHs)																				
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	63 Z	4.5 J	2.6 J	32 U	32 U	29 U	140 J	3.8 U	4.3 U	39 U	3.7 U	NA	NA	NA
Residual Range Organics	mg/kg	2,000	NE	NE	NE	2,000	250 Z	9.1 J	17 J	130 U	130 U	120 U	650	20 J	11 U	280 J	9.4 U	NA	NA	NA

Notes:

B	The sample result is less than five times the blank contamination and cross-contamination is suspected.	UJ	Chemical was not detected. The associated limit is estimated.
J	Estimated Concentration.	X	Chromatogram indicated the presence of non-target components. Matrix interference may have resulted in a slight high bias.
NA	Not applicable or not analyzed.	Z	Chromatographic fingerprint does not resemble a petroleum product.
NE	Not established in lookup tables.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.	LMW PAH	Low molecular weight PAH.
U	Chemical was not detected. The associated value represents the method reporting limit.	HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.2.5-2
FWB Investigation Area WPA Groundwater Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels						WPA Analytical Results
Parameter Name	**Units**	**MTCA Method A**	**MTCA Method B**	**MTCA Method C**	**WA MCL**	**Natural Background**	**PAAOC-WPA-FWB-SB05-GW01**
Aluminum Smelting							
Cyanide, Free	mg/L	NE	0.01	0.022	0.2	ND	0.002 U
Fluoride	mg/L	NE	0.96	2.1	4	0.72	**8.64**
Sulfate	mg/L	NE	NE	NE	250	32	189
Polynuclear Aromatic Hydrocarbons (PAHs)							
2-Methylnaphthalene	ug/L	NL	32	70	NE	NE	0.042
Acenaphthene	ug/L	NA	960	2,100	NE	NE	0.0048 B
Acenaphthylene	ug/L	NA	NE	NE	NE	NE	0.0031 J
Anthracene	ug/L	NA	4,800	11,000	NE	NE	0.0024 JB
Benzo(a)anthracene	ug/L	NL	NL	NL	NE	NE	0.0045 JB
Benzo(a)pyrene	ug/L	0.1	0.023	0.88	0.2	NE	0.0016 JB
Benzo(b)fluoranthene	ug/L	NL	NL	NL	NE	NE	0.0035 JB
Benzo(g,h,i)perylene	ug/L	NA	NE	NE	NE	NE	0.0017 JB
Benzo(k)fluoranthene	ug/L	NL	NL	NL	NE	NE	0.0016 JB
Chrysene	ug/L	NL	NL	NL	NE	NE	0.005 JB
Dibenzo(a,h)anthracene	ug/L	NL	NL	NL	NE	NE	0.02 U
Dibenzofuran	ug/L	NL	NL	NE	NE	NE	0.004 JB
Fluoranthene	ug/L	NL	640	1,400	NE	NE	0.03 B
Fluorene	ug/L	NL	640	1,400	NE	NE	0.0063 B
Indeno(1,2,3-cd)pyrene	ug/L	NL	NL	NL	NE	NE	0.0016 JB
Naphthalene	ug/L	160	160	350	NE	NE	0.0012 JB
Phenanthrene	ug/L	NL	NL	NE	NE	NE	0.036 B
Pyrene	ug/L	NL	480	1,100	NE	NE	0.024 B
TTEC cPAH (calc)	ug/L	0.1	0.2	0.2	0.2	NE	0.003
Total Petroleum Hydrocarbons (TPHs)							
Diesel Range Organics	mg/L	0.5	NE	NE	NE	NE	0.058 JB
Residual Range Organics	mg/L	0.5	NE	NE	NE	NE	0.038 JB

Notes:

B	The sample result is less than five times the blank contamination and cross-contamination is suspected.
J	Estimated concentration.
MCL	Maximum Contaminant Level (Secondary MCL for Sulfate).
NA	Not analyzed or not applicable.
ND	Not detected.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentrations is accounted for by the summation process.
TTEC	Total Toxicity Equivalent Concentration.
U	Chemical was not detected. The associated value represents the method reporting limit.

Detected concentrations shown in **bold** exceed one or more site groundwater screening levels.

total calculated LMW and HMW exceed ecological wildlife screening levels in the shallowest sample depths but not in deeper depth samples. Arsenic and cadmium were detected at multiple depths in SB-FW01 at concentrations that exceed the protection of groundwater screening level, and selenium was detected at multiple depths in SB-FW01, SB-FW02, and SB-FW04 at concentrations that exceed the ecological wildlife screening level.

Logs for the five borings indicate that basalt flow top was encountered in FWB-SB06 at 7 ft bgs, potentially in SB-FW01 at 10.5 ft bgs, in FWB-SB05 at 19.5 ft bgs, with refusal (but not described as basalt) in borings SB-FW02 and SB-FW04 at 6.5 ft bgs. Wet to saturated sand and silty gravel were encountered above basalt or at refusal in borings FWB-SB05 and SB-FW04. During the WPA phase, sufficient groundwater was present in FWB-SB05 for installation of a temporary well screen and collection of a grab groundwater sample.

Analytical results for groundwater indicate that fluoride was detected at a concentration of 8.64 mg/L. This concentration is slightly higher than, but consistent with, the sitewide fluoride plume in shallow groundwater. However, concentrations of fluoride in soil in this boring do not exceed the protection of groundwater screening level, and the boring is located side gradient to boring SB-FW01.

2.2.5.3 Conclusions and Recommendations

The Friction Weld Building was investigated in the initial RI and WPA phases of investigation with a total of five soil borings and one grab groundwater sample. Initial RI boring SB-FW01, the basis for designating the Investigation Area, indicated concentrations of fluoride above the protection of groundwater screening level to the total depth of the boring potentially at the basalt contact at 10.75 ft bgs. Additional borings completed during the WPA phase did not detect fluoride concentrations in soil that would indicate a soil source of contamination to shallow groundwater. Rapid soil analytical results for fluoride indicated that fluoride did not exceed Plant Area AOC soil screening levels in the two WPA borings and the investigation of the Friction Weld Building Investigation Area was considered complete.

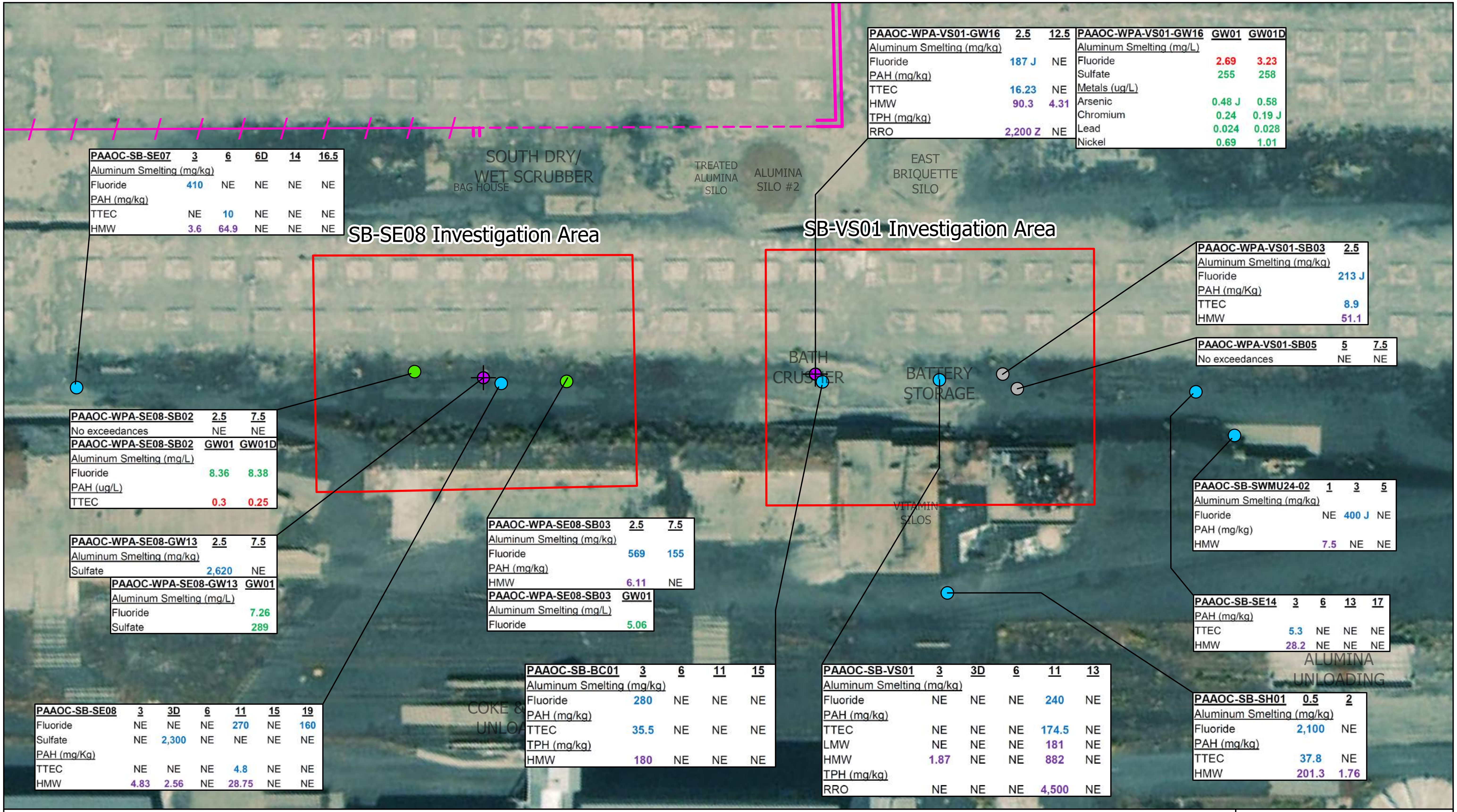
While fluoride was detected in the WPA shallow groundwater grab sample, the concentration of fluoride was consistent with the interpreted sitewide shallow groundwater plume concentrations. The Friction Weld Building Investigation Area is recommended for further evaluation in the FS.

2.2.6 Soil Boring SB-SE08 in Courtyard Segment A4

Soil boring SB-SE08 was completed during the initial RI phase of investigation and is in the central portion of Courtyard Segment A4 (Figure 2.1.2-1). This soil boring was completed to investigate Scrubber Effluent Line 4 that underlies segment A4. Soil samples were planned to be collected at approximate 5 ft intervals, and above and below the Line 4 invert which ranges from 11 to 13 ft bgs in segment A4. Boring SB-SE08 was designated an Investigation Area based on elevated concentrations of fluoride and sulfate in soil at multiple depths and the potential contribution of fluoride and sulfate contamination to shallow groundwater. The SB-VS01 Investigation Area (Section 2.2.1) is in the eastern portion of courtyard A4, nearby to the east of SB-SE08 Investigation Area.

Initial RI results for SB-SE08 indicate that fluoride and sulfate were detected at concentrations that exceed protection of groundwater screening levels to a depth of 11 ft bgs and fluoride was detected at concentrations that exceeded the protection of groundwater screening levels to a total depth of 19 ft bgs (Figure 2.2.6-1). In addition, PAH as TTEC exceeds protection of groundwater screening levels at 11 ft bgs, and PAH as calculated total HMW exceeds the ecological wildlife screening level to a depth of 11 ft bgs. Evaluation of nearby soil borings SB-BC01 (to the east) and SB-SE07 (to the west) indicated that fluoride was detected in soil at concentrations of 213 mg/kg and 410 mg/kg, respectively, that exceeds the protection of groundwater screening level to a depth of 3 ft bgs (Tables 2.2.2-1 and 2.2.6-1). Fluoride did not exceed the protection of groundwater screening level in deeper depth samples in those borings. Sulfate was not detected in borings SB-BC01 or SB-SE07 at concentrations that exceed the protection of groundwater screening level in all depths sampled. These borings provide a bounding to the east and west for occurrence of fluoride and sulfate in soil at depth.

The closest shallow groundwater monitoring well is RI-GW5 located to the west in Courtyard Segment A3. Interpreted groundwater monitoring data indicates a sitewide fluoride plume in UA shallow groundwater (Groundwater AOC, Volume 4, Section 2). Concentrations of fluoride in the UA underlying Courtyard Segment A4 and the SB-SE08 Investigation Area are in the range of 4 to 10 mg/L.



PAAOC-SB-SE07	3	6	6D	14	16.5
Aluminum Smelting (mg/kg)					
Fluoride	410	NE	NE	NE	NE
PAH (mg/kg)					
TTEC	NE	10	NE	NE	NE
HMW	3.6	64.9	NE	NE	NE

PAAOC-WPA-VS01-GW16	2.5	12.5
Aluminum Smelting (mg/kg)		
Fluoride	187 J	NE
PAH (mg/kg)		
TTEC	16.23	NE
HMW	90.3	4.31
TPH (mg/kg)		
RRO	2,200 Z	NE

PAAOC-WPA-VS01-GW16	GW01	GW01D
Aluminum Smelting (mg/L)		
Fluoride	2.69	3.23
Sulfate	255	258
Metals (ug/L)		
Arsenic	0.48 J	0.58
Chromium	0.24	0.19 J
Lead	0.024	0.028
Nickel	0.69	1.01

PAAOC-WPA-VS01-SB03	2.5
Aluminum Smelting (mg/kg)	
Fluoride	213 J
PAH (mg/Kg)	
TTEC	8.9
HMW	51.1

PAAOC-WPA-VS01-SB05	5	7.5
No exceedances	NE	NE

PAAOC-WPA-SE08-SB02	2.5	7.5
No exceedances	NE	NE

PAAOC-WPA-SE08-SB02	GW01	GW01D
Aluminum Smelting (mg/L)		
Fluoride	8.36	8.38
PAH (ug/L)		
TTEC	0.3	0.25

PAAOC-WPA-SE08-GW13	2.5	7.5
Aluminum Smelting (mg/kg)		
Sulfate	2,620	NE

PAAOC-WPA-SE08-GW13	GW01
Aluminum Smelting (mg/L)	
Fluoride	7.26
Sulfate	289

PAAOC-WPA-SE08-SB03	2.5	7.5
Aluminum Smelting (mg/kg)		
Fluoride	569	155
PAH (mg/kg)		
HMW	6.11	NE

PAAOC-WPA-SE08-SB03	GW01
Aluminum Smelting (mg/L)	
Fluoride	5.06

PAAOC-SB-SWMU24-02	1	3	5
Aluminum Smelting (mg/kg)			
Fluoride	NE	400 J	NE
PAH (mg/kg)			
HMW	7.5	NE	NE

PAAOC-SB-SE14	3	6	13	17
PAH (mg/kg)				
TTEC	5.3	NE	NE	NE
HMW	28.2	NE	NE	NE

PAAOC-SB-SE08	3	3D	6	11	15	19
Fluoride	NE	NE	NE	270	NE	160
Sulfate	NE	2,300	NE	NE	NE	NE
PAH (mg/Kg)						
TTEC	NE	NE	NE	4.8	NE	NE
HMW	4.83	2.56	NE	28.75	NE	NE

PAAOC-SB-BC01	3	6	11	15
Aluminum Smelting (mg/kg)				
Fluoride	280	NE	NE	NE
PAH (mg/kg)				
TTEC	35.5	NE	NE	NE
TPH (mg/kg)				
HMW	180	NE	NE	NE

PAAOC-SB-VS01	3	3D	6	11	13
Aluminum Smelting (mg/kg)					
Fluoride	NE	NE	NE	240	NE
PAH (mg/kg)					
TTEC	NE	NE	NE	174.5	NE
LMW	NE	NE	NE	181	NE
HMW	1.87	NE	NE	882	NE
TPH (mg/kg)					
RRO	NE	NE	NE	4,500	NE

PAAOC-SB-SH01	0.5	2
Aluminum Smelting (mg/kg)		
Fluoride	2,100	NE
PAH (mg/kg)		
TTEC	37.8	NE
HMW	201.3	1.76

Maxar, Microsoft

🟥 Investigation Areas
● WPA Boring, temp screen
● WPA Boring, dry
⊕ WPA Monitor Well
● RI Boring

Plant SO2 Purge Lines (See Figure 2.2.1-5)
━ Existing SO2 Lines w/spare
-- Elevated SO2 Line
+ Abandoned SO2 Line

Soil Screening Levels
blue: Exceeds Protection of Groundwater
purple: Exceeds Protection of Wildlife and for TPH diesel and residual range organics also exceeds MTCA Method A

Z: Chromatographic fingerprint does not resemble a petroleum product
D: Duplicate sample
RRO: Residual Range Organics

Water Screening Levels
red: Exceeds MTCA Method C
green: Exceeds WA MCL

All groundwater results have been screened using Table 5-2, Volume 1, screening levels, and are discussed in GWAOC, Volume 4.

W N S E

0 25 50 100
Feet

Figure 2.2.6-1

Plant Area AOC

SB-SE08 Investigation Area Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Table 2.2.6-1
SE08 Investigation Area RI and WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results											WPA Analytical Results					
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-SE07-3	PAAOC-SB-SE07-6	PAAOC-SB-SE07-6D	PAAOC-SB-SE07-14	PAAOC-SB-SE07-16.5	PAAOC-SB-SE08-3	PAAOC-SB-SE08-3D	PAAOC-SB-SE08-6	PAAOC-SB-SE08-11	PAAOC-SB-SE08-15	PAAOC-SB-SE08-19	PAAOC-WPA-SE08-SB02-2.5	PAAOC-WPA-SE08-SB02-7.5	PAAOC-WPA-SE08-SB03-2.5	PAAOC-WPA-SE08-SB03-7.5	PAAOC-WPA-SE08-GW13-2.5	PAAOC-WPA-SE08-GW13-7.5
Aluminum Smelting																							
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**410**	20 J	31	31	20	70 J	50	100	**270**	69	**160**	0.5	21.3	**569**	**155**	48	17 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	50 J	21 J	38	140 J	120 J	240 J	**2,300**	630 J	23 J	180 J	12 J	465 J	161 J	9.9 JB	33.5 J	**2,620 J**	289 J
Polynuclear Aromatic Hydrocarbons (PAHs)																							
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NA	NL	0.035 U	0.15 U	0.0073 U	0.0085 U	0.0082 U	0.037 U	0.0089	0.0075 U	0.15 U	0.0076 U	0.0079 U	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.035 U	0.15 U	0.0073 U	0.0085 U	0.0082 U	0.037 U	0.011	0.0075 U	0.15 U	0.0076 U	0.0079 U	0.00061 JB	0.00041U	0.0019 JB	0.00068 JB	0.00052 JB	0.00059 JB
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.035 U	0.18	0.0073 U	0.0085 U	0.0082 U	0.078	0.059	0.0075 U	0.16	0.0076 U	0.0079 U	0.00034 U	0.00033 U	0.019	0.00095 JB	0.00033 U	0.00035 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.035 U	0.15 U	0.0073 U	0.0085 U	0.0082 U	0.037 U	0.0074	0.0075 U	0.15 U	0.0076 U	0.0079 U	0.00032 U	0.00031 U	0.002 J	0.00035 J	0.0003 U	0.00032 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.048	0.49 J	0.0073 U	0.0085 U	0.0082 U	0.17	0.12	0.0075 U	0.27	0.0076 U	0.0079 U	0.00036 J B	0.00032 U	0.039	0.0015 JB	0.00052 JB	0.00033 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.35	5.7 J	0.0077	0.0085 U	0.0082 U	0.54 J	0.3	0.0075 U	2.5	0.0076 U	0.013	0.00083 J	0.00048 J	0.47	0.019	0.0013 J	0.00072 J
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.4	6.6 J	0.0073 U	0.0085 U	0.0082 U	0.57 J	0.29	0.0075 U	3.3	0.0076 U	0.0079 U	0.00043 U	0.00042 U	0.66	0.027	0.00059 J	0.00044 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.71	16 J	0.019	0.0085 U	0.0082 U	0.84 J	0.43	0.0075 U	6	0.0076 U	0.035	0.0012 J	0.00042 U	1.3	0.065	0.0011 J	0.00052 J
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.36	6.30	0.0073 U	0.0085 U	0.0082 U	0.43	0.22	0.0075 U	3	0.0076 U	0.0079 U	0.00045 U	0.00044 U	0.77	0.032	0.00043 U	0.00046 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.22	3.7 J	0.0073 U	0.0085 U	0.0082 U	0.27	0.13	0.0075 U	1.8	0.0076 U	0.0079 U	0.00027 U	0.00027 U	0.41	0.024	0.00026 U	0.00028 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.6	13 J	0.027	0.0085 U	0.0082 U	0.64 J	0.32	0.019	4.3	0.0076 U	0.056	0.00083 J	0.00034 U	0.74	0.029	0.0011 J	0.00036 J
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.081	1.3 J	0.0073 U	0.0085 U	0.0082 U	0.097	0.048	0.0075 U	0.65	0.0076 U	0.0079 U	0.00026 U	0.00026 U	0.15	0.0058	0.00025 U	0.00027 U
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00068	0.00066 U	0.0062	0.00087 JB	0.00065 U	0.00069 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.51	8.2 J	0.019	0.0085 U	0.0082 U	1.2 J	0.72	0.03	4.5	0.0076 U	0.04	0.00092 JB	0.00069 U	0.081	0.035	0.0028 JB	0.00081 JB
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.035 U	0.15 U	0.0073 U	0.0085 U	0.0082 U	0.082	0.065	0.0075 U	0.15 U	0.0076 U	0.0079 U	0.00064 U	0.00063 U	0.012	0.00083 JB	0.00061 U	0.00065 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.34	4.7 J	0.0073 U	0.0085 U	0.0082 U	0.45 J	0.23	0.0075 U	3.1	0.0076 U	0.0079 U	0.00041 U	0.0004 U	0.79	0.03	0.00039 U	0.00041 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.035 U	0.15 U	0.0073 U	0.0085 U	0.0015 U	0.054 J	0.028	0.0075 U	0.15 U	0.0076 U	0.0079 U	0.001 JB	0.00092 JB	0.0032 JB	0.0013 JB	0.001 JB	0.0013 JB
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.16	1.90	0.0073 U	0.0085 U	0.0082 U	0.78	0.52	0.0075 U	1.4	0.0076 U	0.0079 U	0.0014 JB	0.00065 U	0.24	0.012 B	0.0028 JB	0.00075 JB
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.49	7.6 J	0.016	0.0085 U	0.0082 U	0.99 J	0.59	0.018	4.1	0.0076 U	0.029	0.00089 JB	0.00035 U	0.82	0.038	0.0025 JB	0.00069 JB
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.6	**10**	0.003	0.0085	0.0082	0.8	0.41	0.0002	**4.8**	0.0076	0.01	0.00021	0.00005	0.98	0.04	0.0008	0.0001
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.72	10.8	0.02	0.0085	0.0082	2.36	1.52	0.03	6.23	0.0076	0.04	0.004	0.00092	0.4	0.06	0.007	0.003
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**3.6**	**64.9**	0.07	0.0085	0.0082	**4.83**	**2.56**	0.04	**28.75**	0.0076	0.13	0.004	0.0005	**6.11**	0.27	0.007	0.003
Polychlorinated Biphenyls (PCBs)																							
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.053 U	0.056 U	0.055 U	0.064 U	0.061 U	0.055 U	0.055 U	0.056 U	0.058 U	0.057 U	0.059 U	NA	NA	NA	NA	NA	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.053 U	0.056 U	0.055 U	0.064 U	0.061 U	0.055 U	0.055 U	0.056 U	0.058 U	0.057 U	0.059 U	NA	NA	NA	NA	NA	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.053 U	0.056 U	0.055 U	0.064 U	0.061 U	0.055 U	0.055 U	0.056 U	0.058 U	0.057 U	0.059 U	NA	NA	NA	NA	NA	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.053 U	0.056 U	0.055 U	0.064 U	0.061 U	0.055 U	0.055 U	0.056 U	0.058 U	0.057 U	0.059 U	NA	NA	NA	NA	NA	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.053 U	0.056 U	0.055 U	0.064 U	0.061 U	0.055 U	0.055 U	0.056 U	0.058 U	0.057 U	0.059 U	NA	NA	NA	NA	NA	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.053 U	0.056 U	0.055 U	0.064 U	0.061 U	0.055 U	0.055 U	0.056 U	0.058 U	0.057 U	0.059 U	NA	NA	NA	NA	NA	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.053 U	0.056 U	0.055 U	0.064 U	0.061 U	0.055 U	0.055 U	0.056 U	0.058 U	0.057 U	0.059 U	NA	NA	NA	NA	NA	NA
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.053	0.06	0.055	0.064	0.061	0.055	0.055	0.056	0.058	0.057	0.059	NA	NA	NA	NA	NA	NA
Metals																							
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	6,000	10,000	8,200	13,000	10,000	7,000	7,700	7,200	9,300	6,000	7,200	NA	NA	NA	NA	NA	NA
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	11 U	13 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U	NA	NA	NA	NA	NA	NA
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.57	0.56 U	0.55 U	0.64 U	0.61 U	0.55 U	0.55 U	0.56 U	0.58 U	0.57 U	0.59 U	NA	NA	NA	NA	NA	NA
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	5.5	7.3 J	5.5	3	3.4	3.8	4.6	5.8	13	5.8	5.8	NA	NA	NA	NA	NA	NA
Copper	mg/kg	NA	140,000	280	28.4	217	20	17.00	14	16	15	19 J	11	12	29	19	17	NA	NA	NA	NA	NA	NA
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.3 U	5.6 U	5.5 U	6.4 U	6.1 U	5.5 U	5.6	5.6 U	5.8 U	5.7 U	5.9 U	NA	NA	NA	NA	NA	NA
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.27 U	0.28 U	0.27 U	0.32 U	0.31 U	0.27 U	0.27 U	0.28 U	0.29 U	0.28 U	0.3 U	NA	NA	NA	NA	NA	NA
Nickel	mg/kg	NA	70,000	130	24.54	980	6.9	7.50	5.1	4.1	3.9	4.3	4.2	4.9	20	8.1	6.4	NA	NA	NA	NA	NA	NA
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	13 U	12 U	11 U	11 U	11 U	12 U	11 U	12 U	NA	NA	NA	NA	NA	NA
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	210	57 J	45	45	39	60	55	39	150	61	62	NA	NA	NA	NA	NA	NA
Volatile Organic Compounds (VOCs)																							
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.0011 U	0.00079 U	0.001 U	0.0013 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0013 U	0.00097 U	0.0013 U	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0057 U	0.0039 U	0.005 U	0.0063 U	0.0073 U	0.0056 U	0.006 U	0.0055 U	0.0063 U	0.0048 U	0.0066 U	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.0011 U	0.00079 U	0.001 U	0.0013 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0013 U	0.00097 U	0.0013 U	NA	NA	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.0023 U	0.0016 U	0.002 U	0.0025 U	0.0029 U	0.0023 U	0.0024 U	0.0022 U	0.0025 U	0.0019 U	0.0026 U	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	0.0011 U	0.00079 U	0.001 U	0.0013 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0013 U	0.00097 U	0.0013 U	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.0011 U	0.00079 U	0.001 U	0.0013 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0013 U	0.00097 U	0.0013 U	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.0011 U	0.00079 U	0.001 U	0.0013 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0013 U	0.00097 U	0.0013 U	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.0011 U	0.00079 U	0.001 U	0.0013 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0013 U	0.00097 U	0.0013 U	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.0011 U	0.00079 U	0.001 U	0.0013 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0013 U	0.00097 U	0.0013 U	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	0.0011 U	0.00079 U	0.001 U	0.0013 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0013 U	0.00097 U	0.0013 U	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (TPHs)																							
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	27 U	28 U	27 U	32 U	31 U	430 J	27 U	28 U	71	29 U	30 U	4.2 U	4.0 U	14 J	3.6 J	3.9 U	2.5 J
Residual Range	mg/kg	2,000	NE	NA	NE	2,000	67	95	55 U	64 U	62 U	95	55 U	56 U	440	57 U	60 U	8.9 U	8.7 U	56 J	8.0 J	8.5 U	6.2 J

Notes:

B	The sample result is less than five times the blank contamination and cross-contamination is suspected.
J	Estimated Concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method reporting limit.

TTEC	Total Toxicity Equivalent Concentration for carcinogenich PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

2.2.6.1 Investigation Scope

The SB-SE08 Investigation Area was investigated with a total of four soil borings, one of which was completed during the initial RI phase, and the other three completed during the WPA phase. One WPA soil boring was completed as shallow groundwater monitoring well SE08-GW13. Groundwater was encountered during drilling WPA borings SE08-SB02 and SE08-SB03 and grab samples of shallow groundwater were collected from temporary well screen installations. Logs of borings are included in Volume 5, Appendices G-1 and G-2. Initial RI soil samples were analyzed for cyanide, fluoride, sulfate, PAHs, PCBs, metals, VOCs, and TPH-Dx.

WPA investigation of SB-SE08 incorporated an iterative approach (Volume 1, Section 3.2.1.3, Figure 3-1) to guide field decisions during a single field mobilization to determine whether fluoride and sulfate detected in soil at multiple depths has impacted shallow groundwater, and the need for additional step-out borings. Implementation of the iterative approach included rapid turnaround time for laboratory analysis of fluoride and sulfate in soil.

WPA soil boring SE08-SB02 was completed approximately 60 ft west of SB-SE08 to a depth of 20 ft bgs. Basalt flow top was encountered at 15 ft bgs and consisted of wet black vesicular basalt breccia. Soil samples were collected at 2.5 and 7.5 ft bgs, and a temporary well screen installed at 15 to 20 ft bgs. One grab groundwater sample was collected from the installed well screen. WPA soil boring SE08-SB03 was completed approximately 50 ft east of SB-SE08 to a depth of 22 ft bgs. Basalt flow top was encountered at 13 ft bgs and consisted of wet black vesicular basalt breccia with increased groundwater inflow at approximately 21 ft bgs, and a temporary well screen installed at 12 ft bgs to 22 ft bgs. One grab groundwater sample was collected from the installed well screen.

The third WPA soil boring was completed adjacent to the initial RI boring SB-SE08 location and completed as shallow groundwater monitoring well SE08-GW13. The boring was drilled to 20 ft bgs encountered basalt flow top at 12.5 ft bgs consisting of wet black vesicular basalt breccia. The well screen was installed between 10 and 20 ft bgs with a pre-development water level measured at 12.93 ft bgs. Soil samples were collected at 2.5 and 7.5 ft bgs.

Soil samples were analyzed for cyanide, fluoride, sulfate, PAHs, and TPH-Dx. Grab groundwater samples were analyzed for cyanide, fluoride, sulfate, and PAHs. The monitoring well sample was analyzed for cyanide, fluoride, sulfate, PAHs, and TPH-Dx. Fluoride and sulfate soil and water analyses were completed on an expedited turnaround time. Based on rapid turnaround results for fluoride and sulfate, discussed in the following section, no additional step-out borings were completed.

Results of a video survey of the Scrubber Effluent Line 4 underlying Courtyard Segment A4, discussed in detail below in Section 2.5.4.5.5, indicate a significant breach in the Scrubber Effluent line allowing inflow of shallow groundwater into the line, but located approximately 200 ft east of SB-SE08. Other smaller breaches in the Scrubber Effluent line were observed in the vicinity of SB-SE08 that may allow inflow of shallow groundwater (but inflow at these points was not observed).

2.2.6.2 Investigation Results

Soil boring SB-SE08 was investigated with a total of three soil borings, with a shallow monitoring well SE08-GW13 installed in one of the borings. Two grab groundwater samples were collected from temporary well screens installed in SE08-SB02 and SE08-SB03 borings, and one groundwater sample was collected from monitoring well SE08-GW13. Basalt flow top was encountered in all three borings from west to east at 15 ft bgs (SE08-SB02), 13 ft bgs (SE08-GW13), and 12.5 ft bgs (SE08-SB03). Water levels measured in the borings and well were, from west to east, 13.12 ft bgs (SE08-SB02), 12.63 ft bgs on 10/28/2020 prior to development (SE08-GW13), and 12.93 ft bgs (SE08-SB03).

Soil analytical results are summarized in Table 2.2.6-1 (SE08 Investigation Area RI and WPA Soil Results Summary) and Table 2.2.6-2 (SE08 Investigation Area WPA Groundwater Results Summary). Soil results are compared to MTCA Method A Industrial soil, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. Groundwater results are compared to MTCA Method A, MTCA Method B, MTCA Method C, and WA MCL water screening levels. Natural background concentrations for the site have been used to adjust screening levels where applicable in the screening process. Laboratory analytical results are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Soil reporting limits for arsenic exceed the protection of groundwater screening level, and for selenium exceed protection of groundwater and ecological wildlife screening levels. Water reporting limit objectives were met.

Table 2.2.6-2
SE08 Investigation Area WPA Groundwater Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

		Screening Levels					WPA Analytical Results			
Parameter Name	**Units**	**MTCA Method A**	**MTCA Method B**	**MTCA Method C**	**WA MCL**	**Natural Background**	**PAAOC-WPA-SE08-SB02-GW01**	**PAAOC-WPA-SE08-SB02-GW01D**	**PAAOC-WPA-SE08-SB03-GW01**	**PAAOC-WPA-SE08-GW13-GW01**
Aluminum Smelting										
Cyanide, Free	mg/L	NE	0.01	0.022	0.2	ND	NA	NA	NA	0.002
Fluoride, Total	mg/L	NE	0.96	2.1	4	0.72	**8.36**	**8.38**	**5.06**	**7.26**
Sulfate	mg/L	NE	NE	NE	250	32	219	224	236	**289**
Polynuclear Aromatic Hydrocarbons (PAHs)										
2-Methylnaphthalene	ug/L	NL	32	70	NE	NE	0.034 J	0.037 J	0.009 JB	0.0013 U
Acenaphthene	ug/L	NA	960	2,100	NE	NE	0.013 J	0.012 J	0.0035 J	0.0012 U
Acenaphthylene	ug/L	NA	NE	NE	NE	NE	0.0029 J	0.0032 J	0.002 J	0.0011 U
Anthracene	ug/L	NA	4,800	11,000	NE	NE	0.012 J	0.0091 J	0.003 J	0.00082 U
Benzo(a)anthracene	ug/L	NL	NL	NL	NE	NE	0.13	0.12	0.0052 JB	0.002 J
Benzo(a)pyrene	ug/L	0.1	0.023	0.88	NL	NE	0.22	0.18	0.02 U	0.0011 U
Benzo(b)fluoranthene	ug/L	NL	NL	NL	NE	NE	0.33	0.29	0.0028 J	0.00083 U
Benzo(g,h,i)perylene	ug/L	NA	NE	NE	NE	NE	0.23	0.19	0.02 U	0.00086 U
Benzo(k)fluoranthene	ug/L	NL	NL	NL	NE	NE	0.12	0.092	0.02 U	0.00096 U
Chrysene	ug/L	NL	NL	NL	NE	NE	0.21	0.18	0.0068 J	0.00076 U
Dibenzo(a,h)anthracene	ug/L	NL	NL	NL	NE	NE	0.042	0.037 J	0.02	0.0013 U
Dibenzofuran	ug/L	NL	NL	NE	NE	NE	0.0081 JB	0.0084 JB	0.0044 JB	0.00096 U
Fluoranthene	ug/L	NL	640	1,400	NE	NE	0.19	0.16	0.047	0.00082 U
Fluorene	ug/L	NL	640	1,400	NE	NE	0.011 JB	0.011 JB	0.0043 JB	0.0011
Indeno(1,2,3-cd)pyrene	ug/L	NL	NL	NL	NE	NE	0.21	0.18	0.02	0.00089 U
Naphthalene	ug/L	160	160	350	NE	NE	0.025 JB	0.027 JB	0.0096 JB	0.002 J
Phenanthrene	ug/L	NL	NL	NE	NE	NE	0.072	0.066	0.037	0.0011 U
Pyrene	ug/L	NL	480	1,100	NE	NE	0.2	0.18	0.051	0.0041 J
TTEC cPAH (calc)	ug/L	0.1	0.2	0.2	NE	NE	**0.3**	**0.25**	0.0009	0.0002
Total Petroleum Hydrocarbons (TPHs)										
Diesel Range Organics	mg/L	0.5	NE	NE	NE	NE	NA	NA	NA	0.028 JB
Residual Range Organics	mg/L	0.5	NE	NE	NE	NE	NA	NA	NA	0.061 JB

Notes:

B	The samle result is less than five times the blank contamination and cross-contamination is suspected.
J	Estimated concentration.
MCL	Maximum Contaminant Level.
NA	Not analyzed or not applicable.
ND	Not detected.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
U	Chemical was not detected. The associated value represents the method reporting limit.

Detected concentrations shown in **bold** exceed one or more site groundwater screening levels.

Soil and water analytical results that exceed Plant rea AOC soil and water screening levels are compiled and presented on Figure 2.2.6-1. Analytical results indicate that fluoride, sulfate, and PAH as TTEC and calculated total HMW exceed soil screening levels to a depth of 6 ft bgs. The exceptions are for fluoride and PAH as TTEC and calculated total HMW. Fluoride was detected at a concentration of 155 mg/kg in SE08-SB03 at 7.5 ft bgs the deepest depth sampled, and at concentrations of 270 and 170 mg/kg at 11 ft bgs and 19 ft bgs, respectively, the deepest depth sampled in SB-SE08 that exceed the protection of groundwater screening level. PAHs were detected in SB-SE08 at 11 ft bgs at concentrations of 4.8 mg/kg for TTEC and 28.75 mg/kg for calculated total HMW that exceed the protection of groundwater and ecological wildlife screening levels, respectively.

Analytical results for two grab groundwater samples and one monitoring well sample indicate that fluoride was detected at concentrations that range from 5.06 to 8.38 mg/L that exceeds the WA MCL screening level. Sulfate was detected in one grab groundwater from SE08-SB03-GW01 at a concentration of 289 mg/L that exceeds the WA MCL screening level. PAH as TTEC was detected only in monitoring well SE08-SB02-GW01 and GW01D at concentrations of 0.3 and 0.25 mg/L that exceeds all water screening levels.

2.2.6.3 Conclusions and Recommendations

The SB-SE08 Investigation Area was designated based on concentrations of fluoride and sulfate in soil that exceed protection of groundwater screening levels at multiple depths sampled in the boring. The purpose of the SB-SE08 Investigation Area investigation was to determine the vertical and horizontal extent of fluoride and sulfate soil contamination, and whether SB-SE08 could be a soil source of contamination to shallow groundwater. The following are conclusions based on results of the SB-SE08 investigation:

- Fluoride does not appear to be a potential soil source of contamination to shallow groundwater. In the WPA soil borings fluoride did not exceed the protection of groundwater screening level in two borings and only exceeded in boring SE08-SB03 at concentrations of 569 mg/kg and 155 mg/kg at 2.5 and 7.5 ft bgs respectively. Fluoride exceeded the protection of groundwater screening levels to a maximum depth of 3 ft bgs in nearby soil borings (SB-SE07, SB-BC01) but did not exceed at deeper depths sampled. Fluoride concentrations in water samples collected from two temporary well screens and one shallow monitoring well range from 5.06 to 8.38 mg/L, which falls within the range of 4 to 10 mg/L of the sitewide fluoride plume in groundwater that is interpreted to underly the SB-SE08 Investigation Area (Groundwater AOC, Volume 4, Section 2).

Concentrations of fluoride detected in soil do not suggest a significant source of soil contamination compared to the concentrations of fluoride measured in the underlying shallow groundwater.

- Sulfate soil contamination may have impacted shallow groundwater in a localized area. Sulfate was detected at a concentration of 2,620 mg/kg that exceeds the protection of groundwater screening level in WPA boring SE08-GW13 at 2.5 ft bgs but did not exceed in the 7.5 ft bgs depth sampled. Sulfate was also detected at a concentration of 2,300 mg/kg in initial RI boring SB-SE08 at 3 ft bgs but did not exceed in the deeper depths sampled. Sulfate was detected in one grab water sample collected from WPA boring SE08-SB03 at a concentration of 289 mg/L. Because sulfate concentrations did not exceed the protection of groundwater screening level in other nearby WPA temporary grab or well samples the impact of the two elevated sulfate concentrations is minimal. Sulfate exceedance may likely be related to the previous dry/wet scrubbers and associated piping in passage no. 4.

- PAHs in soil in the SB-SE08 Investigation Area do not appear to be a potential soil source of contamination to shallow groundwater. PAHs as TTEC was detected in only one sample from SB-SE08 at a concentration of 4.8 mg/kg that exceed the protection of groundwater screening level. Concentrations of PAHs as TTEC detected in the sample from monitoring well SE08-GW13 (adjacent to the SB-SE08 location) slightly exceeded the MTCA Method C screening level. It is possible that the one detection of TTEC that exceeds the protection of groundwater screening level collected at a depth of 11 ft bgs, which is at or above the local water table, has impacted shallow groundwater but is not considered to be a significant soil source of contamination.

- No other COPCs were detected at concentrations that exceed Plant Area AOC soil screening levels.

- No areas where actively outflowing water in the Scrubber Effluent line were observed during the video survey suggesting that the line is not a current source of contamination in soil in the vicinity of SB-SE08.

- The most likely sources of sulfate onsite are from the air pollution control water treatment system and associated piping, and from wet scrubbers that are in series with dry scrubbers specifically to remove sulfur dioxide from wastewater. Sulfur dioxide oxidizes to form sulfate. The SB-SE08 Investigation Area is located downgradient from a dry/wet scrubber located in Courtyard Segment B4. Additionally, it is located east of the SWMU 5 Line A Secondary Scrubber Recycle Station, which is in the east end of Courtyard A3.

- Fluoride in soil may be a potential soil source of contamination to shallow groundwater in the vicinity of SB-FW01.

- Sulfate and PAH in soil may have impacted shallow groundwater minimally in a localized area but are not considered to be significant sources of soil contamination to shallow groundwater.

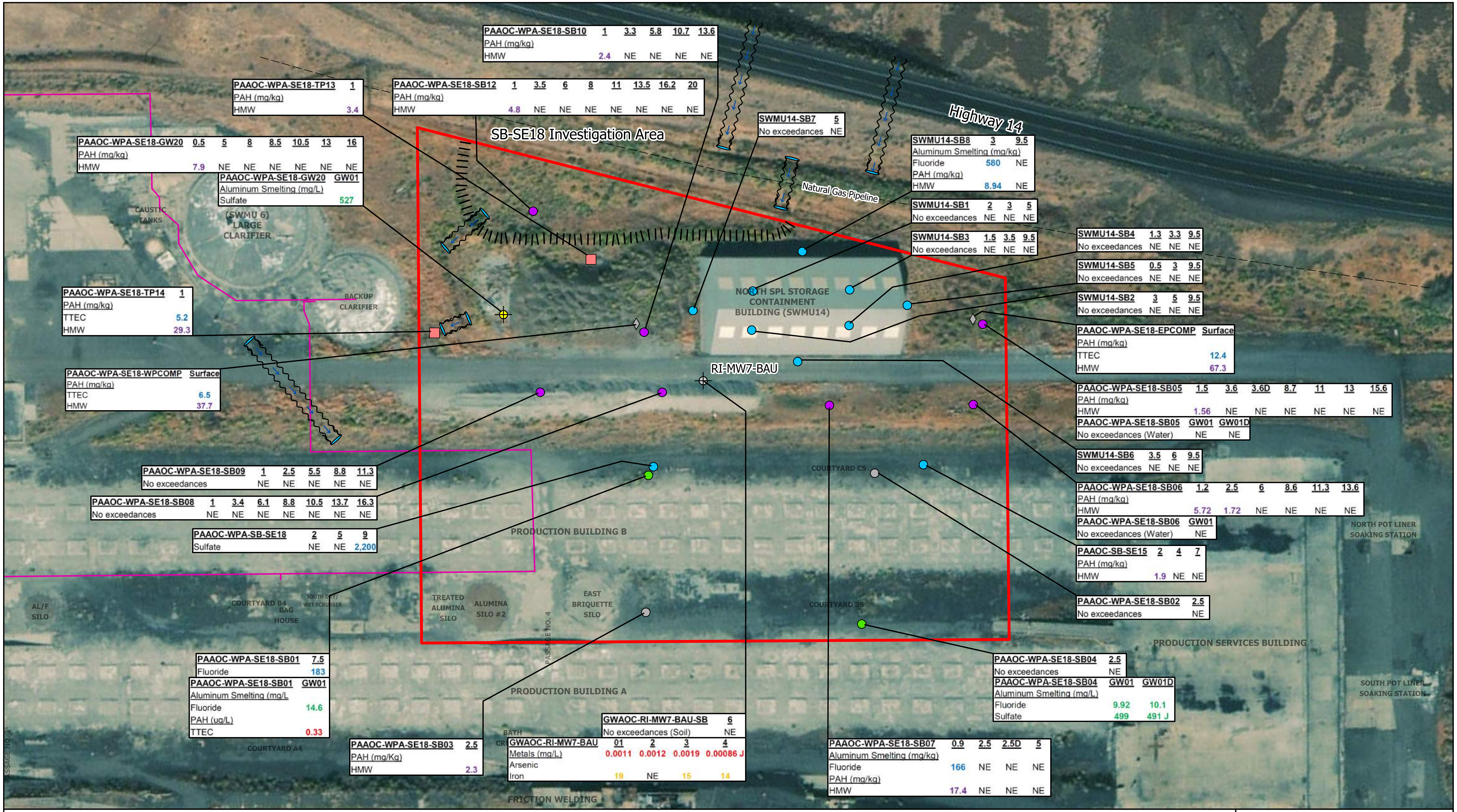
The SB-SE08 Investigation Area is recommended for further evaluation in the FS for fluoride in soil in SB-FW01 that exceeds soil screening levels to depth of the boring. Shallow soil contamination in Courtyard Segment A4, and resulting conclusions and recommendations, are addressed in the following Courtyard Segment Soil Contamination (Section 2.3.4).

2.2.7 Soil Boring SB-SE18 in Courtyard Segment B5 and C5

Soil boring SB-SE18 was completed during the initial RI phase of investigation and is at the west end of Courtyard Segment C5, north of Production Building B (Figure 2.1.2-1). This initial RI boring was one of a series of borings to investigate the Scrubber Effluent line at depth beneath Courtyard C as specified in the Supplemental Remedial Investigation Work Plan (PGG 2017). SB-SE18 was designated an Investigation Area based on elevated concentrations of sulfate detected in the deepest depth sampled in the boring and the potential contribution of sulfate contamination to shallow groundwater. While sulfate was the primary basis for designating this investigation area, fluoride was included in the decision-making process based on proximity to the Crucible Cleaning Room Investigation area and presence of a sitewide fluoride plume in shallow groundwater.

RI results for SB-SE18 indicate that sulfate was detected in soil at a concentration of 2,200 mg/kg that exceeded the protection of groundwater screening level of 2,150 mg/kg at 9 ft bgs (Figure 2.2.7-1). Concentrations of sulfate detected in soil increased from 180 mg/kg at 2 ft bgs, to 400 mg/kg at 5 ft bgs, to 2,200 mg/kg at 9 ft bgs which was the total depth of the boring. Evaluation of nearby soil borings SB-SE10, SB-SE15, SB-BH05, and SB-PF06 indicates that sulfate was detected at a concentration that exceeds the protection of groundwater screening level of 2,150 mg/kg in boring SB-PF06 to the southeast at 3,000 mg/kg at 4 ft bgs. Sulfate was also detected in boring SB-SE10 to the west at concentrations ranging from 91 to 400 mg/kg all below the protection of groundwater screening.

The closest groundwater monitoring well is RI-MW7-BAU located less than 100 ft to the north where sulfate was detected in the well during the 2017 quarterly groundwater monitoring program at concentrations that range from 140 to 220 J mg/L (Groundwater AOC, Volume 4, Section 2). Interpreted groundwater monitoring data does not indicate a sulfate plume above the secondary MCL screening level in the BAU, and no nearby monitoring well is completed in the UA.



PAAOC-WPA-SE18-SB10	1	3.3	5.8	10.7	13.6
PAH (mg/kg)					
HMW	2.4	NE	NE	NE	NE

PAAOC-WPA-SE18-TP13	1
PAH (mg/kg)	
HMW	3.4

PAAOC-WPA-SE18-SB12	1	3.5	6	8	11	13.5	16.2	20
PAH (mg/kg)								
HMW	4.8	NE	NE	NE	NE	NE	NE	NE

PAAOC-WPA-SE18-GW20	0.5	5	8	8.5	10.5	13	16
PAH (mg/kg)							
HMW	7.9	NE	NE	NE	NE	NE	NE

PAAOC-WPA-SE18-GW20	GW01
Aluminum Smelting (mg/L)	
Sulfate	527

SWMU14-SB7	5
No exceedances	NE

SWMU14-SB8	3	9.5
Aluminum Smelting (mg/kg)		
Fluoride	580	NE
PAH (mg/kg)		
HMW	8.94	NE

SWMU14-SB1	2	3	5
No exceedances	NE	NE	NE

SWMU14-SB3	1.5	3.5	9.5
No exceedances	NE	NE	NE

SWMU14-SB4	1.3	3.3	9.5
No exceedances	NE	NE	NE

SWMU14-SB5	0.5	3	9.5
No exceedances	NE	NE	NE

SWMU14-SB2	3	5	9.5
No exceedances	NE	NE	NE

PAAOC-WPA-SE18-TP14	1
PAH (mg/kg)	
TTEC	5.2
HMW	29.3

PAAOC-WPA-SE18-EPCOMP	Surface
PAH (mg/kg)	
TTEC	12.4
HMW	67.3

PAAOC-WPA-SE18-WPCOMP	Surface
PAH (mg/kg)	
TTEC	6.5
HMW	37.7

PAAOC-WPA-SE18-SB05	1.5	3.6	3.6D	8.7	11	13	15.6
PAH (mg/kg)							
HMW	1.56	NE	NE	NE	NE	NE	NE

PAAOC-WPA-SE18-SB05	GW01	GW01D
No exceedances (Water)	NE	NE

SWMU14-SB6	3.5	6	9.5
No exceedances	NE	NE	NE

PAAOC-WPA-SE18-SB09	1	2.5	5.5	8.8	11.3
No exceedances	NE	NE	NE	NE	NE

PAAOC-WPA-SE18-SB06	1.2	2.5	6	8.6	11.3	13.6
PAH (mg/kg)						
HMW	5.72	1.72	NE	NE	NE	NE

PAAOC-WPA-SE18-SB06	GW01
No exceedances (Water)	NE

PAAOC-WPA-SE18-SB08	1	3.4	6.1	8.8	10.5	13.7	16.3
No exceedances	NE	NE	NE	NE	NE	NE	NE

PAAOC-WPA-SB-SE18	2	5	9
Sulfate	NE	NE	2,200

PAAOC-SB-SE15	2	4	7
PAH (mg/kg)			
HMW	1.9	NE	NE

PAAOC-WPA-SE18-SB02	2.5
No exceedances	NE

PAAOC-WPA-SE18-SB01	7.5
Fluoride	183

PAAOC-WPA-SE18-SB01	GW01
Aluminum Smelting (mg/L	
Fluoride	14.6
PAH (ug/L)	
TTEC	0.33

PAAOC-WPA-SE18-SB04	2.5
No exceedances	NE

PAAOC-WPA-SE18-SB04	GW01	GW01D
Aluminum Smelting (mg/L)		
Fluoride	9.92	10.1
Sulfate	499	491 J

GWAOC-RI-MW7-BAU-SB	6
No exceedances (Soil)	NE

PAAOC-WPA-SE18-SB03	2.5
PAH (mg/Kg)	
HMW	2.3

GWAOC-RI-MW7-BAU	01	2	3	4
Metals (mg/L)	0.0011	0.0012	0.0019	0.00086 J
Arsenic				
Iron	19	NE	15	14

PAAOC-WPA-SE18-SB07	0.9	2.5	2.5D	5
Aluminum Smelting (mg/kg)				
Fluoride	166	NE	NE	NE
PAH (mg/kg)				
HMW	17.4	NE	NE	NE

▭ SB-SE18 Investigation Area
● WPA Boring, dry
● WPA Boring, temp screen
● WPA Boring
● RI Boring

⌖ WPA Monitor Well
⌖ RI Monitor Well
◊ Grab Sample
■ WPA Test Pit

— SO2 Scrubber Bleed Waste Line
— — Natural Gas Pipeline
≈ Culvert w/Flow Direction
Culvert Opening
|||| Berm

Soil Screening Levels
blue: Exceeds Protection of Groundwater
purple: Exceeds Ecological Wildlife

J: Estimated concentration
D: Duplicate sample
2: Sample depths in feet

Water Screening Levels
red: Exceeds MTCA Method C
green: Exceeds WA MCL
yellow: Exceeds MTCA Method B

W N S E

0 45 90 180
Feet

Figure 2.2.7-1

Plant Area AOC

SB-SE18 Investigation Area Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Maxar, Microsoft

2.2.7.1 Investigation Scope

The SB-SE18 Investigation Area has been investigated with a series of soil borings including initial RI boring SB-SE18, two test pits, two surface soil samples of apparent soil stockpiles, installation of one shallow groundwater monitoring well, and collection of four grab groundwater samples. Logs of borings and test pits are included in Volume 5, Appendices G-1 and G-2. Initial RI soil samples were analyzed for cyanide, fluoride, sulfate, PAHs, PCBs, metals, VOCs, and TPH-Dx. The results of the initial RI phase of investigation are discussed together with the WPA phase in Section 2.2.7.2.

The WPA investigation was conducted in stages, using the decision tree approach to guide field decisions regarding the need for additional step-out borings during one field mobilization (Volume 1, Section 3.2.1.3, Figure 3-1). Implementing the iterative approach included rapid turnaround time for laboratory analysis of fluoride and sulfate in soil. The following summarizes investigation activities conducted during successive stages of the WPA investigation of the SB-SE18 Investigation Area.

- Four initial soil borings, SE18-SB01 through SE18-SB04, were completed in Courtyard Segments B5 and C5 (Figure 2.2.7-1). The source of sulfate detected at depth in SB-SE18 was unknown but assumed potentially related to the Scrubber Effluent Line 2 underlying Courtyard Segment C5, and/or soil in the courtyards.
    - ❖ The borings were completed to depths of 15 ft bgs, and soil samples were planned to be collected at approximately 5.0 ft intervals; however, basalt bedrock was encountered at 7 to 7.5 ft bgs Soil samples were analyzed for cyanide, fluoride, sulfate, PAHs, and TPH-Dx.
    - ❖ If encountered, grab groundwater samples were to be collected from shallow groundwater using installed temporary well screens. Grab groundwater samples were collected from SE18-SB01 and SE18-SB04 and analyzed for fluoride, sulfate, PAHs, and TPH-Dx.
- Based on rapid turnaround data for soil and groundwater from the initial four borings, further investigation of potential soil sources of fluoride and sulfate contamination was conducted with an additional eight soil borings, SE18-SB05 through SE18-SB12, one shallow groundwater monitoring well SE18-GW20 (installed in the SE18-SB11 boring), two test pits for surface soil sample collection, two grab groundwater samples, and one monitoring well sample (Figure 2.2.7-1).
    - ❖ Eight soil borings were completed east, west, and south of SWMU 14 area which is upgradient from SB-SE18. The boring locations were based on review of historic aerial photographs (1986) showing equipment activity and storage of apparent pots in the area surrounding SWMU 14. The borings were completed to variable depths, and soil samples collected from depths near surface, and at significant changes in

materials encountered. In addition, grab samples would be collected of shallow groundwater if encountered. Soil samples were analyzed for cyanide, fluoride, sulfate, and PAHs.

- Shallow groundwater was encountered in three borings at sufficient volume to collect shallow groundwater samples. One shallow monitoring well SE18-GW20 was installed in one boring and a groundwater sample collected, and temporary well screens were installed in SE18-SB05 and SE18-SB06 and grab groundwater samples were collected. Groundwater samples were analyzed for cyanide, fluoride, sulfate, and PAHs.
- Two surface soil samples were collected at test pits SE18-TP13 and SE18-TP14. Test pit SE18-TP13 was at an intended boring location but was inaccessible. Test pit SE18-TP14 was collected at the discharge point for surface runoff near the backup clarifier (TP14). The soil samples were analyzed for cyanide, fluoride, sulfate, and PAHs.
- Apparent soil stockpiles of unknown source are located adjacent to the west and east of SWMU 14. Soil samples were collected from these piles adjacent to the locations of soil borings SE18-SB10 (SE18-WCOMP) and SE18-SB05 (SE18-ECOMP). The soil samples were analyzed for cyanide, fluoride, sulfate, and PAHs.
- In addition to the borings and soil and water sampling, the area north and west of SWMU 14 was mapped for locations of culverts, and apparent flow of surface water originating partially from Highway 14 to the north, flowing through the SWMU 14 vicinity, and discharging south of the backup clarifier and then to Courtyard Segment C4. These features are shown on Figure 2.2.7-1.

At the conclusion of the second stage of field effort, rapid turnaround analysis results did not indicate a fluoride or sulfate soil source of contamination for shallow groundwater and the investigation for the SE18 Investigation Area was completed.

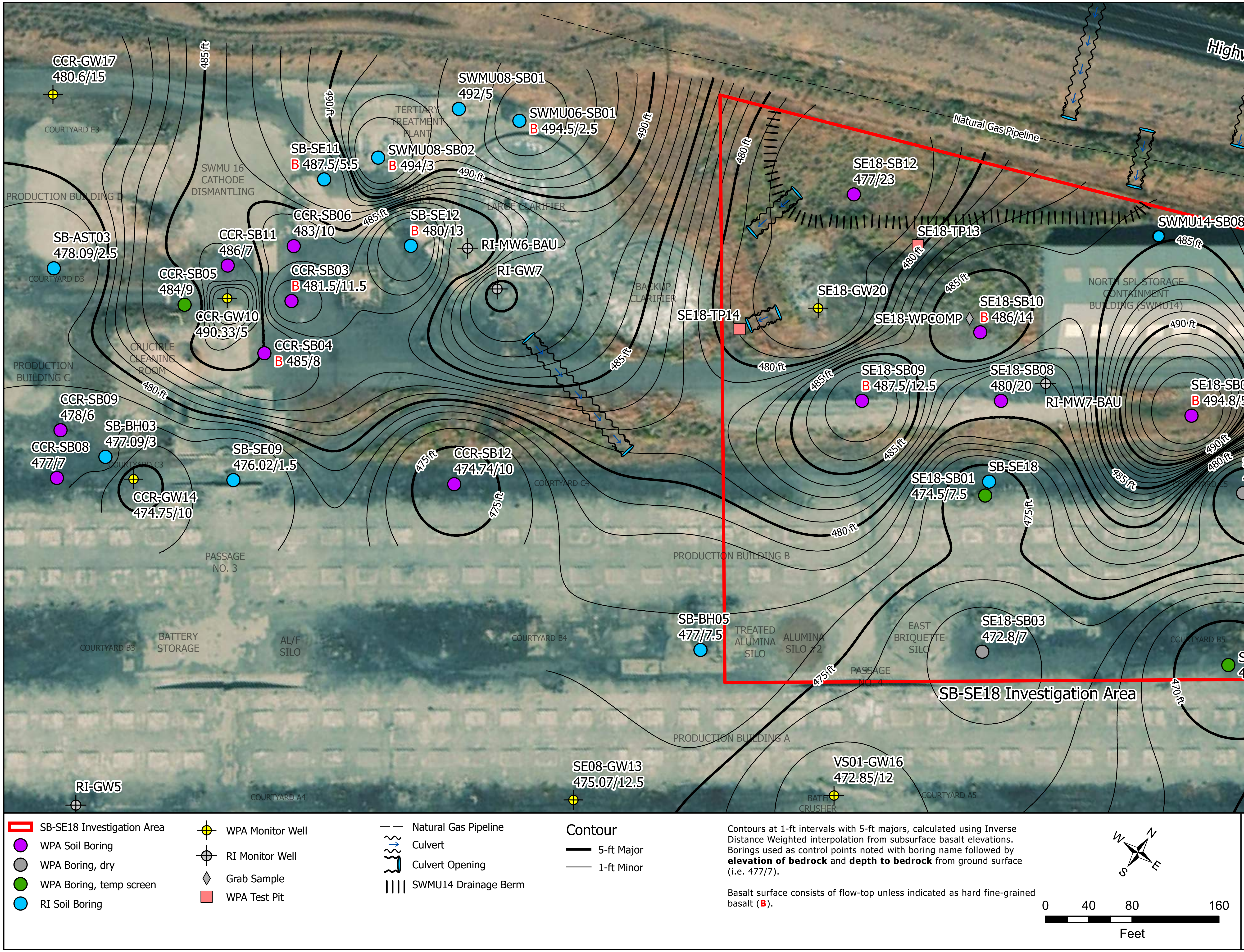
2.2.7.2 Investigation Results

The SB-SE18 Investigation Area was investigated with a total of 13 soil borings, one of which was completed as a shallow groundwater monitoring well and including the initial RI boring SB-SE18, two surface soil samples, two soil stockpile soil samples, one monitoring well sample, four grab groundwater samples, and features for overland flow of surface runoff water.

Four WPA soil borings SE18-SB01 through SE18-SB04 were completed in Courtyard Segments B5 and C5 to depths of 15 ft bgs. Basalt flow top was encountered in the four borings at depths of 7.5 to 10 ft bgs. Shallow groundwater was encountered in SE18-SB01 and SE18-SB-4, temporary well screens were installed, and grab groundwater samples were collected. Water levels measured were 10.81 ft bgs in SE18-SB01, and 10.51 ft bgs in SE18-SB04, or approximately 471 ft elevation.

Eight additional WPA soil borings were completed adjacent to the west, south, and east of SWMU 14. These borings were completed to variable depths that ranged from 10 to 25 ft bgs. Basalt flow top was encountered in borings to the south and east of SWMU 14, hard fine-grained basalt in borings south and southwest of SWMU 14, and bedded silt and fine sand in SE18-SB12 and SE18-GW20. The surface of the basalt underlying the SWMU 14 area is portrayed on Figure 2.2.7-2 (Basalt Surface Contour) and consists of areas where the basalt flow top or hard fine-grained basalt were encountered at higher elevations, with the surface at lower elevations adjacent. This reflects an erosional surface potentially created during periods of glacial related flooding along the Columbia River that has been infilled with fluvial sediments and later alluvium/colluvium from the north. Water levels measured in SE18-GW20, SE18-SB05, and SE18-SB06 were 20.55, 13.58, and 23.74 ft bgs, respectively, which is approximately 476 to 486 ft elevation. Spring activity from the north likely contributes to saturated conditions encountered at depth in borings to the west and east of SWMU 14.

Soil analytical results are summarized in Table 2.2.7-1 (SE18 Investigation Area RI Soil Results Summary) and Table 2.2.7-2 (SE18 Investigation Area WPA Boring and Test Pit Soil Results Summary). Groundwater analytical results are summarized in Table 2.2.7-3 (SE18 Investigation Area RI and WPA Groundwater Results Summary). Soil results are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. Groundwater results are compared to MTCA Method A, MTCA Method B, MTCA Method C, and WA MCL water screening levels. Natural background concentrations for the site have been used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the WPA (Tetra Tech et al. 2020b). Soil reporting limits for arsenic exceed the protection of groundwater screening level in some samples analyzed, and for selenium exceed protection of groundwater and ecological wildlife screening levels for most samples analyzed. Water reporting limit objectives have been met.



Contours at 1-ft intervals with 5-ft majors, calculated using Inverse Distance Weighted interpolation from subsurface basalt elevations. Borings used as control points noted with boring name followed by **elevation of bedrock** and **depth to bedrock** from ground surface (i.e. 477/7).

Basalt surface consists of flow-top unless indicated as hard fine-grained basalt (**B**).

Figure 2.2.7-2

Plant Area AOC

SB-SE18 Investigation Area Contour Map of Basalt Surface

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Maxar, Microsoft

Table 2.2.7-1
SE18 Investigation Area RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 1 of 2

		Screening Levels				Ecological Screening Level	Initial RI Analytical Results															
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-SE15-2	PAAOC-SB-SE15-4	PAAOC-SB-SE15-7	PAAOC-SB-SE18-2	PAAOC-SB-SE18-5	PAAOC-SB-SE18-9	GWAOC-RI-MW7-BAU-SB-6	PAAOC-SWMU14-SB01-2.0	PAAOC-SWMU14-SB01-3.0	PAAOC-SWMU14-SB01-5.0	PAAOC-SWMU14-SB02-3.0	PAAOC-SWMU14-SB02-5.0	PAAOC-SWMU14-SB02-9.5	PAAOC-SWMU14-SB03-1.5	PAAOC-SWMU14-SB03-3.5	PAAOC-SWMU14-SB03--9.5
Aluminum Smelting																						
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.086	0.05 U	0.059	0.05 U	0.05 U	0.05 U	2.7 U	0.086 U	0.086 U	0.089 U	0.086 U	0.37	0.089 U	0.086 U	0.058 UJ	0.058 UJ
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	26 U	5 U	82	5 U	7 U	5 U	2.7	28 J	10 J	11 J	4.4 J	33 J	15 J	4.5 J	4	3.6
Sulfate	mg/kg	NA	NE	2,150	NE	NE	44 U	50 UJ	10 U	180	400	**2,200**	84	65	28	100	28	120	82	46	18	10 U
Polynuclear Aromatic Hydrocarbons (PAHs)																						
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.015 U	0.0074 U	0.0074 U	NA	NA	NA	0.013 U		NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.015 U	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.0067 U	0.0087 U	0.0077 U	0.01 U	0.0097 U	0.021	0.0094 U	0.0098 U	0.0097 U	0.0095 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.015 U	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.0067 U	0.0087 U	0.0077 U	0.01 U	0.0097 U	0.029	0.0094 U	0.0098 U	0.0097 U	0.0095 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.015 U	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.0067 U	0.0087 U	0.0077 U	0.01 U	0.0097 U	0.1	0.0094 U	0.0098 U	0.0097 U	0.0095 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.11	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.0067 U	0.0087 U	0.0077 U	0.01 U	0.0097 U	0.0077 U	0.0094 U	0.0098 U	0.0097 U	0.0095 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.23	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.013 U	0.0087 U	0.0077 U	0.01 U	0.0097 U	0.13	0.0094 U	0.0098 U	0.0097 U	0.0095 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.24	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.0067 U	0.0087 U	0.022	0.01 U	0.0097 U	0.2	0.0094 U	0.0098 U	0.0097 U	0.0095 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.26	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.013 U	0.0087 U	0.026	0.01 U	0.0097 U	0.16	0.0094 U	0.0098 U	0.0097 U	0.0095 U
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.13	0.0074 U	0.0074 U	0.021	0.0072 U	0.0074 U	0.013 U	0.0087 U	0.027	0.01 U	0.0097 U	0.21	0.0094 U	0.0098 U	0.0097 U	0.0095 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.098	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.013 U	0.0087 U	0.045	0.01 U	0.0097 U	0.28	0.0094 U	0.013	0.0097 U	0.0095 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.23	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.0067 U	0.0087 U	0.012	0.01 U	0.0097 U	0.085	0.0094 U	0.0098 U	0.0097 U	0.0095 U
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.03	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.0067 U	0.0087 U	0.031	0.01 U	0.0097 U	0.16	0.0094 U	0.0098 U	0.0097 U	0.0095 U
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	NA	NA	NA	0.015 U	0.0072 U	0.0074 U	NA	0.0087 U	0.0077 U	0.01 U	0.0097 U	0.043	0.0094 U	0.0100 U	0.0097 U	0.0095 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.54	0.0074 U	0.0074 U	0.056	0.0072 U	0.0074 U	0.0067 U	0.0087 U	0.028	0.01 U	0.0097 U	0.37	0.0094 U	0.0098 U	0.0097 U	0.0095 U
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.015 U	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.0067 U	0.0087 U	0.0077 U	0.01 U	0.0097 U	0.046	0.0094 U	0.0098 U	0.0097 U	0.0095 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.15	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.0067 U	0.0087 U	0.02	0.01 U	0.0097 U	0.13	0.0094 U	0.0101 U	0.0097 U	0.0095 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.015 U	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.013 U	0.0087 U	0.0077 U	0.01 U	0.0097 U	0.067	0.0094 U	0.0098 U	0.0097 U	0.0095 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.28	0.0074 U	0.0074 U	0.015	0.0072 U	0.0074 U	0.013 U	0.0087 U	0.012	0.01 U	0.0097 U	0.37	0.0094 U	0.0098 U	0.0097 U	0.0095 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.51	0.0074 U	0.0074 U	0.054	0.0072 U	0.0074 U	0.013 U	0.0087 U	0.025	0.01 U	0.0097 U	0.31	0.0094 U	0.0098 U	0.0097 U	0.0095 U
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.3	0.0074	0.0074	0.02	0.0072	0.0074	0.0067	0.0087	0.03	0.01	0.0097	0.29	0.0094	0.0013	0.0097	0.0095
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.9	0.0074	0.0074	0.07	0.0072	0.0074	0.0067	0.0087	0.04	0.01	0.0097	0.98	0.0094	0.0098	0.0097	0.0095
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**1.9**	0.0074	0.0074	0.08	0.0072	0.0074	0.0067	0.0087	0.21	0.01	0.0097	0.98	0.0094	0.013	0.0097	0.0095
Polychlorinated Biphenyls (PCBs)																						
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.056	0.056	0.056	0.055	0.054	0.056	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals																						
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	7,000	7,600	7,000	8,300	4,200	8,800	8,500	12,000	11,000	29,000	14,000	11,000	17,000	16,000	29,000	20,000
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	11 U	11 U	11 U	11 U	1.8	1.2	2.3	0.59	2.1	1.3	1.1	2.8	1.5	0.88
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.56 U	0.56 U	0.56 U	0.55 U	0.54 U	0.56 U	0.38	0.65 U	0.58 U	0.76 U	0.72 U	0.58 U	0.7 U	0.74 U	0.73 U	0.71 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	5.3	5	6.9	7.7	4.1	6.2	6.9	6.2	8.3	5.7	12	9.2	8.6	15	12	15
Copper	mg/kg	NA	140,000	280	28.4	217	11	10	13	16	11	13	21	18	15	9.2	18	18	27	12	28	16
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.6 U	5.6 U	5.6 U	5.5 U	5.4 U	5.6 U	4.4	6.5 U	7.2	7.6 U	8.1	9.3	7.0 U	7.8	9.3	7.2
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.28 U	0.28 U	0.27 U	0.27 U	0.28 U	0.028 U	0.33 U	0.29 U	0.38 U	0.36 U	0.29 U	0.35 U	0.37 U	0.36 U	0.36 U
Nickel	mg/kg	NA	70,000	130	24.54	980	4.9	4.2	6.8	9.1	6.7	6.3	6.3	6.2	7.5	5.3	6.6	7.3	8.6	9.5	11	7.5
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	11 U	11 U	11 U	**2.2**	6.5 U	5.8 U	7.6 U	7.2 U	5.8 U	7.0 U	7.4 U	7.3 U	7.1 U
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	39	42	44	45	34	40	68	63	47	30	52	68	62	46	72	38
Volatile Organic Compounds (VOCs)																						
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0051 U	0.0049 U	0.0054 U	0.0052 U	0.0052 U	0.0054 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.002 U	0.002 U	0.0022 U	0.0021 U	0.0021 U	0.0022 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	0.001 U	0.00099 U	0.0011 U	0.0012	0.001 U	0.0011 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.0499	NE	9.92	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.0252	NE	12.4	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (TPHs)																						
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	28 U	28 U	28 U	110 U	27 U	28 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Residual Range Organics	mg/kg	2,000	NE	NE	NE	2,000	56 U	56 U	56 U	710	54 U	56 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

J	Estimated Concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method reporting limit.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs..
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.2.7-1
SE18 Investigation Area RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
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	Screening Levels					Ecological Screening Level	Initial RI Analytical Results													
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SWMU14-SB03-3.5	PAAOC-SWMU14-SB03--9.5	PAAOC-SWMU14-SB04-1.3	PAAOC-SWMU14-SB04-3.3	PAAOC-SWMU14-SB04-9.5	PAAOC-SWMU14-SB05-0.5	PAAOC-SWMU14-SB05-3.0	PAAOC-SWMU14-SB05-9.5	PAAOC-SWMU14-SB06-3.5	PAAOC-SWMU14-SB06-6.0	PAAOC-SWMU14-SB06-9.5	PAAOC-SWMU14-SB07-5.0	PAAOC-SWMU14-SB08-3.0	PAAOC-SWMU14-SB08-9.5
Aluminum Smelting																				
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.058 UJ	0.058 UJ	0.058 UJ	0.057 J	0.058 UJ	0.058 UJ	0.06 UJ	0.056 UJ	0.057 UJ	0.06 UJ	0.059 UJ	0.06 UJ	0.057 UJ	0.056 UJ
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	4	3.6	27	30	3.7	57	86	13	9.7	7.1	2.9	31	**580**	20
Sulfate	mg/kg	NA	NE	2,150	NE	NE	18	10 U	110	40	10 U	10 U	10 U	10 U	10 U	27	10 U	10 U	10 U	10 U
Polynuclear Aromatic Hydrocarbons (PAHs)																				
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0097 U	0.0095 U	0.0084 U	0.008 U	0.01 U	0.0074 U	0.0097 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.012	0.0093 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0097 U	0.0095 U	0.0084 U	0.008 U	0.01 U	0.0074 U	0.0097 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.012	0.0093 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0097 U	0.0095 U	0.0084 U	0.008 U	0.01 U	0.0094	0.0097 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.096	0.0093 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0097 U	0.0095 U	0.0084 U	0.008 U	0.01 U	0.0074 U	0.0097 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.0079 U	0.0093 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0097 U	0.0095 U	0.018	0.008 U	0.01 U	0.031	0.0097 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.21	0.0093 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.0097 U	0.0095 U	0.051	0.033	0.01 U	0.2	0.017	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	1	0.0093 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0097 U	0.0095 U	0.053	0.041	0.01 U	0.25	0.025	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	1.1	0.0093 U
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.0097 U	0.0095 U	0.063	0.047	0.01 U	0.27	0.025	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	1.2	0.0093 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0097 U	0.0095 U	0.1	0.072	0.01 U	0.46	0.043	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	1.9	0.011
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.0097 U	0.0095 U	0.028	0.021	0.01 U	0.18	0.013	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.55	0.0093 U
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0097 U	0.0095 U	0.057	0.041	0.01 U	0.24	0.024	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.96	0.0093 U
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	0.0097 U	0.0095 U	0.0085	0.01	0.01 U	0.042	0.0097 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.27	0.0093 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.0097 U	0.0095 U	0.076	0.049	0.01 U	0.28	0.023	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	1.3	0.0097
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0097 U	0.0095 U	0.0084 U	0.008 U	0.01 U	0.0074 U	0.0097 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.056	0.0093 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.0097 U	0.0095 U	0.04	0.03	0.01 U	0.19	0.017	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.82	0.0093 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0097 U	0.0095 U	0.0084 U	0.008 U	0.01 U	0.0074 U	0.0097 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.016	0.0093 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.0097 U	0.0095 U	0.037	0.024	0.01 U	0.089	0.0097 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.58	0.0093 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.0097 U	0.0095 U	0.066	0.044	0.01 U	0.25	0.022	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	1.2	0.0094
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.0097	0.0095	0.08	0.08	0.01	0.32	0.028	0.011	0.01	0.01	0.01	0.0094	1.5	0.001
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.0097	0.0095	0.11	0.09	0.01	0.39	0.023	0.011	0.01	0.01	0.01	0.0094	2.68	0.01
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.0097	0.0095	0.48	0.07	0.01	0.38	0.19	0.011	0.01	0.01	0.01	0.0094	**8.94**	0.02
Polychlorinated Biphenyls (PCBs)																				
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals																				
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	29,000	20,000	14,000	14,000	17,000	16,000	30,000	13,000	20,000	32,000	13,000	19,000	16,000	14,000
Arsenic	mg/kg	20	88	2.9	7.61	132	1.5	0.88	1.3	1.7	3.3	2.3	1.4	0.71	1.6	0.9	0.66	1	2	1.4
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.73 U	0.71 U	0.63 U	0.60 U	0.79 U	0.55 U	0.72 U	0.80 U	0.76 U	0.78 U	0.76 U	0.70 U	0.59 U	0.70 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	12	15	9.9	11	11	11	12	23	11	12	21	11	12	14
Copper	mg/kg	NA	140,000	280	28.4	217	28	16	22	25	13	22	26	9.7	30	20	10	20	23	9.8
Lead	mg/kg	1,000	NE	3,000	13.1	118	9.3	7.2	6.3 U	6.2	7.9 U	7.8	7.8	8.0 U	7.6 U	7.8 U	7.6 U	7.0 U	7.1	7.0 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.36 U	0.36 U	0.32 U	0.30 U	0.39 U	0.28 U	0.36 U	0.40 U	0.38 U	0.39 U	0.38 U	0.35 U	0.30 U	0.35 U
Nickel	mg/kg	NA	70,000	130	24.54	980	11	7.5	7.9	8.3	7.7	9.9	8.3	5.9	9	6.7	4.5	6.1	10	5.9
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	7.3 U	7.1 U	6.3 U	6.0 U	7.9 U	5.5 U	7.2 U	8.0 U	7.6 U	7.8 U	7.6 U	7.0 U	5.9 U	7.0 U
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	72	38	82	68	47	76	61	31	72	41	28	53	73	38
Volatile Organic Compounds (VOCs)																				
Benzene	mg/kg	0.03	2,400	0.027	NE	0.26	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.0499	NE	9.92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.0252	NE	12.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (TPHs)																				
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Residual Range Organics	mg/kg	2,000	NE	NE	NE	2,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

J	Estimated Concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method reporting limit.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shwon in **bold** exceed one or more site soil screening levels.

Table 2.2.7-2
SE18 Investigation Area WPA Boring and Test Pit Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
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Parameter Name	Units	Screening Levels				Ecological Screening Level	WPA Analytical Results														
		MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-WPA-SE18-SB01-7.5	PAAOC-WPA-SE18-SB02-2.5	PAAOC-WPA-SE18-SB03-2.5	PAAOC-WPA-SE18-SB04-2.5	PAAOC-WPA-SE18-SB05-1.5	PAAOC-WPA-SE18-SB05-3.6	PAAOC-WPA-SE18-SB05-3.6D	PAAOC-WPA-SE18-SB05-6.1	PAAOC-WPA-SE18-SB05-8.7	PAAOC-WPA-SE18-SB05-11	PAAOC-WPA-SE18-SB05-13	PAAOC-WPA-SE18-SB05-15.6	PAAOC-WPA-SE18-SB06-1.2	PAAOC-WPA-SE1-SB06-2.5	PAAOC-WPA-SE18-SB06-6.0
Aluminum Smelting																					
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.23 U	0.2 U	0.2 U	0.19 U	0.2 U	0.18 J	0.18 J	0.24 U	0.3 U	0.29 U	0.24 U	0.26 U	0.19 U	0.24 U	0.32 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**183**	22.4	35	15.2	90.2	29.1	22.8	5.0 J	3.9 J	1.8 J	1.0 J	1.2 J	74.4	113	14.6
Sulfate	mg/kg	NA	NE	2,150	NE	NE	101	94	5.4	4.6	2.7 B	10.9	10.1	15	4.5	11.2	5.2	14	1.5 JB	4.7	99.5
Polynuclear Aromatic Hydrocarbons (PAHs)																					
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.00065 J	0.0053 U	0.0018 J	0.0052 U	0.013	0.00076 J	0.00096 J	0.0012 J	0.0011 J	0.00098 J	0.00089 J	0.0012 J	0.0074	0.0025 J	0.0013 J
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.00096 J	0.0053 U	0.015	0.0052 U	0.054	0.0066 U	0.007 U	0.0066 U	0.00055 J	0.0082 U	0.0069 U	0.0072 U	0.051	0.015	0.009 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.00097 J	0.0053 U	0.00044 J	0.0052 U	0.00054 J	0.0066 U	0.007 U	0.0066 U	0.0081 U	0.0082 U	0.0069 U	0.0072 U	0.0007 J	0.001 J	0.009 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0020 J	0.0053 U	0.037	0.0052 U	0.041	0.0066 U	0.007 U	0.0066 U	0.0081 U	0.0082 U	0.0069 U	0.0072 U	0.05	0.029	0.009 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.012	0.00084 JB	0.24	0.00065 JB	0.17	0.00065 JB	0.00072 JB	0.00062 JB	0.00073 JB	0.00051 JB	0.00064 JB	0.00086 JB	0.52	0.16	0.00084 JB
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.02	0.0053 U	0.32	0.0052 U	0.2	0.0066 U	0.007 U	0.0066 U	0.0081 U	0.0082 U	0.0069 U	0.0072 U	0.77	0.23	0.009 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.11	0.00079 J	0.42	0.0052 U	0.27	0.00068 J	0.00084 J	0.0066 U	0.0081 U	0.0082 U	0.0069 U	0.00068 J	1.1	0.32	0.009 U
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.24	0.0006 J	0.203	0.0052 U	0.16	0.0066 U	0.007 U	0.0066 U	0.0081 U	0.0082 U	0.0069 U	0.0072 U	0.59	0.17	0.009 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.022	0.00043 J	0.16	0.0052 U	0.09	0.0066 U	0.007 U	0.0066 U	0.0081 U	0.0082 U	0.0069 U	0.00036 J	0.36	0.12	0.009 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.017	0.00039 J	0.27	0.0052 U	0.19	0.0066 U	0.007 U	0.0066 U	0.0081 U	0.0082 U	0.0069 U	0.0006 J	0.68	0.21	0.009 U
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.024	0.0053 U	0.051	0.0052 U	0.031	0.0066 U	0.007 U	0.0066 U	0.0081 U	0.0082 U	0.0069 U	0.0072 U	0.14	0.034	0.009 U
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	0.00078 J	0.0053 U	0.0058	0.0052 U	0.024	0.0066 U	0.007 U	0.0066 U	0.0081 U	0.0082 U	0.0069 U	0.0072 U	0.015	0.0058 J	0.009 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.018	0.0053 U	0.34	0.0011 J	0.27	0.0066 U	0.007 U	0.0066 U	0.0081 U	0.0082 U	0.0069 U	0.0072 U	0.81	0.25	0.009 U
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.00086 J	0.0053 U	0.0099	0.0052 U	0.015	0.0066 U	0.007 U	0.0066 U	0.0081 U	0.0082 U	0.0069 U	0.0072 U	0.025	0.009	0.009 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.14	0.00039 J	0.25	0.0052 U	0.17	0.0066 U	0.007 U	0.0066 U	0.0081 U	0.0082 U	0.0069 U	0.0072 U	0.63	0.18	0.009 U
Napthalene	mg/kg	5	70	4.5	NE	NL	0.00094 J	0.00053 J	0.0031 J	0.0052 U	0.024	0.0013 J	0.0018 J	0.0022 J	0.0022 JB	0.0018 JB	0.0019 JB	0.002 JB	0.013	0.0049 J	0.0022 JB
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.0075	0.0053 U	0.15	0.0017 J	0.24	0.0066 U	0.007 U	0.0066 U	0.0015 J	0.0082 U	0.0069 U	0.0072 U	0.34	0.13	0.009 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.019	0.00065 J	0.35	0.00087 J	0.31	0.0066 U	0.007 U	0.00044 J	0.00055 J	0.0082 U	0.0069 U	0.00086 J	0.92	0.3	0.009 U
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.05	0.001	0.44	0.07	0.28	0.00007	0.0002	0.00006	0.00007	0.00005	0.00006	0.0002	1.05	0.31	0.00008
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.03	0.0005	0.56	0.003	0.65	0.001	0.002	0.002	0.004	0.008	0.002	0.002	1.28	0.44	0.002
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.6	0.004	**2.3**	0.07	**1.56**	0.001	0.002	0.001	0.001	0.0005	0.0006	0.003	**5.72**	**1.72**	0.0008
Total Petroleum Hydrocarbons (TPHs)																					
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	6.2 J	8.0 J	13 J	8.5 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Residual Range Organics	mg/kg	2,000	NE	NE	NE	2,000	21 JB	33 JB	60 J	29 JB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

B	The sample result is less than five times the blank ontamination and cross-contamination is suspected.
J	Estimated Concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method reporting limit.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening lev

Table 2.2.7-2

SE18 Investigation Area WPA Boring and Test Pit Soil Results Summary

Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Level	WPA Analytical Results														
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-WPA-SE18-SB06-8.6**	**PAAOC-WPA-SE18-SB06-11.3**	**PAAOC-WPA-SE18-SB06-13.6**	**PAAOC-WPA-SE18-SB07-0.9**	**PAAOC-WPA-SE18-SB07-2.5**	**PAAOC-WPA-SE18-SB07-2.5D**	**PAAOC-WPA-SE18-SB07-5**	**PAAOC-WPA-SE18-SB08-1**	**PAAOC-WPA-SE18-SB08-3.4**	**PAAOC-WPA-SE18-SB08-6.1**	**PAAOC-WPA-SE18-SB08-8.8**	**PAAOC-WPA-SE18-SB08-10.5**	**PAAOC-WPA-SE18-SB08-13.7**	**PAAOC-WPA-SE18-SB08-16.3**	**PAAOC-WPA-SE18-SB09-1**
Aluminum Smelting																					
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.33 U	0.27 U	0.23 U	0.2 U	0.27 U	0.28 U	0.25 U	0.2 U	0.2 U	0.27 U	0.25 U	0.24 U	0.19 U.	0.2 U	0.19 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	3.8 J	2.2 J	1.5 J	**166**	12.8	23.1	60.7	93	39.4	12.9	1.9 J	1.3 J	4.4 U	4.6 U	15.2
Sulfate	mg/kg	NA	NE	2,150	NE	NE	16	8	6.7	2.1 JB	98.1 J	43.8 J	20.9	54.7	191	264	92.9	128	73.2	387	44.2
Polynuclear Aromatic Hydrocarbons (PAHs)																					
2-Methylnaphthalene	mg/kg	NA	14,000	2	NE	NL	0.0013 J	0.0011 J	0.00081 J	0.039	0.0012 J	0.0011 J	0.0058 J	0.0054 U	0.00066 J	0.007 U	0.0067 U	0.00058 J	0.00093 J	0.0052 U	0.00042 J
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0091 U	0.0073 U	0.0063 U	0.23	0.0075 U	0.0077 U	0.0071 U	0.00059 J	0.0055 U	0.007 U	0.0067 U	0.006 U	0.0037 J	0.0052 U	0.00038 J
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0091 U	0.0073 U	0.00037 J	0.0021 J	0.0075 U	0.0077 U	0.0071 U	0.0054 U	0.0055 U	0.007 U	0.0067 U	0.006 U	0.0052 U	0.0052 U	0.0053 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0091 U	0.00067 J	0.0063 U	0.16	0.0075 U	0.0077 U	0.0071 U	0.0054 U	0.0055 U	0.007 U	0.0067 U	0.006 U	0.0035 J	0.0052 U	0.00038 J
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0014 JB	0.001 JB	0.001 JB	1.9	0.00079 JB	0.0014 JB	0.00057 JB	0.00038 J	0.0015 J	0.00059 J	0.00047 J	0.00045 J	0.051	0.00041 J	0.004 J
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.0091 U	0.0073 U	0.0063 U	2.2	0.0075 U	0.0077 U	0.0071 U	0.0054 U	0.0016 J	0.007 U	0.0067 U	0.006 U	0.063	0.0052 U	0.0045 J
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.00098 J	0.0073 U	0.0063 U	3.4	0.0075 U	0.0016 J	0.0071 U	0.0054 U	0.0027 J	0.007 U	0.0067 U	0.006 U	0.13	0.0052 U	0.0072 J
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.0012 J	0.0073 U	0.0063 U	1.5	0.0075 U	0.00072 J	0.0071 U	0.0054 U	0.0014 J	0.007 U	0.0067 U	0.006 U	0.061	0.0052 U	0.0038 J
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0091 U	0.0073 U	0.0063 U	1	0.0075 U	0.00052 J	0.0071 U	0.0054 U	0.00077 J	0.007 U	0.0067 U	0.006 U	0.04	0.0052 U	0.0024 J
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.00067 J	0.0073 U	0.0063 U	2.5	0.00064 J	0.0012 J	0.0071 U	0.0054 U	0.0021 J	0.007 U	0.0067 U	0.006 U	0.12	0.0052 U	0.0061 J
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0091 U	0.0073 U	0.0063 U	0.41	0.0075 U	0.0077 U	0.0071 U	0.0054 U	0.00028 J	0.007 U	0.0067 U	0.006 U	0.013	0.0052 U	0.00086 J
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	0.0091 U	0.00098 J	0.0063 U	0.086	0.0075 U	0.0077 U	0.0071 U	0.0054 U	0.0055 U	0.007 U	0.0067 U	0.006 U	0.0014 J	0.0052 U	0.0053 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.0091 U	0.0014 J	0.0063 U	2.6	0.0075 U	0.0013 J	0.0071 U	0.0054 U	0.0022 J	0.007 U	0.0067 U	0.006 U	0.11	0.0052 U	0.0068
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0091 U	0.0073 U	0.0063 U	0.12	0.0075 U	0.0077 U	0.0071 U	0.0054 U	0.0055 U	0.007 U	0.0067 U	0.006 U	0.0019 J	0.0052 U	0.0053 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.0091 U	0.0073 U	0.0063 U	1.7	0.0075 U	0.00066 J	0.0071 U	0.0054 U	0.0013 J	0.007 U	0.0067 U	0.006 U	0.065	0.0052 U	0.0034 J
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0023 JB	0.0018 JB	0.0017 JB	0.054	0.002 JB	0.0017 JB	0.0015 JB	0.0006 J	0.0011 J	0.00069 J	0.00093 J	0.001 J	0.0015 J	0.00058 J	0.00083 J
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.0091 U	0.0035 J	0.0063 U	1.3	0.0075 U	0.001 J	0.0071 U	0.0054 U	0.001 J	0.007 U	0.0067 U	0.006 U	0.027	0.0052 U	0.0029 J
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.0011 J	0.0013 J	0.0063 U	2.8	0.00052 J	0.0015 J	0.00048 J	0.0054 U	0.002 J	0.007 U	0.0067 U	0.006 U	0.1	0.0052 U	0.0075
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.001	0.0001	0.0001	3.07	0.00009	0.0004	0.00006	0.00004	0.002	0.00006	0.00005	0.00005	0.09	0.00004	0.006
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.00	0.0070	0.002	4.47	0.002	0.004	0.002	0.001	0.004	0.0007	0.0009	0.001	0.15	0.0006	0.01
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.01	0.002	0.001	**17.4**	0.002	0.008	0.001	0.0004	0.01	0.0006	0.0005	0.0005	0.64	0.0004	0.04
Total Petroleum Hydrocarbons (TPHs)																					
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Residual Range Organics	mg/kg	2,000	NE	NE	NE	2,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

B The sample result is less than five times the blank ontamination and cross-contamination is suspected.
J Estimated Concentration.
NA Not applicable or not analyzed.
NE Not established in lookup tables.
NL Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U Chemical was not detected. The associated value represents the method reporting limit.

TTEC Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH Low molecular weight PAH.
HMW PAH High molecular weight PAH.
Detected concentrations shown in **bold** exceed one or more site soil screeing levels.

Table 2.2.7-2
SE18 Investigation Area WPA Boring and Test Pit Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Level	WPA Analytical Results													
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-WPA-SE18-SB09-2.5	PAAOC-WPA-SE18-SB09-5.5	PAAOC-WPA-SE18-SB09-8.8	PAAOC-WPA-SE18-SB09-11.3	PAAOC-WPA-SE18-SB10-1	PAAOC-WPA-SE18-SB10-3.3	PAAOC-WPA-SB10-5.8	PAAOC-WPA-SE18-SB10-10.7	PAAOC-WPA-SE18-SB10-13.6	PAAOC-WPA-SE18-GW20-0.5	PAAOC-WPA-SE18-GW20-5	PAAOC-WPA-SE18-GW20-8.0	PAAOC-WPA-SE18-GW20-8.5	PAAOC-WPA-SE18-GW20-10.5
Aluminum Smelting																				
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.2 U	0.15 J	0.22 U	0.17 U	0.19 U	0.21 U	0.28 U	0.21 U	0.24 U	0.21 U	0.21 U	0.28 U	0.26 U	0.22 J
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	55.6	34.9	5.4	4.2 J	64.2	27.7	6.5	2.2 J	5.3 U	109	84.2	83.3	54.7	38.3
Sulfate	mg/kg	NA	NE	2,150	NE	NE	66	129	40.6	88.1	94.5	143	443	89.2	184	29.3	60.8	89.5	47.6	56.4
Polynuclear Aromatic Hydrocarbons (PAHs)																				
2-Methylnaphthalene	mg/kg	NA	14,000	2	NE	NL	0.00055 J	0.00083 J	0.006 U	0.00055 J	0.0021 J	0.00045 J	0.0074 U	0.0057 U	0.00068 J	0.006	0.00098 J	0.0078 U	0.0009 J	0.00071 J
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0058 U	0.0075 U	0.006 U	0.0059 U	0.022	0.0055 U	0.0074 U	0.0057 U	0.0065 U	0.052	0.0058 U	0.0078 U	0.0074 U	0.0079 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0058 U	0.0075 U	0.006 U	0.0059 U	0.00031 J	0.0055 U	0.0074 U	0.0057 U	0.0065 U	0.00074 J	0.0058 U	0.0078 U	0.0074 U	0.0079 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0058 U	0.0075 U	0.006 U	0.0059 U	0.025	0.0055 U	0.0074 U	0.0057 U	0.0065 U	0.055	0.0058 U	0.0078 U	0.0011 J	0.0079 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0013 J	0.00054 J	0.00092 J	0.00049 J	0.23	0.00071 J	0.00052 J	0.00041 J	0.00057 J	0.71	0.0029 J	0.00092 JB	0.00066 JB	0.00087 JB
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.0016 J	0.0075 U	0.006 U	0.0059 U	0.28	0.0055 U	0.0074 U	0.0057 U	0.0065 U	0.93	0.0047 J	0.0078 U	0.0074 U	0.0079 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0041 J	0.0075 U	0.00086 J	0.00051 J	0.45	0.00081 J	0.0074 U	0.0057 U	0.0065 U	1.5	0.0095	0.001 J	0.0074 U	0.00068 J
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.0029 J	0.0075 U	0.00066 J	0.0059 U	0.22	0.0055 U	0.0074 U	0.0057 U	0.0065 U	1	0.006	0.00095 J	0.0074 U	0.0079 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0011 J	0.0075 U	0.006 U	0.0059 U	0.14	0.0055 U	0.0074 U	0.0057 U	0.0065 U	0.47	0.0028 J	0.0078 U	0.0074 U	0.0079 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.0021 J	0.0075 U	0.00048 JB	0.0059 U	0.37	0.00045 JB	0.0074 U	0.0057 U	0.0065 U	1	0.006	0.00061 J	0.0074 U	0.00054 J
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.00048 J	0.0075 U	0.006 U	0.0059 U	0.051	0.0055 U	0.0074 U	0.0057 U	0.0065 U	0.2	0.00084 J	0.0078 U	0.0074 U	0.0079 U
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	0.0058 U	0.0075 U	0.006 U	0.0059 U	0.0071	0.0055 U	0.0074 U	0.0057 U	0.0065 U	0.015	0.0058 U	0.0078 U	0.0074 U	0.0079 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.0016 J	0.0075 U	0.006 U	0.0059 U	0.33	0.0055 U	0.0074 U	0.0057 U	0.0065 U	0.83	0.0041 J	0.0078 U	0.0074 U	0.0079 U
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0058 U	0.0075 U	0.006 U	0.0059 U	0.011	0.0055 U	0.0074 U	0.0057 U	0.0065 U	0.024	0.0058 U	0.0078 U	0.0074 U	0.0079 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.0029 J	0.0075 U	0.00058 J	0.0059 U	0.24	0.0055 U	0.0074 U	0.0057 U	0.0065 U	0.98	0.006	0.0007 J	0.0074 U	0.0079 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.00099 J	0.0075 U	0.00089 J	0.00094 J	0.0061	0.00071 J	0.0074 U	0.00059 J	0.0012 J	0.0093	0.0013 J	0.00086 J	0.0016 J	0.0012 J
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.00082 J	0.0075 U	0.006 U	0.0059 U	0.15	0.0055 U	0.0074 U	0.0057 U	0.0065 U	0.37	0.002 J	0.0078 U	0.0011 J	0.0079 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.0016 J	0.0075 U	0.00071 J	0.0059 U	0.38	0.00072 J	0.0074 U	0.0057 U	0.0065 U	1.1	0.0048 J	0.0007 J	0.00052 J	0.00073 J
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.002	0.00005	0.0002	0.0002	0.32	0.0002	0.00005	0.00004	0.00006	1.32	0.007	0.0003	0.0001	0.0002
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.003	0.008	0.0009	0.0009	0.54	0.0007	0.007	0.0006	0.001	1.34	0.007	0.0009	0.004	0.001
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.02	0.0005	0.004	0.001	**2.4**	0.003	0.0005	0.00041	0.0006	**7.9**	0.04	0.005	0.001	0.003
Total Petroleum Hydrocarbons (TPHs)																				
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Residual Range Organics	mg/kg	2,000	NE	NE	NE	2,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

B	The sample result is less than five times the blank ontamination and cross-contamination is suspected.
J	Estimated Concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method reporting limit.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening lev

Table 2.2.7-2
SE18 Investigation Area WPA Boring and Test Pit Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 4 of 4

	Screening Levels					Ecological Screening Level	WPA Analytical Results													
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-WPA-SE18-GW20-13**	**PAAOC-WPA-SE18-GW20-16**	**PAAOC-WPA-S318-SB12-1.0**	**PAAOC-WPA-SE18-SB12-3.5**	**PAAOC-WPA-SE18-SB12-6.0**	**PAAOC-WPA-SE18-SB12-8.0**	**PAAOC-WPA-SE18-SB12-11**	**PAAOC-WPA-SE18-SB12-13.5**	**PAAOC-WPA-SE18-SB12-16.2**	**PAAOC-WPA-SE18-SB12-20**	**PAAOC-WPA-SE18-TP13-1.0**	**PAAOC-WPA-SE18-TP14-1.0**	**PAAOC-WPA-SE18-WCOMP**	**PAAOC-WPA-SE18-ECOMP**
Aluminum Smelting																				
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.25 U	0.27 U	0.23 U	0.09 J	0.21 U	0.24 U	0.16 J	0.27 U	0.39	0.1 J	0.20 U	0.22 U0.18 J	0.22 U	0.21 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	8.6	6.3 U	115	93	18.9	8	1.5 J	6.0 U	6.0 U	2.7 J	117	106	1.5 J	26.1
Sulfate	mg/kg	NA	NE	2,150	NE	NE	63.1	143	2.6 JB	6.8	5.7	6.8	3B	18.9	104	351	8.1	1.9 JB	4.5	1.4 JB
Polynuclear Aromatic Hydrocarbons (PAHs)																				
2-Methylnaphthalene	mg/kg	NA	14,000	2	NE	NL	0.00072 U	0.0011 J	0.0053 J	0.0015 J	0.0019 J	0.0011 J	0.00076 J	0.00072 J	0.00063 J	0.001 J	0.0027 J	0.053	0.41	0.023 J
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.00072 U	0.0075 U	0.046	0.0061 U	0.0057 U	0.0069 U	0.0068 U	0.0073 U	0.0069 U	0.0069 U	0.017	0.27	1.6	0.26
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.00072 U	0.0075 U	0.00048 J	0.0061 U	0.0057 U	0.0069 U	0.0068 U	0.0073 U	0.0069 U	0.0069 U	0.0056 U	0.0021 J	0.024 J	0.0055 J
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.00072 U	0.0075 U	0.042	0.0061 U	0.0057 U	0.0069 U	0.0068 U	0.0073 U	0.0069 U	0.00056 J	0.022	0.29	1.7	0.38
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.00065 JB	0.00073 JB	0.45 J	0.001 JB	0.0012 JB	0.0006 JB	0.00058 JB	0.00065 JB	0.00064 JB	0.00091 JB	0.28	2.8	4.1	6.4
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.00072 U	0.0075 U	0.66	0.0006 J	0.002 J	0.0069 U	0.0068 U	0.0073 U	0.0069 U	0.0069 U	0.38	3.7	4.8	9.1
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.00072 U	0.00064 J	0.93 J	0.0024 J	0.0073	0.0069 U	0.0068 U	0.0073 U	0.0069 U	0.0069 U	0.66	5.7	5.8	13
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.00072 U	0.0075 U	0.52	0.0009 J	0.0047 J	0.0069 U	0.0068 U	0.0073 U	0.0069 U	0.0069 U	0.45	2.7	3	6.7
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.00072 U	0.0075 U	0.31	0.0061 U	0.0019 J	0.0069 U	0.0068 U	0.0073 U	0.0069 U	0.0069 U	0.2	1.5	2.1	4.5
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.00072 U	0.0075 U	0.58	0.0014 J	0.0058	0.0069 U	0.0068 U	0.0073 U	0.0069 U	0.0012 J	0.41	4	4.7	8.4
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.00072 U	0.0075 U	0.12	0.0061 U	0.00086 J	0.0069 U	0.0068 U	0.0073 U	0.0069 U	0.0069 U	0.085	0.65	0.63	1.3
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	0.00072 U	0.0075 U	0.012	0.0061 U	0.0057 U	0.0069 U	0.0068 U	0.0073 U	0.0069 U	0.0069 U	0.0058	0.073	0.91	0.072
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.00072 U	0.0075 U	0.57 J	0.0061 U	0.00085 J	0.0069 U	0.0068 U	0.0073 U	0.0069 U	0.0042 J	0.35	4.9	8.7	8.5
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.00072 U	0.0075 U	0.02	0.0061 U	0.0057 U	0.0069 U	0.0068 U	0.0073 U	0.0069 U	0.0069 U	0.0094	0.14	0.85	0.13
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.00072 U	0.0075 U	0.56	0.0012 J	0.0049 J	0.0069 U	0.0068 U	0.0073 U	0.0069 U	0.0069 U	0.42	3.1	3.4	6.9
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.00091 J	0.0018 J	0.0096	0.0014 J	0.0013 J	0.0018 J	0.0015 J	0.0013 J	0.0012 J	0.0014 J	0.004 J	0.1	1.1	0.022 JB
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.00072 U	0.0075 U	0.27	0.00075 J	0.001 J	0.0069 U	0.0068 U	0.0073 U	0.0069 U	0.012	0.15	2	8.8	2.8
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.00072 U	0.0075 U	0.69 J	0.00095 J	0.001 J	0.0069 U	0.0068 U	0.0073 U	0.0069 U	0.0011 J	0.46	5.1	9.2	11
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.00007	0.00001	0.91	0.001	0.004	0.00006	0.00006	0.00007	0.00006	0.0001	0.55	**5.2**	**6.5**	**12.4**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.0009	0.002	0.96	0.002	0.003	0.002	0.002	0.001	0.001	0.02	0.55	7.7	22.8	12.1
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.0007	0.001	**4.8**	0.008	0.02	0.0006	0.0006	0.0007	0.0006	0.003	**3.4**	**29.3**	**37.7**	**67.3**
Total Petroleum Hydrocarbons (TPHs)																				
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Residual Range Organics	mg/kg	2,000	NE	NE	NE	2,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

B	The sample result is less than five times the blank ontamination and cross-contamination is suspected.
J	Estimated Concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method reporting limit.

TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.2.7-3
SE18 Investigation Area RI and WPA Groundwater Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

		Screening Levels					Initial RI Analytical Results				WPA Analytical Results						
Parameter Name	**Units**	**MTCA Method A**	**MTCA Method B**	**MTCA Method C**	**WA MCL**	**Natural Background**	**GWAOC-RI-BAU-MW7-01**	**GWAOC-RI-BAU-MW7-02**	**GWAOC-RI-BAU-MW7-03**	**GWAOC-RI-BAU-MW7-04**	**PAAOC-WPA-SE18-SB01-GW01**	**PAAOC-WPA-SE18-SB04-GW01**	**PAAOC-WPA-SE18-SB04-GW01D**	**PAAOC-WPA-GW20-GW01**	**PAAOC-WPA-SB05-GW01**	**PAAOC-WPA-SB05-GW01D**	**PAAOC-WPA-SB06-GW01**
Aluminum Smelting																	
Cyanide, Free	mg/L	NE	0.01	0.022	0.2	NA	0.0015 U	NA	NA	NA	NA	NA	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Fluoride	mg/L	NE	0.96	2.1	4	0.72	0.34	0.79 J	0.9 J	0.54	**14.6**	**9.92**	**10.1**	0.28	0.2 U	0.2 U	0.4
Sulfate	mg/L	NE	NE	NE	250	32	210	140	170	220 J	179 J	**499 J**	**491 J**	**527**	29.3	28.3	105
Polynuclear Aromatic Hydrocarbons (PAHs)																	
1-Methylnaphthalene	ug/L	NL	1.5	15	NE	NE	0.0062 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	ug/L	NL	32	70	NE	NE	0.0092 U	NA	NA	NA	0.0048 J	0.17	0.16	0.013 J	0.017 J	0.018 J	0.076
Acenaphthene	ug/L	NA	960	2,100	NE	NE	0.0012 J	NA	NA	NA	0.0075 J	0.0036 JX	0.0043 JX	0.0019 J	0.0026 J	0.0029 J	0.0038 J
Acenaphthylene	ug/L	NA	NE	NE	NE	NE	0.0021 U	NA	NA	NA	0.02 U	0.0012 JX	0.02 U	0.02 UJJ	0.02 UJ	0.02 UJ	0.02 UJ
Anthracene	ug/L	NA	4,800	11,000	NE	NE	0.0031 U	NA	NA	NA	0.01 J	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Benzo(a)anthracene	ug/L	NL	NL	NL	NE	NE	0.0021 U	NA	NA	NA	0.066	0.0033 JB	0.0051 JB	0.0035 JB	0.0026 JB	0.0021 JB	0.0078 JB
Benzo(a)pyrene	ug/L	0.1	0.023	0.88	NL	NE	0.0031 U	NA	NA	NA	**0.16**	0.0012 JB	0.0024 JB	0.02 U	0.02 U	0.02 U	0.02 U
Benzo(b)fluoranthene	ug/L	NL	NL	NL	NE	NE	0.0082 U	NA	NA	NA	0.78	0.0028 JB	0.006 JB	0.02 U	0.02 U	0.02 U	0.02 U
Benzo(g,h,i)perylene	ug/L	NA	NE	NE	NE	NE	0.0031 U	NA	NA	NA	0.74	0.001 JB	0.0017 JB	0.02 U	0.00098 J	0.02 UJ	0.0012 J
Benzo(k)fluoranthene	ug/L	NL	NL	NL	NE	NE	0.0092 U	NA	NA	NA	0.17	0.0011 JB	0.0018 JB	0.02 U	0.02 U	0.02 U	0.02 U
Chrysene	ug/L	NL	NL	NL	NE	NE	0.0062 U	NA	NA	NA	0.17	0.0011 JB	0.0017 JB	0.02 U	0.00098 J	0.00093 J	0.02 U
Dibenzo(a,h)anthracene	ug/L	NL	NL	NL	NE	NE	0.0021 U	NA	NA	NA	0.087	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Dibenzofuran	ug/L	NL	NL	NE	NE	NE	NA	NA	NA	NA	0.0049 J	0.02 U	0.0013 J	0.0013 J	0.0012 J	0.0012 J	0.0026 J
Fluoranthene	ug/L	NL	640	1,400	NE	NE	0.0021 U	NA	NA	NA	0.11	0.0045 JB	0.0047 JB	0.02 U	0.02 U	0.02 U	0.0036 J
Fluorene	ug/L	NL	640	1,400	NE	NE	0.0031 U	NA	NA	NA	0.0099 J	0.0033 J	0.0032 J	0.0015 J	0.0012 J	0.0013 J	0.0036 J
Indeno(1,2,3-cd)pyrene	ug/L	NL	NL	NL	NE	NE	0.0072 U	NA	NA	NA	0.58	0.02 U	0.0013 JB	0.02 U	0.02 U	0.02 U	0.00098 J
Naphthalene	ug/L	160	160	350	NE	NE	0.013 U	NA	NA	NA	0.0037 J	0.0037 B	0.01 JB	0.019 J	0.0088 J	0.0088 J	0.019 J
Phenanthrene	ug/L	NL	NL	NE	NE	NE	0.0061 B	NA	NA	NA	0.033	0.0029 JB	0.003 JB	0.0032 J	0.004 J	0.0036 J	0.018 J
Pyrene	ug/L	NL	480	1,100	NE	NE	0.0041 U	NA	NA	NA	0.13	0.041 JB	0.046 JB	0.0015 J	0.0016 J	0.0015 J	0.0043 J
TTEC cPAH (calc)	ug/L	0.1	0.2	0.2	NE	NE	0.002	NA	NA	NA	**0.33**	0.002	0.004	0.0004	0.0003	0.0002	0.0009
Polychlorinated Biphynels																	
Arochlor 1016	ug/L	NA	1.1	2.5	NE	NE	0.021 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arochlor 1221	ug/L	NA	NE	NE	NE	NE	0.031 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arochlor 1232	ug/L	NA	NE	NE	NE	NE	0.028 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arochlor 1242	ug/L	NA	NE	NE	NE	NE	0.029 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arochlor 1248	ug/L	NA	NE	NE	NE	NE	0.021 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arochlor 1254	ug/L	NA	0.044	0.44	NE	NE	0.02 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arochlor 1260	ug/L	NA	0.044	0.44	NE	NE	0.027 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arochlor 1268	ug/L	NA	NA	NE	NE	NE	0.032 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PCBs (calc)	ug/L	0.1	0.044	0.44	0.5	NE	0.025	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals																	
Aluminum	mg/L	NE	16	35	NE	1.14	0.53	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	mg/L	0.005	0.000058	0.00058	0.01	0.0069	**0.0011**	**0.0012**	**0.0019**	**0.00086 J**	NA	NA	NA	NA	NA	NA	NA
Cadmium	mg/L	0.005	0.008	0.018	0.05	NE	0.000028 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	mg/L	0.05	24	53	0.1	0.03	0.00078 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	mg/L	NE	0.64	1.4	13	NE	0.0011 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	mg/L	NA	11	25	0.3	13	**19**	10	**15**	**14**	NA	NA	NA	NA	NA	NA	NA
Lead	mg/L	0.015	NE	NE	0.015	0.00046	0.00029 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	mg/L	0.002	NE	NE	0.002	NE	0.000041 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	mg/L	NA	0.000096	0.001	0.1	0.065	0.0004 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	mg/L	NA	0.08	0.180	0.05	NE	0.00054 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	mg/L	NA	4.8	11	NE	NE	0.014	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (TPHs)																	
Diesel Range Organics	mg/L	0.5	NE	NE	NE	NE	NA	NA	NA	NA	0.120 J	0.130 J	0.160 J	NA	NA	NA	NA
Residual Range Organics	mg/L	0.5	NE	NE	NE	NE	NA	NA	NA	NA	0.180 J	0.069 JB	0.089 JB	NA	NA	NA	NA

Notes:

B	The sample result is less than five times the blank contamination and cross-contamination is suspected.
J	Estimated concentration.
MCL	Maximum Contaminant Level.
NA	Not applicable or not analyzed.
B	Analyte detected in associated method blank at a level that is significant relative to the sample result.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
TTEC	Total Toxicity Equivalent Concentration.
U	Chemical was not detected. The associated value represents the method reporting limit.
X	Chromatogram indicated the presence of non-target components. Matrix interference may have resulted in a slight high bias.

Detected concentrations shown in **bold** exceed one or more site groundwater screening levels.

Soil and water analytical results that exceed Plant Area AOC soil and water screening levels are compiled and presented on Figure 2.2.7-1 (SE18 Investigation Area Sampling Location and Exceedance Summary). For soil analytical results indicate that fluoride and PAH as calculated total HMW are the only two COPCs detected in soil at concentrations that exceed soil screening levels in the 12 borings completed for the WPA phase. Sulfate was not detected in soil in any of the borings at concentrations that exceed the protection of groundwater screening level.

Fluoride was detected in two soil borings at concentrations of 183 mg/kg in SE18-SB01 at 7.5 ft bgs, and at 166 mg/kg in SE18-SB07 at 0.9 ft bgs. These concentrations do not represent a significant source of soil contamination to shallow groundwater. PAH as calculated total HMW was detected in 12 out of 54 samples at concentrations that ranged from 1.56 to 17.4 mg/kg at depths of 0.5 to 2.5 ft bgs, but not in deeper depths sampled. These concentrations also do not represent a significant source of soil contamination to shallow groundwater. No other COPCs were detected at concentrations that exceed soil screening levels.

Additional borings completed for the SWMU 14 initial RI investigation, and COPC exceedance of soil screening levels are shown on Figure 2.2.7-1. Of the eight SWMU 14 soil borings completed, only fluoride was detected at a concentration of 580 mg/kg in boring SWMU14-SB08 that exceeds the protection of groundwater screening level at 3 ft bgs but not at the deeper depth sample. No other COPCs were detected in the SWMU 14 borings at concentrations that exceed soil screening levels.

Results of two surface soil samples and two stockpile soil samples indicate that only PAHs as TTEC and calculated total HMW were detected at concentrations that exceed protection of groundwater and/or ecological wildlife soil screening levels. These surface soil sample detected concentrations does not represent a significant source of contamination to shallow groundwater.

For water, analytical results indicate that fluoride, sulfate, and PAH as TTEC exceed water screening levels in three out of five water samples. Fluoride was detected at a concentration of 14.6 mg/L in a grab groundwater sample from WPA boring SE18-SB01 (segment C5). Fluoride was detected at concentrations of 9.92 and 10.1 mg/L in grab groundwater sample/duplicate from WPA boring SE18-SB04 (segment B5). Based on interpretation of the sitewide fluoride plume in shallow groundwater (Groundwater AOC, Volume 4, Section 2), the concentration of fluoride in this area would be approximately half of the concentrations detected in the two grab groundwater samples. This data was the basis for step-out investigation in the upgradient area, in the vicinity of SWMU 14. PAH as TTEC was detected at a low concentration of 0.33 µg/L in the grab groundwater sample from SE18-SB01, but there is not a corresponding detection of PAHs exceeding protection of groundwater screening levels in soil samples from this boring. Sulfate was detected at a concentration of 499 mg/L in the grab water sample from SE18-SB04, and at 527 mg/L in the well SE18-GW20 sample, both of which exceed the WA MCL. There is not a corresponding detection of sulfate exceeding the protection of groundwater screening level in soil samples from SE18-SB04 or SE18-GW20. It is likely that the detection of sulfate in SE18-GW20 and possible SE18-SB04 are associated with water treatment facility and piping, and wet/dry scrubbers, the two most likely sources of sulfate onsite.

As a part of review of historic aerial photographs and identification of equipment activity and storage in the vicinity of SWMU 14, surface water runoff and ponding were also identified. The area to the north and west of SWMU 14 was inspected to better understand sources of water and flow pathways that were apparent in the aerial photographs. Soil berms and culverts that direct and control surface runoff were mapped. Some surface runoff originates from Highway 14 to the north and is directed by culverts beneath the natural gas pipeline ridge at the north edge of the plant area fence line (Figure 2.2.7-1). Surface runoff pools inside a series of berms north of SWMU 14 and then flows to the west directed by culverts beneath the berm. Water again pools to the west of SWMU 14, flows through culverts to a lower area south of the backup clarifier, then through a last culvert south of the clarifier and discharges into Courtyard Segment C4. Soil analytical results for SE18-TP14 at the culvert discharge south of the backup clarifier did not indicate concentrations of fluoride or sulfate that exceed soil screening levels. This surface runoff pathway does, however, represent contribution of water by infiltration to shallow groundwater.

An additional review was conducted of the water and wastewater lines that are present beneath Courtyard Segments B4, B5, C4, and C5 that could represent sources for fluoride and sulfate contamination to shallow groundwater. Analytical results for initial RI and WPA sediment samples collected from the lines beneath these four courtyard segments are summarized on Table 2.2.7-4 and water sample analytical results are summarized on Table 2.2.7-5. Analytical results that exceed Plant Area AOC soil and water screening levels are compiled and presented on Figure 2.2.7-3 (Waste and Wastewater Lines Sediment and Water Sampling Locations and Exceedance Summary).

Table 2.2.7-4
PAAOC SE18 Investigation Area Courtyard Segment C5 Pre-RI and WPA Sediment Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels				Ecological Screening Levels	Pre-RI Analytical Results				WPA Analytical Results		
						Stormwater Collection System Sediment				Scrubber Effluent System Sediment		
Parameter Name	Units	Method C	Protection of Groundwater	Natural Background	Wildlife	CB2L11 (Segment C4)	CB3L11 (Segment C5)	CB4L11 (Segment C5)	CB5L11 (Segment C5)	PAAOC-WPA-MH3L2-SD01 (Segment C4)	PAAOC-WPA-MH4L2-SD01 (Segment C5)	PAAOC-WPA-MH5L2-SD01 (Segment C5)
Aluminum Smelting												
Cyanide, total	mg/kg	2,200	1.9	NE	5	0.1	0.05 U	0.071	0.05 U	0.15 J	0.1 J	0.12 J
Fluoride	mg/kg	210,000	147.6	14.11	NE	**3,900**	**2,700**	**3,500**	**3,700**	**2,210**	**1,840**	**622**
Sulfate	mg/kg	NE	2,150	NE	NE	NA	NA	NA	NA	195	59.3	48.4
Polynuclear Aromatic Hydrocarbons (PAHs)												
1-Methylnaphthalene	mg/kg	NL	NL	NA	NL	27 U	20 U	23 U	19 U	NA	NA	NA
2-Methylnaphthalene	mg/kg	NL	NL	NE	NL	27 U	20 U	23 U	19 U	0.66	0.16	0.38
Acenaphthene	mg/kg	NL	NL	NE	NL	27 U	20 U	23 U	19 U	5.7	1.9	4
Acenaphthylene	mg/kg	NE	NE	NE	NL	27 U	20 U	23 U	19 U	0.27	0.14	0.28
Anthracene	mg/kg	NE	NL	NE	NL	27 U	20 U	23 U	24	21	3.5	8.7
Benzo(a)anthracene	mg/kg	NL	NL	NE	NL	96	86	130	60	110	20	39
Benzo(a)pyrene	mg/kg	NL	NL	NE	NL	91	82	220	76	94	21	40
Benzo(b)fluoranthene	mg/kg	NL	NL	NE	NL	260	230	630	120	190	43	79
Benzo(g,h,i)perylene	mg/kg	NE	NE	NE	NL	79	87	210	62	62	20	35
Benzo(k)fluoranthene	mg/kg	NL	NL	NE	NL	110	100	270	99	55	13	23
Chrysene	mg/kg	NL	NL	NE	NL	290	250	500	94	160	31	59
Dibenzo(a,h)anthracene	mg/kg	NL	NL	NE	NL	27 U	26	57	19 U	17	4.4	7.6
Dibenzofuran	mg/kg	NE	NE	NE	NL	NA	NA	NA	NA	2.1	0.49	1.3
Fluoranthene	mg/kg	NL	NL	NE	NL	310	180	130	180	200	44	88
Fluorene	mg/kg	NL	NL	NE	NL	27 U	20 U	23 U	19 U	5.2	1.2	2.9
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NE	NL	64	73	170	51	79	23	42
Naphthalene	mg/kg	NL	NL	NE	NL	27 U	20 U	23 U	19 U	1	0.2	0.49
Phenanthrene	mg/kg	NE	NE	NE	NL	66	54	33	100	74	15	34
Pyrene	mg/kg	NL	NL	NE	NL	220	150	99	140	200	41	84
TTEC cPAH (calc)	mg/kg	130	3.9	NE	NE	**146.9**	**282.9**	**350.7**	**109.9**	**140.7**	**31.7**	**59.7**
Total LMW PAH (calc)	mg/kg	NE	NE	NE	100	**376**	**234**	**163**	**280**	**300.2**	65.9	**138.5**
Total HMW PAH (calc)	mg/kg	NE	NE	NE	1.1	**1,210**	**1,184**	**2,286**	**702**	**967**	**216.4**	**408.6**
Polychlorinated Biphenyls (PCBs)												
Aroclor 1016	mg/kg	NL	NE	NE	NL	0.10 U	0.077 U	0.087 U	0.070 U	0.069 U	0.061 U	0.053 Ui
Aroclor 1221	mg/kg	NE	NE	NE	NL	0.10 U	0.077 U	0.087 U	0.070 U	0.14 U	0.13 U	0.1 U
Aroclor 1232	mg/kg	NE	NE	NE	NL	0.10 U	0.077 U	0.087 U	0.070 U	0.069 U	0.061 U	0.053 Ui
Aroclor 1242	mg/kg	NE	NE	NE	NL	0.10 U	0.077 U	0.087 U	0.070 U	0.21 PD	0.061 U	0.053 Ui
Aroclor 1248	mg/kg	NE	NE	NE	NL	0.10 U	0.077 U	0.087 U	0.070 U	0.069 U	0.061 U	0.061 Ui
Aroclor 1254	mg/kg	NL	NL	NE	NL	0.10 U	0.21	0.17	0.070 U	0.5 D	0.19	0.26 D
Aroclor 1260	mg/kg	NL	NE	NE	NL	0.10 U	0.077 U	0.087 U	0.070 U	1.9 Ui	0.51 Ui	0.55 Ui
Aroclor 1262	mg/kg	NL	NE	NE	NL	NA	NA	NA	NA	NA	NA	NA
Aroclor 1268	mg/kg	NL	NE	NE	NL	NA	NA	NA	NA	NA	NA	NA
Total PCBs (calc)	mg/kg	66	NE	NE	0.65	0.1	0.21	0.17	0.07	**0.71**	0.19	0.26
Metals												
Aluminum	mg/kg	3,500,000	480,000	28,299	NE	33,000	36,000	45,000	35,000	36,100	43,400	46,900
Arsenic	mg/kg	88	2.9	7.61	132	**45**	**68**	**50**	**40**	**29.8**	**15.3**	**30.7**
Cadmium	mg/kg	3,500	0.69	0.81	14	**16**	**11**	**6.7**	**9.3**	**6.08**	**4**	**4.42**
Chromium	mg/kg	5,300,000	490,000	31.88	67	65	**170**	**95**	**85**	**141**	**97.1**	**168**
Copper	mg/kg	140,000	280	28.4	217	NA	NA	NA	NA	126	70.8	**402**
Lead	mg/kg	NE	3,000	13.1	118	**140**	110	**230**	44	65.6	34.9	36.9
Mercury	mg/kg	NE	2.1	0.04	5.5	0.50 U	0.38 U	0.44 U	0.35 U	0.054	0.079	0.019
Nickel	mg/kg	70,000	130	24.54	980	NA	NA	NA	NA	**193**	126	**198**
Selenium	mg/kg	18,000	5.2	0.29	0.3	20 U	15 U	17 U	14 U	**2.3**	**1.1**	**1.6**
Zinc	mg/kg	1,100,000	6,000	80.91	360	NA	NA	NA	NA	**1,130**	**766**	**997**
Total Petroleum Hydrocarbons (TPHs)												
Diesel Range Organics	mg/kg	NE	NA	NE	2,000	**7,900**	**17,000**	**13,000**	**6,200**	**5,200 H**	950 H	1,100 H
Residual Range Organics	mg/kg	NE	NA	NE	2,000	2,000	**3,700**	1,400	670	**19,000 Z**	**3,500 Z**	**5,400 Z**

Notes:

i	Method Reporting Limit is elevated due to a matrix interference.
J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for in the summation process.
U	Chemical was not detected. The associated value represents the method reporting limit.
H	The sample holding time is immediately after sample collection. The sample was analyzed as possible after recipt by laboratory.
Z	The chromatographic fingerprint does not resemble a petroleum hydrocarbon.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

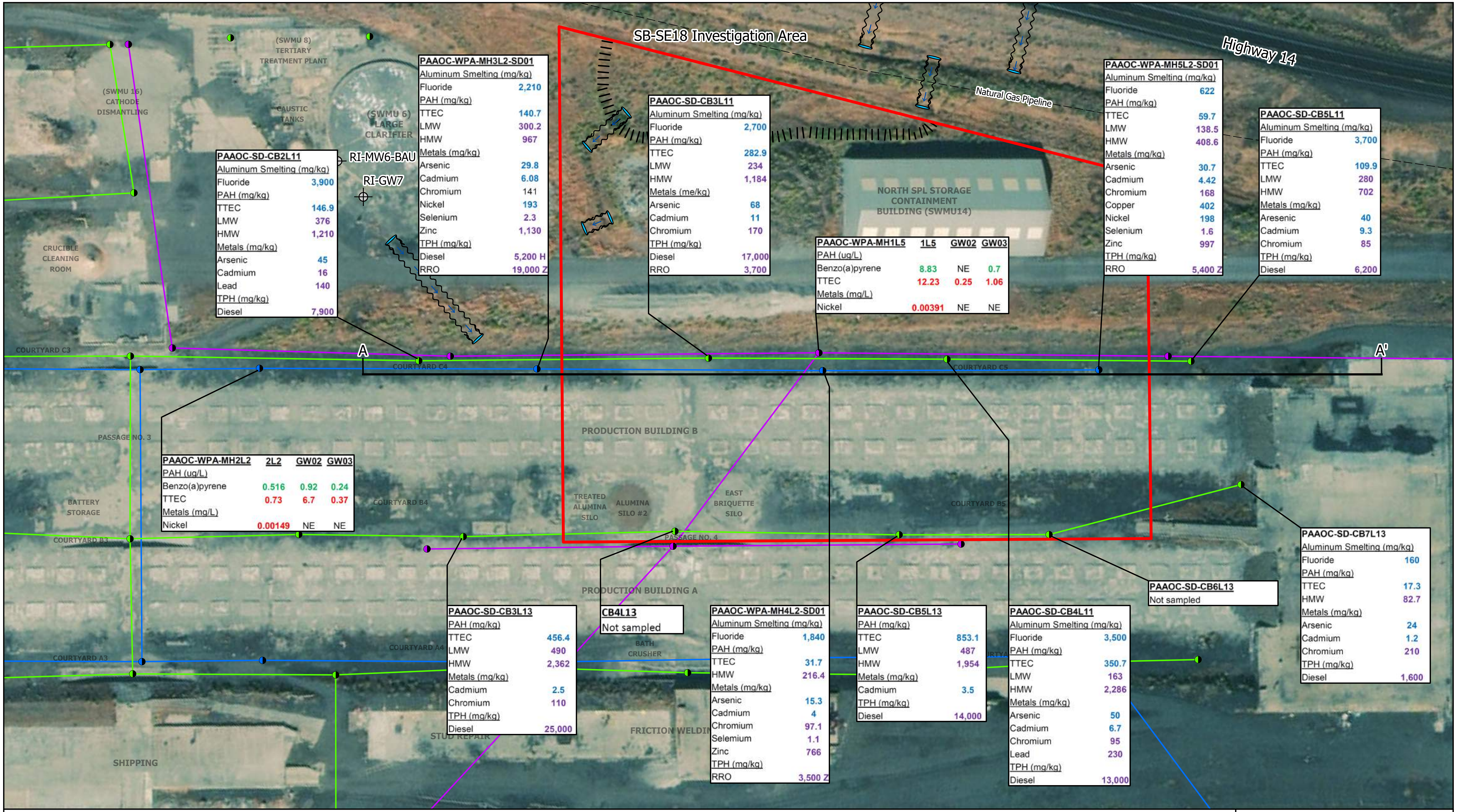
Table 2.2.7-5
PAAOC SE18 Investigation Area Courtyard Segment C5 Groundwater Collection System Water Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels				Initial RI Analytical Results		WPA Analytical Results			
Parameter Name	Units	Method C	WA MCL	Natural Background	SWMU32-GW-GWC-1L5	SWMU32-GW-GWC-2L2	PAAOC-WPA-GWC-MH2L2-GW02	PAAOC-WPA-GWC-MH2L2-GW03	PAAOC-WPA-GWC-MH1L5-GW02	PAAOC-WPA-GWC-MH1L5-GW03
Aluminum Smelting										
Cyanide, Free	mg/L	0.021	0.02	ND	0.0093	0.009	0.005 U	0.002 U	0.005 U	0.002 U
Fluoride, Total	mg/L	2.1	4	0.72	0.1 U	0.669	0.84	1.07	1.3	1.08
Sulfate	mg/L	NE	250	32	37	36	33	32	25	32
Polynuclear Aromatic Hydrocarbons (PAHs)										
1-Methylnaphthalene	ug/L	NL	NE	NE	0.0762 U	0.0762 U	0.1 U	NA	0.1 U	NA
2-Methylnaphthalene	ug/L	NL	NE	NE	0.0762 U	0.0762 U	0.1 U	0.021 U	0.1 U	0.0019 J
Acenaphthene	ug/L	NL	NE	NE	0.654	0.0381 U	0.1 U	0.0089 J	0.1 U	0.024
Acenaphthylene	ug/L	NE	NE	NE	0.0381 U	0.0381 U	0.1 U	0.0077 U	0.1 U	0.015 J
Anthracene	ug/L	NL	NE	NE	0.767	0.0381 U	0.1 U	0.021 J	0.1 U	0.065
Benzo(a)anthracene	ug/L	NL	NE	NE	5.8	0.327	0.83	0.2	0.1	0.65
Benzo(a)pyrene	ug/L	NL	0.2	NE	**8.83**	**0.516**	**0.92**	**0.24**	0.16	**0.7**
Benzo(b)fluoranthene	ug/L	NL	NE	NE	14.4	0.873	1.8	0.52	0.38	1.5
Benzo(g,h,i)perylene	ug/L	NE	NE	NE	5.64	0.397	0.87	0.28	0.27	0.73
Benzo(k)fluoranthene	ug/L	NL	NE	NE	4.72	0.318	0.47	0.16	0.11	0.45
Chrysene	ug/L	NL	NE	NE	8.75	0.498	1.4	0.35	0.2	1
Dibenzo(a,h)anthracene	ug/L	NL	NE	NE	1.71	0.1	0.15	0.06	0.038	0.16
Dibenzofuran	ug/L	NE	NE	NE	0.156	0.0381 U	NA	0.0031 J	NA	0.0076 J
Fluoranthene	ug/L	NL	NE	NE	9.36	0.493	1.1	0.37	0.16	1.1
Fluorene	ug/L	NL	NE	NE	0.303	0.0381 U	0.1 U	0.006 J	0.1 U	0.015 J
Indeno(1,2,3-cd)pyrene	ug/L	NL	NE	NE	6.47	0.436	0.88	0.29	0.25	0.78
Naphthalene	ug/L	NL	NE	NE	0.113	0.0762 U	0.1 U	0.037	0.1 U	0.054
Phenanthrene	ug/L	NE	NE	NE	3.27	0.157	0.4	0.088	0.1 U	0.25
Pyrene	ug/L	NL	NE	NE	8.49	0.463	1	0.36	0.15	1.2
TTEC cPAH (calc)	ug/L	0.2	NE	NE	**12.23**	**0.73**	**6.7**	**0.37**	**0.25**	**1.06**
Polychlorinated Biphenyls (PCBs)										
Aroclor 1016	ug/L	NL	NE	ND	0.0377 U	0.0377 U	0.05 U	0.005 U	0.019 U	0.005 U
Aroclor 1221	ug/L	NE	NE	ND	0.0377 U	0.0377 U	0.05 U	0.01 U	0.019 U	0.01 U
Aroclor 1232	ug/L	NE	NE	ND	0.0377 U	0.0377 U	0.05 U	0.005 U	0.019 U	0.005 U
Aroclor 1242	ug/L	NE	NE	ND	0.0377 U	0.0377 U	0.05 U	0.005 U	0.019 U	0.005 U
Aroclor 1248	ug/L	NE	NE	ND	0.0377 U	0.0377 U	0.05 U	0.005 U	0.019 U	0.005 U
Aroclor 1254	ug/L	NL	NE	ND	0.0377 U	0.0377 U	0.05 U	0.005 U	0.019 U	0.005 U
Aroclor 1260	ug/L	NL	NE	ND	0.0377 U	0.0377 U	0.05 U	0.005 U	0.019 U	0.005 U
Total PCBs (calc)	ug/L	0.44	0.5	ND	0.0377	0.0377	0.05	0.005	0.019	0.005
Metals										
Aluminum	mg/L	35	NE	1.14	1.5	0.393	0.1 U	0.0895	5.30	0.0
Arsenic	mg/L	0.00058	0.01	0.0069	0.00185	0.00109	0.0033 U	0.00147	0.0099	0.00135
Cadmium	mg/L	0.018	0.05	NE	0.0000002 U	0.0000002 U	0.0044 U	0.000028	0.0044 U	0.00002
Chromium	mg/L	53	0.1	0.03	0.00206	0.00103	0.011 U	0.0008	0.011 U	0.00053
Copper	mg/L	1.4	13	NE	0.00573	0.0028	0.011 U	0.0014	0.011 U	0.00022
Lead	mg/L	NE	0.015	0.00046	0.00349	0.0021	0.0011 U	0.00023	0.0073	0.000061
Mercury	mg/L	NE	0.002	NE	0.00008 U	0.00008 U	0.0005 U	0.0002 U	0.0005 U	0.0002 U
Nickel	mg/L	0.00096	0.1	0.065	**0.00391**	**0.00149**	0.022 U	0.0003	0.022 U	0.00008 J
Selenium	mg/L	0.18	0.05	NE	0.001 U	0.001 U	0.0056 U	0.0007 J	0.0056 U	0.0006 J
Zinc	mg/L	11	NE	NE	0.428	0.041	0.028 U	0.0042	0.15	0.0031
Volatile Organic Compounds (VOCs)										
Benzene	ug/L	70	5	NE	NA	NA	0.2 U	NA	0.2 U	NA
Toluene	ug/L	1,400	1,000	NE	NA	NA	1 U	NA	1 U	NA
Ethylbenzene	ug/L	1,800	700	NE	NA	NA	0.2 U	NA	0.2 U	NA
m,p-Xylene	ug/L	3,500	10,000	NE	NA	NA	0.4 U	NA	0.4 U	NA
o-Xylene	ug/L	3,500	10,000	NE	NA	NA	0.2 U	NA	0.2 U	NA
1,1,1-Trichloroethane	ug/L	35,000	200	NE	NA	NA	0.2 U	NA	0.2 U	NA
Cis-1,2-Dichloroethene	ug/L	35	70	NE	NA	NA	0.2 U	NA	0.2 U	NA
Tetrachloroethene	ug/L	105	5	NE	NA	NA	0.2 U	NA	0.2 U	NA
Trichloroethene	ug/L	8.8	5	NE	NA	NA	0.2 U	NA	0.2 U	NA
Vinyl Chloride	ug/L	0.29	2	NE	NA	NA	0.2 U	NA	0.2 U	NA
Total Petroleum Hydrocarbons (TPHs)										
Gasoline Range Organics	mg/L	NE	NE	NE	0.1 U	0.1 U	0.1 U	NA	0.11 U	NA
Diesel Range Organics	mg/L	NE	NE	NE	0.19 U	0.19 U	0.25 U	0.015 J	0.27 U	0.016 J
Residual Range Organics	mg/L	NE	NE	NE	0.381 U	0.381 U	0.4 U	0.036 J	0.43 U	0.045 J

Notes:

J	Estimated concentration.
MCL	Maximum Contaminant Level.
NA	Not applicalbe or not analyzed.
ND	Not detected.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
U	Chemical was not detected. The associated value represents the method reporting limit.

Detected concentrations shown in **bold** exceed one or more site groundwater screening levels.



PAAOC-SD-CB2L11	
Aluminum Smelting (mg/kg)	
Fluoride	3,900
PAH (mg/kg)	
TTEC	146.9
LMW	376
HMW	1,210
Metals (mg/kg)	
Arsenic	45
Cadmium	16
Lead	140
TPH (mg/kg)	
Diesel	7,900

PAAOC-WPA-MH3L2-SD01	
Aluminum Smelting (mg/kg)	
Fluoride	2,210
PAH (mg/kg)	
TTEC	140.7
LMW	300.2
HMW	967
Metals (mg/kg)	
Arsenic	29.8
Cadmium	6.08
Chromium	141
Nickel	193
Selenium	2.3
Zinc	1,130
TPH (mg/kg)	
Diesel	5,200 H
RRO	19,000 Z

PAAOC-SD-CB3L11	
Aluminum Smelting (mg/kg)	
Fluoride	2,700
PAH (mg/kg)	
TTEC	282.9
LMW	234
HMW	1,184
Metals (me/kg)	
Arsenic	68
Cadmium	11
Chromium	170
TPH (mg/kg)	
Diesel	17,000
RRO	3,700

PAAOC-WPA-MH1L5	**1L5**	**GW02**	**GW03**
PAH (ug/L)			
Benzo(a)pyrene	8.83	NE	0.7
TTEC	12.23	0.25	1.06
Metals (mg/L)			
Nickel	0.00391	NE	NE

PAAOC-WPA-MH5L2-SD01	
Aluminum Smelting (mg/kg)	
Fluoride	622
PAH (mg/kg)	
TTEC	59.7
LMW	138.5
HMW	408.6
Metals (mg/kg)	
Arsenic	30.7
Cadmium	4.42
Chromium	168
Copper	402
Nickel	198
Selenium	1.6
Zinc	997
TPH (mg/kg)	
RRO	5,400 Z

PAAOC-SD-CB5L11	
Aluminum Smelting (mg/kg)	
Fluoride	3,700
PAH (mg/kg)	
TTEC	109.9
LMW	280
HMW	702
Metals (mg/kg)	
Aresenic	40
Cadmium	9.3
Chromium	85
TPH (mg/kg)	
Diesel	6,200

PAAOC-WPA-MH2L2	**2L2**	**GW02**	**GW03**
PAH (ug/L)			
Benzo(a)pyrene	0.516	0.92	0.24
TTEC	0.73	6.7	0.37
Metals (mg/L)			
Nickel	0.00149	NE	NE

PAAOC-SD-CB6L13	
Not sampled	

PAAOC-SD-CB7L13	
Aluminum Smelting (mg/kg)	
Fluoride	160
PAH (mg/kg)	
TTEC	17.3
HMW	82.7
Metals (mg/kg)	
Arsenic	24
Cadmium	1.2
Chromium	210
TPH (mg/kg)	
Diesel	1,600

PAAOC-SD-CB3L13	
PAH (mg/kg)	
TTEC	456.4
LMW	490
HMW	2,362
Metals (mg/kg)	
Cadmium	2.5
Chromium	110
TPH (mg/kg)	
Diesel	25,000

CB4L13	
Not sampled	

PAAOC-WPA-MH4L2-SD01	
Aluminum Smelting (mg/kg)	
Fluoride	1,840
PAH (mg/kg)	
TTEC	31.7
HMW	216.4
Metals (mg/kg)	
Arsenic	15.3
Cadmium	4
Chromium	97.1
Selemium	1.1
Zinc	766
TPH (mg/kg)	
RRO	3,500 Z

PAAOC-SD-CB5L13	
PAH (mg/kg)	
TTEC	853.1
LMW	487
HMW	1,954
Metals (mg/kg)	
Cadmium	3.5
TPH (mg/kg)	
Diesel	14,000

PAAOC-SD-CB4L11	
Aluminum Smelting (mg/kg)	
Fluoride	3,500
PAH (mg/kg)	
TTEC	350.7
LMW	163
HMW	2,286
Metals (mg/kg)	
Arsenic	50
Cadmium	6.7
Chromium	95
Lead	230
TPH (mg/kg)	
Diesel	13,000

Stormwater Line Catch Basin
Stormwater Line
Groundwater Collection Line Manhole
Groundwater Collection Line
Scrubber Effluent Line Manhole
Scrubber Effluent Line
Natural Gas Pipeline
Culvert w/Flow Direction
Culvert Opening
Berm
SB-SE18 Investigation Area
Cross Section A-A'

Soil Screening Levels
blue: Exceeds Protection of Groundwater
purple: Exceeds Ecological Wildlife

J: Estimated concentration
D: Duplicate sample
Z: Chromatographic fingerprint does not resemble a petroleum hydrocarbon
RRO: Residual range organics
2: Sample depths in feet

Water Screening Levels
red: Exceeds MTCA Method C
green: Exceeds WA MCL

Figure 2.2.7-3

Plant Area AOC

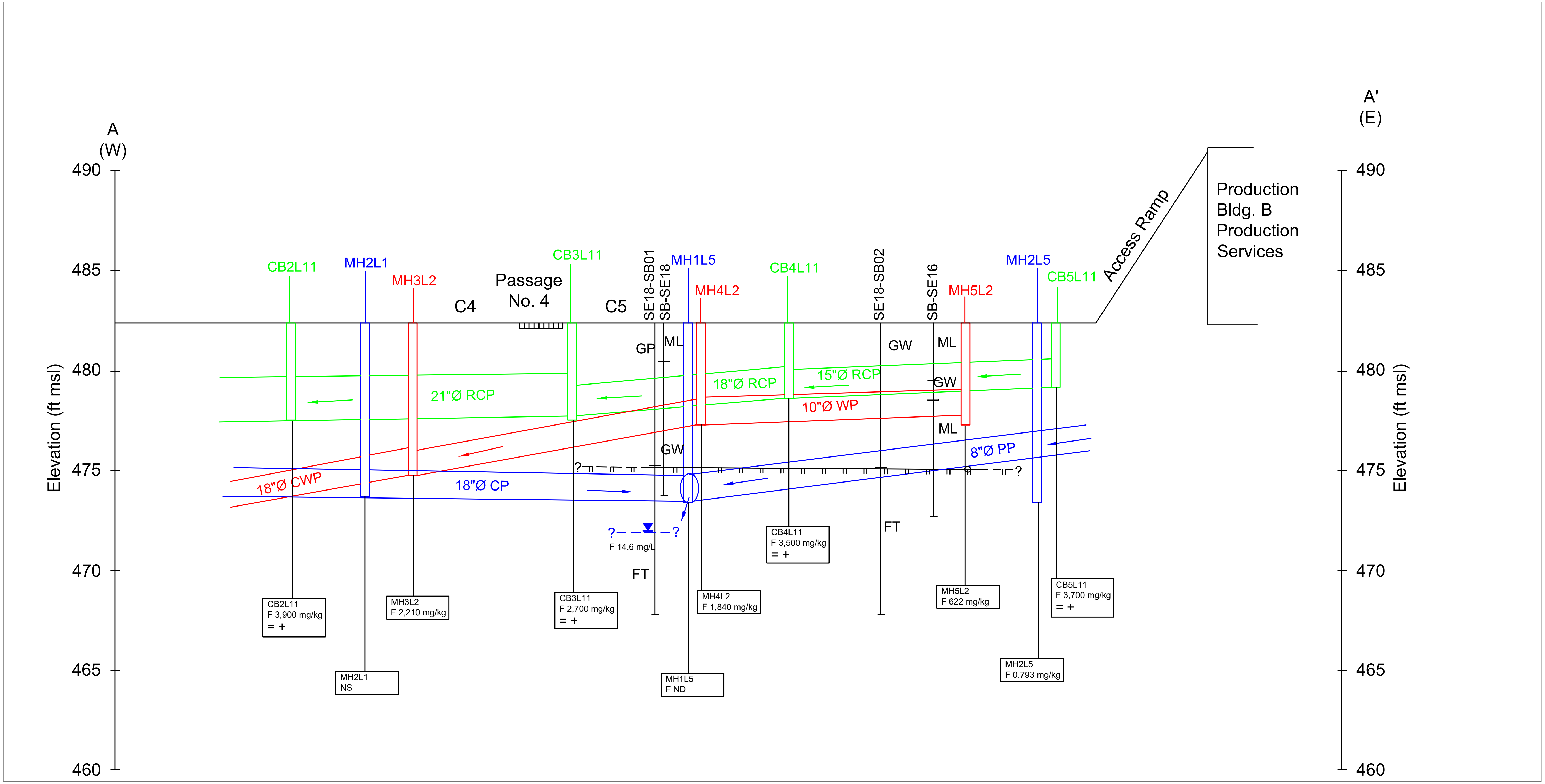
Stormwater, Groundwater Collection, and Scrubber Effluent Lines Sediment and Water Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Maxar, Microsoft

The lines beneath segments C4 and C5 are shown on Cross-Section A-A’ in Figure 2.2.7-4 and include the Groundwater Collection Line 1 (C4) and 2 (C5), Scrubber Effluent Line 2, and Stormwater Line 11. As can be seen in the cross-section, the inverts of the lines are above the local water levels of approximately 472 ft elevation. Concentrations of fluoride detected in sediment and water that exceed soil and water screening levels are shown on the cross-section. Fluoride concentrations range from 1,040 to 3,900 mg/kg and were detected in stormwater catch basins and scrubber effluent manholes. Most of the stormwater catch basins were cleaned in 2011. There is no evidence through video survey or other observations of leakage in any of the three system lines in segments C4 and C5. There is also no evidence of breaches in the Scrubber Effluent line, and no corresponding detection of other COPCs in shallow groundwater that exceed the MTCA Method C or WA MCL water screening levels. While there is no evidence of leakage and the catch basins were cleaned, it is possibly the stormwater line could be a historic source of contamination to the subsurface.

The most likely source of sulfate onsite is the wastewater treatment system, including the Tertiary Treatment Plant and associated piping, and two dry/wet scrubbers present in Courtyard Segments D2 and B4. The dry/wet scrubbers work in series and remove fluoride from air pollution control wastewater (the dry portion of the system) followed by removal of sulfur dioxide (the wet portion of the system) from the wastewater. Sulfur dioxide oxidizes to become sulfate. A review of plant drawings A14840 and A14900 (Appendix G-3) indicate that water flow from the north dry/wet scrubber in segment D2 is to the south along Passage No. 1, then east along Courtyard B to the south dry/wet scrubber in segment B4, then continues east to Passage No. 4. Water flow from Passage No. 4 is to the north along Passage No. 4, then west along segment C4, and finally north to the 90 ft back up clarifier near the Tertiary Treatment System. Where the lines from the south dry/wet scrubber turn west in segment C4 is approximately 120 ft west of boring SB-SE18. According to the notes on drawing A14900, the lines flowing to the backup clarifier may have contained up to 30,000 mg/L sulfate. Leakage in the dry/wet scrubber lines could release high concentrations of sulfate to the subsurface adjacent to SB-SE18, SE18-SB01, and SE18-GW20, and upgradient from SE18-SB04.



Source: Plateau Geosciences Group

Legend

🟩	Stormwater Collection System
🟥	Scrubber Effluent System
🟦	Groundwater Collection System
←	Flow direction
C4	Courtyard segment
F 3,900	Fluoride concentration
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
ND	Not detected
NS	Not sampled
=	Pre-RI analytical data
+	Stormwater catch basin cleaned in 2011

▼	Water level
┬┬	Interpreted basalt surface
GF	Gravel, poorly sorted
GW	Gravel, well sorted
ML	Silt, low plasticity
FT	Flow top

0 50 100 200
HORIZONTAL SCALE IN FEET

Figure 2.2.7-4

PAAOC SB-SE18 Investigation Area
Cross Section A-A'

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

2.2.7.3 Conclusions and Recommendations

The SB-SE18 Investigation Area was designated based on an elevated concentration of sulfate detected in one sample at the total depth of this boring. In addition, this area also is within a sitewide fluoride plume in shallow groundwater. Therefore, the objective for this investigation area was to identify potential sources of fluoride and sulfate soil contamination to shallow groundwater. The following are conclusions based on results of the SB-SE18 investigation:

- Sulfate was detected in initial RI boring SB-SE18 at 9 ft bgs at 2,200 mg/kg exceeding the protection of groundwater screening level.
- A soil source of sulfate contamination to shallow groundwater was not identified. Sulfate was not detected in WPA soil samples at concentrations that exceed the protection of groundwater screening level and was not detected in a grab groundwater sample adjacent to initial RI boring SB-SE18. Sulfate exceedance may likely be related to the previous dry/wet scrubbers and associated piping in passage no. 4.
- A soil source of fluoride contamination to shallow groundwater was not identified. Fluoride was detected in two grab groundwater samples SE18-SB01-GW01 at 14.6 mg/L and SE18-SB04-GW01 and SE18-SB04-GW01D at 9.92 mg/L and 10.1 mg/L, respectively, that are approximately twice the expected concentration for this area of the fluoride plume in shallow groundwater and was the basis for additional step-out investigation. Fluoride was not detected in SWMU 14 soil samples or in WPA soil samples at concentrations that would serve as a significant soil source of contamination to shallow groundwater.
- Groundwater Collection, Scrubber Effluent, and Stormwater Collection lines present beneath Courtyard Segments C4 and C5 are not likely sources of fluoride or sulfate contamination to shallow groundwater. The three system lines are well above the local measured water table, no evidence exists for breaches or leakage from the lines, and there are no corresponding elevated concentrations in groundwater of other COPCs that are present in the lines at concentrations that exceed soil or water screening levels.
- Surface runoff originating most likely from Highway 14 to the north is not a likely source of fluoride or sulfate contamination to shallow groundwater but may be a water contribution to shallow groundwater. Samples of surface soil in the pathway of the surface runoff did not detect concentrations of fluoride or sulfate at concentrations that exceed soil screening levels.
- Concentrations of fluoride and sulfate detected in WPA groundwater samples do not appear to result from soil sources of contamination in the SE18 Investigation Area. More likely, they result from potential leakage from piping associated with the wastewater treatment system. For fluoride the most likely source is the Tertiary Treatment Plant and associated piping in the Crucible Cleaning Room Investigation Area (Section 2.2.1). For

sulfate the most likely source is the return lines running from the south dry/wet scrubber in segment B4 north along Passage No. 4 that passes within 120 ft of SB-SE18, SE18-SB01 and SE18-GW20, and upgradient from SE18-SB04 and connects north to the 90 ft back up clarifier near the Tertiary Treatment System.

The SB-SE18 Investigation Area is recommended for further evaluation in the FS for fluoride, sulfate, and PAH contamination in two deeper samples but does not appear to be a soil source of contamination to shallow groundwater for fluoride or sulfate. Soil contamination in the Courtyard Segments, and resulting conclusions and recommendations, are addressed in the following Courtyard Segment Soil Contamination (Section 2.3.4). Soil stockpiles to the west and east of SWMU 14 are recommended for further evaluation in the FS for PAH contamination that exceed protection of groundwater and ecological wildlife soil screening levels. The Scrubber Effluent line system is discussed further in Section 2.5.4 and includes conclusions and recommendations.

2.2.8 Vertical Extent of Contaminated Soil in Courtyard Segments

Vertical extent of soil contamination in Courtyard Segments was designated as an Investigation Area based on Ecology review of the Draft RI Report (Tetra Tech et al. 2019a). The Draft RI Report presented results of investigations in the courtyards to evaluate several plant operational features associated with the courtyards as specified in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). In their comments, Ecology identified a data gap for areas where the vertical extent of soil contamination had not been defined in courtyard segments.

As discussed in Section 2.1.1 (Initial RI Investigation Program Summary), a series of borings and test pits were completed during the initial RI phase of investigation in courtyard segments to investigate plant operational features and associated soil contamination. The initial RI phase included the following focused areas of investigation:

- Operational structures that were in courtyards such as crane repair locations, product storage silos, ASTs, bag houses, and similar.
- Transformer Substations.
- SWMUs including SWMU 5, SWMU 7, SWMU 24.
- Pre-RI 2010 soil borings targeted for collection of surface soil samples.

- Pre-RI 2010 soil borings, five of which were selected for full COPC analyses of soil samples.
- Mapping and sampling of a surface layer of black soil (surface impacted soil) for evaluation of feasibility of visual separation for disposal in case the Scrubber Effluent lines in Courtyards A and C were removed.

To address Ecology's concern regarding vertical extent of soil contamination, a comprehensive evaluation was conducted for all initial RI phase sample location soil samples to determine whether detected concentrations of site COPCs exceeded soil screening levels at the deepest depths sampled. In the evaluation, initial RI data was compared to MTCA Method C, protection of groundwater, and ecological wildlife screening levels. The result of this evaluation was identification of sample locations where the vertical extent of soil contamination was not defined. Based on this comprehensive evaluation, additional WPA phase investigation was proposed (Tetra Tech et al. 2019a) to determine vertical extent of contamination at the identified initial RI sample locations.

2.2.8.1 Investigation Scope

Objectives for the WPA vertical extent investigation in the courtyard segments focused on vertical extent of PAH and TPH-Dx contamination that exceeds site soil screening levels at deepest depths sampled, and verification of thickness of surface impacted (black) soil. To address the vertical extent data gap, a total of 63 initial RI sample locations were identified for further investigation and are listed on Table 2.2.8-1 (Vertical Extent of Contamination in Courtyard Segments Investigation Area Summary of Objectives Met). The table includes the initial RI data gap sample location and Courtyard Segment, objectives for the WPA test pit and sample(s), and WPA sample names.

The WPA investigated the 63 data gap locations with backhoe test pits. The following summarizes the objectives for the investigation of the 63 data gap locations:

- At 48 of the 63 data gap locations where the vertical extent of contamination had not been defined, one soil sample was collected during the WPA phase at least 2 ft below the deepest depth that was sampled during the initial RI phase.
- At 11 of the 63 data gap locations where the vertical extent of contamination was defined, no additional soil sampling was proposed, and the objective was to confirm the presence and measure the thickness of the surface impacted soil.
- Four of the 63 data gap locations had not been previously sampled, therefore the WPA investigation was to collect one or two soil samples to provide additional soil data in addition to confirming the presence and measure the thickness of surface impacted soil.

Table 2.2.8-1
Vertical Extent of Contamination in Courtyard Segments Investigation Area Summary of Objectives Met
Columbia Gorge Aluminum Smelter, Goldendale, Washington

Page 1 of 2

Data Gap: Vertical Extent not Defined		WPA Objectives for Vertical Extent			WPA Sample Name	WPA Vertical Extent of Contamination Defined Using jMost Restrictive Plant Area AOC Soil Screening Levels					Other COPCs Exceeding Plant Area AOC Soil Screening Levels
Courtyard Segment	**Initial RI Sample Station**	**PAH**	**TPH-Dx**	**Surface Impacted Soil Thickness**		**PAH: TTEC Protection of Groundwater (3.9 mg/kg)**	**PAH: LMW Ecological Wildlife (100 mg/kg)**	**PAH: HMW Ecological Wildlife (1.1 mg/kg)**	**TPH-Dx Ecological Wildlife (2,000 mg/kg)**	**Surface Impacted Soil Thickness, ft**	
A1	T8A	x		x	PAAOC-WPA-A1-TP01-4.0	Y: <SL	Y: <SL	Y: <SL	Y: <SL	0	
	T8B	x		x	PAAOC-WPA-A1-TP02-4.0	Y: <SL	Y: <SL	N: 3.1	Y: <SL	0	
	MM04			x	PAAOC-WPA-A1-TP03 (NS)	NS	NS	NS	NS	0-2	
A2	T9B	x	x	x	PAAOC-WPA-A2-TP04-4.0	Y: <SL	Y: <SL	N: 4.21	Y: <SL	0	Fluoride 153 (mg/kg)
	T9C	x	x	x	PAAOC-WPA-A2-TP05-4.0	Y: <SL	Y: <SL	Y: <SL	Y: <SL	0-1.8	Fluoride 239, Zn 1,280 (mg/kg)
	SE03			x	PAAOC-WPA-A2-TP06 (NS)	NS	NS	NS	NS	0-1	
	BS01-BS	x		x	PAAOC-WPA-A2-TP07-4.0	N: 8.27	Y: <SL	N: 52.9	Y: <SL	0-0.5	Fluoride 1,040, Cd 1.62, Se 0.5 J Zn 656 (mg/kg)
A3	T27/ABC	x		x	PAAOC-WPA-A3-TP08-4.0	Y: <SL	Y: <SL	N: 4.25	Y: <SL	0	
	T27/ABC	x		x	PAAOC-WPA-A3-TP09-4.0	Y: <SL	Y: <SL	N: 1.15	Y: <SL	0	
	T26/AB	x		x	PAAOC-WPA-A3-TP10-4.0	Y: <SL	Y: <SL	N: 16.16	Y: <SL	0	
					PAAOC-WPA-A3-TP10-4.0D			N: 15.21			Cd 1.06 (mg/kg)
	T17/AB	x		x	PAAOC-WPA-A3-TP11-4.0	Y: <SL	Y: <SL	N: 7.35	Y: <SL	0	
	T10A	x	x	x	PAAOC-WPA-A3-TP12-4.0	N: 6.1	Y: <SL	N: 33.21	Y: <SL	0	Fluoride 275, Cd 0.99 (mg/kg)
	SE05			x	PAAOC-WPA-A3-TP13 (NS)	NS	NS	NS	NS	0-1	
A4	BC01			x	PAAOC-WPA-A4-TP14 (NS)	NS	NS	NS	NS	0-0.5	
A5	SE14			x	PAAOC-WPA-A5-TP15 (NS)	NS	NS	NS	NS	0-1	
	SWMU24-03			x	PAAOC-WPA-A5-TP16 (NS)	NS	NS	NS	NS	0-1	
	BS02-BS	x	x	x	PAAOC-WPA-A5-TP17-4.0	N: 3.95	Y: <SL	N: 18.35	Y: <SL	0-1	
	BS03-BS	x	x	x	PAAOC-WPA-A5-TP18-4.0	N: 17.6	Y: <SL	N: 87.5	Y: <SL	0-2	Fluoride 407 (mg/kg)
B1	T1A	x		x	PAAOC-WPA-B1-TP19-4.0	Y: <SL	Y: <SL	N: 5.98	Y: <SL	0-1	
	T1B	x		x	PAAOC-WPA-B1-TP20-4.0	Y: <SL	Y: <SL	N: 2.42	Y: <SL	0-1	
	B29-SS	x	x	x	PAAOC-WPA-B1-TP21-4.0	Y: <SL	Y: <SL	N: 10.87	Y: <SL	0	
	B30-SS	x	x	x	PAAOC-WPA-B1-TP22-4.0	N: 6.25	Y: <SL	N: 31.62	Y: <SL	0-2	
	BH04	x		x	PAAOC-WPA-B1-TP23 (NS)	NS	NS	NS	NS	0	
B2	B32-SS	x	x	x	PAAOC-WPA-B2-TP24-4.0	Y: <SL	Y: <SL	N: 22.5	Y: <SL	0-0.3	
	B33-SS	x	x	x	PAAOC-WPA-B2-TP25-4.0	Y: <SL	Y: <SL	N: 9.28	Y: <SL	0	
B3	B34-SS	x	x	x	PAAOC-WPA-B3-TP26-4.0	N: 13.26	Y: <SL	N: 65.9	Y: <SL	0-3	
	B35-SS	x	x	x	PAAOC-WPA-B3-TP27-4.0	Y: <SL	Y: <SL	N: 3.56	Y: <SL	0-0.1	
	B36-SS	x	x	x	PAAOC-WPA-B3-TP28-4.0	N: 4.57	Y: <SL	N: 23.47	Y: <SL	0-1.5	
					PAAOC-WPA-B3-TP28-4.0D	Y: <SL	Y: <SL	N: 7.65			
B4	T4A	x	x	x	PAAOC-WPA-B4-TP29-4.0	Y: <SL	Y: <SL	N: 11.59	Y: <SL		Fluoride 210 (mg/kg)
	B37-SS	x	x	x	PAAOC-WPA-B4-TP30-4.0	Y: <SL	Y: <SL	N: 7.41	Y: <SL	0-1.8	
	B38-SS	x	x	x	PAAOC-WPA-B4-TP31-4.0	Y: <SL	Y: <SL	N: 8.25	Y: <SL	0-0.1	
	B39-SS	x	x	x	PAAOC-WPA-B4-TP32-4.0	Y: <SL	Y: <SL	N: 18.97	Y: <SL	0-1	Fluoride 239 (mg/kg)
	BS04-BS	x	x	x	PAAOC-WPA-B4-TP33-4.0	N: 6.85	Y: <SL	N: 64.9	Y: <SL	0-1.5	Fluoride 282, Cd 1.62, Se 0.6 J (mg/kg)
B5	T5-01	x	x	x	PAAOC-WPA-B5-TP34-4.0	N: 80.94	N: 139.61	N: 417	Y: <SL	0	Cd 4.47 (mg/kg)
	T5-02	x		x	PAAOC-WPA-B5-TP35-5.0	Y: <SL	Y: <SL	N: 6.34	Y: <SL	0-3	Se 0.4 J (mg/kg)
	T5-03	x		x	PAAOC-WPA-B5-TP36-5.0	N: 11.04	Y: <SL	N: 60.9	Y: <SL	0-1	Cd 1.07, Se 0.6 J (mg/kg)
	BS02-BS	x	x	x	PAAOC-WPA-B5-TP37-5.0	N: 19.81	Y: <SL	N: 95.2	Y: <SL	0	

Notes:

NS	Not Sampled, no samples proposed in WPA (Tetra Tech et al. 2019a).
<SL	Detected soil concentration is below screening level.
(New)	Test pit excavated at location where no RI test pit was previously completed.
mg/kg	Sample concentrations in milligrams per kilogram unless otherwise noted.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Highlighted cells indicate vertical extent not defined and detected concentration for deepest depth sampled.

Surface impacted soil thickness was observed and measured in each test pit at the time of excavation and sampling.

Table 2.2.8-1
Vertical Extent of Contamination in Courtyard Segments Investigation Area Summary of Objectives Met
Columbia Gorge Aluminum Smelter, Goldendale, Washington
Page 2 of 2

Data Gap: Vertical Extent not Defined		WPA Objectives for Vertical Extent			WPA Sample Name	WPA Vertical Extent of Contamination Defined Using jMost Restrictive Plant Area AOC Soil Screening Levels					Other COPCs Exceeding Plant Area AOC Soil Screening Levels
Courtyard Segment	Initial RI Sample Station	PAH	TPH-Dx	Surface Impacted Soil Thickness		PAH: TTEC Protection of Groundwater (3.9 mg/kg)	PAH: LMW Ecological Wildlife (100 mg/kg)	PAH: HMW Ecological Wildlife (1.1 mg/kg)	TPH-Dx Ecological Wildlife (2,000 mg/kg)	Surface Impacted Soil Thickness, ft	
B5 cont'd	B41-SS	x	x	x	PAAOC-WPA-B5-TP38-4.0	Y: <SL	Y: <SL	N: 5.43	Y: <SL	0-0.3	
	B43-SS	x	x	x	PAAOC-WPA-B5-TP39-4.0	N: 5.22	Y: <SL	N: 27.72	Y: <SL	0-1	
C1	CR02			x	PAAOC-WPA-C1-TP40-4.0	Y: <SL	Y: <SL	N: 2.93	Y: <SL	0-2	Fluoride 310, Cd 2.45, Se 0.6 J, Zn 367 (mg/kg)
	SE02			x	PAAOC-WPA-C1-TP41 (NS)	NS	NS	NS	NS	0-1	
C2	SE04	x	x	x	PAAOC-WPA-C2-TP42-0.5	Y: <SL	Y: <SL	N: 18.04	Y: <SL	0-1	Fluoride 719, Se 0.6 J (mg/kg)
					PAAOC-WPA-C2-TP42-4.0						Fluoride 272, sulfate 7,840 (mg/kg)
	SE04	x	x	x	PAAOC-WPA-C2-TP43-0.5	Y: <SL	Y: <SL	N: 5.48	Y: <SL	0-0.3	Fluoride 236, sulfate 9,160 (mg/kg)
					PAAOC-WPA-C2-TP43-4.0						Fluoride 162, sulfate 11,900 (mg/kg)
	SE04	x	x	x	PAAOC-WPA-C2-TP44-0.5	Y: <SL	Y: <SL	N: 14.49	Y: <SL	0-1	Fluoride 1,410, Ar 10.7, Cd 2.02, Cr 109, Se 0.68 J, Zn 541 (mg/kg)
					PAAOC-WPA-C2-TP44-0.5D						Fluoride 1,350, Ar 9.52, Cd 2.09, Cr 122, Se 0.7, Zn 557 (mg/kg)
					PAAOC-WPA-C2-TP44-4.0						Fluoride 349 (mg/kg)
C3	AST02			x	PAAOC-WPA-C3-TP45 (NS)	NS	NS	NS	NS	0-1.5	
C4	SE10			x	PAAOC-WPA-C4-TP46 (NS)	NS	NS	NS	NS	0-1.5	
C5	C5 No Test Pits										
D1	B6-SS	x	x	x	PAAOC-WPA-D1-TP47-4.0	Y: <SL	Y: <SL	Y: <SL	Y: <SL	0-1	
	B9-SS	x	x	x	PAAOC-WPA-D1-TP48-4.0	Y: <SL	Y: <SL	Y: <SL	Y: <SL	0	
D2	T21B	x		x	PAAOC-WPA-D2-TP49-3.0	Y: <SL	Y: <SL	N: 6.99	Y: <SL	0-1.3	Cd 0.837, Zn 386 (mg/kg)
	T22B	x		x	PAAOC-WPA-D2-TP50-2.66	Y: <SL	Y: <SL	N: 12.73	Y: <SL	0-1	Fluoride 162, Cd 1.62 (mg/kg)
	B10-SS	x	x	x	PAAOC-WPA-D2-TP51-4.0	Y: <SL	Y: <SL	N: 2.07	Y: <SL	0-1.5	
	B11-SS	x	x	x	PAAOC-WPA-D2-TP52-3.5	Y: <SL	Y: <SL	N: 5.83	Y: <SL	0-1	Cd 3.67 (mg/kg)
D3	B13-SS			x	PAAOC-WPA-D3-TP53 (NS)	NS	NS	NS	NS	0-0.6	
	B14-SS	x	x	x	PAAOC-WPA-D3-TP54-3.33	Y: <SL	Y: <SL	Y: <SL	Y: <SL	0-3.3	
E1	B1-SS	x	x	x	PAAOC-WPA-E1-TP55-4.0	Y: <SL	Y: <SL	N: 13.02	Y: <SL	0	Fluoride 174 (mg/kg)
	B1-SS (New)	x	x	x	PAAOC-WPA-E1-TP56-4.0	Y: <SL	Y: <SL	N: 10.65	Y: <SL	0-1.5	Fluoride 360 (mg/kg)
	B2-SS	x	x	x	PAAOC-WPA-E1-TP57-4.0	Y: <SL	Y: <SL	N: 1.92	Y: <SL	0-1	
E2	CY E2 (New)	x	x	x	PAAOC-WPA-E2-TP58-0.5	Y: <SL	Y: <SL	N: 4.78	Y: <SL	0-1	Fluoride 485 (mg/kg)
					PAAOC-WPA-E2-TP58-4.0						Fluoride 273 (mg/kg)
	B3-SS	x	x	x	PAAOC-WPA-E2-TP59-3.0	N: 6.89	Y: <SL	N: 45.8	Y: <SL	0-1.5	Fluoride 906, Cd 2.52, Cr 143, Ni 287, Se 0.4 J (mg/kg)
	CY E2 (New)	x	x	x	PAAOC-WPA-E2-TP60-0.5	Y: <SL	Y: <SL	N: 21.68	Y: <SL	0-1	Fluoride 1,080, Ar 8.93, Cd 5.43, Cr 395, Ni 171, Se 0.4 J (mg/kg)
					PAAOC-WPA-E2-TP60-4.0						Fluoride 393 (mg/kg)
					PAAOC-WPA-E2-TP60-4.0D	N: 3.97					Fluoride 362, Cd 1.04 (mg/kg)
E3	B4-SS	x	x	x	PAAOC-WPA-E3-TP61-4.0	Y: <SL	Y: <SL	N: 6.9	Y: <SL	0-2	Fluoride 335 (mg/kg)
	CY E3 (New)	x	x	x	PAAOC-WPA-E3-TP62-0.5	Y: <SL	Y: <SL	N: 7.02	Y: <SL	0-1	Fluoride 1,130, Ar 7.71, Cd 4.06, Cr 293, Ni 141, Se 0.57 J, Zn 609 (mg/kg)
					PAAOC-WPA-E3-TP62-3.75						Fluoride 254, Se 0.6 J(mg/kg)
	B5-SS	x	x	x	PAAOC-WPA-E3-TP63-3.0	N: 4.05	Y: <SL	N: 22.33	Y: <SL	0-0.5	Fluoride 591 (mg/kg)

Notes:

NS	Not Sampled, no samples proposed in WPA (Tetra Tech et al. 2019a).
<SL	Detected soil concentration is below screening level.
(New)	Test pit excavated at location where no RI test pit was previously completed.
mg/kg	Sample concentrations in milligrams per kilogram unless otherwise noted.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Highlighted cells indicate vertical extent not defined and detected concentration for deepest depth sampled.

Surface impacted soil thickness was observed and measured in each test pit at the time of excavation and sampling.

The WPA investigation of the 63 data gap locations was conducted as specified in the WPA (Tetra Tech et al. 2020b). The locations of the western WPA test pits are shown on Figure 2.2.8-1 and the locations of the eastern WPA test pits are shown on Figure 2.2.8-2. In most cases, vertical extent samples were collected at either 4 ft bgs or 5 ft bgs, which was a minimum of 2 ft deeper than the deepest initial RI sample. At the four locations where no previous samples had been collected during the initial RI soil samples were collected at 0.5 ft bgs and 4 ft bgs or 5 ft bgs. In other locations, no samples were proposed because the vertical extent of contamination was defined, and the objective was to verify thickness of surface impacted soil. All WPA test pit and sample names are listed on Table 2.2.8-1 as associated with the initial RI data gap sample location, and the sample depths are incorporated into the WPA sample names. All test pits were logged, and the test pit logs are included in Volume 5, Appendix G-2.

Test pit samples collected from former transformer substation locations were analyzed for fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. Test pit samples collected from all other sample locations were analyzed for cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx.

2.2.8.2 Investigation Results

Vertical extent of contamination in courtyard soil was investigated with a total of 63 test pits with soil samples collected as specified in the WPA (Tetra Tech et al. 2020b). Test pit locations are shown on Figure 2.2.8-1 and Figure 2.2.8-2. Results of the WPA test pit investigation of the vertical extent of soil contamination in courtyards are discussed in this section in terms of whether the objectives for the data gap investigation have been met. A detailed discussion of all analytical results for all soil samples collected in each of the 21 Courtyard Segments is presented below in the Section 2.3.

Soil analytical results are summarized in Table 2.2.8-2 (Vertical Extent of Contaminated Soil in Courtyards Investigation Area WPA Soil Results Summary). Soil results are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. Natural background concentrations for the site have been used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendix H-4, and data validation reports are included in Volume 5, Appendix I-4. All samples have been collected as proposed in the WPA (Tetra Tech et al. 2020b). Soil reporting limit objectives have been met.

🟥 WPA Test Pit

○ RI Boring

▨ RI Test Pit/Transformer Test Pit Samples

PAAOC-WPA-A3-TP13 : Test pit not sampled per WPA (TetraTech et al. 2020b)

Figure 2.2.8-1

Plant Area AOC

WPA Test Pit Locations in the Western Plant Area

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 2.2.8-2

Plant Area AOC

WPA Test Pit Locations in the Eastern Plant Area

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Table 2.2.8-2
PAAOC Vertical Extent of Contaminated Soil in Courtyards Investigation Area WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 1 of 4

	Screening Levels					Ecological Screening Levels	WPA Analytical Results															
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-WPA-A1-TP01-4.0	PAAOC-WPA-A1-TP02-4.0	PAAOC-WPA-A2-TP04-4.0	PAAOC-WPA-A2-TP05-4.0	PAAOC-WPA-A2-TP07-4.0	PAAOC-WPA-A3-TP08-4.0	PAAOC-WPA-A3-TP09-4.0	PAAOC-WPA-A3-TP10-4.0	PAAOC-WPA-A3-TP10-4.0D	PAAOC-WPA-A3-TP11-4.0	PAAOC-WPA-A3-TP12-4.0	PAAOC-WPA-A5-TP17-4.0	PAAOC-WPA-A5-TP18-4.0	PAAOC-WPA-B1-TP19-4.0	PAAOC-WPA-B1-TP20-4.0	PAAOC-WPA-B1-TP21-4.0
Aluminum Smelting																						
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	NA	NA	NA	NA	0.19 U	NA	NA	NA	NA	NA	NA	0.21 U	0.19 U	NA	0.2 U	NA
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	21.6 J	65.9 J	**153 J**	**239 J**	**1,040**	66 J	36.9 J	31.9	29.1 J	58.8 J	**275**	125 J	**407**	38.1 J	32.5 J	28.2 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	2.2 J	2.4	245	7.7	53.9	15.6	4.3	6	6.6	2.1 U	42	19.1	1,420	1.9 J	1.9 J	2.7
Polynuclear Aromatic Hydrocarbons (PAHs)																						
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0056 U	0.00093 J	0.0025 J	0.00049 J	0.0023 J	0.001 J	0.0032 J	0.016	0.016	0.0052 J	0.015	0.01	0.078	0.0076	0.0013 JB	0.0087
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0005 J	0.011	0.017	0.0026 J	0.18	0.0097	0.013	0.15	0.14	0.056	0.19	0.11	0.81	0.056	0.0093	0.081
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0056 U	0.0013 J	0.002 J	0.0061 U	0.015 J	0.0007 J	0.0054 U	0.0011 J	0.0013 J	0.00059 J	0.0032 J	0.00081 J	0.0061 J	0.00076 J	0.00041 J	0.0014 J
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0014 J	0.021	0.035	0.006 J	0.4	0.032	0.02	0.25	0.22	0.1	0.33	0.21	1.2	0.098	0.014	0.097
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.028	0.27	0.37	0.03	4.9	0.36	0.11	1.8	1.7	0.82	3.1	2.1	10	0.69	0.23	1.1
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.02	0.32	0.48	0.032	5.2	0.43	0.12	2.4	2.1	1	4.3	3	13	0.72	0.29	1.3
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.069	0.72	0.88	0.056	13	0.94	0.22	3.1	3.1	1.4	6.8	3.6	16	1.2	0.53	2.5
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.025	0.29	0.44	0.026	4.9	0.42	0.15	1.4	1.3	0.71	3.6	1.4	7.6	0.42	0.25	0.92
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.021	0.22	0.31	0.0196	3.7	0.29	0.071	0.94	0.91	0.46	1.7	1.1	6.4	0.36	0.19	0.74
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.034	0.45	0.52	0.033	7.9	0.82	0.14	1.9	1.8	0.85	3.9	2.1	11	0.82	0.29	1.4
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0056 J	0.077	0.13	0.0074	1.5	0.11	0.029	0.42	0.4	0.2	0.91	0.45	2.6	0.15	0.074	0.31
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	0.0056 U	0.003 J	0.0069	0.00079 J	0.061	0.0027 J	0.0047 J	0.043	0.037	0.015	0.052	0.004	0.22	0.017	0.0029 J	0.023
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.09	0.47	0.57	0.058	7	0.48	0.23	3.3	3.3	1.3	5.6	3.6	16	1.3	0.31	1.6
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0056 U	0.0054 J	0.011	0.0017 J	0.11	0.0057	0.0072	0.078	0.069	0.027	0.1	0.063	0.39	0.027	0.0046 J	0.033
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.027	0.37	0.59	0.035	6.5	0.5	0.16	1.9	1.8	0.94	4.8	2	9.9	0.62	0.33	1.3
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0014 JB	0.0017 JB	0.0037 J	0.0014 JB	0.038	0.0023 JB	0.0038 J	0.029	0.025	0.0087	0.026	0.02	0.13	0.012	0.0021 JB	0.018
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.0063	0.11	0.17	0.022	1.9	0.12	0.1	1	0.96	0.43	1.5	1	6	0.62	0.076	0.56
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.056	0.38	0.49	0.041	5.3	0.38	0.15	2.3	2.1	0.97	4.1	2.6	11	1	0.24	1.3
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.04	0.49	0.71	0.05	**8.27**	0.66	0.18	3.24	2.92	1.39	**6.1**	**3.95**	**17.6**	1.03	0.43	1.91
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.1	0.64	0.81	0.092	9.64	0.65	0.6	4.81	4.72	1.92	7.75	5	24.61	2.11	0.42	2.39
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.27	**3.1**	**4.21**	0.28	**52.9**	**4.25**	**1.15**	**16.16**	**15.21**	**7.35**	**33.21**	**18.35**	**87.5**	**5.98**	**2.42**	**10.87**
Polychlorinated Biphenyls (PCBs)																						
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.011 U	0.011 U	0.012 U	0.012 Ui	0.011 Ui	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.022 Ui	0.012 U	0.011 U	0.012 U	0.01 U	0.012 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.022 U	0.022 U	0.023 U	0.024 U	0.022 U	0.022 U	0.022 U	0.021 U	0.021 U	0.012 U	0.021 U	0.023 U	0.022 U	0.023 U	0.02 U	0.023 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.011 U	0.011 U	0.012 U	0.012 Ui	0.013 Ui	0.011 U	0.011 U	0.011 Ui	0.011 U	0.011 U	0.016 Ui	0.012 U	0.011 U	0.012 U	0.01 U	0.012 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.011 U	0.011 Ui	0.012 U	0.012 U	0.011 Ui	0.011 U	0.011 U	0.011 Ui	0.011 U	0.011 U	0.011 Ui	0.012 U	0.011 U	0.012 U	0.01 U	0.012 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.011 U	0.011 Ui	0.012 U	0.012 U	0.011 Ui	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 Ui	0.012 U	0.011 U	0.012 U	0.01 U	0.012 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.011 U	0.011 Ui	0.012 U	0.012 U	0.016 Ui	0.011 U	0.011 U	0.011 Ui	0.011 U	0.011 U	0.028 Ui	0.012 U	0.011 Ui	0.012 Ui	0.01 U	0.012 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.011 U	0.011 Ui	0.012 Ui	0.012 U	0.058 Ui	0.011 U	0.011 U	0.011 Ui	0.011 Ui	0.011 U	0.29	0.012 U	0.011 Ui	0.0078 J	0.01 U	0.041
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.011	0.011	0.012	0.012	0.011	0.011	0.011	0.011	0.011	0.011	0.29	0.012	0.011	0.0078	0.01	0.041
Metals																						
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	7,420	8,090	9,540	8,960	21,700	7,650	8,000	8,850	9,630	10,000	16,800	8,310	19,400	7,700	8,030	7,380
Arsenic	mg/kg	20	88	2.9	7.61	132	1.21	2.12	2.76	1.98	7.22	2.14	2.53	2.19	2.4	2.08	4.8	1.92	3.68	2.31	2.05	1.71
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.093	0.152	0.278	**1.4**	**1.62**	0.134	0.109	**1.06**	**0.973**	0.188	**0.99**	0.139	0.582	0.335	0.142	0.178
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	2.9	6.78	8.76	5.9	60.9	7.45	6.75	7.63	9.14	7.78	15	9.05	12.3	5.93	6.8	4.55
Copper	mg/kg	NA	140,000	280	28.4	217	14.6	20.9	21.9	29.9	51.5	17.5	16.7	17.7	19.7	18.3	28.9	22.7	19.4	18.7	19.4	16.1
Lead	mg/kg	1,000	NE	3,000	13.1	118	4.04	4.7	5.79	4.56	19.2	4.17	4.5	5.5	6.09	4.89	12	3.7	9.34	4.36	4.89	4.81
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.018 U	0.006 J	0.007 J	0.006 J	0.026	0.006 J	0.006 J	0.032	0.036	0.016 J	0.046	0.005 J	0.005 J	0.02 U	0.022 U	0.022 U
Nickel	mg/kg	NA	70,000	130	24.54	980	4.01	8.58	12.1	15.2	58.2	7.78	8.01	9.63	10.2	9.56	33.5	10.3	18.2	8.18	8.09	7.3
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	0.1 J	0.1 J	0.2 J	0.2 J	**0.5 J**	0.1 J	0.1 J	0.16 J	0.2 J	0.2 J	0.3 J	0.2 J	0.2 J	0.1 J	0.1 J	0.14 J
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	54	70.2	103	**1,280**	**656**	74.2	63.2	119	125	77.7	173	69.4	120	73.5	60.8	118
Total Petroleum Hydrocarbons (TPHs)																						
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	2.1 J	15 J	16 J	6.2 J	130 J	15 J	4.5 J	36 H	41 H	14 J	250 J	160 J	180 J	8.9 J	6.6 J	49 H
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	5.7 J	100 J	97 J	20 J	470 J	96 J	17 J	120 O	140 O	39 J	570 J	600 J	530 J	27 J	25 J	149 O

Notes:

B	The sample result is less than five times the blank contamination and cross-contamination is suspected.		
i	Method Reporting Limit is elevated due to a matrix interference.	O	Chromatograph fingerprint of sample resembles an oil but does not match the calibration standard.
D	The reported result is from a dilution.		
H	Holding times immediately after sampling. Samples analyzed as soon as possible after receipt by laboratory.	P	GC confirmation criteria exceeded. Relative percent difference is greater than 40%.
J	Estimated concentration.	Y	Chromatograph fingerprint of sample resembles a petroleum product eluting in approximately correct carbon range but elution pattern does not resemble the calibration standard.
NA	Not applicable or not analyzed.		
NE	Not established in lookup tables.	Z	Chromatograph fingerprint does not resemble a petroleum product.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
U	Chemical was not detected. The associated value represents the method reporting limit.	LMW PAH	Low molecular weight PAH.
Detected concentrations shown in **bold** exceed one or more site soil screening levels.		HMW PAH	High molecular weight PAH.

Table 2.2.8-2
PAAOC Vertical Extent of Contaminated Soil in Courtyards Investigation Area WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

		Screening Levels				Ecological Screening Levels	WPA Analytical Results															
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-WPA-B1-TP22-4.0**	**PAAOC-WPA-B2-TP24-4.0**	**PAAOC-WPA-B2-TP25-4.0**	**PAAOC-WPA-B3-TP26-4.0**	**PAAOC-WPA-B3-TP27-4.0**	**PAAOC-WPA-B3-TP28-4.0**	**PAAOC-WPA-B3-TP28-4.0D**	**PAAOC-WPA-B4-TP29-4.0**	**PAAOC-WPA-B4-TP30-4.0**	**PAAOC-WPA-B4-TP31-4.0**	**PAAOC-WPA-B4-TP32-4.0**	**PAAOC-WPA-B4-TP33-4.0**	**PAAOC-WPA-B5-TP34-4.0**	**PAAOC-WPA-B5-TP35-5.0**	**PAAOC-WPA-B5-TP36-5.0**	**PAAOC-WPA-B5-TP37-5.0**
Aluminum Smelting																						
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.2 U	0.2 U	0.19 U	0.19 U	0.19 U	0.2 U	0.19 U	NA	0.21 U	0.21 U	0.2 U	0.21 U	NA	NA	NA	0.21 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	37.6 J	22.2 J	35.5 J	108 J	38.8 J	117 J	80 J	**210 J**	53.6 J	53 J	**239**	**282**	103 J	41.6 J	73.2 J	28.4
Sulfate	mg/kg	NA	NE	2,150	NE	NE	5.5	116	10.6	23	4.5	27.3	17.5 J	114	9	7.9	32.9	49.9	52.8	3.1	14.5	4.7
Polynuclear Aromatic Hydrocarbons (PAHs)																						
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.052	0.0029 J	0.0059	0.024 J	0.0014 J	0.02 J	0.0073 J	0.0042 J	0.0042 J	0.0056 J	0.0072	0.29 U	0.48	0.0034 J	0.046	0.067 J
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.34	0.031	0.09	0.3	0.0087	0.16 J	0.053 J	0.056	0.038	0.054	0.083	0.17 J	5.5	0.038	0.52	0.97
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0024 J	0.00067 J	0.00057 J	0.0042 J	0.0016 J	0.0015 J	0.00059 J	0.00065 J	0.00043 J	0.00048 J	0.00086 J	0.29 U	0.026 J	0.00054 J	0.0038 J	0.3 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.36	0.066	0.22	0.57	0.017	0.2 J	0.066 J	0.0095	0.058	0.088	0.18	0.31	7.2	0.058	0.76	2.4
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	4	2	1.2	7.3	0.41	2.3 J	0.83 J	1.2 J	0.72	0.93	1.8	5.5	52	0.64	6.5	12
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	4.6	1.2	1.4	9.8	0.52	3.3 J	1.1 J	1.5 J	0.98	1.2	1.7	3.7	60	0.79	7.9	15
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	5.8	5.4	1.6	12	0.67	4.7 J	1.4 J	2.2 J	1.4	1.5	4.7	14	82	1.3	12	16
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	2.7	1.1	0.71	6	0.36	2.2 J	0.76 J	1 J	0.75	0.75	1.4	3.9	25	0.57	5.5	7.2
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	1.8	1.2	0.55	4.2	0.23	1.4 J	0.48 J	0.82 J	0.5	0.57	1.2	3.8	26	0.44	3.9	5.9
Chrysene	mg/kg	NA	NL	NL	NE	NL	4	7.7	1.1	8	0.42	2.9 J	0.92 J	1.8 J	0.92	1	3.7	22	54	0.83	7.7	11
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.82	0.4	0.22	1.9	0.1	0.67 J	0.23 J	0.27	0.19	0.21	0.47	1.1	10	0.16	1.5	2.1
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	0.12	0.012	0.032	0.093	0.0024 J	0.045 J	0.018 J	0.016	0.013	0.018	0.028	0.29 U	1.7	0.012	0.17	0.35
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	6	3	1.9	10	0.48	3.7 J	1.1 J	1.7	0.95	1.3	3	6.9	82	0.9	9.4	21
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.19	0.016	0.058	0.17	0.0039 J	0.067 J	0.026 J	0.027 J	0.02	0.027	0.046	0.08 J	3	0.018	0.28	0.6
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	3.7	1.5	1.1	8.4	0.46	3.3 J	1 J	1.3 J	0.96	0.99	1.9	4.9	34	0.68	6.7	11
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.09	0.0052 J	0.012	0.046	0.0027 JB	0.032 J	0.0097 J	0.0097	0.0095	0.014	0.014	0.064 JB	0.88	0.0065	0.091	0.18 J
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	1.9	0.39	0.76	3.2	0.078	1 J	0.38 J	0.5	0.3	0.47	0.74	1.5	41	0.34	4.1	8.9
Pyrene	mg/kg	NA	110,000	650	NE	NL	4.2	2	1.4	8.3	0.39	2.7 J	0.93 J	1.5 J	0.82	1.1	2.1	6	74	0.93	9.2	15
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**6.25**	2.33	1.88	**13.26**	0.71	**4.57**	1.5	2.1	1.37	1.63	2.74	**6.85**	**80.94**	1.12	**11.04**	**19.81**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	8.88	3.66	3.04	14.02	0.76	5.16	1.64	2.3	1.38	2.06	4.06	9.02	**139.61**	1.36	15.16	34.05
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**31.62**	**22.5**	**9.28**	**65.9**	**3.56**	**23.47**	**7.65**	**11.59**	**7.41**	**8.25**	**18.97**	**64.9**	**417**	**6.34**	**60.9**	**95.2**
Polychlorinated Biphenyls (PCBs)																						
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.012 U	0.012 U	0.011 Ui	0.012 U	0.012 Ui	0.011 Ui	0.011 U	0.012 U	0.013 U	0.012 U	0.012 U	0.012 U	0.11 U	0.11 U	0.056 U	0.012 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.023 U	0.023 U	0.022 U	0.023 U	0.023 U	0.022 U	0.021 U	0.024 U	0.025 U	0.023 U	0.023 U	0.023 U	0.22 U	0.22 U	0.12 U	0.024 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.012 U	0.013 U	0.011 U	0.012 U	0.012 U	0.011 Ui	0.011 U	0.012 U	0.013 U	0.012 U	0.012 U	0.012 U	0.11 Ui	0.11 U	0.056 U	0.012 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.012 U	0.0082 J	0.011 Ui	0.0077 J	0.012 U	0.011 Ui	0.011 U	0.0061 J	0.013 U	0.012 U	0.069	0.013 JP	0.11 U	0.11 U	0.056 U	0.012 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.012 U	0.012 U	0.011 Ui	0.012 U	0.012 U	0.011 Ui	0.011 U	0.012 U	0.013 U	0.012 U	0.012 U	0.012 U	0.11 U	0.11 U	0.056 U	0.021
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.012 U	0.012 U	0.011 Ui	0.012 Ui	0.012 U	0.011 Ui	0.011 U	0.012 U	0.013 U	0.012 U	0.012 U	0.012 U	0.11 Ui	0.11 U	0.056 U	0.012 Ui
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.012 U	0.012 Ui	0.011 U	0.017 JP	0.013	0.011 Ui	0.011 U	0.012 U	0.0081 JP	0.012 U	0.012 U	0.012 U	0.16 JPD	0.011 J	0.062 JPD	0.012 Ui
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.012	0.0082	0.011	0.0247	0.013	0.011	0.011	0.0061	0.0081	0.012	0.069	0.013	0.16	0.011	0.062	0.021
0.011																						
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	8,270	10,200	7,370	11,000	7,580	7,590	7,060	10,600	9,640	10,700	17,200	12,900	20,700	7,950	9,080	9,700
Arsenic	mg/kg	20	88	2.9	7.61	132	1.93	2.77	1.58	2.96	2.98	2.81 J	1.72 J	2.05	2.42	2.61	3.96	4.61	2.22	3.68	4.19	2.41
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.115	0.134	0.134	0.41	0.147	0.196 J	0.137 J	0.141	0.189	0.181	0.802	**1.62**	**4.47**	0.408	**1.07**	0.237
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	7.30	11.3	6.3	20.8	8.82	7	7.4	10.6	9.56	11.8	21.5	44.8	9.75 J	6.64 J	6.17 J	8.49
Copper	mg/kg	NA	140,000	280	28.4	217	17.9	18.1	17.3	28.9	20.6	22.3	20.7	21	23.3	21	47.5	33.3	24.3	19.8	27.3	20.4
Lead	mg/kg	1,000	NE	3,000	13.1	118	4.47	5.89	4.29	8.38	4.62	6.85 J	5.09 J	4.74	4.91	5.23	10.1	14.4	12.1	4.56	6.12	6.76
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.022 U	0.005 J	0.004 J	0.032	0.006 J	0.007 J	0.014 J	0.008 J	0.006 J	0.005 J	0.014 J	0.037	0.02 U	0.019 U	0.019 U	0.0007 J
Nickel	mg/kg	NA	70,000	130	24.54	980	7.25	12.1	6.64	21	8.79	12.4 J	8.55 J	11.3	10.7	12.5	29.4	55.1	13.7 J	9.15 J	11.9 J	12
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	0.1 J	0.2 J	0.1 J	0.3 J	0.1 J	0.1 J	0.1 J	0.2 J	0.2 J	0.2 J	0.2 J	**0.6 J**	0.2 J	**0.4 J**	**0.6 J**	0.2 J
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	75.8	60.1	68	106	71.2	64.2	62	86.9	80.1	77	165	249	249	65.5	87.8	80
Total Petroleum Hydrocarbons (TPHs)																						
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	72 H	17 J	22 J	110 J	7.5 J	54 JZ	16 J	48 H	13 J	18 J	80 J	110 J	370 Z	20 J	190 Z	390 H
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	230 O	59 J	83 J	510 J	30 J	250 JZ	58 J	170 Z	43 J	75 J	250 J	470 J	1,500 Z	82 J	460 O	1,200 J

Notes:

B	The sample result is less than five times the blank contamination and cross-contamination is suspected.
i	Method Reporting Limit is elevated due to a matrix interference.
D	The reported result is from a dilution.
H	Holding times immediately after sampling. Samples analyzed as soon as possible after receipt by laboratory.
J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method reporting limit.

Detected concentrations shown in **bold** exceed one or more site soil screening level.

O	Chromatograph fingerprint of sample resembles an oil but does not match the calibration standard.
P	GC confirmation criteria exceeded. Relative percent difference is greater than 40%.
Y	Chromatograph fingerprint of sample resembles a petroleum product eluting in approximately correct carbon range but elution pattern does not resemble the calibration standard.
Z	Chromatograph fingerprint does not resemble a petroleum product.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Table 2.2.8-2
PAAOC Vertical Extent of Contaminated Soil in Courtyards Investigation Area WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

		Screening Levels				Ecological Screening Levels	WPA Analytical Results															
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-WPA-B5-TP38-4.0**	**PAAOC-WPA-B5-TP39-4.0**	**PAAOC-WPA-C1-TP40-4.0**	**PAAOC-WPA-C2-TP42-0.5**	**PAAOC-WPA-C2-TP42-4.0**	**PAAOC-WPA-C2-TP43-0.5**	**PAAOC-WPA-C2-TP43-4.0**	**PAAOC-WPA-C2-TP44-0.5**	**PAAOC-WPA-C2-TP44-0.5D**	**PAAOC-WPA-C2-TP44-4.0**	**PAAOC-WPA-D1-TP47-4.0**	**PAAOC-WPA-D1-TP48-4.0**	**PAAOC-WPA-D1-TP49-3.0**	**PAAOC-WPA-D2-TP50-2.66**	**PAAOC-WPA-D2-TP51-4.0**	**PAAOC-WPA-D2-TP52-3.5**
Aluminum Smelting																						
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.19 U	0.19 U	0.2 U	0.2 U	0.2 U	0.19 U	0.2 U	0.19 U	0.18 U	0.2 U	0.2 U	0.18 U	NA	NA	NA	0.2 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	111 J	131	**310**	**719 J**	**272 J**	**236 J**	**162 J**	**1,410 J**	**1,350 J**	**349 J**	27.5 J	26.5 J	103 J	**162 J**	37 J	146 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	8.1	13.5	20.3	662	**7,840 J**	**9,160**	**11,900**	80.9 J	76.6	654 J	19.7	3.4	24.5	20.1	7.7	12.6
Polynuclear Aromatic Hydrocarbons (PAHs)																						
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0018 JB	0.02 J	0.0019 J	0.0016 JB	0.0036 J	0.02	0.0012 JB	0.025 J	0.012 J	0.022	0.0011 JB	0.00099 JB	0.0032 J	0.0034 J	0.001 JB	0.001 JB
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.022	0.22	0.0077	0.016	0.048	0.16	0.017	0.38 J	0.34	0.13	0.00079 J	0.0048 J	0.02	0.014	0.0019 J	0.0033 J
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0054 U	0.0017 J	0.0009 J	0.0026 J	0.0054 J	0.0045 J	0.0021 J	0.048 J	0.027 J	0.0067	0.0055 U	0.00066 J	0.0016 J	0.0025 J	0.0004 J	0.00089 J
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.046	0.29	0.052	0.056	0.13	0.61	0.071	0.95 J	1.1	0.28	0.0025 J	0.0082	0.029	0.33	0.0039 J	0.01
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.58 J	2.9	0.28	0.77	1.6	2	0.59	10 J	7.1	1.3	0.027	0.078	0.49	0.97	0.12	0.37
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.73 J	3.8	0.35	0.79	1.6	1.7	0.61	13 J	7.3 J	1.5	0.034	0.079	0.36	0.45	0.084	0.18
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	1 J	5.2	0.63	1.5	4.2	3.2	0.96	23 J	13 J	2.8 J	0.11	0.2	1.6	3.2	0.58	1.3
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.5	2.6	0.62	0.78	1.7	1.1	0.45	14 J	6.7 J	1.5 J	0.06	0.12	0.57	0.83	0.25	0.53
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.37	1.9	0.19	0.52	1.1	0.88	0.33	6.5 J	3.8 J	0.85	0.045	0.061	0.47	0.6	0.16	0.37
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.73 J	3.5	0.36	1.1	2.7	2.4	0.78	15 J	9.4 J	1.9 J	0.037	0.12	1.5	3.1	0.43	1.5
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.13	0.72	0.11	0.2	0.44	0.33	0.12	2.8 J	1.6 J	0.34	0.018	0.028	0.16	0.23	0.0065	0.14
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	0.0087	0.071	0.0038 J	0.0038 J	0.017	0.049	0.0036 J	0.095 J	0.08	0.089	0.0017 J	0.0023 J	0.0073	0.0058	0.0019 J	0.0019 J
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.78 J	4.1	0.45	1	2	4.3	0.94	17 J	12	2.1 J	0.04	0.15	1.1	2.6	0.16	0.96
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.015	0.11	0.0064	0.0089	0.036	0.15	0.011	0.25 J	0.25	0.13	0.0019 J	0.0032 J	0.012	0.0096	0.0021 J	0.0024 J
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.58 J	3.1	0.65	0.88	2	1.4	0.54	16 J	7.6 J	1.7	0.07	0.14	0.64	0.95	0.27	0.59
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0023 JB	0.038	0.0035 J	0.0027 J	0.0042 J	0.023	0.0017 JB	0.033 J	0.021 J	0.031	0.0015 JB	0.0022 JB	0.0043 J	0.0044 J	0.0016 JB	1.4 JB
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.29	1.7	0.11	0.22	0.68	2	0.24	4.1 J	4.4	1.1 J	0.017	0.047	0.22	0.2	0.029	0.062
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.81 J	4	0.36	1.2	2.7	3.8	1.1	18 J	12	2.6 J	0.031	0.1	1.2	2.4	0.17	0.85
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	1.5	**5.22**	0.54	1.19	2.56	2.51	0.87	**18.98**	**10.7**	2.22	0.06	0.13	0.71	1.08	0.21	0.47
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	1.16	6.46	0.71	1.31	2.87	7.25	1.28	22.76	18.14	3.78	0.07	0.22	1.39	3.16	0.2	2.44
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**5.43**	**27.72**	**2.93**	**7.74**	**18.04**	**16.81**	**5.48**	**118.3**	**68.5**	**14.49**	0.43	0.93	**6.99**	**12.73**	**2.07**	**5.83**
Polychlorinated Biphenyls (PCBs)																						
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.011 U	0.055 U	0.012 U	0.11 Ui	0.012 Ui	0.011 U	0.012 U	0.051 Ui	0.05 Ui	0.013 Ui	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.012 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.021 U	0.11 U	0.023 U	0.22 U	0.023 U	0.022 U	0.023 U	0.11 U	0.1 U	0.022 U	0.022 U	0.021 U	0.022 U	0.021 U	0.022 U	0.023 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.011 U	0.055 U	0.012 U	0.11 Ui	0.012 Ui	0.011 U	0.012 U	0.051 Ui	0.05 Ui	0.013 Ui	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.012 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.011 U	0.055 U	0.012 U	0.11 Ui	0.012 Ui	0.011 U	0.012 U	0.051 Ui	0.05 U	0.013 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.012 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.011 U	0.055 U	0.012 U	0.11 Ui	0.012 Ui	0.011 U	0.012 U	0.051 Ui	0.05 Ui	0.013 Ui	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.012 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.011 U	0.055 U	0.0062 J	0.11 Ui	0.012 Ui	0.011 U	0.012 U	0.051 Ui	0.05 Ui	0.039 JP	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.012 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.011 U	0.055 U	0.012 U	0.11 U	0.012 Ui	0.011 U	0.012 U	0.051 Ui	0.05 Ui	0.013 Ui	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.012 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.011	0.055	0.0062	0.11	0.012	0.011	0.012	0.051	0.05	0.04	0.011	0.011	0.011	0.011	0.011	0.012
Metals																						
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	9,310	9,790	12,300	10,500	8,720	8,460	8,830	28,100 J	22,600 J	10,200	5,870	8,420	10,000	11,100	7,360	9,310
Arsenic	mg/kg	20	88	2.9	7.61	132	2.11	2.17	7.19	3.21	2.25	1.81	2.51	**10.7 J**	**9.52**	2.46	1.8	3.15	3.12	3.27	2.15	1.99
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.369	0.127	**2.45**	0.486	0.332	0.175	0.14	**2.02 J**	**2.09**	0.223	0.113	0.349	**0.837**	**1.62**	0.244	**3.67**
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	6.68 J	6.69	11.9	33.1 J	15.9 J	15.5 J	8.46 J	**109 J**	**122 J**	16.1 J	4.65	13.6	19.2 J	24.3 J	11.8 J	13.1 J
Copper	mg/kg	NA	140,000	280	28.4	217	17.5	20.8	22.6	67.8	20.6	18.7	16.1	160 J	166	30.2	15.7	20	30.9	34.7	17.3	22.6
Lead	mg/kg	1,000	NE	3,000	13.1	118	4.56	4.48	7.79	5.31	4.82	4.31	4.6	20.9 J	17.5	5.25	3.3	4.63	7.9	50.1	9.35	5.49
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.022 U	0.021 U	0.016 J	0.004 J	0.005 J	0.02 U	0.023 U	0.014 J	0.017 J	0.021 U	0.022 U	0.018 U	0.018 U	0.021 U	0.02 U	0.023 U
Nickel	mg/kg	NA	70,000	130	24.54	980	8.32 J	8.68	38.7	19.5 J	13.3 J	18.2 J	13.1 J	98.2 J	83.7 J	20.2 J	6.16	14.7	18.4 J	21.8 J	12.4 J	14.6 J
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	0.2 J	0.2 J	**0.6 J**	**0.4 J**	0.2 J	0.2 J	0.1 J	**0.68 J**	**0.7**	0.2 J	0.14 J	0.14 J	0.2 J	0.3 J	0.1 J	0.3 J
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	60	71.3	**367**	126	113	81.4	62.2	**541 J**	**557**	95	56.7	147	**386**	186	91.2	154
Total Petroleum Hydrocarbons (TPHs)																						
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	19 J	73 H	11 J	98 H	28 J	37 H	6.9 J	300 JH	240 H	28 H	3.7 J	16 J	40 H	55 H	6.6 J	11 J
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	66 J	210 O	51 J	870 O	120 O	130 O	19 J	1,300 JO	1,100 O	100 J	19 J	66 J	210 O	320 O	22 J	72 J

Notes:

B	The sample result is less than five times the blank contamination and cross-contamination is suspected.		
i	Method Reporting Limit is elevated due to a matrix interference.	O	Chromatograph fingerprint of sample resembles an oil but does not match
D	The reported result is from a dilution.		the calibration standard.
H	Holding times immediately after sampling. Samples analyzed as soon as possible after receipt by laboratory.	P	GC confirmation criteria exceeded. Relative percent difference is greater than 40%.
J	Estimated concentration.	Y	Chromatograph fingerprint of sample resembles a petroleum product eluting in approximately correct
NA	Not applicable or not analyzed.		carbon range but elution pattern does not resemble the calibration standard.
NE	Not established in lookup tables.	Z	Chromatograph fingerprint does not resemble a petroleum product.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
U	Chemical was not detected. The associated value represents the method reporting limit.	LMW PAH	Low molecular weight PAH.
Detected concentrations shown in **bold** exceed one or more site soil screening levels.		HMW PAH	High molecular weight PAH.

Table 2.2.8-2
PAAOC Vertical Extent of Contaminated Soil in Courtyards Investigation Area WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	WPA Analytical Results													
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-WPA-D3-TP54-3.33	PAAOC-WPA-E1-TP55-4.0	PAAOC-WPA-E1-TP56-4.0	PAAOC-WPA-E1-TP57-4.0	PAAOC-WPA-E2-TP58-0.5	PAAOC-WPA-E2-TP58-4.0	PAAOC-WPA-E2-TP59-3.0	PAAOC-WPA-E2-TP60-0.5	PAAOC-WPA-E2-TP60-4.0	PAAOC-WPA-E2-TP60-4.0D	PAAOC-WPA-E3-TP61-4.0	PAAOC-WPA-E3-TP62-0.5	PAAOC-WPA-E3-TP62-3.75	PAAOC-WPA-E3-TP63-3.0
Aluminum Smelting																				
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.98	0.2 U	0.2 U	0.19 U	0.2 U	0.2 U	0.18 U	0.18 U	0.23 U	0.23 U	0.2 U	0.18 U	0.22 U	0.2 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	32.9 J	**174 J**	**360 J**	36.6 J	**485 J**	**273 J**	**906 J**	**1,080 J**	**393 J**	**362 J**	**335 J**	**1,130 J**	**254 J**	**591**
Sulfate	mg/kg	NA	NE	2,150	NE	NE	47.5	198	26.5	4.2	14	83.7	26.2	19.8	25.9	21.7	16.8 J	56	792 J	166 J
Polynuclear Aromatic Hydrocarbons (PAHs)																				
2-Methylnaphthalene	mg/kg	NA	14,000	2	NE	NL	0.00088 JB	0.0036 J	0.0071	0.00065 JB	0.0014 JB	0.0012 JB	0.0089 JB	0.0049 J	0.0023 J	0.0048 J	0.007	0.014 J	0.0021 J	0.003 J
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0014 J	0.064	0.048	0.0044 J	0.025	0.011	0.16	0.17	0.027 J	0.078 J	0.054	0.31	0.029	0.051
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0061 U	0.0067	0.003 J	0.00078 J	0.0051 J	0.0034 J	0.033	0.016 J	0.0023 J	0.004 J	0.0015 J	0.048	0.0036 J	0.0064
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0018 J	0.26	0.2	0.021	0.1	0.03	0.51	0.8	0.13 J	0.37 J	0.2	1.1	0.077	0.29
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.049	1.8	1.1	0.21	1.1	0.44	4.6	8.6	1.3 J	2.7 J	0.88	11	0.84	2.6
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.034	1.7	1.1	0.24	1.3	0.5	4.6	8.6	1.4 J	2.9 J	0.87	13	0.93	2.9
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.23	2.5	2.2	0.35	2.2	0.99	8.6	15	1.8 J	3.8 J	1.2	17	1.2	4.2
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.067	1.2	0.88	0.18	1.1	0.5	4.2	5.7	0.88 J	1.6 J	0.52	8.1	0.56	1.6
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.059	0.86	0.68	0.12	0.74	0.36	3	4.4	0.66 J	1.2 J	0.4	6.5	0.44	1.2
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.13	1.7	1.5	0.23	1.5	0.49	6.4	9.4	1.3 J	2.8 J	0.87	12	0.88	2.9
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.019	0.36	0.29	0.051	0.28	0.13	1.1	1.7	0.25 J	0.48 J	0.15	2.7	0.17	0.53
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	0.001 J	0.015	0.016	0.0011 J	0.0057	0.0046 J	0.054	0.038	0.0055 J	0.018 J	0.022	0.079	0.0095	0.015
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.076	3.7	2.1	0.38	1.7	0.77	8.3	15	2 J	5.3 J	1.5	23	1.5	5.1
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.001 J	0.048	0.04	0.0033 J	0.017	0.0086	0.14	0.12	0.019 J	0.06 J	0.051	0.23	0.022	0.04
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.076	1.7	1.3	0.24	1.3	0.59	5	8.1	1.2 J	2.2 J	0.74	11	0.8	2.7
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.001 JB	0.0063	0.014	0.0013 JB	0.0032 J	0.0025 JB	0.017 J	0.01 J	0.0045 J	0.0089	0.017	0.028	0.0041 J	0.0069
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.015	0.88	0.74	0.074	0.46	0.25	2.9	2.8	0.43 J	1.2 J	0.64	5.2	0.5	1.2
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.095	2.5	1.6	0.3	1.9	0.78	8.3	13	1.8 J	4 J	1.3	17	1.2	3.7
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.08	2.44	1.67	0.34	1.89	0.76	**6.89**	**12.47**	1.93	**3.97**	1.22	**17.94**	1.28	**4.05**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.1	4.97	3.15	0.49	2.31	1.08	12.06	18.92	2.61	7.02	2.46	29.92	2.14	6.69
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.76	**13.02**	**10.65**	**1.92**	**11.42**	**4.78**	**45.8**	**74.5**	**10.59**	**21.68**	**6.9**	**98.3**	**7.02**	**22.33**
Polychlorinated Biphenyls (PCBs)																				
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.013 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 Ui	0.052 U	0.1 U	0.013 U	0.013 U	0.012 U	0.11 U	0.013 U	0.057 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.025 U	0.021 U	0.023 U	0.021 U	0.022 U	0.022 U	0.11 U	0.2 U	0.026 U	0.025 U	0.023 U	0.21 U	0.025 U	0.12 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.013 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 Ui	0.052 U	0.1 U	0.013 U	0.013 U	0.012 U	0.11 U	0.013 U	0.057 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.013 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 Ui	0.052 U	0.1 U	0.013 U	0.013 U	0.012 U	0.11 U	0.013 U	0.057 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.013 U	0.011 U	0.012 U	0.011 U	0.011 U	0.012 Ui	0.052 U	0.1 U	0.013 U	0.013 U	0.012 U	0.11 U	0.013 U	0.057 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.013 U	0.011 U	0.012 U	0.011 U	0.011 U	0.016 Ui	0.052 U	0.1 U	0.013 U	0.013 U	0.012 U	0.11 U	0.013 U	0.057 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.013 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 U	0.052 U	0.1 U	0.013 U	0.013 U	0.012 U	0.11 U	0.013 U	0.057 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.013	0.011	0.012	0.011	0.011	0.011	0.052	0.1	0.013	0.013	0.012	0.011	0.013	0.057
Metals																				
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	8,960	8,120	8,020	6,050	9,220	9,910	8,850	11,700	15,200 J	12,200 J	7,410	15,400	12,400	11,500
Arsenic	mg/kg	20	88	2.9	7.61	132	1.09	3.13	2.5	4.16	2.96	3.19	4.71	**8.93**	2.13	1.89	3.23	**7.71**	4.09	2.87
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.122	0.353	0.357	0.165	0.655	0.402	**2.52**	**5.43**	0.581 J	**1.04 J**	0.204	**4.06**	0.493	0.688
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	3.32 J	13.1	14.3	12.6	32.8 J	25.8 J	**143 J**	**395**	37.2	42	19.2	**293**	31.7	64.8
Copper	mg/kg	NA	140,000	280	28.4	217	17.6	15.6	18.7	16.6	23.9	21	34.1	85.3	30.6 J	23.2 J	21.5	41	25	22.5
Lead	mg/kg	1,000	NE	3,000	13.1	118	3.57	4.96	4.2	4.16	5.29	5.03	6.43	10.4	5.15	5.25	3.69	10.4	5.32	5.72
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.021 U	0.021 U	0.021 U	0.003 J	0.021 U	0.02 U	0.02 U	0.02 U	0.023 U	0.025 U	0.02 U	0.003 J	0.022 U	0.022 U
Nickel	mg/kg	NA	70,000	130	24.54	980	6.8 J	12	21.8	12.6	21.3 J	15.6 J	**287 J**	**171 J**	20 J	23.1 J	13.4 J	**141 J**	21.8 J	46.6 J
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	0.2 J	0.15 J	0.27 J	0.13 J	0.2 J	0.2 J	**0.4 J**	**0.65 J**	0.3 J	0.2 J	0.2 J	**0.57 J**	**0.6 J**	0.2 J
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	64.6	96.1	89.4	65.8	176	107	293	715	128	119	63.3	**609**	100	171
Total Petroleum Hydrocarbons (TPHs)																				
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	3.5 J	41 H	46 H	14 J	45 H	31 Y	110 H	510 H	55 H	49 H	20 J	460 H	51 H	97 J
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	11 J	110 O	150 O	31 J	150 O	55 J	350 O	1,200 O	140 O	150 O	56 J	1,500 O	150 O	260 J

Notes:

B	The sample result is less than five times the blank contamination and cross-contamination is suspected.		
i	Method Reporting Limit is elevated due to a matrix interference.	O	Chromatograph fingerprint of sample resembles an oil but does not match the calibration standard.
D	The reported result is from a dilution.		
H	Holding times immediately after sampling. Samples analyzed as soon as possible after receipt by laboratory.	P	GC confirmation criteria exceeded. Relative percent difference is greater than 40%.
J	Estimated concentration.	Y	Chromatograph fingerprint of sample resembles a petroleum product eluting in approximately correct carbon range but elution pattern does not resemble the calibration standard.
NA	Not applicable or not analyzed.		
NE	Not established in lookup tables.	Z	Chromatograph fingerprint does not resemble a petroleum product.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
U	Chemical was not detected. The associated value represents the method reporting limit.	LMW PAH	Low molecular weight PAH.
Detected concentrations shown in **bold** exceed one or more site soil screening levels.		HMW PAH	High molecular weight PAH.

2.2.8.2.1 PAHs in Soil

Analytical results for PAH analyses indicate that the vertical extent of PAH contamination is not defined at all locations. For PAH as TTEC, the vertical extent of contamination has not been defined for 15 out of 59 samples. In 15 of the 59 soil samples, PAH as TTEC exceeds the protection of groundwater soil screening level of 3.9 mg/kg. Five of the 15 locations that exceed the protection of groundwater soil screening level are at impacted surface (black) soil sample locations in Courtyard Segments A2, A5, B4, and B5. Detected concentrations of total TTEC range from 6.85 to 19.81 mg/kg at depths of 4 to 5 ft bgs. Three of the 15 locations that exceed the protection of groundwater soil screening level are at former transformer substations T10A and T5 located in Courtyard Segments A3 and B5, respectively. Detected concentrations of total TTEC range from 6.1 mg/kg at T10A to 80.94 mg/kg at T5. A transformer oil spill occurred at transformer substation T5, with subsequent soil removal, during demolition of the plant in 2011 (PGG 2012b). Six of the 15 locations that exceed the protection of groundwater soil screening level are at pre-RI 2010 boring locations where surface soil samples were collected in Courtyard Segments B1, B3, B5, E2, and E3. Detected concentrations of TTEC range from 4.05 to 13.26 mg/kg. One out of the 15 locations that exceeds the protection of groundwater is in Courtyard Segment E3 at a location not previously sampled. The detected concentration of calculated total TTEC is 3.97 mg/kg.

For PAH as LMW and HMW, the vertical extent of contamination has not been defined for 57 out of 59 samples. One out of 59 soil samples for PAH as LMW exceeds the ecological wildlife screening level of 100 mg/kg. In 57 out of 59 soil samples, PAH as HMW exceeds the ecological wildlife screening level of 1.1 mg/kg.

For PAH as calculated total LMW the vertical extent of contamination was not defined at only one out of 59 initial RI data gap sample locations, using the ecological wildlife soil screening level of 100 mg/kg. The calculated total LMW concentration is 139.61 mg/kg at transformer substation T5, where a transformer oil spill and removal occurred in 2011. The vertical extent of contamination has been defined for LMW at the other 58 data gap sample locations.

For PAH as calculated total HMW the vertical extent of contamination has not been defined at 57 out of 59 initial RI data gap sample locations, using the ecological wildlife soil screening level of 1.1 mg/kg. Detected concentrations of calculated total HMW ranges from 1.15 mg/kg to 417 mg/kg, with the highest concentration located in Courtyard B5 at former transformer substation T5 where a transformer oil spill and removal occurred in 2011. The next highest detected concentration of calculated total HMW is 118.3 mg/kg located in Courtyard Segment C3.

2.2.8.2.2 TPH-Dx in Soil

For TPH-Dx, the vertical extent of soil contamination has been determined at all 59 initial RI data gap sample locations, using MTCA Method A Industrial and the ecological wildlife soil screening levels of 2,000 mg/kg.

2.2.8.2.3 Surface Impacted Soil

The thickness of impacted (black) surface soil was observed and measured in each of the 63 test pits excavated. The thickness measurements range from 0, where an identifiable dark gray to black surface soil layer was not observed, to 3.3 ft. The original objective for the initial RI black soil mapping and sampling effort has indicated that the black soil may have elevated concentrations of COPCs, but COPCs may be present in soil adjacent to or underlying the black soil.

2.2.8.2.4 Other COPCs in Soil

Other COPCs that exceeded soil screening levels in the WPA test pit samples include fluoride, sulfate, and several metals (Ar, Cd, Cr, Ni, Se, and Zn). Fluoride was detected at concentrations that range from 153 to 1,410 mg/kg that exceeds the protection of groundwater screening level in most samples. Sulfate was detected at concentrations that exceed site soil screening levels in only one area, Courtyard Segment C3, and is associated with the Crucible Cleaning Room Investigation Area, discussed in Section 2.2.1.

2.2.8.3 Conclusions and Recommendations

The vertical extent of soil contamination in Courtyard Segment soil, and confirmation and measurement of surface impacted soil, was evaluated through excavation of test pits at 63 initial RI data gap locations. A total of 63 soil samples were collected. The focus of the vertical extent investigation was mainly PAH and TPH-Dx, but other COPCs that also exceed soil screening levels at depth are noted in the summary Table 2.2.8-1.

Vertical extent of PAH contamination has not been defined at all 59 sample locations. TTEC was not defined at 15 out of 59 locations, total LMW was not defined at only 1 out of 59 locations, and total HMW was not defined at 57 out of 59 locations. Vertical extent of TPH-Dx has been defined at all 59 sample locations. The WPA investigation also included measurement of the thickness of surface impacted (black) soil in each test pit.

Other COPCs, including fluoride, sulfate, and metals, were detected at concentrations that exceed soil screening levels. These COPCs will be considered together with PAH contamination in each courtyard segment in the following section.

The Vertical Extent of Contamination in Courtyards is recommended for further evaluation in the FS because vertical extent of PAH contamination has not been defined. Soil contamination in the Courtyard Segments, and resulting conclusions and recommendations, are addressed in the following Courtyard Segment Soil Contamination (Section 2.3.4).

2.3 COURTYARD SEGMENTS SOIL CONTAMINATION SUMMARY

Within the Plant Area AOC are five Courtyards, A through E, with a total of 21 courtyard segments. The segments are bounded by production building foundations and are adjacent to either the north and/or south side of a production building or foundation (Figure 2.1.2-1). Courtyard segments are designated according to their proximity to a former production building. Courtyard segments and the remaining production building foundations are at a similar elevation (within approximately 2 to 4 ft), but as a whole range from approximately 5 to 15 ft elevation below the level of surrounding plant operations and structures. Steep slopes occur between the segments/foundations level and surrounding portion of the plant. The slopes are generally rock surfaced (near Cast House), weathered exposed soil/basalt (north of Courtyard C), or partially asphalt paved (ramps, adjacent to A5). The five Courtyards are described in detail below:

- **Courtyard A** extends along the southern edge of Production Building A and the northern edge of the Cast House buildings from the machine shop in the courtyard southwest corner to the western edge of the Pot Liner Soaking Station (SWMU 11) area in the east. Courtyard A consists of segments A1 in the west through A5 in the east.

- **Courtyard B** extends along the northern edge of Production Building A and the southern edge of Production Building B from the West Passage at the west end of the production buildings to the Pot Liner Soaking Station (SWMU 11) area in the east. Courtyard B consists of segments B1 in the west through B5 in the east.

- **Courtyard C** extends along the north side of Production Building B and the south side of Production Building C from the West Passage at the west end of the production buildings to the Pot Liner Soaking Station (SWMU 10) area in the northeast. Courtyard C consists of segments C1 in the west through C5 in the east.

- **Courtyard D** extends along the north side of Production Building C and the south side of Production Building D from the West Passage at the west end of the production buildings to the western boundary of the Crucible Cleaning Room Investigation Area. Courtyard D consists of segments D1 in the west through D3 in the east.

- **Courtyard E** extends along the north side of Production Building D from the boundary of the Rectifier Yard AOC in the west to the boundary of the Crucible Cleaning Room Investigation Area and SWMU 16 in the east. Courtyard E is bounded to the north by the northern plant area paved access road. Courtyard E consists of segments E1 in the west through E3 in the east.

Courtyard segments were investigated during the initial RI and WPA phases of investigation based upon varying operations, features and structures that previously existed within their boundaries, and vertical distribution of COPCs in soil, consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b), the Supplemental Remedial Investigation Work Plan for the Plant Area AOC (PGG 2017), and the WPA (Tetra Tech et al. 2020b). Site features and structures included material storage silos, operational treatment systems including dry/wet scrubbers, and other investigated features such as SWMU 5, transformer substations (part of the Rectifier Yard AOC), underground water and waste conveyance lines (part of the Plant Area AOC), and other maintenance and storage structures. A comprehensive list of site features and structures identified for the Plant Area AOC is presented in Table 5.2.5-1 of the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b).

Limited investigation (pre-RI) of site features and structures occurred prior to Ecology issuance of an Agreed Order for the site (Ecology 2014) and some of that data has been incorporated into this RI report as applicable. The following are aspects of each phase of investigation that has occurred in courtyard segments:

- **Pre-RI investigation**: In 2010, a preliminary series of 51 soil borings were completed in the courtyard segments. Their location was spatial distribution of 1 to 4 borings per courtyard segment. Samples were generally collected at depth intervals of 1 ft, 3 ft, and 5 or 6 ft. The analyte list did not include all COPCs established for the RI under the current Agreed Order. The Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) specified collection of one surface soil sample at the 2010 boring locations and completion of five soil borings at selected 2010 boring locations to replicate soil sample collection depths and to analyze for all COPCs.

- **Initial RI phase of investigation**: Between 2016 and 2018 test pits and soil borings were used to investigate specific features and structures that existed in courtyard segments. This included plant operational features and conveyance lines, SWMUs, locations of 2010 pre-RI soil borings, and areas where black soil was mapped at ground surface. At the conclusion of this work a draft RI report was submitted to Ecology and their review resulted in identification of several data gaps.

- **WPA phase of investigation**: WPA data gaps relating directly to courtyard segments resulted in additional work to further delineate the distribution and vertical extent of contamination. In addition, *Investigation Areas* were identified to further investigate the potential for soil sources of contamination to shallow groundwater. Four of these investigation areas are in or include courtyard segments, including Crucible Cleaning Room, initial RI soil borings SE08, SE18, and VS01 (Figure 2.1.2-1). These four investigation areas focused on fluoride which is present in shallow groundwater as a sitewide plume and sulfate which occurs in more localized areas in shallow groundwater at concentrations that exceed soil screening levels. A fifth courtyard segment related investigation area (refer to Section 2.2.8, Vertical Extent of Contamination in Courtyard Segments), investigated vertical extent of contamination at previous sampling stations where vertical extent was not defined. Table 2.2.8-1 summarizes whether vertical extent of contamination investigation objective was met.

This section of the RI report focuses on courtyard segment soil inside an identified perimeter of exposed soil that would be accessible for potential future remedial action. All sample collection stations and data associated with the identified perimeter of exposed soil are compiled for each segment. Sloped areas at the margin of the courtyard footprints were excluded from the identified perimeter of exposed soil in segments because of steepness of slopes and inaccessibility. The purpose of evaluating all data from each courtyard segment collectively is to develop a comprehensive assessment of relevant soil data that is then cast in terms of layers of contamination within the exposed soil perimeter, and definition of vertical extent of contamination, for consideration in the FS. Most of the data evaluated in this section has been discussed in other sections of this report.

The distribution and vertical extent of contamination in exposed soil is evaluated for individual courtyard segments in the following sections because the segments are large, bounded by site features, and separated by thick production building foundations. These physical boundaries for each segment, as well as the differing features, structures, and operational activities that occurred in each, result in differing contaminant profiles, distribution, and vertical extent of contamination.

The following sections describe and discuss features and structures that were present in each courtyard segment, the scope of the initial RI and WPA phases of investigations, results of the investigations including pre-RI data where applicable, and recommendations for further evaluation in the FS.

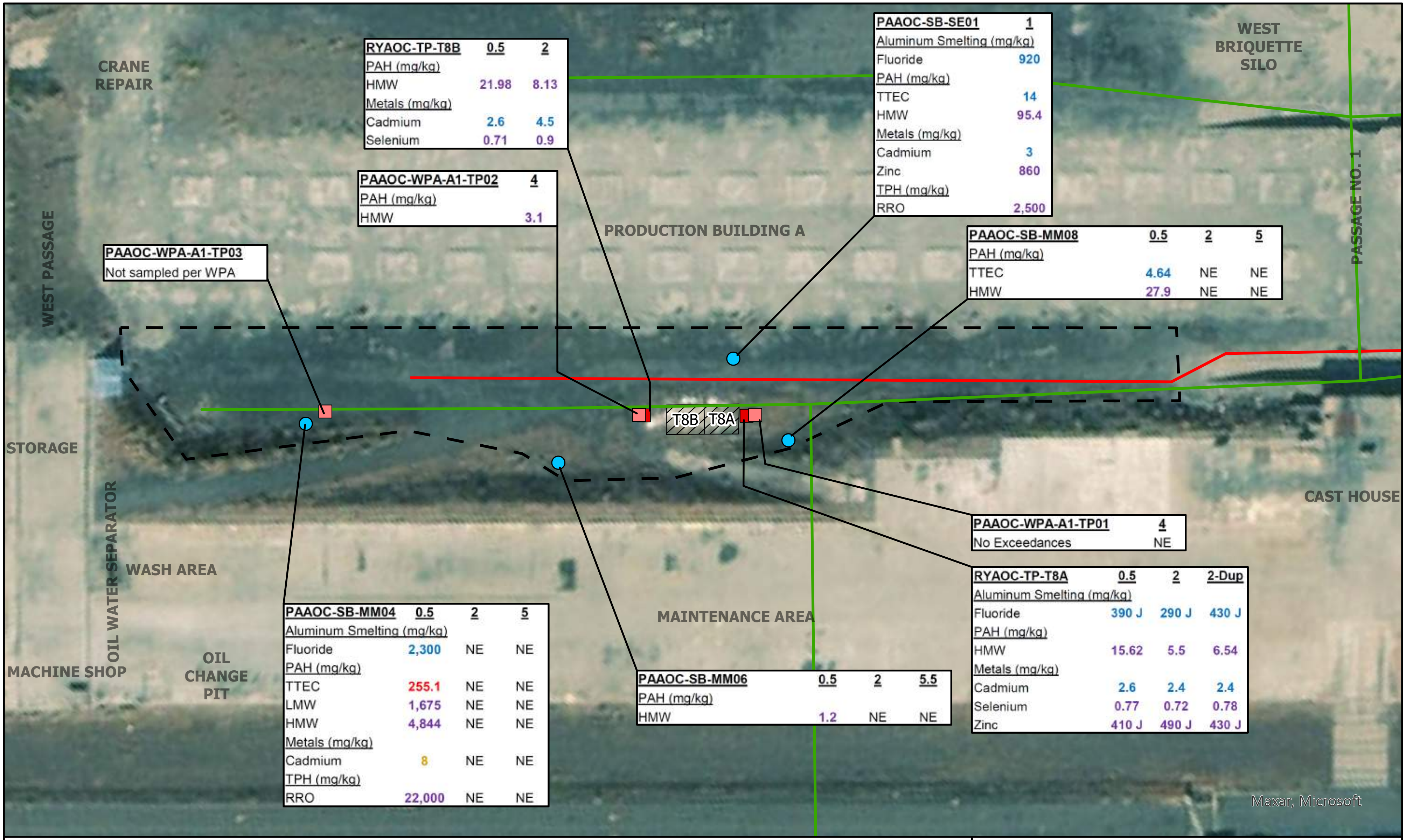
2.3.1 Courtyard Segment A1

Courtyard segment A1 is in the western end of Courtyard A. The west end of segment A1 is approximately 50 ft wide, narrowing to approximately 30 ft wide in the eastern portion with an area of approximately 26,327 square feet). Its size is irregular due to the shape of the northern margin of the Maintenance Building west of the Cast House. Calculated area in segment A1 does not include surfaces such as concrete foundations, sloped areas, or ramps. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. At the eastern end of segment A1 is a concrete underpass beneath Passage No. 1 (an above-ground structure which provided access between production buildings) to provide ground access between segments A1 and A2.

Several features and structures existed in and adjacent to segment A1 (Figure 2.3.1-1) as follows:

- Transformer Substation T8A/T8B (two units set on one slab, previously investigated as part of Rectifier Yard AOC)
- Maintenance offices in southeast corner (on Machine Shop and Maintenance Building foundation)
- Machine Shop and Maintenance Building adjacent to the south
- Scrubber Effluent System line no. 4 horizontal subsurface pipe and manholes
- Stormwater System line no. 5 horizontal subsurface pipe and catch basins
- Surface impacted soil mapped during the initial RI across most of A1

These features in and adjacent to Courtyard segment A1 were the focus of the initial RI phase of investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data, and to confirm thickness of impacted surface soil (previously referred to as black soil).



RYAOC-TP-T8B	0.5	2
PAH (mg/kg)		
HMW	21.98	8.13
Metals (mg/kg)		
Cadmium	2.6	4.5
Selenium	0.71	0.9

PAAOC-SB-SE01	1
Aluminum Smelting (mg/kg)	
Fluoride	920
PAH (mg/kg)	
TTEC	14
HMW	95.4
Metals (mg/kg)	
Cadmium	3
Zinc	860
TPH (mg/kg)	
RRO	2,500

PAAOC-WPA-A1-TP02	4
PAH (mg/kg)	
HMW	3.1

PAAOC-WPA-A1-TP03
Not sampled per WPA

PAAOC-SB-MM08	0.5	2	5
PAH (mg/kg)			
TTEC	4.64	NE	NE
HMW	27.9	NE	NE

PAAOC-WPA-A1-TP01	4
No Exceedances	NE

RYAOC-TP-T8A	0.5	2	2-Dup
Aluminum Smelting (mg/kg)			
Fluoride	390 J	290 J	430 J
PAH (mg/kg)			
HMW	15.62	5.5	6.54
Metals (mg/kg)			
Cadmium	2.6	2.4	2.4
Selenium	0.77	0.72	0.78
Zinc	410 J	490 J	430 J

PAAOC-SB-MM04	0.5	2	5
Aluminum Smelting (mg/kg)			
Fluoride	2,300	NE	NE
PAH (mg/kg)			
TTEC	255.1	NE	NE
LMW	1,675	NE	NE
HMW	4,844	NE	NE
Metals (mg/kg)			
Cadmium	8	NE	NE
TPH (mg/kg)			
RRO	22,000	NE	NE

PAAOC-SB-MM06	0.5	2	5.5
PAH (mg/kg)			
HMW	1.2	NE	NE

⌐ ¬	Courtyard Segment A1
●	RI Soil Boring
🟥	RI Test Pit
🟥	WPA Test Pit
▨	Approximate Transformer Pad
—	Scrubber Effluent System Line
—	Stormwater System Line

Soil Screening Levels
red: exceeds MTCA Method C
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife and for TPH diesel and residual range organics exceeds MTCA Method A
orange: exceeds MTCA Method A
NE: No exceedance
J: Estimated concentration
RRO: TPH as residual range organics
Dup: Duplicate sample
2: Sample depth in feet bgs

Segment A1 approximate area: 26,327 sq. ft.

Figure 2.3.1-1

Plant Area AOC

Courtyard Segment A1 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

2.3.1.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment A1 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included four soil borings and two test pits. The soil borings investigated the Scrubber Effluent line and the Machine Shop and Maintenance Building, while the two test pits investigated transformer substation T8A/T8B. RI boring and test pit locations are shown on Figure 2.3.1-1.

Sample depths and analyses are as follows:

- Scrubber Effluent line boring samples targeted to above and below horizontal pipe invert at approximately 2.5 to 4 ft bgs (plant drawing A00201)
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAH, PCBs, Metals, TPH-Dx
- Machine Shop and Maintenance Building samples 0.5, 2, 4, 6 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx
- Transformer substation samples 0.5, 2.0 ft bgs
    - ❖ Analytes: total cyanide, fluoride, PAHs, PCBs, metals, TPH-Dx

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected RI sample stations where the deepest sample exceeded site soil screen levels (Tetra Tech et al. 2020b). This included three test pits excavated at initial RI sample stations. Two test pits were excavated at transformer substation T8A/T8B to a depth of 4 ft, 2 ft below the previous sample depth. The third test pit was excavated near soil boring SB-MM04 to 4-ft depth to confirm the thickness of impacted surface soil and as proposed in the WPA no samples were collected. WPA soil samples were analyzed for, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. WPA test pit locations are shown on Figure 2.3.1-1.

2.3.1.2 Investigation Results

Segment A1 soil was investigated with four soil borings and five test pits in the initial RI and WPA phases of investigation. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.1-1 (PAAOC Courtyard Segment A1 Initial RI and WPA Soil Results Summary). Soil

Table 2.3.1-1
PAAOC Courtyard Segment A1 Initial RI and WPA Soil Results Summary
Columbmia Gorge Aluminum Smelter Site, Goldendale, Washington

		Screening Levels				Ecological Screening Levels	Initial RI Analytical Results															WPA Analytical Results	
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-MM04-0.5	PAAOC-SB-MM04-2	PAAOC-SB-MM04-5	PAAOC-SB-MM06-0.5	PAAOC-SB-MM06-2	PAAOC-SB-MM06-5.5	PAAOC-SB-MM08-0.5	PAAOC-SB-MM08-2	PAAOC-SB-MM08-5	PAAOC-SB-SE01-1	RYAOC-TP-T8A-0.5	RYAOC-TP-T8A-2	RYAOC-TP40-2 (Dup T8A-2)	RYAOC-TP-T8B-0.5	RYAOC-TP-T8B-2	PAAOC-WPA-A1-TP01-4.0	PAAOC-WPA-A1-TP02-4.0
Aluminum Smelting																							
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.069	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.5 U	2 U	2 U	1.9 U	2 U	2.1 U	NA	NA
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**2,300**	77	23	27	29	6.1	34	59	5 U	**920**	**390 J**	**290 J**	**430 J**	47 J	65 J	21.6 J	65.9 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	200	21	30	10 U	10 U	10 U	10 U	19	10 U	12	NA	NA	NA	NA	NA	2.2 J	2.4
Polynuclear Aromatic Hydrocarbons (PAHs)																							
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	15 U	0.0074 U	0.0072 U	0.0076 U	0.0071 U	0.007 U	0.15 U	0.0071 U	0.0071 U	0.28 U	0.0056	0.0017 J	0.0021 J	0.032	0.0038 J	0.0056 U	0.00093 J
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	15 U	0.0074 U	0.0072 U	0.0076 U	0.0071 U	0.007 U	0.15 U	0.0071 U	0.0071 U	0.28 U	0.0083	0.0028 J	0.0032 J	0.033	0.0044 J	0.0005 J	0.011
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	15 U	0.0074 U	0.0072 U	0.0076 U	0.0071 U	0.007 U	0.45	0.0071 U	0.0071 U	0.56	0.053	0.017	0.019	0.54	0.045 J	0.0056 U	0.0013 J
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	15 U	0.0074 U	0.0072 U	0.0076 U	0.0071 U	0.007 U	0.15 U	0.0071 U	0.0071 U	0.28 U	0.0053	0.0022 J	0.0026 J	0.0069	0.0026 J	0.0014 J	0.021
Anthracene	mg/kg	NA	NE	2,300	NE	NL	15 U	0.0083	0.0072 U	0.013	0.0071 U	0.007 U	1.1	0.0071 U	0.0071 U	1.3	0.15	0.078	0.099	1.2	0.0722 J	0.028	0.27
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	400	0.091	0.0072 U	0.1	0.0071 U	0.007 U	3.1	0.0071 U	0.0071 U	7.7	0.97	0.37	0.48	2.3	0.62 J	0.02	0.32
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	60	0.11	0.0072 U	0.11	0.0071 U	0.007 U	3.4	0.0071 U	0.0071 U	8.8	0.99	0.44	0.55	2	0.78 J	0.069	0.72
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	1,100	0.15	0.018	0.27	0.0071 U	0.007 U	4.3	0.0071 U	0.0099	24	3.7	1.1	1.2	3.3	1.8 J	0.025	0.29
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	150	0.1	0.0072 U	0.13	0.0071 U	0.007 U	2.5	0.0071 U	0.0071 U	9.2	2.1	0.89	0.97	1.8	1 J	0.021	0.22
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	210	0.054	0.0072 U	0.085	0.0071 U	0.007 U	1.6	0.0071 U	0.0071 U	6.9	0.82	0.34	0.42	1.2	0.59 J	0.034	0.45
Chrysene	mg/kg	NA	NL	NL	NE	NL	1,700	0.13	0.021	0.16	0.0071 U	0.007 U	3.2	0.0071 U	0.0077	13	2.4	0.7	0.86	2.8	1 J	0.0056 J	0.077
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	54	0.02	0.0072 U	0.029	0.0071 U	0.007 U	0.5	0.0071 U	0.0071 U	2.1	0.34	0.1	0.12	0.28	0.15	0.0056 U	0.003 J
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	1,600	0.094	0.013	0.21	0.0071 U	0.007 U	8.3	0.0071 U	0.0095	16	1.8	0.68	0.91	7.8	1.1 J	0.09	0.47
Fluorene	mg/kg	NL	140,000	100	NE	NL	15 U	0.0074 U	0.0072 U	0.0076 U	0.0071 U	0.007 U	0.39	0.0071 U	0.0071 U	0.4	0.025	0.0092	0.012	0.42	0.018 J	0.0056 U	0.0054 J
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	170	0.077	0.0072 U	0.13	0.0071 U	0.007 U	2.6	0.0071 U	0.0071 U	9.7	2.5	0.96	1.1	2.1	1.2 J	0.027	0.37
Naphthalene	mg/kg	5	70	4.5	NE	NL	15 U	0.0074 U	0.0072 U	0.0076 U	0.0071 U	0.007 U	0.15 U	0.0071 U	0.0071 U	0.0061	0.014	0.0053	0.007	0.14	0.0079	0.0014 JB	0.0017 JB
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	75	0.02	0.0072 U	0.068	0.0071 U	0.007 U	4.7	0.0071 U	0.0071 U	5.7	0.38	0.18	0.25	4.5	0.33 J	0.0063	0.11
Pyrene	mg/kg	NA	110,000	650	NE	NL	1,000	0.1	0.011	0.19	0.0071 U	0.007 U	6.7	0.0071 U	0.0071 U	14	1.8	0.6	0.84	6.2	0.99 J	0.056	0.38
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**255.1**	0.15	0.0021	0.18	0.0071	0.007	**4.64**	0.0071	0.001	**14**	1.85	0.73	0.89	2.95	1.23	0.04	0.49
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	**1,675**	0.12	0.01	0.3	0.0071	0.007	14.9	0.0071	0.01	23.97	2.43	0.97	1.39	14.2	1.58	0.1	0.64
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**4,844**	0.83	0.05	**1.2**	0.0071	0.007	**27.9**	0.0071	0.02	**95.4**	**15.62**	**5.5**	**6.54**	**21.98**	**8.13**	0.27	**3.1**
Polychlorinated Biphenyls (PCBs)																							
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.056 U	0.055 U	0.054 U	0.057 U	0.053 U	0.052 U	0.055 U	0.053 U	0.053 U	0.053 U	0.0075 U	0.0074 U	0.0071 U	0.0073 U	0.0073 U	0.011 U	0.011 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.055 U	0.054 U	0.057 U	0.053 U	0.052 U	0.055 U	0.053 U	0.053 U	0.053 U	0.0043 U	0.0042 U	0.004 U	0.0041 U	0.0041 U	0.022 U	0.022 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.055 U	0.054 U	0.057 U	0.053 U	0.052 U	0.055 U	0.053 U	0.053 U	0.053 U	0.005 U	0.0049 U	0.0047 U	0.0048 U	0.0048 U	0.011 U	0.011 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.055 U	0.054 U	0.057 U	0.053 U	0.052 U	0.055 U	0.053 U	0.053 U	0.053 U	0.0016 U	0.0016 U	0.0015 U	0.0016 U	0.0016 U	0.011 U	0.011 Ui
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.055 U	0.054 U	0.057 U	0.053 U	0.052 U	0.055 U	0.053 U	0.053 U	0.053 U	0.0029 U	0.0029 U	0.0028 U	0.0028 U	0.0028 U	0.011 U	0.011 Ui
Aroclor 1254	mg/kg	NA	66.0	0.71	NE	NE	0.056 U	0.055 U	0.054 U	0.057 U	0.053 U	0.052 U	0.055 U	0.053 U	0.053 U	0.053 U	0.0015 U	0.0015 U	0.0014 U	0.0015 U	0.0015 U	0.011 U	0.011 Ui
Aroclor 1260	mg/kg	NA	66.0	NE	NE	NE	0.056 U	0.055 U	0.054 U	0.057 U	0.053 U	0.052 U	0.055 U	0.053 U	0.053 U	0.053 U	0.18	0.0019 UJ	0.43 J	0.016	0.17	0.011 U	0.011 Ui
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	0.056	0.055	0.054	0.057	0.053	0.052	0.055	0.053	0.053	0.053	0.18	0.0015	0.43	0.016	0.17	0.011 U	0.011 U
Metals																							
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	20,000	4,900	5,600	12,000	5,900	4,600	7,800	4,100	5,900	15,000	8,100 J	8,700 J	10,000 J	5,800 J	11,000 J	7,420	8,090
Arsenic	mg/kg	20	88	2.9	7.61	132	48	11 U	11 U	11 U	11 U	10 U	11 U	11 U	11 U	11 U	3.7 J	5.1 J	4.6 J	1 J	4.1 J	1.21	2.12
Cadmium	mg/kg	2	3,500	0.69	0.81	14	**8**	0.56 U	0.54 U	0.57 U	0.53 U	0.52 U	0.55 U	0.53 U	0.53 U	**3**	**2.6**	**2.4**	**2.4**	**2.6**	**4.5**	0.093	0.152
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	140	3.9	4.1	11	6.8	2.4	6.8	1.8	4.7	34	9.9 J	11 J	11 J	5.2 J	11 J	2.9	6.78
Copper	mg/kg	NA	140,000	280	28.4	217	110	11	17	16	15	14	13	11	11	130	28 J	26 J	25 J	22 J	36 J	14.6	20.9
Lead	mg/kg	1,000	NE	3,000	13.1	118	240	5.5 U	5.4 U	5.9	5.3 U	5.2 U	5.7	5.3 U	5.3 U	21	8.9 J	6.7 J	8.7 J	2.8 J	11 J	4.04	4.7
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.83	0.28 U	0.27 U	0.29	0.26 U	0.26	0.27 U	0.26 U	0.27 U	0.26 U	0.01 J	0.013 J	0.068 J	0.0056 J	0.018 J	0.018 U	0.006 J
Nickel	mg/kg	NA	70,000	130	24.54	980	540	18	4.7	9.6	5.1	4.2	6.8	12.6 U	3.6	62	24 J	24 J	21 J	10 J	21 J	4.01	8.58
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	16	11 U	11 U	11 U	11 U	10 U	11 U	11 U	11 U	11 U	**0.77**	**0.72**	**0.78**	**0.71**	**0.9**	0.1 J	0.1 J
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	280	31	40	51	42	32	100	29	42	**860**	**410 J**	**490 J**	**430 J**	130 J	330 J	54	70.2
Total Petroleum Hydrocarbons (TPHs)																							
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	4,800 U	28 U	27 U	29 U	27 U	26 U	46 U	27 U	27 U	300 U	35	15 J	160 J	11 U	32	2.1 J	15 J
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	**22,000**	55 U	54 U	57 U	53 U	52 U	180	53 U	53 U	**2,500**	120	100 J	310 J	12 B	120	5.7 J	100 J

Notes:

i	Method reporting limit is elevated due to a matrix interference.
J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
B	The sample result is less than five times the blank contaminaiton and cross-contamination is suspected.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples were collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in half of samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment A1 are compiled and presented on Figure 2.3.1-1. In the borings and test pits, the vertical extent of contamination was generally defined in the initial RI data, by contact with basalt bedrock, or by subsequent WPA test pits.

In initial RI borings SB-MM04, SB-MM06, SB-MM08 that investigated the adjacent Machine Shop and Maintenance Building, COPCs were detected at concentrations that exceeded soil screening levels in the 0.5 ft bgs sample depth but did not exceed at deeper depth samples at 2, 5, and 5.5 ft bgs. The vertical extent has been defined by initial RI data.

In initial RI test pits TP-T8A and TP-T8B that investigated transformer substation T8A/T8B, COPCs were detected at concentrations that exceeded soil screening levels to the total depth of the test pits at 2 ft bgs. Subsequent WPA test pits A1-TP01 and A1-TP02 defined the vertical extent of contamination with no exceedances detected at depths of 4 ft bgs.

SB-SE01 investigated the Scrubber Effluent line no. 4 horizontal pipe and its invert at a depth of approximately 4 ft bgs. One sample was collected at 1 ft bgs, and basalt bedrock was encountered at 2.25 ft bgs. No additional soil samples could be collected, and the vertical extent of contamination is considered defined through contact with basalt bedrock.

Basalt bedrock was encountered at a shallow depth in the western portion of the segment. Based on water levels measured as part of the Groundwater AOC investigation, the depth to the shallowest groundwater (UA aquifer) beneath A1, if present, is approximately elevation 472 ft or approximately 12 or more feet bgs. The concentration of fluoride in shallow groundwater beneath this segment is expected to be between 0.96 and 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). The maximum concentration of fluoride detected in soil in segment A1 is 2,300 mg/kg collected from 0.5 ft bgs.

2.3.1.3 Conclusions and Recommendations

COPCs were not detected at concentrations that exceed soil screening levels to depths of 2 ft bgs and the vertical extent of contamination has been defined using results and/or bedrock contact. The maximum concentration of fluoride detected in soil in segment A1 is 2,300 mg/kg collected from 0.5 ft bgs.

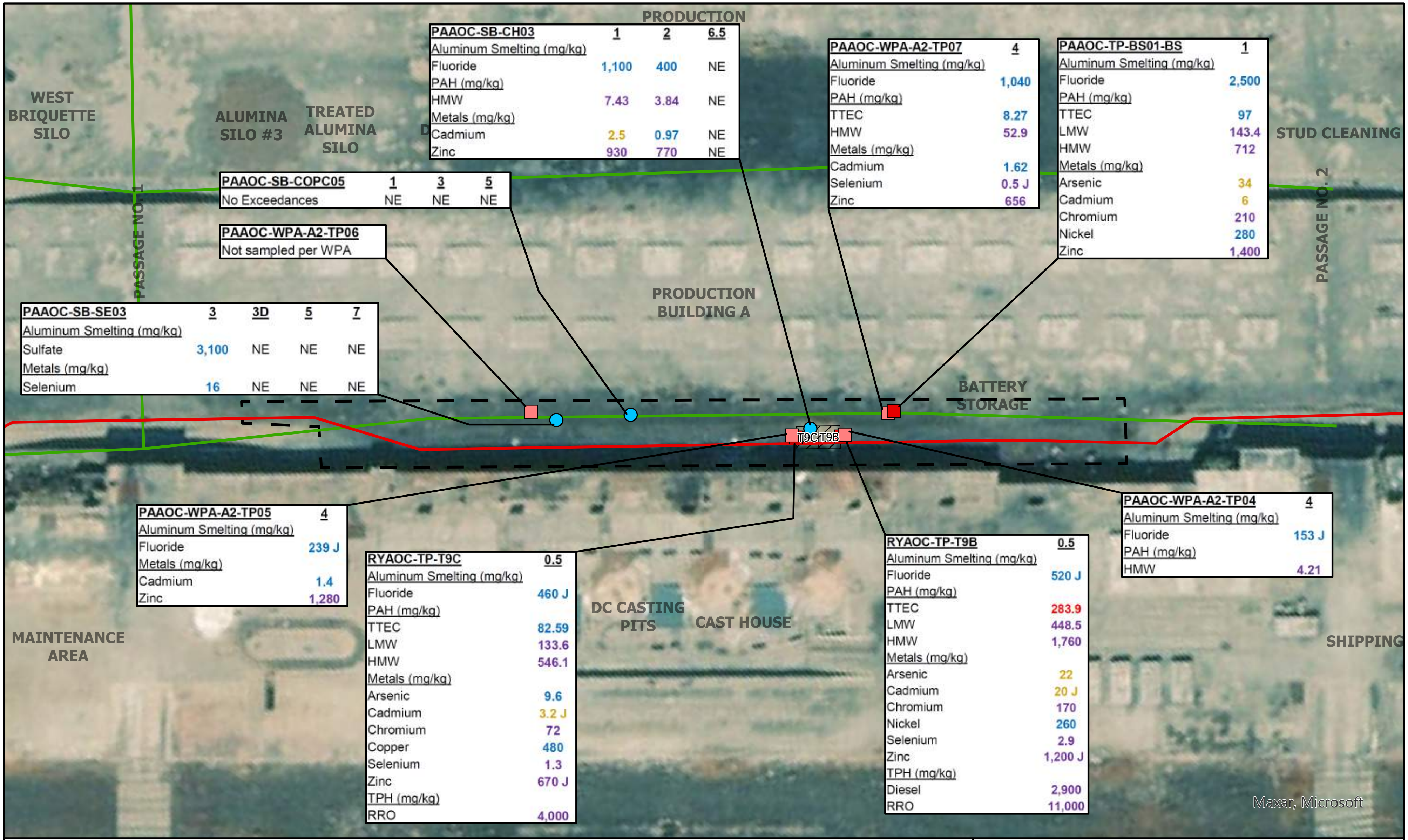
Based on COPCs exceedance of soil screening levels in the upper 2 ft of soil, Segment A1 is recommended for further evaluation in the FS.

2.3.2 Courtyard Segment A2

Courtyard segment A2 is in the western portion of Courtyard A, immediately adjacent to the east of courtyard segment A1. The west end of segment A2 is approximately 20 ft wide and widens to approximately 50 towards the eastern end with an area of approximately 13,416 square feet. Calculated area in segment A2 does not include surface such as concrete foundations, sloped areas, or ramps. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. The western end of segment A2 is a concrete underpass beneath Passage No. 1 to provide access between segments A1 and A2. At the eastern end of segment A2 is a concrete underpass beneath Passage No. 2 to provide access between segments A2 and A3.

Several features and structures existed in and adjacent to segment A2 (Figure 2.3.2-1) as follows:

- Transformer Substation T9B/T9C (two of three units on one slab, previously investigated as part of Rectifier Yard AOC)
- Cast House foundation containing the DC Casting Pits adjacent to the south
- Surface impacted soil mapped during the initial RI across A2
- Scrubber Effluent line no. 4 horizontal subsurface pipe and manholes
- Pre-RI 2010 soil boring location (identified for initial RI sampling)
- Stormwater line no. 6 horizontal subsurface pipe and catch basins
- Surface impacted soil mapped during the initial RI across most of A2



PAAOC-SB-CH03	1	2	6.5
Aluminum Smelting (mg/kg)			
Fluoride	1,100	400	NE
PAH (mg/kg)			
HMW	7.43	3.84	NE
Metals (mg/kg)			
Cadmium	2.5	0.97	NE
Zinc	930	770	NE

PAAOC-WPA-A2-TP07	4
Aluminum Smelting (mg/kg)	
Fluoride	1,040
PAH (mg/kg)	
TTEC	8.27
HMW	52.9
Metals (mg/kg)	
Cadmium	1.62
Selenium	0.5 J
Zinc	656

PAAOC-TP-BS01-BS	1
Aluminum Smelting (mg/kg)	
Fluoride	2,500
PAH (mg/kg)	
TTEC	97
LMW	143.4
HMW	712
Metals (mg/kg)	
Arsenic	34
Cadmium	6
Chromium	210
Nickel	280
Zinc	1,400

PAAOC-SB-COPC05	1	3	5
No Exceedances	NE	NE	NE

PAAOC-WPA-A2-TP06
Not sampled per WPA

PAAOC-SB-SE03	3	3D	5	7
Aluminum Smelting (mg/kg)				
Sulfate	3,100	NE	NE	NE
Metals (mg/kg)				
Selenium	16	NE	NE	NE

PAAOC-WPA-A2-TP05	4
Aluminum Smelting (mg/kg)	
Fluoride	239 J
Metals (mg/kg)	
Cadmium	1.4
Zinc	1,280

RYAOC-TP-T9C	0.5
Aluminum Smelting (mg/kg)	
Fluoride	460 J
PAH (mg/kg)	
TTEC	82.59
LMW	133.6
HMW	546.1
Metals (mg/kg)	
Arsenic	9.6
Cadmium	3.2 J
Chromium	72
Copper	480
Selenium	1.3
Zinc	670 J
TPH (mg/kg)	
RRO	4,000

RYAOC-TP-T9B	0.5
Aluminum Smelting (mg/kg)	
Fluoride	520 J
PAH (mg/kg)	
TTEC	283.9
LMW	448.5
HMW	1,760
Metals (mg/kg)	
Arsenic	22
Cadmium	20 J
Chromium	170
Nickel	260
Selenium	2.9
Zinc	1,200 J
TPH (mg/kg)	
Diesel	2,900
RRO	11,000

PAAOC-WPA-A2-TP04	4
Aluminum Smelting (mg/kg)	
Fluoride	153 J
PAH (mg/kg)	
HMW	4.21

- ⌐ ¬ Courtyard Segment A2
- ● RI Soil Boring
- 🟥 RI Test Pit
- 🟥 WPA Test Pit
- ▨ Approximate Transformer Pad
- — Stormwater System Line
- — Scrubber Effluent Line

Segment A2 approximate area: 13,416 sq. ft.

Soil Screening Levels
red: exceeds MTCA Method C
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife and for TPH diesel and residual range organics exceeds MTCA Method A
orange: exceeds MTCA Method A
NE: No exceedance
J: Estimated concentration
D: Duplicate sample
3: Sample depth in feet bgs

W N S E

0 25 50 100
Feet

Figure 2.3.2-1

Plant Area AOC

Courtyard Segment A2 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

These features in Courtyard segment A2 were the focus of the initial RI phase of investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data, and to confirm thickness of impacted surface soil.

2.3.2.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment A2 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included three soil borings and three test pits. The soil borings investigated Scrubber Effluent line no. 4, the location of a pre-RI 2010 soil boring, and the adjacent Cast House while the three test pits investigated the surface impacted soil and transformer substation T9B/T9C. RI boring and test pit locations are shown on Figure 2.3.2-1.

Sample depths and analyses are as follows:

- SE boring sample targeted to above and below horizontal pipe invert at approximately 7 ft bgs (plant drawing A00201)
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs
- Transformer substation samples at 0.5 ft bgs
    - ❖ Analytes: total cyanide, fluoride, PAHs, PCBs, metals, TPH-Dx
- Pre-RI 2010 boring location for COPC analyses samples at 1, 3, 5 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs
- Cast House boring samples at 1, 2, 6.5 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs
- Surface impacted soil sample at 1 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, metals

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected RI sample stations where the deepest sample exceeded site soil screen levels (Tetra Tech et al. 2020b). This included three test pits, two (A2-TP04 and A2-TP05) excavated at transformer substation T9B/T9C to a depth of 4 ft, 2 ft below the previous sample depths, and the third (A2-TP07) was excavated at TP-BS01 to a depth of 4 ft, which is 3 ft below the depth of the previous samples. A fourth test pit A2-TP06 was excavated near soil boring SB-SE03 to confirm the thickness of surface impacted soil and as proposed in the WPA, no samples were collected. WPA soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. WPA test pit locations are shown on Figure 2.3.2-1.

2.3.2.2 Investigation Results

Segment A2 soil was investigated with a combined total of three soil borings and seven test pits in the initial RI and WPA phases of investigation. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.2-1 (PAAOC Courtyard Segment A2 Initial RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in most samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment A2 are compiled and presented on Figure 2.3.2-1. The vertical extent of soil contamination has been defined by initial RI data for the SE, pre-RI 2010 boring, and the Cast House boring locations. The vertical extent of contamination is not confirmed at the impacted surface soil and transformer substation T9B/T9C locations where subsequent WPA test pits also detected COPCs at concentrations that exceed soil screening levels to depths of 4 ft bgs.

Initial RI borings SB-COPC5, SB-SE03, and SB-CH03 detected concentrations of COPCs that exceeded soil screening levels up to 2 ft bgs sample but did not exceed at deeper depths sampled. The vertical extent has been defined by initial RI data.

In initial RI test pits TP-T9B and TP-T9C that investigated transformer substation T9B/T9C, COPCs were detected at concentrations that exceeded soil screening levels to the total depth of the test pits at 0.5 ft bgs. Subsequent WPA test pits A2-TP04 and A2-TP05 detected concentrations of fluoride, PAH as total HMW, cadmium, and zinc that exceed soil screening levels at 4 ft bgs. The vertical extent of soil contamination at T9B/T9C has not been defined.

Table 2.3.2-1
PAAOC Courtyard Segment A2 Initial RI and WPA Soil Results Summary
Columbmia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results													WPA Analytical Results		
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-BS01-SS (1ft)**	**PAAOC-SB-CH03-1**	**PAAOC-SB-CH03-2**	**PAAOC-SB-CH03-6.5**	**PAAOC-SB-COPC05-1**	**PAAOC-SB-COPC05-3**	**PAAOC-SB-COPC05-5**	**PAAOC-SB-SE03-3**	**PAAOC-SB-SE03-3D**	**PAAOC-SB-SE03-5**	**PAAOC-SB-SE03-7**	**RYAOC-TP-T9B-0.5**	**RYAOC-TP-T9C-0.5**	**PAAOC-WPA-A2-TP04-4**	**PAAOC-WPA-A2-TP05-4**	**PAAOC-WPA-A2-TP07-4**
Aluminum Smelting																						
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.63	0.05 U	0.16	0.07	0.05 U	0.19	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	2 U	1.8 U	NA	NA	0.19 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**2,500**	**1,100**	**400**	5 U	72	14	7.7	6.5	5 U	5 U	29	**520 J**	**460 J**	**153 J**	**239 J**	**1,040**
Sulfate	mg/kg	NA	NE	2,150	NE	NE	120 U	220 J	130 J	290 J	180	520	2,000	**3,100**	290	800	110	NA	NA	245	7.7	53.9
Polynuclear Aromatic Hydrocarbons (PAHs)																						
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.38	0.038 U	0.038 U	0.0072 U	0.0073 U	0.0077 U	0.0075 U	0.0072 U	0.0071 U	0.0072 U	0.0071 U	0.66	0.19	0.0025 J	0.00049 J	0.0023 J
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.37	0.038 U	0.038 U	0.0072 U	0.0073 U	0.0077 U	0.0075 U	0.0072 U	0.0071 U	0.0072 U	0.0071 U	0.61	0.27	0.017	0.0026 J	0.18
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	2.6	0.038 U	0.038 U	0.0072 U	0.0073 U	0.0077 U	0.0075 U	0.0072 U	0.0071 U	0.0072 U	0.0071 U	8.2	2.9	0.002 J	0.0061 U	0.015 J
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.48	0.038 U	0.038 U	0.0072 U	0.0073 U	0.0077 U	0.0075 U	0.0072 U	0.0071 U	0.0072 U	0.0071 U	0.025 U	0.1	0.035	0.006 J	0.4
Anthracene	mg/kg	NA	NE	2,300	NE	NL	6.5	0.07	0.038 U	0.0072 U	0.0073 U	0.0077 U	0.0075 U	0.0072 U	0.0071 U	0.0072 U	0.0071 U	19	7.2	0.37	0.03	4.9
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	58	0.59	0.29	0.0072 U	0.013	0.0077 U	0.0075 U	0.0072 U	0.0071 U	0.0072 U	0.0071 U	170	51	0.48	0.032	5.2
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	59	0.78	0.38	0.0072 U	0.011	0.0077 U	0.0075 U	0.0072 U	0.0071 U	0.0072 U	0.0071 U	190	63	0.88	0.056	13
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	180	1.6	0.83	0.0088	0.021	0.0077 U	0.008	0.0072 U	0.011	0.0093	0.0071 U	380	130	0.44	0.026	4.9
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	65	1	0.54	0.0072 U	0.0082	0.0077 U	0.0075 U	0.0072 U	0.0071 U	0.0072 U	0.0071 U	160	40	0.31	0.0196	3.7
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	47	0.47	0.24	0.0072 U	0.0075	0.0077 U	0.0075 U	0.0072 U	0.0071 U	0.0072 U	0.0071 U	110	27	0.52	0.033	7.9
Chrysene	mg/kg	NA	NL	NL	NE	NL	120	0.91	0.5	0.0072 U	0.018	0.0077 U	0.0075 U	0.011	0.0096	0.0073	0.0071 U	190	68	0.13	0.0074	1.5
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	16	0.19	0.1	0.0072 U	0.0073 U	0.0077 U	0.0075 U	0.0072 U	0.0071 U	0.0072 U	0.0071 U	40	9.1	0.0069	0.00079 J	0.061
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	99	1.1	0.55	0.0072 U	0.031	0.0077 U	0.0075 U	0.0072 U	0.0089	0.0072 U	0.0071 U	330	93	0.57	0.058	7
Fluorene	mg/kg	NL	140,000	100	NE	NL	2	0.038 U	0.038 U	0.0072 U	0.0073 U	0.0077 U	0.0075 U	0.0072 U	0.0071 U	0.0072 U	0.0071 U	5.2	1.9	0.011	0.0017 J	0.11
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	67	0.92	0.48	0.0072 U	0.0073 U	0.0077 U	0.0075 U	0.0072 U	0.0071 U	0.0072 U	0.0071 U	220	72	0.59	0.035	6.5
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.78	0.038 U	0.038 U	0.0072 U	0.0073 U	0.0077 U	0.0075 U	0.0072 U	0.0071 U	0.0072 U	0.0071 U	1.1	0.49	0.0037 J	0.0014 JB	0.038
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	32	0.34	0.16	0.0072 U	0.022	0.0077 U	0.0075 U	0.0072 U	0.0071 U	0.0072 U	0.0071 U	85	28	0.17	0.022	1.9
Pyrene	mg/kg	NA	110,000	650	NE	NL	100	0.97	0.48	0.0072 U	0.028	0.0077 U	0.0075 U	0.0072 U	0.0085	0.0072 U	0.0071 U	300	86	0.49	0.041	5.3
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**97**	1.2	0.6	0.0009	0.03	0.0077	0.0008	0.001	0.001	0.001	0.0071	**283.9**	**82.59**	0.71	0.05	**8.27**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	**143.4**	1.51	0.71	0.007	0.05	0.0077	0.008	0.007	0.009	0.007	0.0071	**448.5**	**133.6**	0.81	0.092	9.64
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**712**	**7.43**	**3.84**	0.009	0.11	0.0077	0.0008	0.01	0.021	0.02	0.0071	**1,760**	**546.1**	**4.21**	0.28	**52.9**
Polychlorinated Biphenyls (PCBs)																						
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	0.057 U	0.058 U	0.054 U	0.055 U	0.058 U	0.057 U	0.054 U	0.053 U	0.054 U	0.053 U	0.027 J	0.00049 U	0.012 U	0.012 Ui	0.011 Ui
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	0.057 U	0.058 U	0.054 U	0.055 U	0.058 U	0.057 U	0.054 U	0.053 U	0.054 U	0.053 U	0.00034 U	0.00034 U	0.023 U	0.024 U	0.022 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	0.057 U	0.058 U	0.054 U	0.055 U	0.058 U	0.057 U	0.054 U	0.053 U	0.054 U	0.053 U	0.0022 U	0.0022 U	0.012 U	0.012 Ui	0.013 Ui
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	0.057 U	0.058 U	0.054 U	0.055 U	0.058 U	0.057 U	0.054 U	0.053 U	0.054 U	0.053 U	0.002 UJ	0.0021 U	0.012 U	0.012 U	0.011 Ui
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	0.057 U	0.058 U	0.054 U	0.055 U	0.058 U	0.057 U	0.054 U	0.053 U	0.054 U	0.053 U	0.0016 UJ	0.0016 U	0.012 U	0.012 U	0.011 Ui
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	0.057 U	0.058 U	0.054 U	0.055 U	0.058 U	0.057 U	0.054 U	0.053 U	0.054 U	0.053 U	0.00091 UJ	0.00089 U	0.012 U	0.012 U	0.016 Ui
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	0.057 U	0.058 U	0.054 U	0.055 U	0.058 U	0.057 U	0.054 U	0.053 U	0.054 U	0.053 U	0.2 J	0.0013 U	0.012 Ui	0.012 U	0.058 Ui
Aroclor 1262	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0019 UJ	0.0019 U	NA	NA	NA
Aroclor 1268	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0021 UJ	0.0021 UJ	NA	NA	NA
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	NA	0.057	0.058	0.054	0.055	0.058	0.057	0.054	0.053	0.054	0.053	0.027	0.00049	0.012	0.012	0.011
Metals																						
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	76,000	11,000	11,000	9,800	8,500	8,600	9,500	6,900	6,600	6,000	4,800	85,000	47,000	9,540	8,960	21,700
Arsenic	mg/kg	20	88	2.9	7.61	132	**34**	11 U	12 U	11 U	11 U	12 U	11 U	11 U	11 U	11 U	11 U	**22**	**9.6**	2.76	1.98	7.22
Cadmium	mg/kg	2	3,500	0.69	0.81	14	**6**	**2.5**	**0.97**	0.54 U	0.55 U	0.58 U	0.57 U	0.54 U	0.53 U	0.54 U	0.53 U	**20 J**	**3.2 J**	0.278	**1.4**	**1.62**
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	**210**	10	7.8	27	7.6	7.1	6.1	5.9	6	4.6	1.1 U	**170**	**72**	8.76	5.9	60.9
Copper	mg/kg	NA	140,000	280	28.4	217	160	24	19	28	14	12	13	12	14	12	12	150	**480**	21.9	29.9	51.5
Lead	mg/kg	1,000	NE	3,000	13.1	118	58	5.9	5.8 U	5.4 U	5.8	5.8 U	6.8	5.4 U	5.3 U	5.4 U	5.3 U	69 J	34 J	5.79	4.56	19.2
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.27 U	0.29 U	0.29 U	0.27 U	0.28 U	0.29 U	0.28 U	0.27 U	0.27 U	0.27 U	0.26 U	0.097	0.056	0.007 J	0.006 J	0.026
Nickel	mg/kg	NA	70,000	130	24.54	980	**280**	35	23	18	7	6.1	5.8	5.9	5.4	4.7	3.7	**260**	82	12.1	15.2	58.2
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	12 U	11 U	11 U	12 U	11 U	**16**	11 U	11 U	11 U	**2.9**	**1.3**	0.2 J	0.2 J	**0.5 J**
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	**1,400**	**930**	**770**	33	45	44	49	40	39	36	24	**1,200 J**	**670 J**	103	**1,280**	**656**
Total Petroleum Hydrocarbons (TPHs)																						
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	60	29 U	27 U	28 U	29 U	28 U	27 U	27 U	27 U	27 U	**2,900**	1,000	16 J	6.2 J	130 J
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	360	120	54 U	55 U	58 U	57 U	55 U	53 U	54 U	53 U	**11,00**	**4,000**	97 J	20 J	470 J
Volatile Organic Compounds (VOC)s																						
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	NA	0.00081 U	0.0012 U	0.00097 U	0.0014 U	0.0013 U	0.0013 U	0.00089 U	0.0012 U	0.00097 U	0.00083 U	NA	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	NA	0.004 U	0.0061 U	0.0048 U	0.0071 U	0.0063 U	0.0064 U	0.0044 U	0.006 U	0.0048 U	0.0042 U	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	NA	0.00081 U	0.0012 U	0.00097 U	0.0014 U	0.0013 U	0.0013 U	0.00089 U	0.0012 U	0.00097 U	0.00083 U	NA	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	NA	0.0016 U	0.0024 U	0.0019 U	0.0028 U	0.0025 U	0.0025 U	0.0018 U	0.0024 U	0.0019 U	0.0017 U	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	NA	0.00081 U	0.0012 U	0.00097 U	0.0014 U	0.0013 U	0.0013 U	0.00089 U	0.0012 U	0.00097 U	0.00083 U	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	NA	0.00081 U	0.0012 U	0.00097 U	0.0014 U	0.0013 U	0.0013 U	0.00089 U	0.0012 U	0.00097 U	0.00083 U	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	NA	0.00081 U	0.0012 U	0.00097 U	0.0014 U	0.0013 U	0.0013 U	0.00089 U	0.0012 U	0.00097 U	0.00083 U	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	NA	0.00081 U	0.0012 U	0.00097 U	0.0014 U	0.0013 U	0.0013 U	0.00089 U	0.0012 U	0.00097 U	0.00083 U	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	NA	0.00081 U	0.0012 U	0.00097 U	0.0014 U	0.0013 U	0.0013 U	0.00089 U	0.0012 U	0.00097 U	0.00083 U	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	NA	0.00081 U	0.0012 U	0.00097 U	0.0014 U	0.0013 U	0.0013 U	0.00089 U	0.0012 U	0.00097 U	0.00083 U	NA	NA	NA	NA	NA

Notes:

i	Method reporting limit is elevated due to a matrix interference.	B	The sample result is five times less than blank contamination and cross-contamination is suspected.
J	Estimated concentration.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
NA	Not applicable or not analyzed.	LMW PAH	Low molecular weight PAH.
NE	Not established.	HMW PAH	High molecular weight PAH.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.	Detected concentrations shown in **bold** exceed one or more site soil screening levels.	
U	Chemical was not detected. The associated value represents the method detection limit.		
UJ	Chemical was not detected. The associated limit is estimated.		

In initial RI test pit TP-BS01-BS that investigated surface impacted soil, COPCs were detected at concentrations that exceeded soil screening levels to the total depth of the test pits at 1 ft bgs. A subsequent WPA test pit A2-TP07 detected concentrations of fluoride, PAH as TTEC and total HMW, arsenic, cadmium, chromium, nickel, and zinc that exceed soil screening levels at 4 ft bgs. The vertical extent of soil contamination at TP-BS01 has not been defined.

Based on water levels measured as part of the Groundwater AOC investigation, the depth to the shallowest groundwater (UA aquifer) beneath A2, if present, is approximately elevation 470 ft or approximately 12 or more feet bgs. The concentration of fluoride in shallow groundwater beneath this segment is expected to be approximately 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). The maximum concentration of fluoride detected in segment A2 is 2,500 mg/kg and is associated with a sample collected from impacted surface soil at 1 ft bgs.

2.3.2.3 Conclusions and Recommendations

The vertical extent of contamination has been defined except at test pits A2-TP05, A2-TP04, and A2-TP07 where fluoride, PAH as TTEC and HMW, cadmium, selenium and zinc were detected at concentrations that exceed soil screening levels at 4 ft bgs the deepest depth of sampling. The maximum concentration of fluoride detected in segment A2 is 2,500 mg/kg and is associated with a sample collected from impacted surface soil at 1 ft bgs.

Based on COPCs exceedance of soil screening levels to depths of 4 ft bgs, Segment A2 is recommended for further evaluation in the FS.

2.3.3 Courtyard Segment A3

Courtyard segment A3 is the central segment of Courtyard A. The west end of segment A3 is approximately 20 ft wide, the middle portion is approximately 40 ft wide, and east end narrows to 30 ft wide then 20 ft wide. The total area of segment A3 is approximately 17,028 square feet. Its size is irregular due to the shape of the northern margin of the Cast House and Shipping building adjacent to the south. Calculated area in segment A3 does not include surfaces such as concrete foundations, sloped areas, or ramps. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. At the western end of segment A3 is a concrete underpass beneath Passage No. 2 to provide access between segments A2 and A3. At the eastern end of segment A3 is a concrete underpass beneath Passage No. 3 to provide access between segments A3 and A4.

Several features and structures existed in and adjacent to segment A3 (Figure 2.3.3-1) as follows:

- Transformer Substation T27A/T27B/T27C, and T10A (three units on one slab and one of two units on one slab, previously investigated as part of Rectifier Yard AOC, T27A/T27B are shown on Figure 2.3.3-1 but outside of the segment exposed soil perimeter)
- SWMU 5 Line A Secondary Scrubber Recycle Station (three soil borings, one installed as a shallow groundwater monitoring well RI-GW5, shown on Figure 2.3.3-1 but outside of the segment exposed soil perimeter)
- Cast house foundation adjacent to the south
- Scrubber Effluent line no. 4 horizontal subsurface pipe and manholes
- Stormwater line no. 14 horizontal subsurface pipe and catch basins
- Impacted surface soil mapped during the initial RI across most of A3

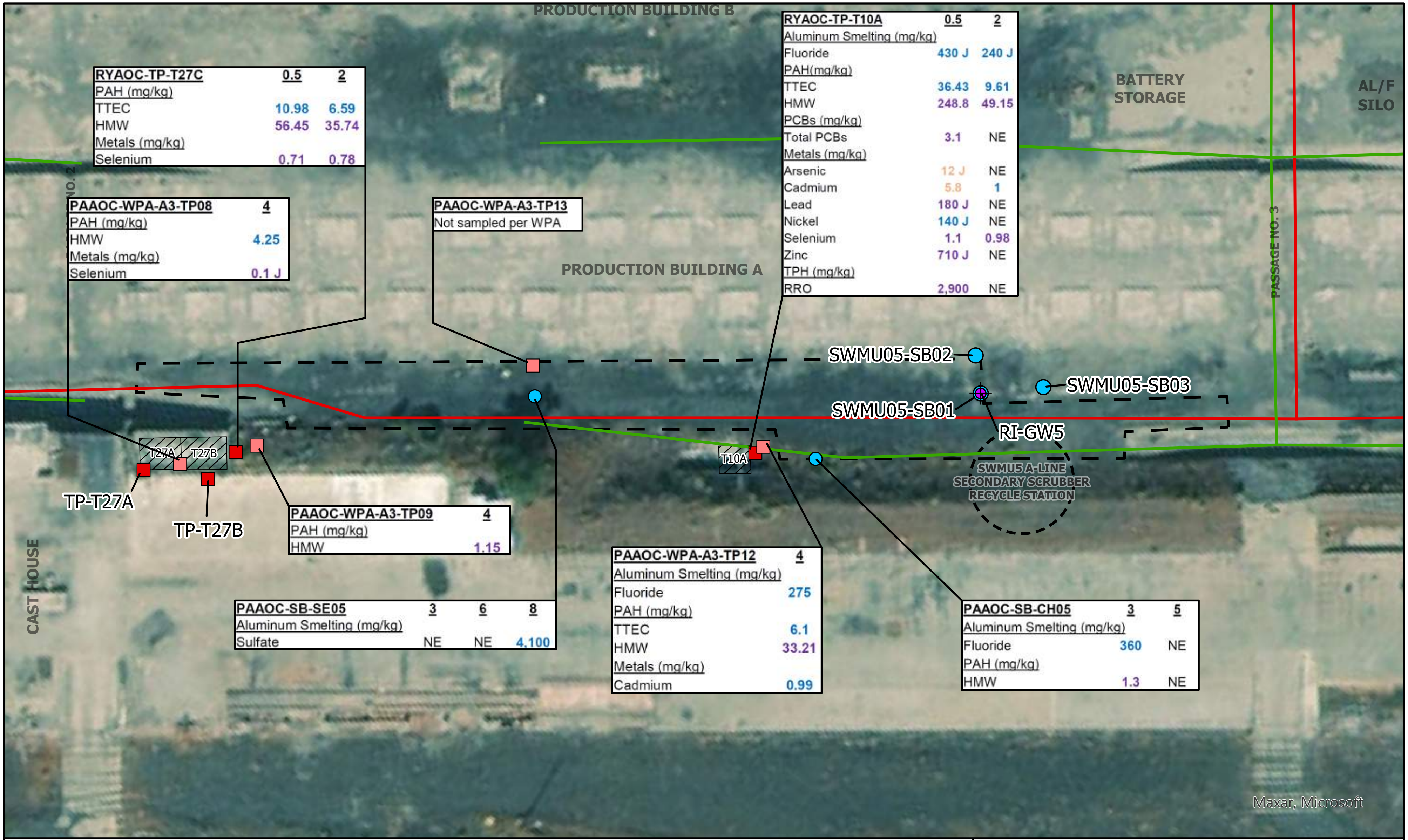
These features in and adjacent to Courtyard segment A3 were the focus of the initial RI investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data, and to confirm thickness of impacted surface soil.

2.3.3.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment A3 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included two soil borings and four test pits. The soil borings investigated the Scrubber Effluent line and the Cast House building while four test pits investigated the transformer substations T27/T27B/T27C and T10A and one test pit investigated soil boring location SB-SE05. RI boring and test pit locations are shown on Figure 2.3.3-1.

Sample depths and analyses are as follows:

- Scrubber Effluent line boring samples targeted to above and below horizontal pipe invert at approximately 9 to 10 ft bgs (plant drawing A00201)
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs
- Transformer substation samples 0.5, 2.0 ft bgs
    - ❖ Analytes: total cyanide, fluoride, PAHs, PCBs, metals, TPH-Dx



RYAOC-TP-T27C	0.5	2
PAH (mg/kg)		
TTEC	10.98	6.59
HMW	56.45	35.74
Metals (mg/kg)		
Selenium	0.71	0.78

PAAOC-WPA-A3-TP08	4
PAH (mg/kg)	
HMW	4.25
Metals (mg/kg)	
Selenium	0.1 J

PAAOC-WPA-A3-TP13
Not sampled per WPA

RYAOC-TP-T10A	0.5	2
Aluminum Smelting (mg/kg)		
Fluoride	430 J	240 J
PAH(mg/kg)		
TTEC	36.43	9.61
HMW	248.8	49.15
PCBs (mg/kg)		
Total PCBs	3.1	NE
Metals (mg/kg)		
Arsenic	12 J	NE
Cadmium	5.8	1
Lead	180 J	NE
Nickel	140 J	NE
Selenium	1.1	0.98
Zinc	710 J	NE
TPH (mg/kg)		
RRO	2,900	NE

PAAOC-WPA-A3-TP09	4
PAH (mg/kg)	
HMW	1.15

PAAOC-SB-SE05	3	6	8
Aluminum Smelting (mg/kg)			
Sulfate	NE	NE	4,100

PAAOC-WPA-A3-TP12	4
Aluminum Smelting (mg/kg)	
Fluoride	275
PAH (mg/kg)	
TTEC	6.1
HMW	33.21
Metals (mg/kg)	
Cadmium	0.99

PAAOC-SB-CH05	3	5
Aluminum Smelting (mg/kg)		
Fluoride	360	NE
PAH (mg/kg)		
HMW	1.3	NE

⌐ ¬	Courtyard Segment A3
●	RI Soil Boring
⊕	RI Monitor Well
🟥	RI Test Pit
🟥	WPA Test Pit
—	Scrubber Effluent Line
—	Stormwater System Line
▨	Approximate Transformer Pad

Segment A3 approximate area: 17,028 sq. ft.

Soil Screening Levels

blue: exceeds Protection of Groundwater

purple: exceeds ecological wildlife and for TPH diesel and residual range organics exceeds MTCA Method A

orange: exceeds MTCA Method A

NE: No exceedance

J: Estimated concentration

2: Sample depth in feet bgs

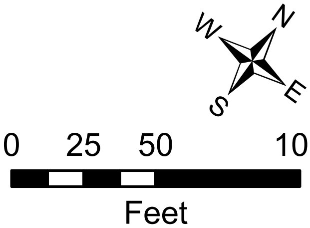


Figure 2.3.3-1

Plant Area AOC

Courtyard Segment A3 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected RI sample stations where the deepest sample exceeded site soil screen levels (Tetra Tech et al. 2020b). This included four test pits excavated at initial RI-phase sample stations. Three test pits were excavated at transformer substation T27A/T27B/T27C, and T10A to a depth of 4 ft, 2 ft below the previous sample depth. The fourth test pit was excavated at soil boring SB-SE05 to 4 ft depth to confirm the upper 2 ft of soil profile and as proposed in the WPA, no samples were collected. WPA soil samples were analyzed for fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. WPA test pit locations are shown on Figure 2.3.3-1.

2.3.3.2 Investigation Results

Segment A3 soil was investigated with a combined total of two soil borings and eight test pits in the initial RI and WPA phases of investigation. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.3-1 (PAAOC Courtyard Segment A3 RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in 5 out of 12 samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment A3 are compiled and presented on Figure 2.3.3-1. The vertical extent of contamination has been defined for the scrubber effluent and cast house sampling locations through initial RI data, except for sulfate detected at 8 ft bgs at the SB-SE05 location. The vertical extent of contamination is not defined at transformer substations T27A/T27B/T27C and T10A where subsequent WPA test pits detected some COPCs at low concentrations but still exceeding soil screening levels.

At scrubber effluent sampling location SB-SE05, COPCs were not detected at concentrations that exceed soil screening levels except for one detection of sulfate at 4,100 mg/kg in the 8 ft bgs sample, the deepest depth sampled. Sulfate was detected at this location at concentrations that increase with

Table 2.3.3-1
PAAOC Courtyard Segment A3 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results									WPA Analytical Results		
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-CH05-3	PAAOC-SB-CH05-5	PAAOC-SB-SE05-3	PAAOC-SB-SE05-6	PAAOC-SB-SE05-8	RYAOC-TP-T10A-0.5	RYAOC-TP-T10A-2	RYAOC-TP-T27C-0.5	RYAOC-TP-T27C-2	PAAOC-WPA-A3-TP08-4	PAAOC-WPA-A3-TP09-4	PAAOC-WPA-A3-TP12-4
Aluminum Smelting																		
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.12	0.05 U	0.05 U	0.05 U	1.9 U	2.1 U	1.9 U	2 U	NA	NA	NA
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**360**	43	20	7	20	**430 J**	**240 J**	25	42	66 J	36.9 J	**275**
Sulfate	mg/kg	NA	NE	2,150	NE	NE	97 J	14 J	840 J	2,000 J	**4,100**	NA	NA	NA	NA	15.6	4.3	42
Polynuclear Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0071 U	0.0079 U	0.0074 U	0.0073 U	0.0085 U	0.18	0.045	0.061	0.035	0.001 J	0.0032 J	0.015
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0071 U	0.0079 U	0.0074 U	0.0073 U	0.0085 U	0.25	0.061	0.086 J	0.035	0.0097	0.013	0.19
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.018	0.0079 U	0.0074 U	0.0073 U	0.0085 U	2.3	0.38	0.72 J	0.26	0.0007 J	0.0054 U	0.0032 J
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0071 U	0.0079 U	0.0074 U	0.0073 U	0.0085 U	0.061	0.015 J	0.007	0.017 J	0.032	0.02	0.33
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.03	0.0079 U	0.0074 U	0.0073 U	0.0085 U	3.4	0.64	0.76 J	0.52	0.36	0.11	3.1
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.14	0.0079 U	0.0074 U	0.036	0.0085 U	24	4.6	6.7	2.9	0.43	0.12	4.3
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.099	0.0079 U	0.0074 U	0.032	0.0085 U	24	5.1	8.3	4.8	0.94	0.22	6.8
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.22	0.0079 U	0.0074 U	0.059	0.0085 U	46	8.7	11	6.5	0.42	0.15	3.6
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.076	0.0079 U	0.0074 U	0.028	0.0085 U	29	6.5	3.7 J	4.2	0.29	0.071	1.7
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.066	0.0079 U	0.0074 U	0.019	0.0085 U	13	3.1	2.8 J	2.4	0.82	0.14	3.9
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.28	0.0079 U	0.0074 U	0.048	0.0085 U	35	6.1	8.5	3.9	0.11	0.029	0.91
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.02	0.0079 U	0.0074 U	0.0073 U	0.0085 U	4.8	0.95	0.95 J	0.64	0.0027 J	0.0047 J	0.052
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.32	0.0079 U	0.0074 U	0.065	0.0085 U	46	7.9	12	5.8	0.48	0.23	5.6
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0083	0.0079 U	0.0074 U	0.0073 U	0.0085 U	1	0.17	0.31 J	0.14	0.0057	0.0072	0.1
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.08	0.0079 U	0.0074 U	0.028	0.0085 U	33	7.1	4.5	5.1	0.5	0.16	4.8
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0071 U	0.0079 U	0.0074 U	0.0073 U	0.0085 U	0.4	0.078	0.13 J	0.056	0.0023 JB	0.0038 J	0.026
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.12	0.0079 U	0.0074 U	0.025	0.0085 U	15	2.4	3.9	2.1	0.12	0.1	1.5
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.3	0.0079 U	0.0074 U	0.06	0.0085 U	40	7	10	5.3	0.38	0.15	4.1
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.15	0.0079	0.0074	0.06	0.0085	**36.43**	**9.61**	**10.98**	**6.59**	0.66	0.18	**6.1**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.5	0.0079	0.0074	0.09	0.0085	68.16	11.58	17.83	8.9	0.65	0.6	7.75
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**1.3**	0.0079	0.0074	0.31	0.0085	**248.8**	**49.15**	**56.45**	**35.74**	**4.25**	**1.15**	**33.21**
Polychlorinated Biphenyls (PCBs)																		
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.053 U	0.059 U	0.055 U	0.055 U	0.064 U	0.0069 U	0.0073 U	0.0064	0.0069 U	0.011 U	0.011 U	0.022 Ui
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.053 U	0.059 U	0.055 U	0.055 U	0.064 U	0.0039 U	0.0041 U	0.0036 UJ	0.0039 UJ	0.022 U	0.022 U	0.021 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.053 U	0.059 U	0.055 U	0.055 U	0.064 U	0.0046 U	0.0048 U	0.0042 U	0.0046 U	0.011 U	0.011 U	0.016 Ui
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.053 U	0.059 U	0.055 U	0.055 U	0.064 U	0.0015 U	0.0016 U	0.0014 U	0.0015 U	0.011 U	0.011 U	0.011 Ui
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.053 U	0.059 U	0.055 U	0.055 U	0.064 U	0.0027 U	0.0029 U	0.0025 U	0.0027 U	0.011 U	0.011 U	0.011 Ui
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.053 U	0.059 U	0.055 U	0.055 U	0.064 U	0.0014 U	0.0015 U	0.0013 UJ	0.0014 UJ	0.011 U	0.011 U	0.028 Ui
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.053 U	0.059 U	0.055 U	0.055 U	0.064 U	3.1	0.59	0.0016 UJ	0.0018 UJ	0.011 U	0.011 U	0.29
Aroclor 1262	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	0.00047 U	0.00049 U	0.00043 UJ	0.00047 UJ	NA	NA	NA
Aroclor 1268	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	0.00084 U	0.00089 U	0.00078 UJ	0.00084 UJ	NA	NA	NA
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	0.053	0.059	0.055	0.055	0.064	**3.1**	0.59	0.00043	0.00047	0.011	0.011	0.29
Metals																		
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	7,700	7,900	6,200	6,400	17,000	49,000 J	16,000 J	6,900 J	7,200 J	7,650	8,000	16,800
Arsenic	mg/kg	20	87.5	2.9	7.61	132	11 U	12 U	11 U	11 U	13 U	**12 J**	5 J	2.3	2.6	2.14	2.53	4.8
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.53 U	0.59 U	0.55 U	0.55 U	0.64 U	**5.8**	**1**	0.52 J	0.61 J	0.134	0.109	**0.99**
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	5.3	6.3	4.7	5.8	7.1	58 J	12 J	9.3 J	9.1 J	7.45	6.75	15
Copper	mg/kg	NA	140,000	280	28.4	217	15	14	16	18	23	64 J	63 J	16 J	18 J	17.5	16.7	28.9
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.3 U	5.9 U	5.5 U	5.5 U	6.4 U	**180 J**	14 J	4.6 J	5.8 J	4.17	4.5	12
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.27 U	0.29 U	0.28 U	0.27 U	0.32 U	0.51	0.044	0.093 J	0.14 J	0.006 J	0.006 J	0.046
Nickel	mg/kg	NA	70,000	130	24.54	980	5.1	7.9	5.1	5	7.4	**140 J**	31 J	12 J	12 J	7.78	8.01	33.5
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	12 U	11 U	11 U	13 U	**1.1**	**0.98**	**0.71**	**0.78**	**0.1 J**	0.1 J	0.3 J
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	49	41	40	44	63	**710 J**	190 J	100 J	99 J	74.2	63.2	173
Total Petroleum Hydrocarbons (TPHs)																		
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	27 U	29 U	28 U	27 U	32 U	1,400	130	85	140	15 J	4.5 J	250 J
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	53 U	59 U	55 U	55 U	64 U	**2,900**	300	270	350	96 J	17 J	570 J
Volatile Organic Compounds (VOCs)																		
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.0011 U	0.001 U	0.00097 U	0.0011 U	0.0014 U	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0053 U	0.0052 U	0.0049 U	0.0056 U	0.007 U	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.0011 U	0.001 U	0.00097 U	0.0011 U	0.0014 U	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.0021 U	0.0021 U	0.0019 U	0.0023 U	0.0028 U	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	0.0011 U	0.001 U	0.00097 U	0.0011 U	0.0014 U	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.0011 U	0.001 U	0.00097 U	0.0011 U	0.0014 U	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.0011 U	0.001 U	0.00097 U	0.0011 U	0.0014 U	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.0011 U	0.001 U	0.00097 U	0.0011 U	0.0014 U	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.0011 U	0.001 U	0.00097 U	0.0011 U	0.0014 U	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	0.0011 U	0.001 U	0.00097 U	0.0011 U	0.0014 U	NA	NA	NA	NA	NA	NA	NA

Notes:

i	Method reporting limit is elevated due to a matrix interference.	B	The sample result is five times less than blank contamination and cross-contamination is suspected.
J	Estimated concentration.		Total Toxicity Equivalent Concentration for carcinogenic PAHs.
NA	Not applicable or not analyzed.		Low molecular weight PAH.
NE	Not established.		High molecular weight PAH.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.		
U	Chemical was not detected. The associated value represents the method detection limit.		
UJ	Chemical was not detected. The associated limit is estimated.		

depth (840 J mg/kg at 3 ft bgs, 2,000 J mg/kg at 6 ft bgs, and 4,100 mg/kg at 8 ft bgs) and may reflect a localized area of elevated concentrations of sulfate in shallow groundwater. Basalt flow top may have been encountered in boring SB-SE05 at a depth of about 6.5 ft bgs and the SB-SE05 sample may have been collected from below the water table. The source of sulfate at this location may be associated with the nearby SWMU 5 Line A Secondary Scrubber Recycle Station and/or subsurface piping associated with this SWMU. In addition, presence of sulfate in shallow groundwater beneath this segment may also be associated with subsurface piping leaks in the Crucible Cleaning Room Investigation Area (Section 2.2.1) upgradient and to the north of segment A3. No other surface source of sulfate has been identified in this segment.

Initial RI test pit TP-T27A, TP-T27B, and TP-T27C are located outside of the exposed soil perimeter of segment A3 and were collected from inside the vault that holds transformer substation T27A/T27B/T27C. Initial RI test pit TP-T27C investigated transformer substation unit T-27C closest to exposed soil of segment A3. COPCs were detected at concentrations that exceeded soil screening levels to the total depth of the test pit at 4 ft bgs. Subsequent WPA test pits A3-TP08 and A3-TP09 excavated at T27B/T27C units detected low concentrations of PAH as total HMW and selenium that exceed the ecological wildlife soil screening level. The vertical extent of soil contamination at T-27A/B/C has not been defined but the transformer vault may limit depth of contamination in soil.

Initial RI test pit TP-T10A investigated transformer substation unit T10A, COPCs were detected at concentrations that exceeded soil screening levels to the total depth of the test pit at 2 ft bgs. Subsequent WPA test pit A3-TP12 detected concentrations of fluoride, PAHs as total HMW, and cadmium that exceed soil screening levels at 4 ft bgs, the deepest depth sampled. The vertical extent of soil contamination at T10A has not been defined.

Basalt flow top may have been encountered at 6.5 ft bgs in the center portion of segment A3. The water level measured at the time of well installation in UA aquifer monitoring well RI-GW5 in the eastern portion of A3, was approximately 12 ft bgs. The concentrations of fluoride in shallow groundwater beneath this segment are expected to be at or greater than 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). The maximum concentration of fluoride detected in segment A3 is 430 J associated with transformer substation T10A collected at 0.5 ft bgs.

2.3.3.3 Conclusions and Recommendations

The vertical extent of contamination has not been defined at soil boring SB-SE05 where sulfate was detected at concentrations that exceed soil screening levels at 8 ft bgs but was not detected in the 3- and 6-ft bgs samples. The sulfate concentration may be associated SWMU 5 underground piping potential subsurface leaks.

The vertical extent of contamination has not been defined at test pits A3-TP08, A3-TP09, and A3-TP12 where fluoride, PAH as HMW, cadmium, and selenium were detected at concentrations that exceed soil screening levels at 4 ft bgs the deepest depth of sampling. The maximum concentration of fluoride detected in segment A3 is 430 J associated with transformer substation T10A collected at 0.5 ft bgs.

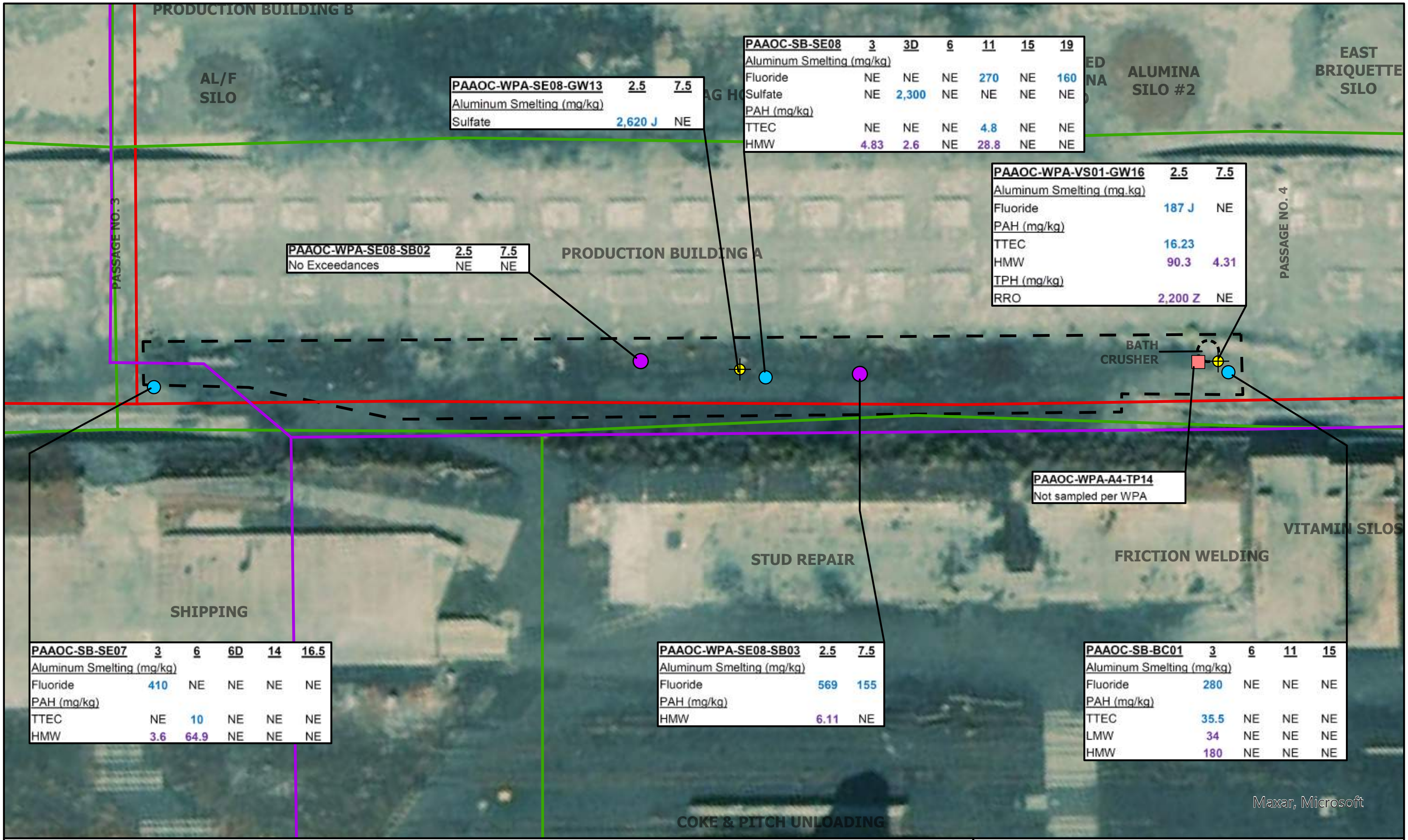
Based on COPCs exceedance of soil screening levels to depths of 4 ft bgs, Segment A3 is recommended for further evaluation in the FS.

2.3.4 Courtyard Segment A4

Courtyard segment A4 is in the eastern portion of Courtyard A, adjacent east of segment A3 and adjacent west of segment A5. The west end of segment A4 is approximately 22 ft wide, widening to approximately 40 ft wide in the middle and towards the eastern end with an approximate area of 19,701 square feet. Its irregular size is due to a ramp in the southwest corner leading up between the Shipping Building and the Stud Repair building. Calculated area in segment A4 does not include surfaces such as concrete foundations, sloped areas, or ramps. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. At the western end of segment A4 is a concrete underpass beneath Passage No. 2 to provide access between segments A3 and A4. At the eastern end of segment A4 is a concrete underpass beneath Passage No. 3 to provide access between segments A4 and A5.

Several features and structures existed in and adjacent to segment A4 (Figure 2.3.4-1) as follows:

- I&M line no. 3 subsurface pipe and manholes
- Bath crusher structure located at the eastern end of segment A4
- Scrubber Effluent line no. 4 horizontal subsurface pipe and manholes
- Stormwater line no. 15 horizontal subsurface pipe and catch basins
- Impacted surface soil mapped during the initial RI across portions of A4



PAAOC-WPA-SE08-GW13	2.5	7.5
Aluminum Smelting (mg/kg)		
Sulfate	2,620 J	NE

PAAOC-SB-SE08	3	3D	6	11	15	19
Aluminum Smelting (mg/kg)						
Fluoride	NE	NE	NE	270	NE	160
Sulfate	NE	2,300	NE	NE	NE	NE
PAH (mg/kg)						
TTEC	NE	NE	NE	4.8	NE	NE
HMW	4.83	2.6	NE	28.8	NE	NE

PAAOC-WPA-VS01-GW16	2.5	7.5
Aluminum Smelting (mg.kg)		
Fluoride	187 J	NE
PAH (mg/kg)		
TTEC	16.23	
HMW	90.3	4.31
TPH (mg/kg)		
RRO	2,200 Z	NE

PAAOC-WPA-SE08-SB02	2.5	7.5
No Exceedances	NE	NE

PAAOC-WPA-A4-TP14
Not sampled per WPA

PAAOC-SB-SE07	3	6	6D	14	16.5
Aluminum Smelting (mg/kg)					
Fluoride	410	NE	NE	NE	NE
PAH (mg/kg)					
TTEC	NE	10	NE	NE	NE
HMW	3.6	64.9	NE	NE	NE

PAAOC-WPA-SE08-SB03	2.5	7.5
Aluminum Smelting (mg/kg)		
Fluoride	569	155
PAH (mg/kg)		
HMW	6.11	NE

PAAOC-SB-BC01	3	6	11	15
Aluminum Smelting (mg/kg)				
Fluoride	280	NE	NE	NE
PAH (mg/kg)				
TTEC	35.5	NE	NE	NE
LMW	34	NE	NE	NE
HMW	180	NE	NE	NE

- ⌐ ¬ Courtyard Segment A4
- ● RI Soil Boring
- ● WPA Soil Boring
- ⊕ WPA Monitor Well
- 🟥 WPA Test Pit
- — Scrubber Effluent Line
- — Stormwater System Line
- — Industrial & Monitoring Line

Segment A4 approximate area: 19,701 sq. ft.

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife and for TPH diesel and residual range organics exceeds MTCA Method A
NE: No exceedance
Z: Chromatograph fingerprint does not resemble a petroleum product
D: Duplicate sample
2: Sample depth in feet bgs

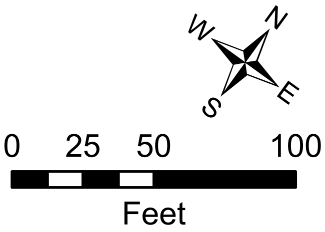


Figure 2.3.4-1

Plant Area AOC

Courtyard Segment A4 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

These features in and adjacent to Courtyard segment A4 were the focus of the initial RI phase of investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data, and to confirm thickness of impacted surface soil.

2.3.4.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment A4 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included three soil borings that investigated the Scrubber Effluent line, the previous Bath Crusher structure, and the vitamin silo. RI boring locations are shown on Figure 2.3.4-1.

Sample depths and analyses are as follows:

- Scrubber Effluent line boring samples 3, 5, 14, 16.5 ft bgs and 3, 6, 11, 15, 19 ft bgs targeted to above and below the Scrubber Effluent line horizontal pipe invert at approximately 11 ft bgs to 13 ft bgs
  - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs
- Bath Crusher boring samples 3, 6, 11, 15 ft bgs targeted to above and below the Scrubber Effluent line invert at approximately 13 ft bgs
  - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected RI sample stations where the deepest sample exceeded site soil screen levels (Tetra Tech et al. 2020b). This included two soil borings and one shallow groundwater monitoring well to investigate the Scrubber Effluent Boring SB-SE08 (Section 2.2.6, SE08 Investigation Area), and one shallow groundwater monitoring well at the eastern end of A4 associated with sampling locations in adjacent segment A5. One test pit was excavated near SB-BC01 to a depth of 4 ft, to confirm the surface impacted soil and, as proposed in the WPA, no samples were collected. WPA soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, metals, and TPH-Dx. WPA boring, monitoring well, and test pit locations are shown on Figure 2.3.4-1.

2.3.4.2 Investigation Results

Segment A4 soil was investigated with a combined total of five soil borings, two shallow monitoring well installations, and one test pit. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.4-1 (PAAOC Courtyard Segment A4 Initial RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in most samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment A4 are compiled and presented on Figure 2.3.4-1. The vertical extent of contamination has been defined for the SB-SE07, SE08-SB02, SE08-GW13, and SB-BC01 sampling locations through initial RI data. The vertical extent of contamination is not defined at boring locations SB-SE08, SE08-SB03, and VS01-GW16 where initial RI and subsequent WPA borings detected some COPCs at low concentrations but still exceeding soil screening levels.

Initial RI borings SB-SE07 and SB-BC01 detected COPCs at concentrations that exceed soil screening levels to 6 ft bgs and 3 ft bgs, respectively, but did not exceed at deeper depths sampled. The vertical extent has been defined by initial RI data. In subsequent WPA boring SE08-SB02, concentrations of COPC were not detected above screening levels.

Initial RI boring SB-SE08 was investigated with nearby subsequent WPA boring SE08-GW13 and sulfate was detected at 6 ft bgs at a concentration that exceeds ecological wildlife soil screening level. COPCs did not exceed soil screening levels at deeper depths sampled. The vertical extent of soil contamination for these borings has been defined.

WPA phase borings were completed in segment A4 as part of the VS01 and SE08 investigation areas (refer to Section 2.2.2 and 2.2.6) to investigate higher concentrations of fluoride and sulfate at

Table 2.3.4-1
PAAOC Courtyard Segment A4 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington
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		Screening Levels				Ecological Screening Levels	Initial RI Analytical Results											
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-BC01-3**	**PAAOC-SB-BC01-6**	**PAAOC-SB-BC01-11**	**PAAOC-SB-BC01-15**	**PAAOC-SB-SE07-3**	**PAAOC-SB-SE07-6**	**PAAOC-SB-SE07-6D**	**PAAOC-SB-SE07-14**	**PAAOC-SB-SE07-16.5**	**PAAOC-SB-SE08-3**	**PAAOC-SB-SE08-3D**	**PAAOC-SB-SE08-6**
Aluminum Smelting																		
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**280**	76	80	32	**410**	20 J	31	31	20	70 J	50	100
Sulfate	mg/kg	NA	NE	2,150	NE	NE	61 J	35 J	46	140 J	50 J	21 J	38	140 J	120 J	240 J	**2,300**	630 J
Polynuclear Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	16 U	0.0084 U	0.0073 U	0.0077 U	0.035 U	0.15 U	0.0073 U	0.0085 U	0.0082 U	0.037 U	0.0089	0.0075 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	16 U	0.0084 U	0.0073 U	0.0077 U	0.035 U	0.15 U	0.0073 U	0.0085 U	0.0082 U	0.037 U	0.011	0.0075 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	16 U	0.0084 U	0.0073 U	0.0077 U	0.035 U	0.18	0.0073 U	0.0085 U	0.0082 U	0.078	0.059	0.0075 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	16 U	0.0084 U	0.0073 U	0.0077 U	0.035 U	0.15 U	0.0073 U	0.0085 U	0.0082 U	0.037 U	0.0074	0.0075 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	16 U	0.0084 U	0.0073 U	0.0077 U	0.048	0.49 J	0.0073 U	0.0085 U	0.0082 U	0.17	0.12	0.0075 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	21	0.0084 U	0.011	0.036	0.35	5.7 J	0.0077	0.0085 U	0.0082 U	0.54 J	0.3	0.0075 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	28	0.0084 U	0.016	0.053	0.4	6.6 J	0.0073 U	0.0085 U	0.0082 U	0.57 J	0.29	0.0075 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	32	0.012	0.023	0.069	0.71	16 J	0.019	0.0085 U	0.0082 U	0.84 J	0.43	0.0075 U
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	18	0.0084 U	0.014	0.039	0.36	6.3	0.0073 U	0.0085 U	0.0082 U	0.43	0.22	0.0075 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	16 U	0.0084 U	0.0073 U	0.024	0.22	3.7 J	0.0073 U	0.0085 U	0.0082 U	0.27	0.13	0.0075 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	25	0.0093	0.013	0.042	0.6	13 J	0.027	0.0085 U	0.0082 U	0.64 J	0.32	0.019
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	16 U	0.0084 U	0.0073 U	0.0082	0.081	1.3 J	0.0073 U	0.0085 U	0.0082 U	0.097	0.048	0.0075 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	36	0.018	0.016	0.054	0.51	8.2 J	0.019	0.0085 U	0.0082 U	1.2 J	0.72	0.03
Fluorene	mg/kg	NL	140,000	100	NE	NL	16 U	0.0084 U	0.0073 U	0.0077 U	0.035 U	0.15 U	0.0073 U	0.0085 U	0.0082 U	0.082	0.065	0.0075 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	19	0.0084 U	0.011	0.04	0.34	4.7 J	0.0073 U	0.0085 U	0.0082 U	0.45 J	0.23	0.0075 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0053	0.0014 U	0.0073 U	0.0077 U	0.035 U	0.15 U	0.0073 U	0.0085 U	0.0015 U	0.054 J	0.028	0.0075 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	18	0.0014 U	0.0073 U	0.021	0.16	1.9	0.0073 U	0.0085 U	0.0082 U	0.78	0.52	0.0075 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	37	0.017	0.015	0.051	0.49	7.6 J	0.016	0.0085 U	0.0082 U	0.99 J	0.59	0.018
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**35.5**	0.001	0.02	0.07	0.6	**10**	0.003	0.0085	0.0082	0.8	0.41	0.0002
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	**34**	0.02	0.02	0.08	0.72	10.8	0.02	0.0085	0.0082	2.36	1.52	0.03
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**180**	0.04	0.1	0.36	**3.6**	**64.9**	0.07	0.0085	0.0082	**4.83**	**2.6**	0.04
Polychlorinated Biphenyls (PCBs)																		
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.06 U	0.063 U	0.055 U	0.058 U	0.053 U	0.056 U	0.055 U	0.064 U	0.061 U	0.055 U	0.055 U	0.056 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.06 U	0.063 U	0.055 U	0.058 U	0.053 U	0.056 U	0.055 U	0.064 U	0.061 U	0.055 U	0.055 U	0.056 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.06 U	0.063 U	0.055 U	0.058 U	0.053 U	0.056 U	0.055 U	0.064 U	0.061 U	0.055 U	0.055 U	0.056 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.06 U	0.063 U	0.055 U	0.058 U	0.053 U	0.056 U	0.055 U	0.064 U	0.061 U	0.055 U	0.055 U	0.056 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.06 U	0.063 U	0.055 U	0.058 U	0.053 U	0.056 U	0.055 U	0.064 U	0.061 U	0.055 U	0.055 U	0.056 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.06 U	0.063 U	0.055 U	0.058 U	0.053 U	0.056 U	0.055 U	0.064 U	0.061 U	0.055 U	0.055 U	0.056 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.06 U	0.063 U	0.055 U	0.058 U	0.053 U	0.056 U	0.055 U	0.064 U	0.061 U	0.055 U	0.055 U	0.056 U
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	0.06	0.063	0.055	0.058	0.053	0.056	0.055	0.064	0.061	0.055	0.055	0.056
Metals																		
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	17,000	13,000	4,300	3,800	6,000	10,000	8,200	13,000	10,000	7,000	7,700	7,200
Arsenic	mg/kg	20	88	2.9	7.61	132	12 U	13 U	11 U	12 U	11 U	11 U	11 U	13 U	12 U	11 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.6 U	0.63 U	0.55 U	0.58 U	0.57	0.56 U	0.55 U	0.64 U	0.61 U	0.55 U	0.55 U	0.56 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	5.7	1.9	1.8	2.2	5.5	7.3 J	5.5	3	3.4	3.8	4.6	5.8
Copper	mg/kg	NA	140,000	280	28.4	217	17	18	12	14	20	17	14	16	15	19 J	11	12
Lead	mg/kg	1,000	NE	3,000	13.1	118	6 U	6.3 U	5.5 U	5.8 U	5.3 U	5.6 U	5.5 U	6.4 U	6.1 U	5.5 U	5.6	5.6 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.3 U	0.31 U	0.27 U	0.29 U	0.27 U	0.28 U	0.27 U	0.32 U	0.31 U	0.27 U	0.27 U	0.28 U
Nickel	mg/kg	NA	70,000	130	24.54	980	12	3.6	2.7 U	2.9	6.9	7.5	5.1	4.1	3.9	4.3	4.2	4.9
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	12 U	13 U	11 U	12 U	11 U	11 U	11 U	13 U	12 U	11 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	68	33	32	34	210	57 J	45	45	39	60	55	39
Total Petroleum Hydrocarbons (TPHs)																		
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	210 U	32 U	28 U	29 U	27 U	28 U	27 U	32 U	31 U	430 J	27 U	28 U
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	1,400	63 U	55 U	58 U	67	95	55 U	64 U	62 U	95	55 U	56 U
Volatile Organic Compounds (VOCs)																		
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.0011 U	0.00079 U	0.001 U	0.0013 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0066 U	0.007 U	0.0038 U	0.0051 U	0.0057 U	0.0039 U	0.005 U	0.0063 U	0.0073 U	0.0056 U	0.006 U	0.0055 U
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.0011 U	0.00079 U	0.001 U	0.0013 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.0026 U	0.0028 U	0.0015 U	0.002 U	0.0023 U	0.0016 U	0.002 U	0.0025 U	0.0029 U	0.0023 U	0.0024 U	0.0022 U
o-Xylene	mg/kg	9	700,000	14	NE	10	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.0011 U	0.00079 U	0.001 U	0.0013 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.0011 U	0.00079 U	0.001 U	0.0013 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.0011 U	0.00079 U	0.001 U	0.0013 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.0011 U	0.00079 U	0.001 U	0.0013 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.0011 U	0.00079 U	0.001 U	0.0013 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.0011 U	0.00079 U	0.001 U	0.0013 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U

Notes:

i	Method reporting limit is elevated due to a matrix interference.
J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
B	The sample result is five times less than the blank contamination and cross-contamination is suspected.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.3.4-1
PAAOC Courtyard Segment A4 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results			WPA Analytical Results							
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-SE08-11**	**PAAOC-SB-SE08-15**	**PAAOC-SB-SE08-19**	**PAAOC-WPA-SE08-SB02-2.5**	**PAAOC-WPA-SE08-SB02-7.5**	**PAAOC-WPA-SE08-SB03-2.5**	**PAAOC-WPA-SE08-SB03-7.5**	**PAAOC-WPA-SE08-GW13-2.5**	**PAAOC-WPA-SE08-GW13-7.5**	**PAAOC-WPA-VS01-GW16-2.5**	**PAAOC-WPA-VS01-GW16-7.5**
Aluminum Smelting																	
Cyanide	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.05 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.2 UJ	0.22 UJ
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**270**	69	**160**	0.5	21.3	**569**	**155**	48	17 J	**187 J**	74.6 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	23 J	180 J	12 J	465 J	161 J	9.9 JB	33.5 J	**2,620 J**	289 J	210 J	192 J
Polynuclear Aromatic Hydrocarbons (PAHs)																	
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.15 U	0.0076 U	0.0079 U	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.15 U	0.0076 U	0.0079 U	0.00061 JB	0.00041U	0.0019 JB	0.00068 JB	0.00052 JB	0.00059 JB	0.16	0.002 J
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.16	0.0076 U	0.0079 U	0.00034 U	0.00033 U	0.019	0.00095 JB	0.00033 U	0.00035 U	1.3	0.017
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.15 U	0.0076 U	0.0079 U	0.00032 U	0.00031 U	0.002 J	0.00035 J	0.0003 U	0.00032 U	0.0095 J	0.00068 J
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.27	0.0076 U	0.0079 U	0.00036 J B	0.00032 U	0.039	0.0015 JB	0.00052 JB	0.00033 U	2.4	0.025
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	2.5	0.0076 U	0.013	0.00083 J	0.00048 J	0.47	0.019	0.0013 J	0.00072 J	11	0.41
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	3.3	0.0076 U	0.0079 U	0.00043 U	0.00042 U	0.66	0.027	0.00059 J	0.00044 U	12	0.47
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	6	0.0076 U	0.035	0.0012 J	0.00042 U	1.3	0.065	0.0011 J	0.00052 J	15	0.95
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	3	0.0076 U	0.0079 U	0.00045 U	0.00044 U	0.77	0.032	0.00043 U	0.00046 U	6.2	0.39
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	1.8	0.0076 U	0.0079 U	0.00027 U	0.00027 U	0.41	0.024	0.00026 U	0.00028 U	5.6	0.31
Chrysene	mg/kg	NA	NL	NL	NE	NL	4.3	0.0076 U	0.056	0.00083 J	0.00034 U	0.74	0.029	0.0011 J	0.00036 J	12	0.65
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.65	0.0076 U	0.0079 U	0.00026 U	0.00026 U	0.15	0.0058	0.00025 U	0.00027 U	1.8	0.11
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	4.5	0.0076 U	0.04	0.00092 JB	0.00069 U	0.081	0.035	0.0028 JB	0.00081 JB	22	0.5
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.15 U	0.0076 U	0.0079 U	0.00064 U	0.00063 U	0.012	0.00083 JB	0.00061 U	0.00065 U	0.68	0.0089
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	3.1	0.0076 U	0.0079 U	0.00041 U	0.0004 U	0.79	0.03	0.00039 U	0.00041 U	7.7	0.45
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.15 U	0.0076 U	0.0079 U	0.001 JB	0.00092 JB	0.0032 JB	0.0013 JB	0.001 JB	0.0013 JB	0.25	0.0032
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	1.4	0.0076 U	0.0079 U	0.0014 JB	0.00065 U	0.24	0.012 B	0.0028 JB	0.00075 JB	10	0.17
Pyrene	mg/kg	NA	110,000	650	NE	NL	4.1	0.0076 U	0.029	0.00089 JB	0.00035 U	0.82	0.038	0.0025 JB	0.00069 JB	19	0.57
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**4.8**	0.0076	0.01	0.00021	0.00005	0.98	0.04	0.0008	0.0001	**16.23**	0.7
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	6.33	0.0076	0.04	0.004	0.00092	0.4	0.06	0.007	0.003	36.64	0.73
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**28.8**	0.0076	0.13	0.004	0.0005	**6.11**	0.27	0.007	0.003	**90.3**	**4.31**
Polychlorinated Biphenyls (PCBs)																	
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.058 U	0.057 U	0.059 U	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.058 U	0.057 U	0.059 U	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.058 U	0.057 U	0.059 U	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.058 U	0.057 U	0.059 U	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.058 U	0.057 U	0.059 U	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.058 U	0.057 U	0.059 U	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.058 U	0.057 U	0.059 U	NA	NA	NA	NA	NA	NA	NA	NA
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	0.058	0.057	0.059	NA	NA	NA	NA	NA	NA	NA	NA
Metals																	
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	9,300	6,000	7,200	NA	NA	NA	NA	NA	NA	16,300	7,800
Arsenic	mg/kg	20	88	2.9	7.61	132	12 U	11 U	12 U	NA	NA	NA	NA	NA	NA	2.35	1.05
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.58 U	0.57 U	0.59 U	NA	NA	NA	NA	NA	NA	0.646	0.073
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	13	5.8	5.8	NA	NA	NA	NA	NA	NA	8.75	2
Copper	mg/kg	NA	140,000	280	28.4	217	29	19	17	NA	NA	NA	NA	NA	NA	20.4	21.4
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.8 U	5.7 U	5.9 U	NA	NA	NA	NA	NA	NA	10.6	3.11
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.29 U	0.28 U	0.3 U	NA	NA	NA	NA	NA	NA	0.021 U	0.023 U
Nickel	mg/kg	NA	70,000	130	24.54	980	20	8.1	6.4	NA	NA	NA	NA	NA	NA	11.8	2.84
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	12 U	11 U	12 U	NA	NA	NA	NA	NA	NA	0.2 J	0.4 J
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	150	61	62	NA	NA	NA	NA	NA	NA	103	49.4
Total Petroleum Hydrocarbons (TPHs)																	
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	71	29 U	30 U	4.2 U	4.0 U	14 J	3.6 J	3.9 U	2.5 J	510 Z	13 J
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	440	57 U	60 U	8.9 U	8.7 U	56 J	8.0 J	8.5 U	6.2 J	**2,200 Z**	49 J
Volatile Organic Compounds (VOCs)																	
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.0013 U	0.00097 U	0.0013 U	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0063 U	0.0048 U	0.0066 U	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.0013 U	0.00097 U	0.0013 U	NA	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.0025 U	0.0019 U	0.0026 U	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	0.0013 U	0.00097 U	0.0013 U	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.0013 U	0.00097 U	0.0013 U	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.0013 U	0.00097 U	0.0013 U	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.0013 U	0.00097 U	0.0013 U	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.0013 U	0.00097 U	0.0013 U	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	0.0013 U	0.00097 U	0.0013 U	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

i	Method reporting limit is elevated due to a matrix interference.	B	The sample result is five times less than the blank contamination and cross-contamination is suspected.
J	Estimated concentration.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
NA	Not applicable or not analyzed.	LMW PAH	Low molecular weight PAH.
NE	Not established.	HMW PAH	High molecular weight PAH.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.	Detected concentrations shown in bold exceed one or more site soil screening levels.	
U	Chemical was not detected. The associated value represents the method detection limit.		
UJ	Chemical was not detected. The associated limit is estimated.		

depth in initial RI borings SB-VS01 (segment A5) and SB-SE08. The vertical extent of contamination is not defined at WPA borings SE08-SB03 and VS01-GW16 where fluoride, PAH as TTEC and total HMW, and TPH as residual range organics exceed soil screening levels at 2 ft bgs, but fluoride and PAH as total HMW were detected at concentrations that still exceed soil screening levels at 7.5 ft bgs, the deepest depth sampled.

The vertical extent of contamination has not been defined at soil boring SB-SE08 where fluoride was detected at concentrations that exceed soil screening levels at 19 ft bgs. The depth to groundwater was measured at 13 ft bgs in SE08-GW13 and at 14 ft bgs in VS01-GW16. Basalt bedrock was encountered at 12.5 ft bgs in SE08-GW13 and 12 ft bgs in VS01-GW16. The 19 ft bgs soil sample in SB-SE08 with fluoride exceeding screening levels may have been collected below the water table, within the basalt flowtop, and likely reflects the sitewide fluoride plume.

Basalt flow top was encountered at around 12 ft bgs in the central and eastern portion of this segment. The water level measured at the time of well installation in UA aquifer monitoring well SE08-GW13 in the central portion of A4, was approximately 13 ft bgs, and in VS01-GW16 in the eastern portion of A4 was approximately 14 ft bgs. The concentrations of fluoride in shallow groundwater beneath this segment are expected to be greater than 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). The maximum concentration of fluoride detected in segment A4 is 2,620 mg/kg collected at 2.5 ft bgs.

2.3.4.3 Conclusions and Recommendations

The vertical extent of contamination has not been defined at soil borings VS01-GW16 and SE08-SB03 where fluoride and PAH as HMW were detected at concentrations that exceed soil screening levels at 7.5 ft bgs, the deepest depth of sampling. The maximum concentration of fluoride detected in segment A4 is 2,620 mg/kg collected at 2.5 ft bgs.

The vertical extent of contamination has not been defined at soil boring SB-SE08 where fluoride was detected at concentrations that exceed soil screening levels in the 19 ft bgs sample that was likely collected below the water table, within the basalt flowtop, and likely reflects the site-wide fluoride plume. Subsequent WPA investigations were completed as part of the VS01 and SE08 investigation areas and are further discussed in Section 2.2.

Based on COPC exceedance of soil screening levels to depths of 7.5 ft bgs, Segment A4 is recommended for further evaluation in the FS.

2.3.5 Courtyard Segment A5

Courtyard segment A5 is at the east end of Courtyard A, adjacent northeast to the Friction Weld Building and north of the Alumina Unloading station. The west end of segment A5 is approximately 15 ft wide and widens to approximately 45 ft through the center and to the eastern portion with an area of approximately 22,656 square feet. The irregular shape of the southwest corner is due to the ramp leading from segment A5 west underneath Passage No. 4. Calculated area in segment A5 does not include surfaces such as concrete foundations, sloped areas, or ramps. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. At the western end of segment A5 is a concrete underpass beneath Passage No. 3 to provide access between segments A4 and A5. At the eastern end of segment A5 is the Production Services building.

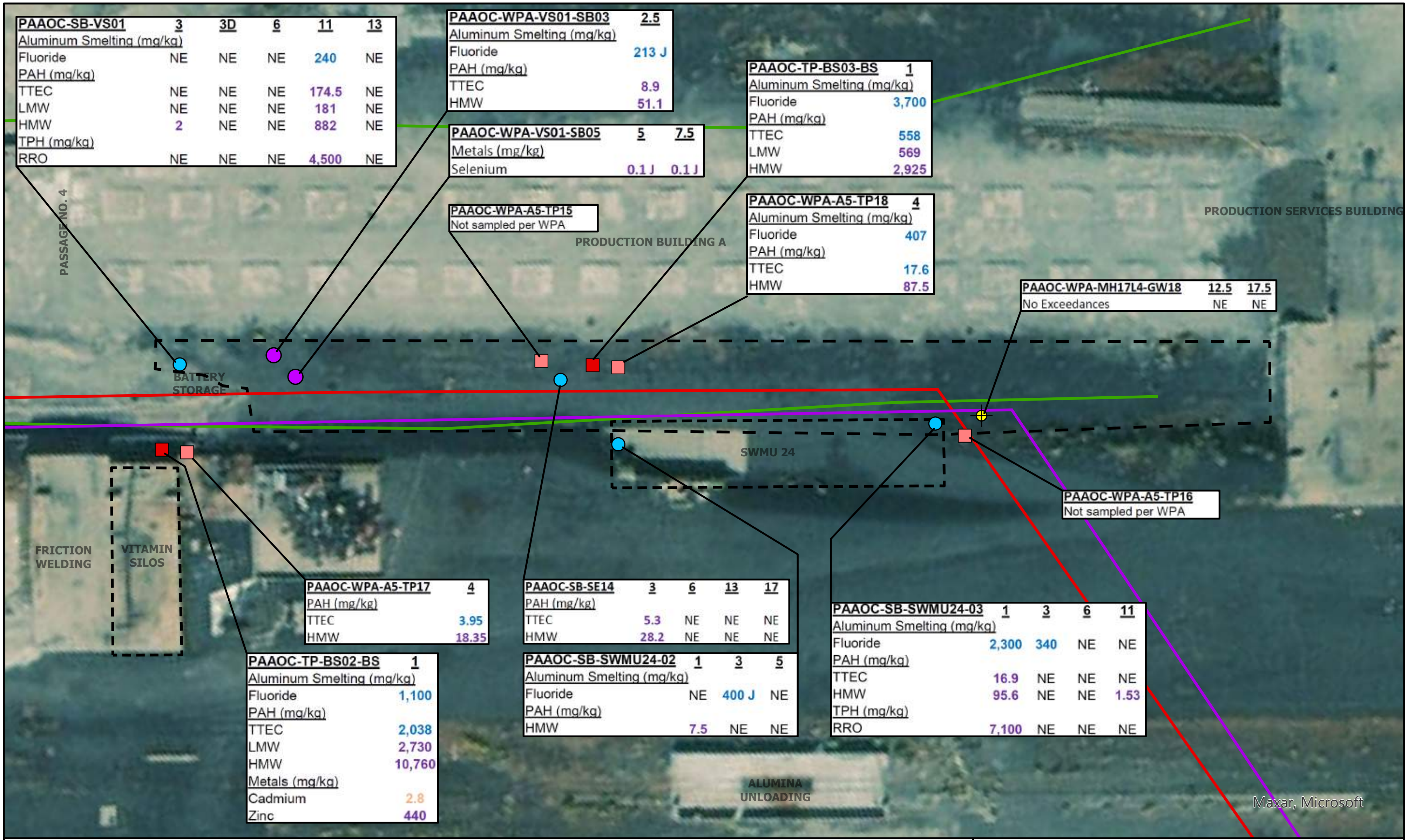
Several features and structures existed in and adjacent to segment A5 (Figure 2.3.5-1) as follows:

- I&M line no. 3 horizontal subsurface pipe and manholes
- Former carbon waste roll-off bin known area (SWMU 24) located in the central portion of segment A5
- Former vitamin silo in western end of the segment A5
- Scrubber Effluent line no. 4 horizontal subsurface pipe and manholes
- Stormwater line no. 15 horizontal subsurface pipe and catch basins, including MH17L4
- Pre-RI 2010 soil boring location (identified for initial RI sampling)
- Surface impacted soil mapped during the initial RI across the western portion of A5

These features in and adjacent to Courtyard segment A5 were the focus of the initial RI phase of investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data, and to confirm thickness of impacted surface soil.

2.3.5.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment A5 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included four soil borings and two test pits. The soil borings investigated the Scrubber Effluent line and known locations for SWMU 24. Two test



PAAOC-SB-VS01	3	3D	6	11	13
Aluminum Smelting (mg/kg)					
Fluoride	NE	NE	NE	240	NE
PAH (mg/kg)					
TTEC	NE	NE	NE	174.5	NE
LMW	NE	NE	NE	181	NE
HMW	2	NE	NE	882	NE
TPH (mg/kg)					
RRO	NE	NE	NE	4,500	NE

PAAOC-WPA-VS01-SB03	2.5
Aluminum Smelting (mg/kg)	
Fluoride	213 J
PAH (mg/kg)	
TTEC	8.9
HMW	51.1

PAAOC-WPA-VS01-SB05	5	7.5
Metals (mg/kg)		
Selenium	0.1 J	0.1 J

PAAOC-TP-BS03-BS	1
Aluminum Smelting (mg/kg)	
Fluoride	3,700
PAH (mg/kg)	
TTEC	558
LMW	569
HMW	2,925

PAAOC-WPA-A5-TP15
Not sampled per WPA

PAAOC-WPA-A5-TP18	4
Aluminum Smelting (mg/kg)	
Fluoride	407
PAH (mg/kg)	
TTEC	17.6
HMW	87.5

PAAOC-WPA-MH17L4-GW18	12.5	17.5
No Exceedances	NE	NE

PAAOC-WPA-A5-TP16
Not sampled per WPA

PAAOC-WPA-A5-TP17	4
PAH (mg/kg)	
TTEC	3.95
HMW	18.35

PAAOC-SB-SE14	3	6	13	17
PAH (mg/kg)				
TTEC	5.3	NE	NE	NE
HMW	28.2	NE	NE	NE

PAAOC-SB-SWMU24-03	1	3	6	11
Aluminum Smelting (mg/kg)				
Fluoride	2,300	340	NE	NE
PAH (mg/kg)				
TTEC	16.9	NE	NE	NE
HMW	95.6	NE	NE	1.53
TPH (mg/kg)				
RRO	7,100	NE	NE	NE

PAAOC-TP-BS02-BS	1
Aluminum Smelting (mg/kg)	
Fluoride	1,100
PAH (mg/kg)	
TTEC	2,038
LMW	2,730
HMW	10,760
Metals (mg/kg)	
Cadmium	2.8
Zinc	440

PAAOC-SB-SWMU24-02	1	3	5
Aluminum Smelting (mg/kg)			
Fluoride	NE	400 J	NE
PAH (mg/kg)			
HMW	7.5	NE	NE

▭	Courtyard Segment A5
●	RI Soil Boring
■	RI Test Pit
●	WPA Soil Boring
⊕	WPA Monitor Well
■	WPA Test Pit
—	Stormwater System Line
—	Scrubber Effluent Line
—	PAAOC Industrial & Monitoring Lines

Segment A5 approximate area: 22,656 sq. ft.
Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife and for TPH diesel and residual range organics exceeds MTCA Method A
orange: exceeds MTCA Method A
NE: No exceedance
J: Estimated concentration
1: Sample depth in feet bgs

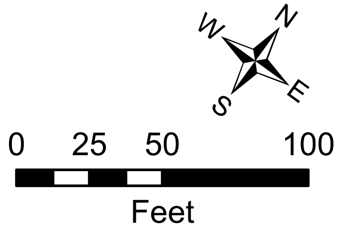


Figure 2.3.5-1

Plant Area AOC

Courtyard Segment A5 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

pits were excavated to investigate presence of impacted surface soil in the western portion of A5. RI boring and test pit locations are shown on Figure 2.3.5-1.

Sample depths and analyses are as follows:

- Scrubber Effluent line borings (SB-SE14, SB-VS01, and SB-SWMU24-03) samples at approximately 2.5 ft intervals and targeted to be collected above and below the horizontal pipe invert at approximately 13 ft bgs to 17 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs
- SWMU 24 location samples at 1 ft bgs, 3 ft bgs, and 6 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs
- Pre-RI 2010 soil boring locations vertical composite samples 0-12 inches depth
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected RI sample stations where the deepest sample exceeded site soil screen levels and confirm the thickness of impacted surface soil (Tetra Tech et al. 2020b). This included two soil borings completed near initial RI boring SB-VS01, four test pits, and one shallow groundwater monitoring well adjacent to Scrubber Effluent line manhole MH17L4. Two test pits were excavated at initial RI surface impacted soil locations TP-BS02-BS and TP-BS03-BS to a depth of 4 ft bgs, 2 ft below the previous sample depths. Two other test pits (A5-TP15 and A5-TP16) were excavated near initial RI borings SB-SE14 and SB-SWMU24-03 to depths of 4 ft bgs to confirm the thickness of the surface impacted soil and, as proposed in the WPA, no samples were collected. WPA soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. WPA boring and test pit locations are shown on Figure 2.3.5-1.

2.3.5.2 Investigation Results

Segment A5 soil was investigated with a combined total of six soil borings, six test pits, and one shallow monitoring well in the initial RI and WPA phases of investigation. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.5-1 (PAAOC Courtyard Segment A5 Initial RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most

Table 2.3.5-1
PAAOC Courtyard Segment A5 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 1 of 2

Parameter Name	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results												
	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-TP-BS02-BS (1 ft)	PAAOC-TP-BS03-BS (1 ft)	PAAOC-SB-SE14-3	PAAOC-SB-SE14-6	PAAOC-SB-SE14-13	PAAOC-SB-SE14-17	PAAOC-SB-SWMU24-02-1	PAAOC-SB-SWMU24-02-3	PAAOC-SB-SWMU24-02-5	PAAOC-SB-SWMU24-03-1	PAAOC-SB-SWMU24-03-3	PAAOC-SB-SWMU24-03-6	PAAOC-SB-SWMU24-03-11
Aluminum Smelting																			
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.051	0.05 U	0.15	0.05 U	0.05 U	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**1,100**	**3,700**	130	46	16	14	41 U	**400 J**	110	**2,300**	**340**	68	47 U
Sulfate	mg/kg	NA	NE	2,150	NE	NE	36 U	1,700 U	28 J	10 UJ	14 J	160 J	18 U	84	17 U	20 U	23 U	16 U	50 U
Polynuclear Aromatic Hydrocarbons (PAHs)																			
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	4.4	1.7	0.3 U	0.0077 U	0.0073 U	0.0075 U	0.28 U	0.015 U	0.0073 U	1.4 U	0.0074 U	0.0092 U	0.0075 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	6.1	1.9	0.3 U	0.0077 U	0.0073 U	0.0075 U	0.28 U	0.015 U	0.0073 U	1.4 U	0.0074 U	0.0092 U	0.0075 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	74	21	0.3 U	0.0077 U	0.0073 U	0.0075 U	0.28 U	0.015 U	0.0073 U	1.4 U	0.0074 U	0.0092 U	0.0075 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	1	0.38	0.3 U	0.0077 U	0.0073 U	0.0075 U	0.28 U	0.015 U	0.0073 U	1.4 U	0.0074 U	0.0092 U	0.0075 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	110	24	0.34	0.0077 U	0.0073 U	0.0075 U	0.28 U	0.015 U	0.0073 U	1.4 U	0.0074 U	0.0092 U	0.01
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	1,100	280	2.9	0.0096	0.014	0.0075 U	0.68	0.04	0.0085	8.3	0.0074 U	0.0092 U	0.13
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	1,500	410	3.9	0.012	0.02	0.0075 U	1.1	0.057	0.012	12	0.0074 U	0.0092 U	0.17
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	2,100	570	5.5	0.02	0.033	0.0095	1.5	0.082	0.019	19	0.0074 U	0.0092 U	0.32
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	1,100	320	3.4	0.015	0.022	0.0075 U	0.93	0.05	0.012	12	0.0074 U	0.0092 U	0.18
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	680	190	1.7	0.0088	0.015	0.0075 U	0.49	0.026	0.0073 U	5.9	0.0074 U	0.0092 U	0.097
Chrysene	mg/kg	NA	NL	NL	NE	NL	1,300	350	3.1	0.014	0.027	0.0081	0.88	0.047	0.01	11	0.0074 U	0.0092 U	0.19
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	270	75	0.78	0.0077 U	0.0073 U	0.0075 U	0.28 U	0.015 U	0.0073 U	2.4	0.0074 U	0.0092 U	0.039
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	1,800	440	4.5	0.017	0.029	0.01	1	0.057	0.012	13	0.0074 U	0.0092 U	0.22
Fluorene	mg/kg	NL	140,000	100	NE	NL	43	10	0.3 U	0.0077 U	0.0073 U	0.0075 U	0.28 U	0.015 U	0.0073 U	1.4 U	0.0074 U	0.0092 U	0.0075 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	1,100	330	2.8	0.011	0.017	0.0075 U	0.92	0.041	0.0088	12	0.0074 U	0.0092 U	0.18
Naphthalene	mg/kg	5	70	4.5	NE	NL	12	3.7	0.3 U	0.0077 U	0.0073 U	0.0075 U	0.28 U	0.015 U	0.0073 U	1.4 U	0.0074 U	0.0092 U	0.0075 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	690	160	1.6	0.0077 U	0.0098	0.0075 U	0.43	0.027	0.0073 U	3.9	0.0074 U	0.0092 U	0.053
Pyrene	mg/kg	NA	110,000	650	NE	NL	1,500	400	4.1	0.017	0.029	0.01	0.96	0.052	0.011	13	0.0074 U	0.0092 U	0.22
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**2,038**	**558**	**5.3**	0.02	0.03	0.001	1.6	0.08	0.02	**16.9**	0.0074	0.0092	0.25
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	**2,730**	**569**	6.44	0.02	0.04	0.04	1.43	0.08	0.01	16.9	0.0074	0.0092	0.3
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**10,760**	**2,925**	**28.2**	0.11	0.2	0.03	**7.5**	0.4	0.08	**95.6**	0.0074	0.0092	**1.53**
Polychlorinated Biphenyls (PCBs)																			
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	0.056 U	0.058 U	0.055 U	0.056 U	0.053 U	0.057 U	0.055 U	0.052 UJ	0.055 U	0.069 U	0.056 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	0.056 U	0.058 U	0.055 U	0.056 U	0.053 U	0.057 U	0.055 U	0.052 UJ	0.055 U	0.069 U	0.056 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	0.056 U	0.058 U	0.055 U	0.056 U	0.053 U	0.057 U	0.055 U	0.052 UJ	0.055 U	0.069 U	0.056 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	0.056 U	0.058 U	0.055 U	0.056 U	0.053 U	0.057 U	0.055 U	0.052 UJ	0.055 U	0.069 U	0.056 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	0.056 U	0.058 U	0.055 U	0.056 U	0.053 U	0.057 U	0.055 U	0.052 UJ	0.055 U	0.069 U	0.056 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	0.056 U	0.058 U	0.055 U	0.056 U	0.053 U	0.057 U	0.055 U	0.052 UJ	0.055 U	0.069 U	0.056 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	0.056 U	0.058 U	0.055 U	0.056 U	0.053 U	0.057 U	0.055 U	0.052 UJ	0.055 U	0.069 U	0.056 U
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	0.056	0.058	0.055	0.056	0.053	0.057	0.055	0.052	0.055	0.069	0.056
Metals																			
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	45,000	140,000	7,900	7,700	6,700	6,000	4,100	9,400	6,900	18,000	5,700	17,000	7,200
Arsenic	mg/kg	20	88	2.9	7.61	132	10 U	19	11 U	12 U	11 U	11 U	11 U	11 U	11 U	10 U	11 U	14 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	**2.8**	6.4	0.56 U	0.58 U	0.55 U	0.56 U	0.53 U	0.57 U	0.55 U	0.52 U	0.55 U	0.69 U	0.56 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	22	98	7.3	4.6	6.1	3.6	2.3	5	4	12	3.1	8.7	9.4
Copper	mg/kg	NA	140,000	280	28.4	217	50	130	14	11	12	21	18	11	12	25	8.4	17	11
Lead	mg/kg	1,000	NE	3,000	13.1	118	28	46	5.6 U	5.8 U	5.5 U	5.6 U	5.3 U	6.7	5.5 U	7.6	5.5 U	7.7	5.6 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.26 U	0.28 U	0.28 U	0.29 U	0.28 U	0.28 U	0.26 U	0.28 U	0.27 U	0.26 U	0.28 U	0.35 U	0.28 U
Nickel	mg/kg	NA	70,000	130	24.54	980	73	260	6	4.3	6.6	4.3	15	8.6	3.8	30	2.8 U	7.9	5.1
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	10 U	11 U	11 U	12 U	11 U	11 U	11 U	11 U	11 U	10 U	11 U	14 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	**440**	1700	54	40	36	41	18	49	45	86	33	58	40
Total Petroleum Hydrocarbons (TPHs)																			
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	28 U	29 U	28 U	28 U	29 U	28 U	27 U	700 U	28 U	35 U	28 U
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	110	58 U	55 U	56 U	210	57 U	55 U	**7,100**	56 U	69 U	130
Volatile Organic Compounds (VOCs)																			
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	NA	NA	0.0012 U	0.00097 U	0.00093 U	0.00079 U	0.00099 U	0.0011 U	0.0011 U	0.00094 U	0.001 U	0.0014 U	0.0011 U
Toluene	mg/kg	7	280,000	4.5	NE	5.45	NA	NA	0.0061 U	0.0048 U	0.0047 U	0.004 U	0.005 U	0.0055 U	0.0054 U	0.0047 U	0.0052 U	0.0068 U	0.0053 U
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	NA	NA	0.0012 U	0.00097 U	0.00093 U	0.00079 U	0.00099 U	0.0011 U	0.0011 U	0.00094 U	0.001 U	0.0014 U	0.0011 U
m,p-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	0.0024 U	0.0019 U	0.0019 U	0.0016 U	0.002 U	0.0022 U	0.0022 U	0.0019 U	0.0021 U	0.0027 U	0.0021 U
o-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	0.0012 U	0.00097 U	0.00093 U	0.00079 U	0.00099 U	0.0011 U	0.0011 U	0.00094 U	0.001 U	0.0014 U	0.0011 U
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	NA	NA	0.0012 U	0.00097 U	0.00093 U	0.00079 U	0.00099 U	0.0011 U	0.0011 U	0.00094 U	0.001 U	0.0014 U	0.0011 U
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	NA	NA	0.0012 U	0.00097 U	0.00093 U	0.00079 U	0.00099 U	0.0011 U	0.0011 U	0.00094 U	0.001 U	0.0014 U	0.0011 U
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	NA	NA	0.0012 U	0.00097 U	0.00093 U	0.00079 U	0.00099 U	0.0011 U	0.0011 U	0.00094 U	0.001 U	0.0014 U	0.0011 U
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	NA	NA	0.0012 U	0.00097 U	0.00093 U	0.00079 U	0.00099 U	0.0011 U	0.0011 U	0.00097	0.001 U	0.0014 U	0.0011 U
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	NA	NA	0.0012 U	0.00097 U	0.00093 U	0.00079 U	0.00099 U	0.0011 U	0.0011 U	0.00094 U	0.001 U	0.0014 U	0.0011 U

Notes:

i	Method reporting limit is elevated due to a matrix interference.
J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
B	The sample result is less than five times the blank contamination and cross-contamination is suspected.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.3.5-1
PAAOC Courtyard Segment A5 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington

		Screening Levels				Ecological Screening Levels	Initial RI Analytical Results					WPA Analytical Results						
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-VS01-3**	**PAAOCSB-VS01-3D**	**PAAOC-SB-VS01-6**	**PAAOC-SB-VS01-11**	**PAAOC-SB-VS01-13**	**PAAOC-WPA-MH17L4-GW18-12.5**	**PAAOC-WPA-MH17L4-GW18-17.5**	**PAAOC-WPA-A5-TP17-4**	**PAAOC-WPA-A5-TP18-4**	**PAAOC-WPA-VS01-SB03-2.5**	**PAAOC-WPA-VS01-SB05-5**	**PAAOC-WPA-VS01-SB05-7.5**
Aluminum Smelting																		
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.21 U	0.38 U	0.21 U	0.19 U	0.2 UJ	0.20 U	0.21 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	45 J	59	5 U	**240**	7.4	50.2 J	95.7	125 J	**407**	**213 J**	37.1	45.2
Sulfate	mg/kg	NA	NE	2,150	NE	NE	25 J	26	280 J	350 J	180 J	68.3	283	19.1	1,420	63.9 J	24.8	52
Polynuclear Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.015 U	0.016 U	0.0087 U	15 U	0.0078 U	NA	NA	0.01	0.078	NA	NA	NA
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.015 U	0.016 U	0.0087 U	15 U	0.0078 U	0.00066 J	0.0024 J	0.11	0.81	0.096	0.0008 J	0.00066 J
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.015 U	0.016 U	0.0087 U	15 U	0.0078 U	0.00073 J	0.0019 J	0.00081 J	0.0061 J	0.56	0.00057 J	0.00067 J
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.015 U	0.016 U	0.0087 U	15 U	0.0078 U	0.0058 U	0.0085 J	0.21	1.2	0.055 U	0.0055 U	0.0056 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.024	0.016 U	0.0087 U	15 U	0.0078 U	0.00096 J	0.0017 J	2.1	10	0.83	0.00096 J	0.0006 J
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.19 J	0.096	0.0087 U	83	0.019	0.014	0.011 U	3	13	6	0.0051 J	0.0076
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.28 J	0.14	0.0087 U	130	0.027	0.018	0.011 U	3.6	16	6.3	0.0034 J	0.011
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.36 J	0.18	0.0087 U	170	0.036	0.048	0.011 U	1.4	7.6	9.8	0.0057	0.018
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.2	0.1	0.0087 U	98	0.021	0.039	0.011 U	1.1	6.4	4	0.0026 J	0.011
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.13 J	0.059	0.0087 U	60	0.012	0.048	0.011 U	2.1	11	3.2	0.0025 J	0.0077
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.22 J	0.11	0.0087 U	110	0.023	0.025	0.011 U	0.45	2.6	7.6	0.0057	0.012
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.047	0.023	0.0087 U	21	0.0078 U	0.0061	0.011 U	0.004	0.22	1.1	0.0055 U	0.0017 J
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.31 J	0.16	0.0087 U	130	0.029	0.02	0.0064 J	3.6	16	10	0.0096	0.012
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.015 U	0.016 U	0.0087 U	15 U	0.0078 U	0.0058 U	0.0027 J	0.063	0.39	0.36	0.0055 U	0.0056 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.21 J	0.11	0.0087 U	100	0.022	0.029 J	0.011 U	2	9.9	4.7	0.0024 J	0.01 J
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.015 U	0.016 U	0.0087 U	0.0019	0.0078 U	0.001 JB	0.0032 JB	0.02	0.13	0.13	0.0011 JB	0.0011 JB
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.13	0.062	0.0087 U	51	0.012	0.0059	0.017	1	6	4.7	0.0068	0.0046 J
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.28 J	0.14	0.0087 U	110	0.028	0.019	0.0048 JXB	2.6	11	8.4	0.0092	0.012
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.4	0.2	0.0087	**174.5**	0.04	0.03	0.011	**3.95**	**17.6**	**8.9**	0.005	0.03
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.46	0.22	0.0087	**181**	0.04	0.03	0.04	5	24.61	16.58	0.02	0.02
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**2**	0.96	0.0087	**882**	0.19	0.25	0.0048	**18.35**	**87.5**	**51.1**	0.04	0.09
Polychlorinated Biphenyls (PCBs)																		
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U	NA	NA	0.012 U	0.011 U	NA	NA	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U	NA	NA	0.023 U	0.022 U	NA	NA	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U	NA	NA	0.012 U	0.011 U	NA	NA	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U	NA	NA	0.012 U	0.011 U	NA	NA	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U	NA	NA	0.012 U	0.011 U	NA	NA	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U	NA	NA	0.012 U	0.011 Ui	NA	NA	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U	NA	NA	0.012 U	0.011 Ui	NA	NA	NA
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	0.056	0.059	0.065	0.055	0.059	NA	NA	0.012	0.011	NA	NA	NA
Metals																		
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	6,800 J	8,400	15,000	8,200	5,800	9,810	23,500	8,310	19,400	10,800	7,350	6,730
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	12 U	13 U	11 U	12 U	2.42	1.8	1.92	3.68	2.62	1.78	1.44
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.56 U	0.59 U	0.65 U	0.55 U	0.59 U	0.246	0.303	0.139	0.582	0.268	0.11	0.103
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	4 J	5.7	5.1	13	6.1	6.93	2.89	9.05	12.3	9.14	4.35	5.33
Copper	mg/kg	NA	140,000	280	28.4	217	11 J	14	15	15	22	16.4	37	22.7	19.4	19.7	17.1	15.6
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.6 U	5.9 U	6.5 U	5.5 U	5.9 U	5.69 J	8.74 J	3.7	9.34	6.66	4.89	4.96
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.29 U	0.33 U	0.27 U	0.29 U	0.005 J	0.004 J	0.005 J	0.005 J	0.02 U	0.004 J	0.003 J
Nickel	mg/kg	NA	70,000	130	24.54	980	3.5	5.1	6.3	8.7	3.1	13	13.4	10.3	18.2	10.2	5.18	4.68
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	12 U	13 U	11 U	12 U	0.1 J	0.2 J	0.2 J	0.2 J	0.2 J	0.1 J	0.1 J
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	43	46	54	58	36	59.3	157	69.4	120	90.4	51	39.7
Total Petroleum Hydrocarbons (TPHs)																		
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	28 U	29 U	33 U	460 U	29 U	4.1 J	54 U	160 J	180 J	260 J	12 J	14 J
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	57 U	59 U	65 U	**4,500**	59 U	11 J	220 U	600 J	530 J	970 J	45 J	57 J
Volatile Organic Compounds (VOCs)																		
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.005 U	0.006 U	0.0055 U	0.0054 U	0.0048 U	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.002 U	0.0024 U	0.0022 U	0.0021 U	0.0019 U	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U	NA	NA	NA	NA	NA	NA	NA

Notes:

i	Method reporting limit is elevated due to a matrix interference.
J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
B	The sample result is less than five times the blank contamination and cross-contamination is suspected.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in most samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment A5 are compiled and presented on Figure 2.3.5-1. The vertical extent of contamination has been defined for the SB-SE14, SB-SWMU24-02, and SB-VS01 (in soil above 11 ft bgs) sampling locations through initial RI data. The vertical extent of contamination is not defined at boring locations SB-SWMU24-03, TP-BS02-BS, and TP-BS03-BS with subsequent WPA data.

Initial RI borings SB-SE14 and SB-SWMU24-02 detected COPCs at concentrations that exceed soil screening levels to 3 ft bgs but did not exceed at deeper depths sampled. COPCs were detected at concentrations that exceed soil screening levels in SB-VS01 in one sample at 11 ft bgs but did not exceed at shallower samples or the deeper depth sample at 13 ft bgs. The source of fluoride, PAH, and TPH as residual range organics in SB-VS01 at 11 ft bgs is unknown. The vertical extent has been defined by initial RI data.

SB-VS01 was identified as an Investigation Area and is further discussed with FS recommendations in Section 2.2.2. In nearby WPA boring VS01-SB03 COPCs including fluoride and PAHs as TTEC and total HMW were detected at concentrations that exceed soil screening levels to a depth of 2.5 ft bgs. In adjacent WPA boring VS01-SB05 (VS01-SB05 was completed adjacent to VS01-SB03 when drilling halted due to an obstruction encountered in VS01-SB03), selenium was detected at low concentrations at 5 and 7.5 ft bgs that exceed ecological wildlife soil screening levels. The vertical extent has not been defined for WPA borings SV01-SB-3 and VS01-SB05.

In initial RI boring SB-SWMU24-03, detected concentrations of fluoride, PAH as TTEC and HMW, and TPH-Dx as residual range organics were detected at concentrations that exceed soil screening levels at 1 ft bgs. with fluoride detected at 3 ft bgs, and PAHs as HMW detected at 11 ft bgs. In subsequent nearby WPA boring MH17L4-GW18, COPCs were not detected in samples collected 12.5 and 17.5 ft bgs; however, the vertical extent has not been defined by initial RI data.

In initial RI test pits TP-BS02-BS and TP-BS03-BS that investigated surface impacted soil, detected concentrations of fluoride, PAHs as TTEC and total LMW and HMW, cadmium, and zinc at 1 ft depth exceed soil screening levels. Subsequent WPA test pits A5-TP17 and A5-TP17 excavated at two impacted surface soil sampling locations detected fluoride and PAH as TTEC and total HMW at lower concentrations that still exceeded soil screening levels at 4 ft bgs.

Basalt flow top appears to have been encountered at approximately 11 ft bgs surface in the western and central portions of the segment, and at 15 ft bgs in MH17L4-GW18 in the eastern portion. The water level measured at the time of well installation in UA aquifer monitoring well MH17L4-GW18 in the eastern portion of A5 was 17.2 ft bgs. The concentration of fluoride in shallow groundwater beneath this segment is expected to be at or greater than 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). The maximum concentration of fluoride detected in segment A5 is 3,700 mg/kg and is associated with a sample collected from impacted surface soil at 1 ft bgs.

2.3.5.3 Conclusions and Recommendations

The vertical extent of contamination has not been defined at soil boring SB-SWMU24-03 where COPCs exceed soil screening levels to 3 ft bgs, but then PAH as HMW exceeds at 11 ft bgs, the deepest depth sampled, and above the ecological wildlife screening level depth of concern of 15 ft bgs. The detection of several COPCs at depth in SB-VS01 was further addressed in Section 2.2.2 (SB-VS01 investigation area). The maximum concentration of fluoride detected in segment A5 is 3,700 mg/kg and is associated with a sample collected from impacted surface soil at 1 ft bgs.

The vertical extent of contamination has not been defined at WPA test pits A5-TP17 and A5-TP18 where fluoride, PAH as TTEC and HMW are detected at concentrations that exceed soil screening levels at 4 ft bgs, the deepest depth sampled.

Based on COPC exceedance of soil screening levels to depths up to 3 ft bgs, and potential for COPCs to exceed soil screening levels at depths of 4 ft bgs or deeper, Segment A5 is recommended for further evaluation in the FS.

2.3.6 Courtyard Segment B1

Courtyard segment B1 is at the west end of Courtyard B, adjacent east of the West Passage. Segment B1 is approximately 72 ft wide and 490 ft long with an area of approximately 35,073 square feet. Calculated area in segment B1 does not include surfaces such as concrete foundations, sloped areas, or ramps. The ground surface is mainly unpaved exposed soil with narrow sections of weathered asphalt access road. At the eastern end of segment B1 is a concrete underpass beneath Passage No. 1 to provide access between segments B1 and B2.

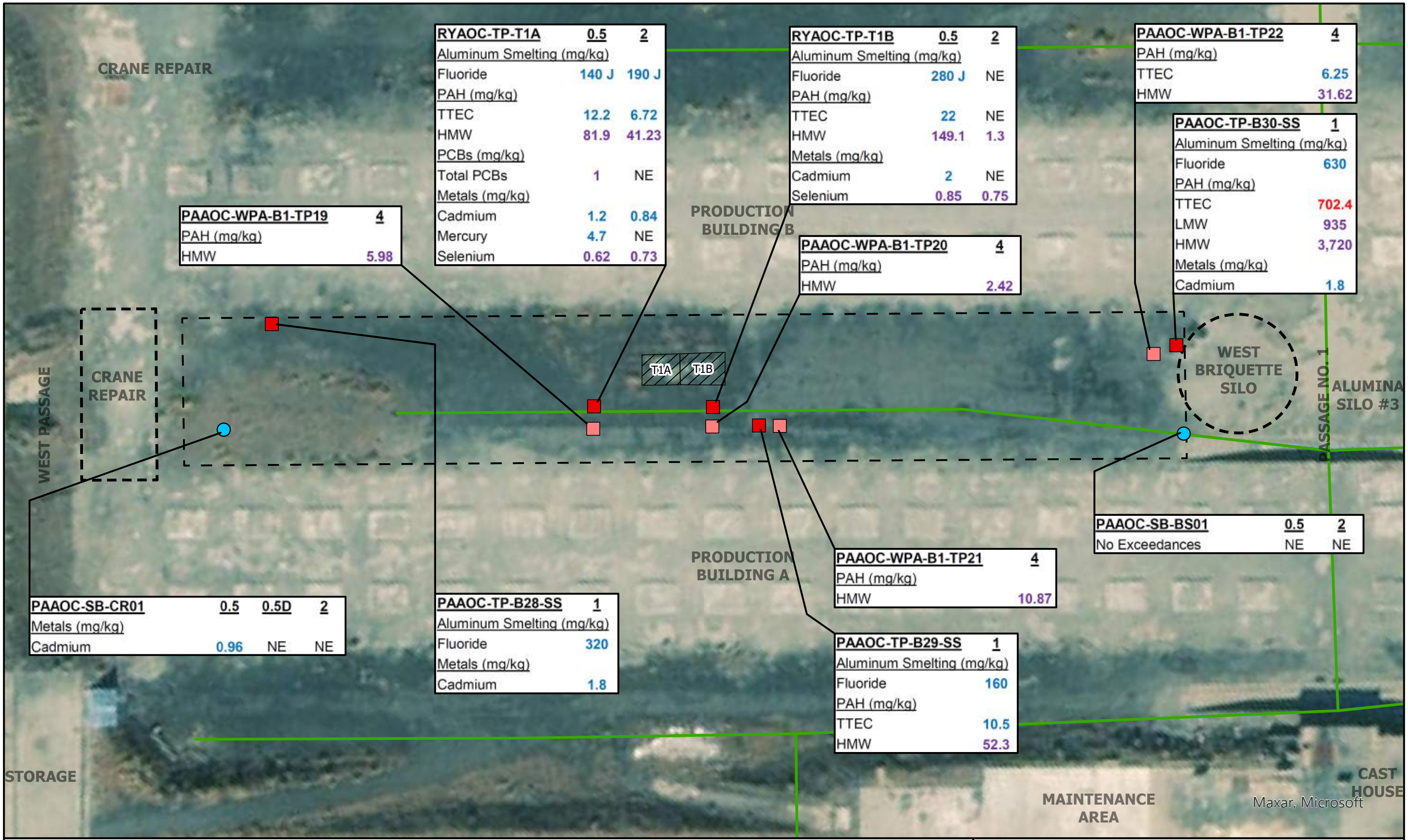
Several features and structures existed in and adjacent to segment B1 (Figure 2.3.6-1) as follows:

- Transformer Substation T1A/T1B (two units on one slab, previously investigated as part of the Rectifier Yard AOC)
- Crane repair facilities in the western end of Segment B1
- West briquette silo on the eastern edge of Segment B1
- Stormwater line no. 3 horizontal subsurface pipe and catch basins
- Pre-RI 2010 soil boring locations (identified for initial RI sampling)
- SWMU 7 Decommissioned Pollution Air Control Equipment which was an overhead line the length of B1 with no direct surface contact
- Impacted surface soil mapped during the initial RI not observed in B1

These features in and adjacent to Courtyard segment B1 were the focus of the initial RI phase of investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data, and to confirm thickness of impacted surface soil, if present.

2.3.6.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment B1 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included two soil borings and five test pits. The soil borings investigated the Crane Repair facility and the West Briquette Silo. Two of the test pits investigated transformer substation T1A/T1B, and three investigated Pre-RI 2010 soil boring locations. RI boring and test pit locations are shown on Figure 2.3.6-1.



PAAOC-WPA-B1-TP19	4
PAH (mg/kg)	
HMW	5.98

RYAOC-TP-T1A	0.5	2
Aluminum Smelting (mg/kg)		
Fluoride	140 J	190 J
PAH (mg/kg)		
TTEC	12.2	6.72
HMW	81.9	41.23
PCBs (mg/kg)		
Total PCBs	1	NE
Metals (mg/kg)		
Cadmium	1.2	0.84
Mercury	4.7	NE
Selenium	0.62	0.73

RYAOC-TP-T1B	0.5	2
Aluminum Smelting (mg/kg)		
Fluoride	280 J	NE
PAH (mg/kg)		
TTEC	22	NE
HMW	149.1	1.3
Metals (mg/kg)		
Cadmium	2	NE
Selenium	0.85	0.75

PAAOC-WPA-B1-TP20	4
PAH (mg/kg)	
HMW	2.42

PAAOC-WPA-B1-TP22	4
PAH (mg/kg)	
TTEC	6.25
HMW	31.62

PAAOC-TP-B30-SS	1
Aluminum Smelting (mg/kg)	
Fluoride	630
PAH (mg/kg)	
TTEC	702.4
LMW	935
HMW	3,720
Metals (mg/kg)	
Cadmium	1.8

PAAOC-SB-BS01	0.5	2
No Exceedances	NE	NE

PAAOC-WPA-B1-TP21	4
PAH (mg/kg)	
HMW	10.87

PAAOC-SB-CR01	0.5	0.5D	2
Metals (mg/kg)			
Cadmium	0.96	NE	NE

PAAOC-TP-B28-SS	1
Aluminum Smelting (mg/kg)	
Fluoride	320
Metals (mg/kg)	
Cadmium	1.8

PAAOC-TP-B29-SS	1
Aluminum Smelting (mg/kg)	
Fluoride	160
PAH (mg/kg)	
TTEC	10.5
HMW	52.3

- Courtyard Segment B1
- ● RI Boring
- 🟥 RI Test Pit
- 🟥 WPA Test Pit
- Stormwater System Line
- ▨ Approximate Transformer Pad

Segment B1 approximate area: 35,073 sq. ft.

Soil Screening Levels
red: exceeds MTCA Method C
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife and for TPH diesel and residual range organics exceeds MTCA Method A
NE: No exceedance
J: Estimated concentration
D: Duplicate sample
1: Sample depth in feet bgs

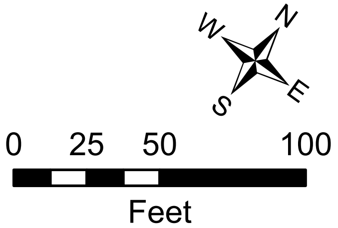


Figure 2.3.6-1

Plant Area AOC

Courtyard Segment B1 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Sample depths and analyses are as follows:

- Crane repair samples at 0.5, 2 ft bgs
    - ❖ Analytes: metals, TPH-Dx, VOCs
- Briquette silo samples at 0.5, 2 ft bgs
    - ❖ Analytes: PAHs, metals
- Transformer substation samples 0.5, 2.0 ft bgs
    - ❖ Analytes: total cyanide, fluoride, PAHs, PCBs, metals, TPH-Dx
- Pre-RI 2010 soil boring locations test pit vertical composite sample 0-12 inches depth
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, metals

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected RI sample stations where the deepest sample exceeded site soil screen levels (Tetra Tech et al. 2020b). This included four test pits excavated at transformer substation and 2010 boring sample stations. Two test pits were excavated at transformer substation T1A/T1B to a depth of 4 ft, 2 ft below the previous sample depth. Two test pits were excavated at initial RI 2010 boring location test pits TPB29-SS and TPB30-SS to 4-ft depth, 3 ft below the previous sample depths. WPA soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. WPA test pit locations are shown on Figure 2.3.6-1.

2.3.6.2 Investigation Results

Segment B1 soil was investigated with a combined total of two soil borings and nine test pits in the initial RI and WPA phases of investigation. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.6-1 (PAAOC Courtyard Segment A5 Initial RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in half of samples analyzed.

Table 2.3.6-1
PAAOC Courtyard Segment B1 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results												WPA Analytical Results			
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-TP-B28-SS (1 ft)	PAAOC-TP-B29-SS (1 ft)	PAAOC-TP-B30-BS (1 ft)	PAAOC-SB-BS01-0.5	PAAOC-SB-BS01-2	PAAOC-SB-CR01-0.5	PAAOC-SB-CR01-0.5D	PAAOC-SB-CR01-2	RYAOC-TP-T1A-0.5	RYAOC-TP-T1A-2	RYAOC-TP-T1B-0.5	RYAOC-TP-T1B-2	PAAOC-WPA-B1-TP19-4	PAAOC-WPA-B1-TP20-4	PAAOC-WPA-B1-TP21-4	PAAOC-WPA-B1-TP22-4
Aluminum Smelting																						
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.057	NA	NA	NA	NA	NA	2 U	2.1 U	2 U	2.2 U	NA	0.2 U	NA	0.2 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**320**	**160**	**630**	NA	NA	NA	NA	NA	**140 J**	**190 J**	**280 J**	45 J	38.1 J	32.5 J	28.2 J	37.6 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	14 U	10 U	12 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.9 J	1.9 J	2.7	5.5
Polynuclear Aromatic Hydrocarbons (PAHs)																						
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0077 U	0.15 U	4.3	0.017 U	0.0073 U	NA	NA	NA	0.055	0.098	0.082	0.0026 J	0.0076	0.0013 JB	0.0087	0.052
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0077 U	0.15 U	5.2	0.017 U	0.0073 U	NA	NA	NA	0.083	0.1	0.11	0.0037 J	0.056	0.0093	0.081	0.34
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0077 U	0.49	44	0.06	0.0073 U	NA	NA	NA	0.7	0.37	1.2	0.012	0.00076 J	0.00041 J	0.0014 J	0.0024 J
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0077 U	0.15 U	1.5 U	0.017 U	0.0073 U	NA	NA	NA	0.023 J	0.0085 J	0.027	0.00054 U	0.098	0.014	0.097	0.36
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0077 U	0.6	39	0.078	0.0073 U	NA	NA	NA	0.89	0.49	1.5	0.025	0.69	0.23	1.1	4
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.066	5.2	410	0.1	0.0073 U	NA	NA	NA	5.9	4	13	0.17	0.72	0.29	1.3	4.6
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.072	7.6	510	0.049	0.0073 U	NA	NA	NA	7.8	4.6	14	0.2	1.2	0.53	2.5	5.8
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.2	11	710	0.087	0.0073 U	NA	NA	NA	17	8.2	37	0.36	0.42	0.25	0.92	2.7
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.09	6.9	390	0.027	0.0073 U	NA	NA	NA	12	4.7	14	0.21	0.36	0.19	0.74	1.8
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.051	3.7	230	0.029	0.0073 U	NA	NA	NA	4.4	2.1	9.5	0.13	0.82	0.29	1.4	4
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.11	6.3	440	0.12	0.0073 U	NA	NA	NA	10	5.3	22	0.23	0.15	0.074	0.31	0.82
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.023	1.7	110	0.017 U	0.0073 U	NA	NA	NA	1.7	0.73	2.6	0.032	0.017	0.0029 J	0.023	0.12
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.1	7.5	570	0.45	0.0073 U	NA	NA	NA	9.9	6.5	22	0.27	1.3	0.31	1.6	6
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0077 U	0.24	22	0.04	0.0073 U	NA	NA	NA	0.23	0.12	0.42	0.0052 J	0.027	0.0046 J	0.033	0.19
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.095	7	420	0.023	0.0073 U	NA	NA	NA	14	5.6	16	0.25	0.62	0.33	1.3	3.7
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0077 U	0.15 U	10	0.017 U	0.0073 U	NA	NA	NA	0.24	0.085	0.2	0.0033 J	0.012	0.0021 JB	0.018	0.09
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.024	NA	250	0.45	0.0073 U	NA	NA	NA	4.2	2.2	7.4	0.089	0.62	0.076	0.56	1.9
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.094	2.9	500	0.34	0.0073 U	NA	NA	NA	9.1	6	21	0.24	**1**	0.24	1.3	4.2
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.12	**10.5**	**702.4**	0.07	0.0073	NA	NA	NA	**12.2**	**6.72**	**22**	0.297	1.03	0.43	1.91	**6.25**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.12	8.83	**935**	1.1	0.0073	NA	NA	NA	16.18	9.8	32.75	0.4	2.11	0.42	2.39	8.88
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.8	**52.3**	**3,720**	0.8	0.0073	NA	NA	NA	**81.9**	**41.23**	**149.1**	**1.3**	**5.98**	**2.42**	**10.87**	**31.62**
Polychlorinated Biphenyls (PCBs)																						
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.0065 U	0.0077 U	0.0072 U	0.008 U	0.012 U	0.01 U	0.012 U	0.012 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.0037 U	0.0044 U	0.0041 U	0.0045 U	0.023 U	0.02 U	0.023 U	0.023 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.0043 U	0.0051 U	0.0048 U	0.0053 U	0.012 U	0.01 U	0.012 U	0.012 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.0014 U	0.0017 U	0.0016 U	0.0017 U	0.012 U	0.01 U	0.012 U	0.012 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.0026 U	0.003 U	0.0028 U	0.0031 U	0.012 U	0.01 U	0.012 U	0.012 U
Aroclor 1254	mg/kg	NA	66.0	0.71	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.0013 U	0.0016 U	0.0015 U	0.0016 U	0.012 Ui	0.01 U	0.012 U	0.012 U
Aroclor 1260	mg/kg	NA	66.0	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	1	0.13	0.08 J	0.0088 J	0.0078 J	0.01 U	0.041	0.012 U
Aroclor 1262	mg/kg	NL	NL	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.00044 u	0.00052 U	0.00049 U	0.00054 U	NA	NA	NA	NA
Aroclor 1268	mg/kg	NL	NL	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.00079 u	0.00093 U	0.068 J	0.00097 U	NA	NA	NA	NA
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	NA	NA	NA	NA	NA	NA	1	0.13	0.15	0.0088	0.0078	0.01	0.041	0.012
Metals																						
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	15,000	11,000	54,000	6,900	6,800	5,800	7,000	9,100	4,600 J	14,000	15,000	9,100 J	7,700	8,030	7,380	8,270
Arsenic	mg/kg	20	87.5	2.9	7.61	132	12 U	11 U	11 U	13 U	11 U	11 U	11 U	11 U	1 J	2.6 J	3.5 J	1.9 J	2.31	2.05	1.71	1.93
Cadmium	mg/kg	2	3,500	0.69	0.81	14	**1.8**	0.55 U	**1.8**	0.63 U	0.55 U	**0.96**	0.58	0.56 U	**1.2**	**0.84**	**2**	0.55	0.335	0.142	0.178	0.115
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	24	7.6	33	8.8 J	5.3 J	5.8 J	7.3	7.1	3.4 J	9.9 J	16 J	6.5 J	5.93	6.8	4.55	7.3
Copper	mg/kg	NA	140,000	280	28.4	217	36	16	31	13	13	20	20	16	19 J	22 J	73 J	18 J	18.7	19.4	16.1	17.9
Lead	mg/kg	1,000	NE	3,000	13.1	118	11	8.9	25	6.3 U	5.5 U	5.4 U	6	7.4	9.6 J	7.5 J	12 J	5 J	4.36	4.89	4.81	4.47
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.29 U	0.28 U	0.28 U	0.31 U	0.27 U	0.27 U	0.27 U	0.28 U	**4.7**	0.046	0.027	0.0063 U	0.02 U	0.022 U	0.022 U	0.022 U
Nickel	mg/kg	NA	70,000	130	24.54	980	7.8	14	66	8.1	5.4	17	17	12	10 J	14 J	35 J	9.4 J	8.18	8.09	7.3	7.25
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	5.8 U	5.5 U	5.6 U	13 U	11 U	11 U	11 U	11 U	**0.62**	**0.73**	**0.85**	**0.75**	0.1 J	0.1 J	0.14 J	0.1 J
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	53	63	300	38 J	35 J	83	75	66	220 J	100 J	210 J	120 J	73.5	60.8	118	75.8
Total Petroleum Hydrocarbons (TPHs)																						
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	270 U	270 U	140 U	660	210	190	13 U	8.9 J	6.6 J	49 H	72 H
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	1,500	1,400	540	350	930	760	33 J	27 J	25 J	149 O	230 O
Volatile Organic Compounds (VOCs)																						
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	NA	NA	NA	NA	NA	0.0011 U	0.001 U	0.00092 U	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	NA	NA	NA	NA	NA	0.0056 U	0.0052 U	0.0046 U	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	NA	NA	NA	NA	NA	0.0011 U	0.001 U	0.00092 U	NA	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	NA	0.0022 U	0.001 U	0.0018 U	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	NA	0.0011 U	0.001 U	0.00092 U	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	NA	NA	NA	NA	NA	0.0011 U	0.001 U	0.0011	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	NA	NA	NA	NA	NA	0.0011 U	0.001 U	0.00092 U	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	NA	NA	NA	NA	NA	0.0011 U	0.001 U	0.00092 U	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	NA	NA	NA	NA	NA	0.0011 U	0.001 U	0.00092 U	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	NA	NA	NA	NA	NA	0.0011 U	0.001 U	0.00092 U	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

i	Method reporting limit is elevated due to a matrix interference.
J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
B	The sample result is less than five times the blank contamination and cross-contamination is suspected.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment B1 are compiled and presented on Figure 2.3.6-1. The vertical extent of contamination has been defined for the SB-BS01 and SB-CR01 sampling locations through initial RI data. The vertical extent of contamination is not defined at initial RI sample station TP-B2-SS. The vertical extent of contamination has not been defined at transformer substation T-1A/T1B or 2010 soil boring locations TP-B29-SS and TP-B30-SS with subsequent WPA data from test pits B1-TP19, B1-TP20, B1-TP21, and B1-TP22.

In initial RI borings SB-BS01 and SB-CR01, the only COPCs that was detected at concentrations that exceed soil screening levels was cadmium at 0.5 ft bgs in SB-CR01. The vertical extent has been defined by initial RI data.

In initial RI test pits TP-B28-SS, TP-B29-SS, TPB30-SS, TP-T1A, and TP-T1B detected concentrations of COPCs exceed soil screening levels up to 2 ft bgs. This represents the 2010 boring locations and transformer substation T1A/T1B. Subsequent WPA test pits B1-TP19, B1-TP20, B1-TP21, and B1-TP22 detected fluoride, PAH as TTEC and total HMW at lower concentrations that still exceeded soil screening levels at 4 ft bgs.

Based on water levels measured as part of the Groundwater AOC investigation, the depth to the shallowest groundwater (UA aquifer) beneath B1, if present, is approximately elevation 470 ft or approximately 12 or more feet bgs. The concentration of fluoride in shallow groundwater beneath this segment is expected to be between 0.96 mg/L and 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). The maximum concentration of fluoride detected in segment B1 is 630 mg/kg collected at 1 ft bgs.

2.3.6.3 Conclusions and Recommendations

The vertical extent of contamination has not been defined at WPA test pits B1-TP19, B1-TP20, B1-TP21, and B1-TP22. Detected concentrations of PAH as TTEC and HMW exceeded soil screening levels at 4 ft bgs, the deepest depth sampled. Vertical extent of contamination also has not been defined at initial RI test pit TP-B28-SS located at a 2010 boring location sampled at 1 ft bgs. The maximum concentration of fluoride detected in segment B1 is 630 mg/kg collected at 1 ft bgs.

Based on COPC exceedance of soil screening levels to depths up to 4 ft bgs, Segment B1 is recommended for further evaluation in the FS.

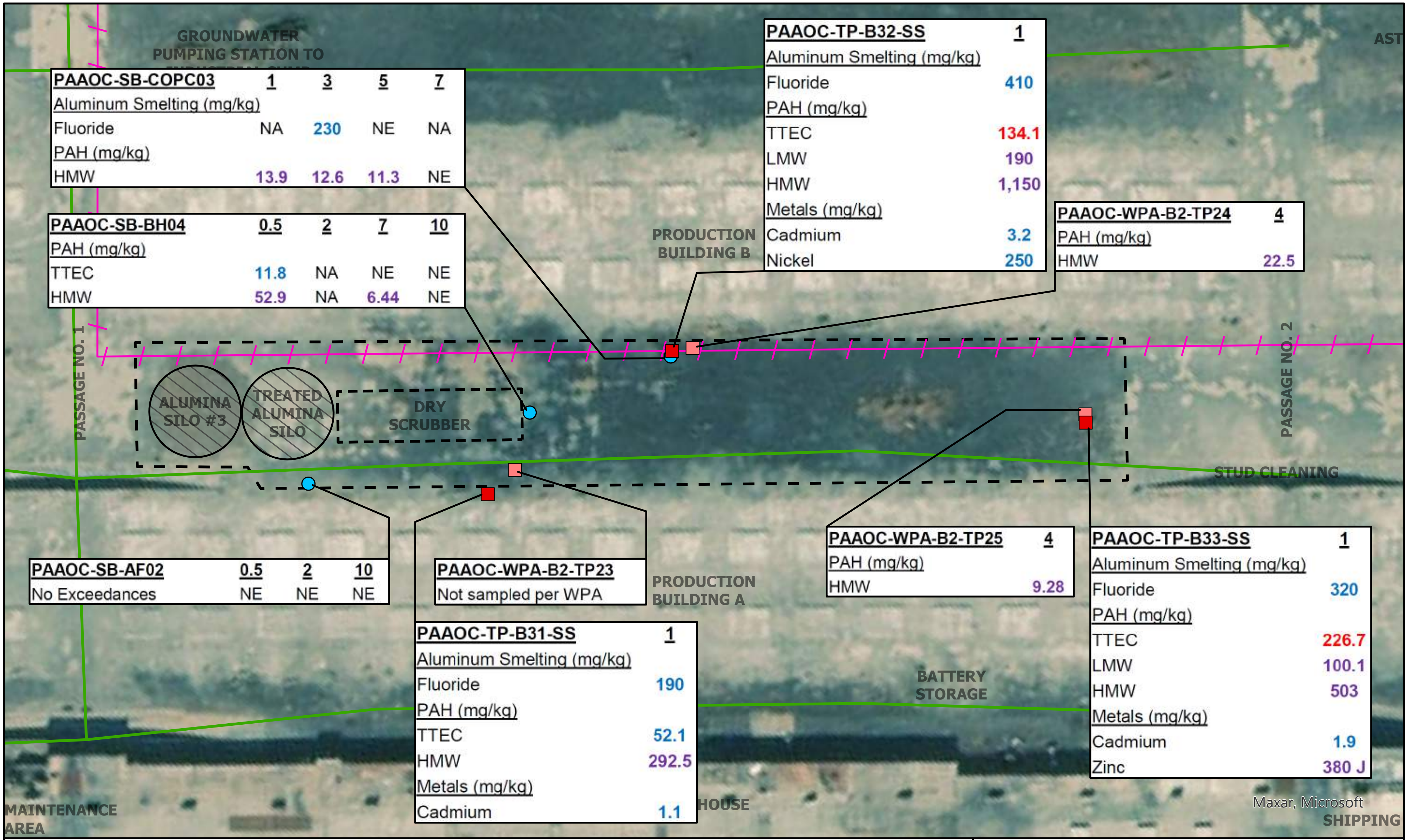
2.3.7 Courtyard Segment B2

Courtyard segment B2 is in the western portion of Courtyard B. The west end of segment B2 is approximately 60 ft wide, widening to approximately 70 ft wide out to the eastern end with an area of approximately 33,144 square feet. This area does not include the combined approximate 3,116-square-foot footprints of the former Treated Alumina Silo and Alumina Silo #3 at the western end of the courtyard segment. The adjusted calculated area segment B2 is approximately 30,028 square feet. Calculated area in segment B2 does not include surfaces such as concrete foundations. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. At the western end of segment B2 is a concrete underpass beneath Passage No. 1 to provide access between segments B1 and B2. At the eastern end of segment B2 is a concrete underpass beneath Passage No. 2 to provide access between segments B2 and B3.

Features and structures that existed in and adjacent to segment B2 (Figure 2.3.7-1) are as follows:

- Bag house funnel silo in center of courtyard segment
- Aluminum/Fluoride silos in western end of courtyard segment
- Dry Scrubber Air Pollution Control Unit located in the western end of courtyard segment
- Stormwater line no. 4 horizontal subsurface pipe and catch basins
- Pre-RI 2010 soil boring locations (identified for initial RI sampling)
- SWMU 7 Decommissioned Pollution Air Control Equipment which was an overhead line the length of B2 with no direct surface contact
- Pre-RI 2010 soil boring location
- Impacted surface soil mapped during the initial RI not observed in B2

These features in and adjacent to Courtyard segment B2 were the focus of the initial RI phase of investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data, and to confirm thickness of impacted surface soil, if present.



PAAOC-SB-COPC03	1	3	5	7
Aluminum Smelting (mg/kg)				
Fluoride	NA	230	NE	NA
PAH (mg/kg)				
HMW	13.9	12.6	11.3	NE

PAAOC-SB-BH04	0.5	2	7	10
PAH (mg/kg)				
TTEC	11.8	NA	NE	NE
HMW	52.9	NA	6.44	NE

PAAOC-TP-B32-SS	1
Aluminum Smelting (mg/kg)	
Fluoride	410
PAH (mg/kg)	
TTEC	134.1
LMW	190
HMW	1,150
Metals (mg/kg)	
Cadmium	3.2
Nickel	250

PAAOC-WPA-B2-TP24	4
PAH (mg/kg)	
HMW	22.5

PAAOC-SB-AF02	0.5	2	10
No Exceedances	NE	NE	NE

PAAOC-WPA-B2-TP23
Not sampled per WPA

PAAOC-WPA-B2-TP25	4
PAH (mg/kg)	
HMW	9.28

PAAOC-TP-B33-SS	1
Aluminum Smelting (mg/kg)	
Fluoride	320
PAH (mg/kg)	
TTEC	226.7
LMW	100.1
HMW	503
Metals (mg/kg)	
Cadmium	1.9
Zinc	380 J

PAAOC-TP-B31-SS	1
Aluminum Smelting (mg/kg)	
Fluoride	190
PAH (mg/kg)	
TTEC	52.1
HMW	292.5
Metals (mg/kg)	
Cadmium	1.1

- ⬚ Courtyard Segment B2
- ● RI Soil Boring
- 🟥 RI Test Pit
- 🟥 WPA Test Pit
- ─ Stormwater System Line

Plant SO2 Lines

- ┼ Abandoned SO2 Line

Segment B2 approximate area: 30,028 sq. ft.
(33,144 sq. ft. minus 3,116 sq. ft. area of two Alumina silos)

Soil Screening Levels
red: exceeds MTCA Method C
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife

NE: No exceedance
J: Estimated concentration
1: Sample depth in feet bgs

Figure 2.3.7-1

Plant Area AOC

Courtyard Segment B2 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

2.3.7.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment B2 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included three soil borings to investigate the Bag House structure, the former Alumina silos, and one pre-RI 2010 boring location, and three test pits to investigate surface soil at three pre-RI 2010 boring locations. RI boring and test pit locations are shown on Figure 2.3.7-1. Sample depths and analyses are as follows:

- Pre-RI 2010 boring locations test pit vertical composite sample 0-12 inches depth
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs
- Pre-RI 2010 boring location for COPC analyses samples 1, 3, 5, 7 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs
- Alumina Fluoride Silos samples at 0.5, 2, 10 ft bgs
    - ❖ Analytes: fluoride, metals
- Bag House samples at 0.5, 2, 7, 10 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected RI sample stations where the deepest sample exceeded site soil screen levels (Tetra Tech et al. 2020b). This included three test pits excavated to depths of 4 ft bgs, 2 ft below previous sample depths. Two test pits (B2-TP24 and B2-TP25) were excavated at pre-RI 2010 boring locations. The third test pit (B2-TP23) was excavated near initial RI boring SB-BH04 to confirm the thickness of impacted surface soil and, as proposed in the WPA, no samples were collected. WPA soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. WPA test pit locations are shown on Figure 2.3.7-1.

2.3.7.2 Investigation Results

Segment B2 soil was investigated with a combined total of three soil borings and three test pits in the initial RI and WPA phases of investigation. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.7-1 (PAAOC Courtyard Segment B2 Initial RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of

Table 2.3.7-1
PAAOC Courtyard Segment B2 Initial RI and WPA Soil Results Summary
Columbmia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results														WPA Analytical Results	
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-AF02-0.5	PAAOC-SB-AF02-2	PAAOC-SB-AF02-10	PAAOC-TP-B31-SS (1 ft)	PAAOC-TP-B32-SS (1 ft)	PAAOC-TP-B33-SS (1 ft)	PAAOC-SB-BH04-0.5	PAAOC-SB-BH04-2	PAAOC-SB-BH04-7	PAAOC-SB-BH04-10	PAAOC-SB-COPC03-1	PAAOC-SB-COPC03-3	PAAOC-SB-COPC03-5	PAAOC-SB-COPC03-7	PAAOC-WPA-B2-TP24-4	PAAOC-WPA-B2-TP25-4
Aluminum Smelting																						
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	NA	NA	NA	0.08	0.05 U	0.059	0.27	0.05 U	0.05 U	0.05 U	NA	0.05 UJ	0.05 U	NA	0.2 U	0.19 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	56	12	5.2	**190**	**410**	**320**	32	32	5 U	25	NA	**230**	85	NA	22.2 J	35.5 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	NA	NA	29	69	23	15	15	110	10 U	NA	28	86 J	NA	116	10.6
Polynuclear Aromatic Hydrocarbons (PAHs)																						
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	NA	NA	NA	0.16	0.15 U	1.5 U	0.15 U	NA	0.15 U	0.0071 U	0.076 U	0.14 U	0.15 U	0.0077 U	0.0029 J	0.0059
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	NA	NA	NA	0.25	0.15 U	1.5 U	0.15 U	NA	0.15 U	0.0071 U	0.076 U	0.14 U	0.15 U	0.0077 U	0.031	0.09
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	NA	NA	NA	2.5	1.3	3.2	0.55	NA	0.15 U	0.0071 U	0.076 U	0.14 U	0.15 U	0.0077 U	0.00067 J	0.00057 J
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	NA	NA	NA	0.15 U	0.22	1.5 U	0.15 U	NA	0.15 U	0.0071 U	0.076 U	0.14 U	0.15 U	0.0077 U	0.066	0.22
Anthracene	mg/kg	NA	NE	2,300	NE	NL	NA	NA	NA	4.1	4.4	3.9	1	NA	0.15 U	0.0071 U	0.076 U	0.14 U	0.15 U	0.0077 U	2	1.2
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	NA	NA	NA	32	120	46	6.1	NA	0.64	0.012	1.2	1	0.87	0.0077 U	1.2	1.4
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	NA	NA	NA	38	67	67	9	NA	0.89	0.017	0.76	1.2	0.86	0.0077 U	5.4	1.6
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	NA	NA	NA	52	360	99	10	NA	1.2	0.024	4.2	3.1	2.8	0.0077 U	1.1	0.71
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	NA	NA	NA	27	82	58	0.15 U	NA	0.68	0.015	0.88	1.2	0.92	0.0077 U	1.2	0.55
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	NA	NA	NA	18	80	32	3.7	NA	0.39	0.0075	0.97	0.76	0.73	0.0077 U	7.7	1.1
Chrysene	mg/kg	NA	NL	NL	NE	NL	NA	NA	NA	41	420	63	6.4	NA	0.88	0.013	3.8	2.6	2.6	0.0077 U	0.4	0.22
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	NA	NA	NA	6.5	24	14	1.3	NA	0.15 U	0.0071 U	0.26	0.21	0.23	0.0077 U	0.012	0.032
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	NA	NA	NA	53	160	70	11	NA	1.1	0.015	1.1	1.5	1.4	0.0077 U	3	1.9
Fluorene	mg/kg	NL	140,000	100	NE	NL	NA	NA	NA	1	0.79	1.5 U	0.25	NA	0.15 U	0.0071 U	0.076 U	0.14 U	0.15 U	0.0077 U	0.016	0.058
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	NA	NA	NA	28	83	59 J	6.5	NA	0.66	0.012	0.87	0.98	0.96	0.0077 U	1.5	1.1
Naphthalene	mg/kg	5	70	4.5	NE	NL	NA	NA	NA	0.51	0.2	1.5 U	0.15 U	NA	0.15 U	0.0071 U	0.076 U	0.14 U	0.15 U	0.0077 U	0.0052 J	0.012
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	NA	NA	NA	18	23	23	4.2	NA	0.46	0.0071 U	0.18	0.37	0.34	0.0077 U	0.39	0.76
Pyrene	mg/kg	NA	110,000	650	NE	NL	NA	NA	NA	50	160	65	9.9	NA	1.1	0.015	1	1.5	1.3	0.0077 U	2	1.4
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	NA	NA	NA	**52.1**	**134.1**	**226.7**	**11.8**	NA	1.19	0.02	1.56	1.8	1.44	0.0077	2.33	1.88
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	NA	NA	NA	79.1	**190**	**100.1**	26.9	NA	1.6	0.02	1.3	1.9	1.74	0.0077	3.66	3.04
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	NA	NA	NA	**292.5**	**1,150**	**503**	**52.9**	NA	**6.44**	0.12	**13.9**	**12.6**	**11.3**	0.0077	**22.5**	**9.28**
Polychlorinated Biphenyls (PCBs)																						
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.056 U	NA	0.056 U	0.053 U	0.057 U	0.054 U	0.056 U	0.058 U	0.012 U	0.011 Ui
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.056 U	NA	0.056 U	0.053 U	0.057 U	0.054 U	0.056 U	0.058 U	0.023 U	0.022 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.056 U	NA	0.056 U	0.053 U	0.057 U	0.054 U	0.056 U	0.058 U	0.013 U	0.011 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.056 U	NA	0.056 U	0.053 U	0.057 U	0.054 U	0.056 U	0.058 U	0.0082 J	0.011 Ui
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.056 U	NA	0.056 U	0.053 U	0.057 U	0.054 U	0.056 U	0.058 U	0.012 U	0.011 Ui
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	NA	NA	NA	NA	0.056 U	NA	0.056 U	0.053 U	0.057 U	0.054 U	0.056 U	0.058 U	0.012 U	0.011 Ui
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.056 U	NA	0.056 U	0.053 U	0.057 U	0.054 U	0.056 U	0.058 U	0.012 Ui	0.011 U
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	NA	NA	NA	NA	0.056	NA	0.056	0.053	0.057	0.054	0.056	0.058	0.0082	0.011
Metals																						
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	8,500	7,100	5,000	19,000	47,000	31,000 J	9,800	6,600	10,000	3,300	NA	6,100	7,600	NA	10,200	7,370
Arsenic	mg/kg	20	87.5	2.9	7.61	132	11 U	11 U	11 U	11 U	15	11 U	11 U	11 U	11 U	11 U	NA	11 U	11 U	NA	2.77	1.58
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.56 U	0.56 U	0.56 U	**1.1**	**3.2**	**1.9**	0.56 U	0.56 U	0.56 U	0.53 U	NA	0.54 U	0.56 U	NA	0.134	0.134
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	6.1	6.1	10	16	61	23	7.6	7.1	9.2	2.4	NA	11	5.9	NA	11.3	6.3
Copper	mg/kg	NA	140,000	280	28.4	217	16	16	11	19	27	25	14	68	15	19	NA	20	20	NA	18.1	17.3
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.6 U	5.6 U	5.6 U	12	95	14	5.9	5.6 U	5.6 U	5.3 U	NA	5.4 U	5.6 U	NA	5.89	4.29
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U	0.27 U	0.28 U	0.28 U	0.28 U	0.27 U	NA	0.27 U	0.28 U	NA	0.005 J	0.004 J
Nickel	mg/kg	NA	70,000	130	24.54	980	4.9	5.4	4	29	**250**	44 J	6.8	4.6	7.6	4.6	NA	8.7	6.6	NA	12.1	6.64
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	NA	11 U	11 U	NA	0.2 J	0.1 J
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	50	43	29	73	120	**380 J**	88	29	47	32	NA	38	44	NA	60.1	68
Total Petroleum Hydrocarbons (TPHs)																						
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	NA	38 U	NA	28 U	27 U	29 U	NA	28 U	29 U	17 J	22 J
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	NA	240	NA	56 U	53 U	61	NA	56 U	58 U	59 J	83 J
Volatile Organic Compounds (VOCs)																						
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	NA	NA	NA	NA	NA	NA	0.0012 U	NA	0.00095 U	0.00097 U	0.00097 U	0.00097 U	0.00093 U	0.0011 U	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	NA	NA	NA	NA	NA	NA	0.0059 U	NA	0.0047 U	0.0048 U	0.0048 U	0.0049 U	0.0047 U	0.0054 U	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5	NA	NA	NA	NA	NA	NA	0.0012 U	NA	0.00095 U	0.00097 U	0.00097 U	0.00097 U	0.00093 U	0.0011 U	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	NA	NA	0.0024 U	NA	0.0019 U	0.0019 U	0.0019 U	0.0019 U	0.0019 U	0.0022 U	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	NA	NA	0.0012 U	NA	0.00095 U	0.00097 U	0.00097 U	0.00097 U	0.00093 U	0.0011 U	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	NA	NA	NA	NA	NA	NA	0.0012 U	NA	0.00095 U	0.00097 U	0.00097 U	0.00097 U	0.00093 U	0.0011 U	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	NA	NA	NA	NA	NA	NA	0.0012 U	NA	0.00095 U	0.00097 U	0.00097 U	0.00097 U	0.00093 U	0.0011 U	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	NA	NA	NA	NA	NA	NA	0.0012 U	NA	0.00095 U	0.00097 U	0.00097 U	0.00097 U	0.00093 U	0.0011 U	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	NA	NA	NA	NA	NA	NA	0.0012 U	NA	0.00095 U	0.00097 U	0.00097 U	0.00097 U	0.00093 U	0.0011 U	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	NA	NA	NA	NA	NA	NA	0.0012 U	NA	0.00095 U	0.00097 U	0.00097 U	0.00097 U	0.00093 U	0.0011 U	NA	NA

Notes:

i	Method reporting limit is elevated due to a matrix interference.
J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
B	The sample result is five times less than blank contamination and cross-contamination is suspected.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in all samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment B2 are compiled and presented on Figure 2.3.7-1. The vertical extent of contamination has been defined for the SB-AF02, SB-BH04, and SB-COPC03 sampling locations through initial RI data. The vertical extent of contamination is not confirmed at sample locations TP-B31-SS for fluoride, PAH at TTEC and total HMW, and cadmium, and at B2-TP24, and B1-TP25 for PAH as HMW at 4 ft bgs.

In initial RI boring SB-AF02, COPCs were not detected in concentrations that exceed soil screening levels. The vertical extent has been defined by initial RI data.

In initial RI borings SB-BH04, PAH as TTEC and HMW were detected in the 0.5 and 7 ft bgs sample depths at concentrations that exceed soil screening levels but did not exceed in the deepest sample at 10 ft bgs. The vertical extent has been defined by initial RI data.

In initial RI boring SB-COPC03, PAH as HMW was detected in the 1, 3 and 5 ft bgs sample depths at concentrations that exceed ecological wildlife soil screening levels but did not exceed at the 7 ft bgs sample. Fluoride was also detected in the 3 ft bgs sample but did not exceed in the 5 ft bgs sample. The vertical extent has been defined by initial RI data.

In initial RI test pits TP-B31-SS, TP-B32-SS, and TP-B33-SS detected concentrations of fluoride, PAH as TTEC, LMW and HMW, cadmium, nickel, and zinc exceed soil screening levels at 1 ft bgs. Subsequent WPA test pits B2-TP24 and B2-TP25 detected concentrations of PAHs as HMW exceeds ecological wildlife soil screening levels up to 4 ft bgs.

Based on water levels measured as part of the Groundwater AOC investigation, the depth to the shallowest groundwater (UA aquifer) beneath B2, if present, is approximately elevation 470 ft or approximately 12 or more feet bgs. The concentrations of fluoride in shallow groundwater beneath this segment are expected to be between 0.96 mg/L and 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). The maximum concentration of fluoride detected in segment B2 is 410 mg/kg collected at 1 ft bgs.

2.3.7.3 Conclusions and Recommendations

The vertical extent of contamination has not been defined at initial RI test pit TP-B31-SS where detected concentrations of fluoride, PAHs, and cadmium exceed screening levels at the deepest depth of 1 ft bgs, and at WPA test pits B2-TP24 and B1-TP25 where PAH as HMW exceeded soil screening levels at 4 ft bgs, the deepest depth sampled. The maximum concentration of fluoride detected in segment B2 is 410 mg/kg collected at 1 ft bgs.

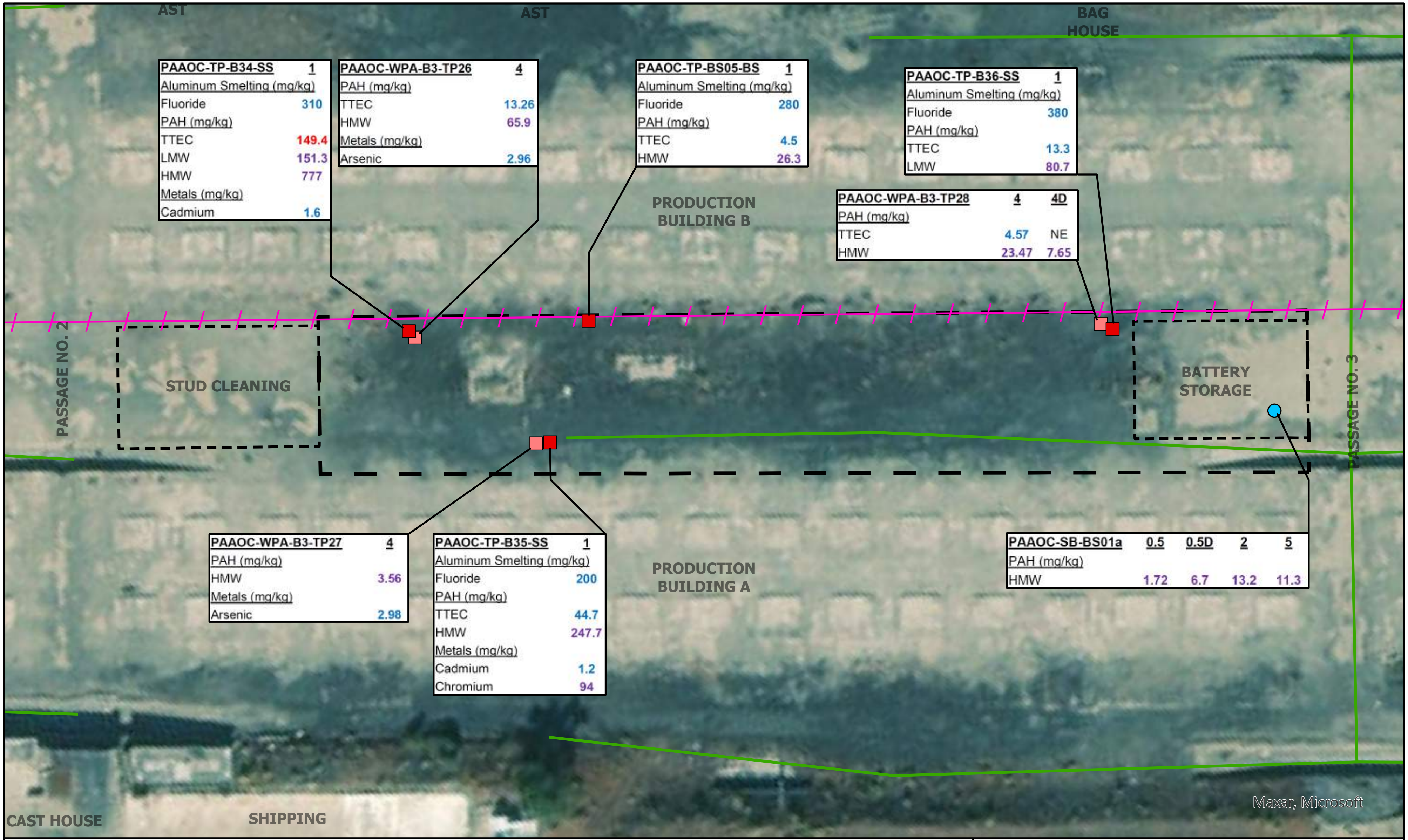
Based on COPC exceedance of soil screening levels to depths up to 4 ft bgs, Segment B2 is recommended for further evaluation in the FS.

2.3.8 Courtyard Segment B3

Courtyard segment B3 is the central segment of Courtyard B. Segment B3 is approximately 72 ft wide, 381 ft long, with an area of approximately 33,390 square feet. Calculated area in segment B3 does not include surfaces such as concrete foundations. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. At the western end of segment B3 is a concrete underpass beneath Passage No. 2 to provide access between segments B2 and B3. At the eastern end of segment B3 is a concrete underpass beneath Passage No. 3 to provide access between segments B3 and B4.

Several features and structures existed in and adjacent to segment B3 (Figure 2.3.8-1) as follows:

- Stud cleaning room at the western end of the segment
- Battery storage room at eastern end of segment
- Stormwater line no. 12 horizontal subsurface pipe and catch basins
- SWMU 7 Decommissioned Pollution Air Control Equipment which was an overhead line the length of B1 with no direct surface contact
- Pre-RI 2010 soil boring locations (identified for initial RI sampling)
- Surface impacted soil mapped during the initial RI across most of B3



PAAOC-TP-B34-SS	1
Aluminum Smelting (mg/kg)	
Fluoride	310
PAH (mg/kg)	
TTEC	149.4
LMW	151.3
HMW	777
Metals (mg/kg)	
Cadmium	1.6

PAAOC-WPA-B3-TP26	4
PAH (mg/kg)	
TTEC	13.26
HMW	65.9
Metals (mg/kg)	
Arsenic	2.96

PAAOC-TP-BS05-BS	1
Aluminum Smelting (mg/kg)	
Fluoride	280
PAH (mg/kg)	
TTEC	4.5
HMW	26.3

PAAOC-TP-B36-SS	1
Aluminum Smelting (mg/kg)	
Fluoride	380
PAH (mg/kg)	
TTEC	13.3
LMW	80.7

PAAOC-WPA-B3-TP28	4	4D
PAH (mg/kg)		
TTEC	4.57	NE
HMW	23.47	7.65

PAAOC-WPA-B3-TP27	4
PAH (mg/kg)	
HMW	3.56
Metals (mg/kg)	
Arsenic	2.98

PAAOC-TP-B35-SS	1
Aluminum Smelting (mg/kg)	
Fluoride	200
PAH (mg/kg)	
TTEC	44.7
HMW	247.7
Metals (mg/kg)	
Cadmium	1.2
Chromium	94

PAAOC-SB-BS01a	0.5	0.5D	2	5
PAH (mg/kg)				
HMW	1.72	6.7	13.2	11.3

- ⌜ ⌟ Courtyard Segment B3
- ● RI Boring
- 🟥 RI Test Pit
- ■ WPA Test Pits
- — Stormwater System Line

Plant SO2 Lines

- + Abandoned SO2 Line

Segment B3 approximate area: 33,390 sq. ft.

Soil Screening Levels
red: exceeds MTCA Method C
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife and for TPH diesel and residual range organics exceeds MTCA Method A

NE: No exceedance
D: Duplicate sample
4: Sample depth in feet bgs

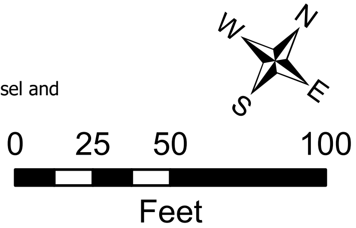


Figure 2.3.8-1

Plant Area AOC

Courtyard Segment B3 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

These features in and adjacent to Courtyard segment B3 were the focus of the initial RI phase of investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data, and to confirm thickness of impacted surface soil.

2.3.8.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment B3 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included one soil boring and three test pits. The soil boring investigated the battery storage room while the three test pits investigated pre-RI 2010 soil borings and one investigated suspected black soil. RI boring and test pit locations are shown on Figure 2.3.8-1. Sample depths and analyses are as follows:

- Pre-RI 2010 soil boring location test pit vertical composite sample 0-12 inches depth
  - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, metals
- Battery storage samples 0.5, 2, 5 ft bgs
  - ❖ Analytes: PAHs, metals
- Impacted surface soil samples at 1 ft bgs
  - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, metals

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected RI sample stations where the deepest sample exceeded site soil screen levels (Tetra Tech et al. 2020b). This included three test pits excavated at pre-RI 2010 boring locations excavated to a depths of 4 ft bgs, 3 ft below the previous sample depth. WPA soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. WPA test pit locations are shown on Figure 2.3.8-1.

2.3.8.2 Investigation Results

Segment B3 soil was investigated with a combined total of one soil boring and six test pits in the initial RI and WPA phases of investigation. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.8-1 (PAAOC Courtyard Segment B3 Initial RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of

Table 2.3.8-1
PAAOC Courtyard Segment B3 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results								WPA Analytical Results			
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-TP-B34-SS (1 ft)**	**PAAOC-TP-B35-SS (1 ft)**	**PAAOC-TP-B36-SS (1 ft)**	**PAAOC-SB-BS01a-0.5**	**PAAOC-SB-BS01a-0.5D**	**PAAOC-SB-BS01a-2**	**PAAOC-SB-BS01a-5**	**PAAOC-TP-BS05-BS (1 ft)**	**PAAOC-WPA-B3-TP26-4**	**PAAOC-WPA-B3-TP27-4**	**PAAOC-WPA-B3-TP28-4**	**PAAOC-WPA-B3-TP28-4D**
Aluminum Smelting																		
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.05 U	NA	NA	NA	NA	0.05 U	0.19 U	0.19 U	0.2 U	0.19 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**310**	**200**	**380**	NA	NA	NA	NA	**280**	108 J	38.8 J	117 J	80 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	64	17	24	NA	NA	NA	NA	20	23	4.5	27.3 J	17.5 J
Polynuclear Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.21	0.15 U	0.15 U	0.074 U	0.015 U	0.015 U	0.15 U	0.073 U	0.024 J	0.0014 J	0.02	0.0073
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.28	0.15 U	0.15 U	0.074 U	0.015 U	0.015 U	0.15 U	0.073 U	0.3	0.0087	0.16	0.053
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	3.6	0.94	0.38	0.074 U	0.015 U	0.16	0.15 U	0.1	0.0042 J	0.0016 J	0.0015 J	0.00059 J
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.15 U	0.15 U	0.15 U	0.074 U	0.015 U	0.015 U	0.15 U	4	0.57	0.017	0.2	0.066
Anthracene	mg/kg	NA	NE	2,300	NE	NL	4.9	1.3	0.67	0.074 U	0.19	0.5	0.15 U	0.17	7.3	0.41	2.3	0.83
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	71	22	7.4	0.17 J	0.74 J	1.5	0.87	2.4	9.8	0.52	3.3	1.1
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	110	32	9.1	0.26 J	0.98 J	2	0.86	3.1	12	0.67	4.7	1.4
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	150	48	17	0.3 J	1.2 J	2.3	2.8	5.5	6	0.36	2.2	0.76
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	92	30	8	0.22 J	0.85 J	1.4	0.92	2.8	4.2	0.23	1.4	0.48
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	52	17	5.5	0.1 J	0.42 J	0.81	0.73	1.7	8	0.42	2.9	0.92
Chrysene	mg/kg	NA	NL	NL	NE	NL	90	30	12	0.19 J	0.72 J	1.5	2.6	3.6	1.9	0.1	0.67	0.23
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	20	6.7	2.1	0.074 U	0.015 U	0.26	0.23	0.68	0.093	0.0024 J	0.045	0.018
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	110	32	13	0.29 J	1.2 J	2.6	1.4	3.9	10	0.48	3.7	1.1
Fluorene	mg/kg	NL	140,000	100	NE	NL	1.9	0.43	0.19	0.074 U	0.015 U	0.16	0.15 U	0.073 U	0.17	0.0039 J	0.067	0.026
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	92	30	8.6	0.21 J	0.67 J	1.2	0.96	2.9	8.4	0.46	3.3	1
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.52	0.15	0.15 U	0.074 U	0.015 U	0.015 U	0.15 U	0.073 U	0.046	0.0027 J	0.032	0.0097
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	35	7.5	3.8	0.13 J	0.62 J	1.5	0.34	1.1	3.2	0.078	1	0.38
Pyrene	mg/kg	NA	110,000	650	NE	NL	100	32	11	0.27 J	1.1 J	2.2	1.3	3.6	8.3	0.39	2.7	0.93
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**149.4**	**44.7**	**13.3**	0.34	1.3	2.4	1.4	**4.5**	**13.26**	0.71	**4.57**	1.5
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	**151.3**	42.32	18.04	0.42	2.01	4.92	1.74	9.3	14.02	0.76	5.16	1.64
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**777**	**247.7**	**80.7**	**1.72**	**6.7**	**13.2**	**11.3**	**26.3**	**65.9**	**3.56**	**23.47**	**7.65**
Polychlorinated Biphenyls (PCBs)																		
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.012 U	0.012 Ui	0.011 Ui	0.011 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.023 U	0.023 U	0.022 U	0.021 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.012 U	0.012 U	0.011 Ui	0.011 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.0077 J	0.012 U	0.011 Ui	0.011 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.012 U	0.012 U	0.011 Ui	0.011 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.012 Ui	0.012 U	0.011 Ui	0.011 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.017 P	0.013	0.011 Ui	0.011 U
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	NA	NA	NA	NA	NA	NA	0.0247	0.013	0.011	0.011
Metals																		
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	39,000	18,000	9,800	9,000	11,000	7,600	6,500	10,000	11,000	7,580	7,590	7,060
Arsenic	mg/kg	20	87.5	2.9	7.61	132	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	**2.96**	**2.98**	2.81 J	1.72 J
Cadmium	mg/kg	2	3,500	0.69	0.81	14	**1.6**	**1.2**	0.73	0.55 U	**1.3**	0.56 U	0.56 U	0.55 U	0.41	0.147	0.196 J	0.137 J
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	55	**94**	8.9	5 J	11 J	4.2	5.5	8.8 J	20.8	8.82	7	7.4
Copper	mg/kg	NA	140,000	280	28.4	217	75	46	22	17	17	20	14	20	28.9	20.6	22.3	20.7
Lead	mg/kg	1,000	NE	3,000	13.1	118	27	13	8.8	6	10	5.6 U	5.6 U	8.5	8.38	4.62	6.85 J	5.09 J
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.27 U	0.27 U	0.27 U	0.28 U	0.28 U	0.28 U	0.28 U	0.27 U	0.032	0.006 J	0.007 J	0.014 J
Nickel	mg/kg	NA	70,000	130	24.54	980	73	84	26	5.3	9.3	6.1	4.9	13	21	8.79	12.4 J	8.55 J
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	0.3 J	0.1 J	0.1 J	0.1 J
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	250	160	110	48 J	71 J	48	39	79 J	106	71.2	64.2	62
Total Petroleum Hydrocarbons (TPHs)																		
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	NA	NA	NA	110 J	7.5 J	54 JZ	16 J
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	NA	NA	NA	510 J	30 J	250 JZ	58 J

Notes:

i	Method reporting limit is elevated due to a matrix interference.
J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
B	The sample result is five times less than blank contamination and cross-contamination is suspected.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in bold exceed one or more site soil screening levels.

groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in eight out of 12 samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment B3 are compiled and presented on Figure 2.3.8-1. The vertical extent of contamination is not defined at all sample locations SB-BS01a, B3-TP26-4, B3-TP27-4, B3-TP28-4, and TP-BS05-SS.

In initial RI boring SB-BS01a, PAH as HMW was detected at concentrations that exceed the ecological wildlife soil screening level to the deepest depths sampled at 5 ft bgs. The vertical extent of contamination has not been defined by initial RI data.

In initial RI test pits TP-B34-SS, TP-B35-SS, TP-B36-SS, and TP-BS05-SS detected concentrations of fluoride, PAH as TTEC, LMW and HMW, cadmium, and chromium exceed soil screening levels at 1 ft bgs. Subsequent WPA test pits B3-TP26-4, B3-TP27-4, and B3-TP28-4 detected concentrations of PAHs as TTEC and HMW, and arsenic (in B3-TP26 only) that exceeds soil screening levels to 4 ft bgs, the deepest depth sampled.

Based on water levels measured as part of the Groundwater AOC investigation, the depth to the shallowest groundwater (UA aquifer) beneath B3, if present, is approximately elevation 470 ft or approximately 12 or more feet bgs. The concentration of fluoride in shallow groundwater beneath this segment is expected to be between 0.96 and 4 mg/L based on groundwater data in Volume 4, Section 2, Groundwater AOC. The maximum concentration of fluoride detected in segment B3 is 380 mg/kg collected from 1 ft bgs.

2.3.8.3 Conclusions and Recommendations

The vertical extent of contamination has not been defined at initial RI soil boring SB-BS01a. Detected concentrations of PAH as HMW exceeded soil screening levels at 5 ft bgs, the deepest depth sampled.

The vertical extent of contamination has not been defined at initial RI test pit TP-BS05-BS. Detected concentrations of fluoride, PAH as TTEC, and HMW exceeded soil screening levels at 1 ft bgs, the deepest depth sampled. The maximum concentration of fluoride detected in segment B3 is 380 mg/kg collected from 1 ft bgs.

The vertical extent of contamination has not been defined at WPA test pits B3-TP26, B3-TP27, and B3-TP28. Detected concentrations of PAH as TTEC and HMW, and arsenic exceeded soil screening levels at 4 ft bgs, the deepest depth sampled.

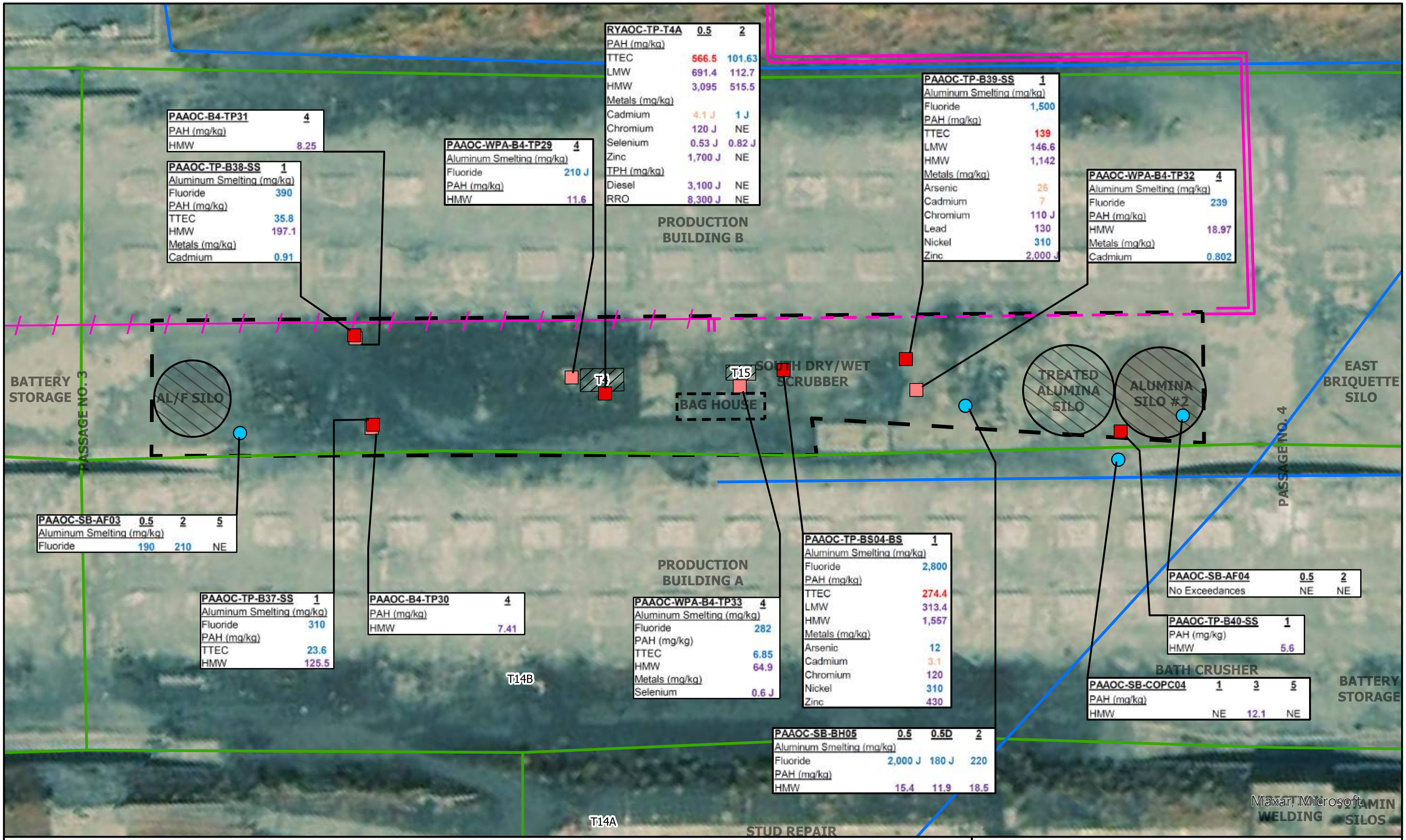
Based on COPC exceedance of soil screening levels to depths up to 5 ft bgs, Segment B3 is recommended for further evaluation in the FS.

2.3.9 Courtyard Segment B4

Courtyard segment B4 is in the eastern portion of Courtyard A. The west end of segment B4 is approximately 67 ft wide with an area of approximately 32,771 square feet. This area does not include the combined approximate 4,219-square-foot footprints of the former Treated Alumina Silo and Alumina Silo #2 at the eastern end of the courtyard segment and the Treated Alumni Silo at the western end of the courtyard segment. The adjusted calculated area segment B4 is approximately 28,552 square feet. Calculated area in segment B4 does not include surfaces such as concrete foundations, sloped areas, or ramps. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. At the western end of segment B4 is the foundation for the former alumina fluoride silo and a concrete underpass beneath Passage No. 3 to provide access between segments B3 and B4. At the eastern end of segment B4 are the former foundations for a treated alumina silo and alumina silo #2 and a concrete underpass beneath Passage No. 4 to provide access between segments B4 and B5.

Several features and structures existed in and adjacent to segment B5 (Figure 2.3.9-1) as follows:

- Transformer Substation T4A (one of two units on a single slab, previously investigated as part of the Rectifier Yard AOC)
- Alumina Fluoride silo at western end of segment
- Treated alumina silo and alumina silo #2 at eastern end of segment
- Bag house in the eastern portion of the segment



RYAOC-TP-T4A	0.5	2
PAH (mg/kg)		
TTEC	566.5	101.63
LMW	691.4	112.7
HMW	3,095	515.5
Metals (mg/kg)		
Cadmium	4.1 J	1 J
Chromium	120 J	NE
Selenium	0.53 J	0.82 J
Zinc	1,700 J	NE
TPH (mg/kg)		
Diesel	3,100 J	NE
RRO	8,300 J	NE

PAAOC-B4-TP31	4
PAH (mg/kg)	
HMW	8.25

PAAOC-TP-B38-SS	1
Aluminum Smelting (mg/kg)	
Fluoride	390
PAH (mg/kg)	
TTEC	35.8
HMW	197.1
Metals (mg/kg)	
Cadmium	0.91

PAAOC-WPA-B4-TP29	4
Aluminum Smelting (mg/kg)	
Fluoride	210 J
PAH (mg/kg)	
HMW	11.6

PAAOC-TP-B39-SS	1
Aluminum Smelting (mg/kg)	
Fluoride	1,500
PAH (mg/kg)	
TTEC	139
LMW	146.6
HMW	1,142
Metals (mg/kg)	
Arsenic	26
Cadmium	7
Chromium	110 J
Lead	130
Nickel	310
Zinc	2,000 J

PAAOC-WPA-B4-TP32	4
Aluminum Smelting (mg/kg)	
Fluoride	239
PAH (mg/kg)	
HMW	18.97
Metals (mg/kg)	
Cadmium	0.802

PAAOC-SB-AF03	0.5	2	5
Aluminum Smelting (mg/kg)			
Fluoride	190	210	NE

PAAOC-TP-B37-SS	1
Aluminum Smelting (mg/kg)	
Fluoride	310
PAH (mg/kg)	
TTEC	23.6
HMW	125.5

PAAOC-B4-TP30	4
PAH (mg/kg)	
HMW	7.41

PAAOC-WPA-B4-TP33	4
Aluminum Smelting (mg/kg)	
Fluoride	282
PAH (mg/kg)	
TTEC	6.85
HMW	64.9
Metals (mg/kg)	
Selenium	0.6 J

PAAOC-TP-BS04-BS	1
Aluminum Smelting (mg/kg)	
Fluoride	2,800
PAH (mg/kg)	
TTEC	274.4
LMW	313.4
HMW	1,557
Metals (mg/kg)	
Arsenic	12
Cadmium	3.1
Chromium	120
Nickel	310
Zinc	430

PAAOC-SB-BH05	0.5	0.5D	2
Aluminum Smelting (mg/kg)			
Fluoride	2,000 J	180 J	220
PAH (mg/kg)			
HMW	15.4	11.9	18.5

PAAOC-SB-AF04	0.5	2
No Exceedances	NE	NE

PAAOC-TP-B40-SS	1
PAH (mg/kg)	
HMW	5.6

PAAOC-SB-COPC04	1	3	5
PAH (mg/kg)			
HMW	NE	12.1	NE

▛▟ Courtyard Segment B4
● RI Boring
🟥 RI Test Pit
🟥 WPA Test Pit
— Stormwater System Line
— Groundwater Collection Line
▨ Approximate Transformer Pad

Segment B4 approximate area: 28,552 sq. ft.
(32,771 sq. ft. minus combined 4,219 sq. ft. area of Alumina silos)

Plant SO2 Lines

═ Existing SO2 Line, entrenched w/ spare
- - Elevated SO2 Line
-+- Abandoned SO2 Line

Soil Screening Levels
red: exceeds MTCA Method C
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife and for TPH diesel and residual range organics exceeds MTCA Method A
orange: exceeds MTCA Method A
NE: No exceedance
J: Estimated concentration
D: Duplicate Sample
RRO: TPH as residual range organics
2: Sample depth in feet bgs

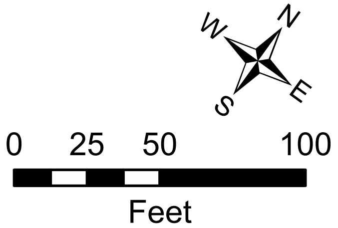


Figure 2.3.9-1

Plant Area AOC

Courtyard Segment B4 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

- Dry/Wet Scrubber Air Pollution Control Unit (south) located in the eastern end of courtyard segment
- Stormwater line no. 13 horizontal subsurface pipe and catch basins
- SWMU 7 Decommissioned Pollution Air Control Equipment which was an overhead line the length of B1 with no direct surface contact
- Pre-RI 2010 soil boring locations (identified for initial RI sampling)
- Surface impacted soil mapped during the initial RI across limited portions of B4

These features in and adjacent to Courtyard segment B4 were the focus of the initial RI and WPA phases of investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data, and to confirm thickness of impacted surface soil.

2.3.9.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment B4 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included four soil borings and six test pits. The soil borings investigated the former alumina silos and bag house foundations, and one pre-RI 2010 soil boring location. One of the test pits investigated the transformer substation T4A, one investigated impacted surface soil in the center of the courtyard, and four test pits investigated surface soil at pre-RI 2010 soil boring locations. Boring and test pit locations are shown on Figure 2.3.9-1. Sample depths and analyses are as follows:

- Pre-RI 2010 soil boring locations test pit samples vertical composite 0-12 inches depth
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, metals
- Alumina fluoride silo foundation samples 0.5, 2 ft bgs, and 0.5, 2, 5 ft bgs
    - ❖ Analytes: fluoride, metals
- Bag house samples at 0.5, 2 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PCBs, metals, TPH-Dx

- Pre-RI 2010 boring location for COPC analyses samples 1, 3, 5 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs
- Transformer substation T4A samples 0.5, 2.0 ft bgs
    - ❖ Analytes: total cyanide, fluoride, PAHs, PCBs, metals, TPH-Dx

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected RI sample stations where the deepest sample exceeded site soil screen levels (Tetra Tech et al. 2020b). This included five test pits excavated at initial RI-phase sample stations. Three test pits were excavated at pre-RI 2010 boring surface soil locations to 4 ft bgs, three ft below the deepest previous sample. One test pit was excavated at the location of a impacted surface soil sample location. One test pit was excavated at transformer substation T4A. WPA soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. WPA test pit locations are shown on Figure 2.3.9-1.

2.3.9.2 Investigation Results

Segment B4 soil was investigated with a combined total of four soil borings and eleven test pits in the initial RI and WPA phases of investigation. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.9-1 (PAAOC Courtyard Segment B4 Initial RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in most samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment B4 are compiled and presented on Figure 2.3.9-1. The vertical extent of contamination is defined at sample locations SB-AF03, SBAF04, and SB-COPC04. The vertical extent of

Table 2.3.9-1
PAAOC Courtyard Segment B4 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 1 of 2

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results											
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-AF03-0.5	PAAOC-SB-AF03-2	PAAOC-SB-AF03-5	PAAOC-SB-AF04-0.5	PAAOC-SB-AF04-2	PAAOC-SB-BH05-0.5	PAAOC-SB-BH05-0.5D	PAAOC-SB-BH05-2	PAAOC-SB-COPC04-1	PAAOC-SB-COPC04-3	PAAOC-SB-COPC04-5	PAAOC-TP-BS04-SS (1 ft)
Aluminum Smelting																		
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	NA	NA	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**190**	**210**	89	38	32	**2,000 J**	**180 J**	**220**	21	24	5 U	**2,800**
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	NA	NA	NA	NA	32	31	18	16	10 U	21	94 U
Polynuclear Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	NA	NA	NA	NA	NA	0.3 U	0.3 U	0.31 U	0.015 U	0.15 U	0.015 U	0.84
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	NA	NA	NA	NA	NA	0.3 U	0.3 U	0.31 U	0.015 U	0.15 U	0.015 U	0.9
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	NA	NA	NA	NA	NA	0.3 U	0.3 U	0.31 U	0.015 U	0.15 U	0.015 U	10
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	NA	NA	NA	NA	NA	0.3 U	0.3 U	0.31 U	0.015 U	0.15 U	0.015 U	0.29 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	NA	NA	NA	NA	NA	0.33	0.3 U	0.44	0.015 U	0.24	0.015 U	12
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	NA	NA	NA	NA	NA	1.6	1.5	2	0.039	1.3	0.1	130
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	NA	NA	NA	NA	NA	2.2	1.8	2.6	0.045	1.6	0.14	200
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	NA	NA	NA	NA	NA	2.6	2.4	3.2	0.052	2	0.18	280
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	NA	NA	NA	NA	NA	2	0.3 U	2.4	0.031	1.2	0.12	170
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	NA	NA	NA	NA	NA	0.97	0.87	1.1	0.02	0.82	0.056	98
Chrysene	mg/kg	NA	NL	NL	NE	NL	NA	NA	NA	NA	NA	1.9	1.7	2.3	0.041	1.6	0.11	170
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	NA	NA	NA	NA	NA	0.3 U	0.3 U	0.31 U	0.015 U	0.24	0.026	39
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	NA	NA	NA	NA	NA	2.8	2.4	3.3	0.06	2.1	0.15	210
Fluorene	mg/kg	NL	140,000	100	NE	NL	NA	NA	NA	NA	NA	0.3 U	0.3 U	0.31 U	0.015 U	0.15 U	0.015 U	5.4
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	NA	NA	NA	NA	NA	1.4	1.3	1.7	0.027	1.2	0.096	180
Naphthalene	mg/kg	5	70	4.5	NE	NL	NA	NA	NA	NA	NA	0.3 U	0.3 U	0.31 U	0.015 U	0.15 U	0.015 U	2
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	NA	NA	NA	NA	NA	1.1	0.91	1.5	0.02	0.4	0.056	74
Pyrene	mg/kg	NA	110,000	650	NE	NL	NA	NA	NA	NA	NA	2.7	2.3	3.2	0.058	2.1	0.15	190
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	NA	NA	NA	NA	NA	2.9	2.4	3.4	0.06	2.3	0.19	**274.4**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	NA	NA	NA	NA	NA	4.2	4.2	5.2	0.1	2.7	0.21	**313.4**
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	NA	NA	NA	NA	NA	**15.4**	**11.9**	**18.5**	0.3	**12.1**	0.98	**1,557**
Polychlorinated Biphenyls (PCBs)																		
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	NA	NA	0.056 U	0.056 U	0.058 U	0.057 U	0.056 U	0.055 U	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	0.056 U	0.056 U	0.058 U	0.057 U	0.056 U	0.055 U	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	0.056 U	0.056 U	0.058 U	0.057 U	0.056 U	0.055 U	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	0.056 U	0.056 U	0.058 U	0.057 U	0.056 U	0.055 U	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	0.056 U	0.056 U	0.058 U	0.057 U	0.056 U	0.055 U	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	NA	NA	NA	0.056 U	0.056 U	0.058 U	0.057 U	0.056 U	0.055 U	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	NA	NA	NA	0.056 U	0.056 U	0.058 U	0.057 U	0.056 U	0.055 U	NA
Aroclor 1262	mg/kg	NL	NL	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1268	mg/kg	NL	NL	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	NA	NA	NA	0.056	0.056	0.058	0.057	0.056	0.055	NA
Metals																		
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	19,000	11,000	6,300	9,900	12,000	10,000	8,800	7,700	8,800	5,200	8,200	110,000
Arsenic	mg/kg	20	87.5	2.9	7.61	132	11 U	12 U	11 U	11 U	11 U	11 U	11 U	12 U	11 U	11 U	11 U	**12**
Cadmium	mg/kg	2	3,500	0.69	0.81	14	1.1	0.59 U	0.53 U	0.56 U	0.56 U	0.56 U	0.56 U	0.58 U	0.57 U	0.56 U	0.55 U	**3.1**
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	6.9	11	7.1	8	19	5.6	5.7	4.5	8.3	3.5	16	**120**
Copper	mg/kg	NA	140,000	280	28.4	217	20	14	17	13	13	12	13	9.8	13	15	14	97
Lead	mg/kg	1,000	NE	3,000	13.1	118	13	20	6.3	6.2	5.8	5.6 U	5.8	5.8 U	8.2	5.6 U	5.5 U	54
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.27 U	0.29 U	0.27 U	0.28 U	0.28 U	0.28 U	0.28 U	0.29 U	0.29 U	0.28 U	0.28 U	0.28 U
Nickel	mg/kg	NA	70,000	130	24.54	980	17	8.8	7.4	9.7	12	6.7	6.7	4.1	6.5	5.3	7.5	**310**
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	12 U	11 U	11 U	11 U	11 U	11 U	12 U	11 U	11 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	150	62	40	50	59	98	83	110	49	42	48	**430**
Total Petroleum Hydrocarbons (TPHs)																		
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	140 U	28 U	150 U	29 U	28 U	28 U	NA
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	330	170	420	87	120	56	NA
Volatile Organic Compounds (VOCs)																		
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	NA	NA	NA	NA	NA	NA	NA	NA	0.0011 U	0.001 U	0.0011 U	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	NA	NA	NA	NA	NA	NA	NA	NA	0.0054 U	0.0051 U	0.0054 U	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	NA	NA	NA	NA	NA	NA	NA	NA	0.0011 U	0.001 U	0.0011 U	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	NA	NA	NA	NA	0.0021 U	0.002 U	0.0022 U	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	NA	NA	NA	NA	0.0011 U	0.001 U	0.0011 U	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	NA	NA	NA	NA	NA	NA	NA	NA	0.0011 U	0.001 U	0.0011 U	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	NA	NA	NA	NA	NA	NA	NA	NA	0.0011 U	0.001 U	0.0011 U	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	NA	NA	NA	NA	NA	NA	NA	NA	0.0011 U	0.001 U	0.0011 U	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	NA	NA	NA	NA	NA	NA	NA	NA	0.0011 U	0.001 U	0.0011 U	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	NA	NA	NA	NA	NA	NA	NA	NA	0.0011 U	0.001 U	0.0011 U	NA

Notes:

i	Method reporting limit is elevated due to a matrix interference.
J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
B	The sample result if five times less than blank contamination and cross-contamoination is suspected.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.3.9-1
PAAOC Courtyard Segment B4 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 2 of 2

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results						WPA Analytical Results				
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-TP-B37-SS (1 ft)	PAAOOC-TP-B38-SS (1 ft)	PAAOC-TP-B39-SS (1 ft)	PAAOC-TP-B40-SS (1 ft)	RYAOC-TP-T4A-0.5	RYAOC-TP-T4A-2	PAAOC-B4-TP29-4	PAAOC-B4-TP30-4	PAAOC-B4-TP31-4	PAAOC-B4-TP32-4	PAAOC-B4-TP33-4
Aluminum Smelting																	
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.068	0.39	0.05 U	2.1 U	2.2 U	NA	0.21 U	0.21 U	0.2 U	0.21 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**310**	**390**	**1,500**	26	140	140	**210 J**	53.6 J	53 J	**239**	**282**
Sulfate	mg/kg	NA	NE	2,150	NE	NE	19	15	190	13	NA	NA	114	9	7.9	32.9	49.9
Polynuclear Aromatic Hydrocarbons (PAHs)																	
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.15 U	0.15 U	0.15 U	0.038 U	1.1	0.21	0.0042 J	0.0042 J	0.0056 J	0.0072	0.29 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.15 U	0.15 U	0.15	0.038 U	1.7	0.28	0.056	0.038	0.054	0.083	0.17 J
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.59	0.98	1.5	0.076	20	3.4	0.00065 J	0.00043 J	0.00048 J	0.00086 J	0.29 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.15 U	0.15 U	0.48	0.038 U	0.26	0.051 J	0.0095	0.058	0.088	0.18	0.31
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.7	1.4	5.4	0.1	29	5.7	1.2	0.72	0.93	1.8	5.5
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	23.6	35.8	139	0.8	280	45	1.5	0.98	1.2	1.7	3.7
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	11	18	92	0.5	410	74	2.2	1.4	1.5	4.7	14
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	17	26	65	1	640	110	1	0.75	0.75	1.4	3.9
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	16	22	91	0.46	330	46	0.82	0.5	0.57	1.2	3.8
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	8.1	12	86	0.29	160	25	1.8	0.92	1	3.7	22
Chrysene	mg/kg	NA	NL	NL	NE	NL	15	23	430	1	300	48	0.27	0.19	0.21	0.47	1.1
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	3.8	5.1	27	0.11	65	9.5	0.016	0.013	0.018	0.028	0.29 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	16	28	120	1	480	77	1.7	0.95	1.3	3	6.9
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.27	0.55	0.86	0.038 U	8.8	1.7	0.027	0.02	0.027	0.046	0.08 J
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	16	23	92	0.48	390	82	1.3	0.96	0.99	1.9	4.9
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.15 U	0.19	0.34	0.038 U	3.3	0.58	0.0097	0.0095	0.014	0.014	0.064 JB
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	4.4	8.4	18	0.52	150	25	0.5	0.3	0.47	0.74	1.5
Pyrene	mg/kg	NA	110,000	650	NE	NL	15	25	120	0.91	520	76	1.5	0.82	1.1	2.1	6
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**23.6**	**35.8**	**139**	0.8	**566.5**	**101.63**	2.1	1.37	1.63	2.74	**6.85**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	22	39.5	**146.6**	1.7	**691.4**	**112.7**	2.3	1.38	2.06	4.06	9.02
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**125.5**	**197.1**	**1,142**	**5.6**	**3,095**	**515.5**	**11.6**	**7.41**	**8.25**	**18.97**	**64.9**
Polychlorinated Biphenyls (PCBs)																	
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	NA	0.0081 UJ	0.0084 UJ	0.012 U	0.013 U	0.012 U	0.012 U	0.012 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	0.0046 UJ	0.0048 UJ	0.024 U	0.025 U	0.023 U	0.023 U	0.023 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	0.0054 UJ	0.0056 UJ	0.012 U	0.013 U	0.012 U	0.012 U	0.012 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	0.0018 UJ	0.0018 U	0.0061 J	0.013 U	0.012 U	0.069	0.013 P
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	0.0032 UJ	0.0033 UJ	0.012 U	0.013 U	0.012 U	0.012 U	0.012 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	NA	NA	0.0016 UJ	0.0017 UJ	0.012 U	0.013 U	0.012 U	0.012 U	0.012 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	NA	NA	0.0021 UJ	0.0022 UJ	0.012 U	0.0081 JP	0.012 U	0.012 U	0.012 U
Aroclor 1262	mg/kg	NL	NL	NE	NE	NE	NA	NA	NA	NA	0.048 J	0.00057 U	NA	NA	NA	NA	NA
Aroclor 1268	mg/kg	NL	NL	NE	NE	NE	NA	NA	NA	NA	0.00099 UJ	0.011 J	NA	NA	NA	NA	NA
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	NA	NA	0.048	0.011	0.0061	0.0081	0.012	0.069	0.013
Metals																	
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	16,000	20,000	100,000	9,700	51,000 J	14,000 J	10,600	9,640	10,700	17,200	12,900
Arsenic	mg/kg	20	87.5	2.9	7.61	132	11 U	11 U	**26**	11 U	5.4	4.3	2.05	2.42	2.61	3.96	4.61
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.85	**0.91**	**7**	0.57 U	**4.1 J**	**1 J**	0.141	0.189	0.181	**0.802**	1.62
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	16	17	**110 J**	8.5 J	**120 J**	32 J	10.6	9.56	11.8	21.5	44.8
Copper	mg/kg	NA	140,000	280	28.4	217	22	23	34	12	69	27	21	23.3	21	47.5	33.3
Lead	mg/kg	1,000	NE	3,000	13.1	118	9.2	8.6	**130**	5.7 U	34 J	9.1 J	4.74	4.91	5.23	10.1	14.4
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.28 U	0.29 U	0.29 U	0.15	0.066	0.008 J	0.006 J	0.005 J	0.014 J	0.037
Nickel	mg/kg	NA	70,000	130	24.54	980	29	34	**310**	8.2	120 J	22 J	11.3	10.7	12.5	29.4	55.1
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	11 U	**0.53 J**	**0.82 J**	0.2 J	0.2 J	0.2 J	0.2 J	**0.6 J**
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	160	170	**2,000 J**	45 J	**1,700 J**	360 J	86.9	80.1	77	165	249
Total Petroleum Hydrocarbons (TPHs)																	
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	**3,100 J**	600	48 H	13 J	18 J	80 J	110 J
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	**8,300 J**	2,000	170 Z	43 J	75 J	250 J	470 J
Volatile Organic Compounds (VOCs)																	
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

i	Method reporting limit is elevated due to a matrix interference.	B	The sample result if five times less than blank contamination and cross-contamoination is suspected.
J	Estimated concentration.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
NA	Not applicable or not analyzed.	LMW PAH	Low molecular weight PAH.
NE	Not established.	HMW PAH	High molecular weight PAH.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.	Detected concentrations shown in bold exceed one or more site soil screening levels.	
U	Chemical was not detected. The associated value represents the method detection limit.		
UJ	Chemical was not detected. The associated limit is estimated.		

contamination is not defined at sample locations B4-TP29, B4-TP30, B4-TP31, B4-TP32, and B4-TP33 to 4 ft bgs the deepest depth sampled, or for sample location SB-BH05 at 2 ft bgs the deepest depth sampled.

In initial RI boring SB-AF04, COPCs were not detected in concentrations that exceed soil screening levels. The vertical extent has been defined by initial RI data.

In initial RI boring SB-AF03 and SB-COPC04 detected COPCs at concentrations exceed soil screening levels to 2 and 3 ft bgs, respectively, but did not exceed at 5 ft bgs the deepest depths sampled. The vertical extent has been defined by initial RI data.

In initial RI boring SB-BH05, fluoride and PAH as HMW were detected in samples at 0.5 and 2 ft bgs, the deepest depths sampled, at concentrations that exceed soil screening levels. The vertical extent of contamination has not been defined by initial RI data.

In initial RI test pits TP-BS04-BS and TP-T4A detected concentrations of fluoride, PAH as TTEC, LMW and HMW, cadmium, chromium, selenium, nickel, zinc, and TPH as diesel and residual range organics exceeds soil screening levels at 1 and 2 ft bgs, respectively. Subsequent WPA test pits B4-TP33 and B4-TP-29 detected concentrations of fluoride, PAHs as TTEC and HMW, and selenium at concentrations that exceed soil screening levels at 4 ft bgs the deepest depth sampled. The vertical extent of contamination is not defined by WPA test pit data.

In four initial RI test pits TP-B37-SS through TP-B40-SS detected concentrations of fluoride, PAH as TTEC and total LMW and HMW, arsenic, cadmium, chromium, lead, nickel, and zinc were detected at concentrations that exceed soil screening levels at 1 ft bgs. Subsequent WPA test pits B4-TP30 through B4-TP32 detected fluoride, PAH as total HMW, and cadmium at concentrations that still exceed soil screening levels at 4 ft bgs, the deepest depth sampled. The vertical extent of contamination is not defined for the four initial RI test pits with initial RI and WPA data.

Based on water levels measured as part of the Groundwater AOC investigation, the depth to the shallowest groundwater (UA aquifer) beneath B4, if present, is approximately elevation 470 ft or approximately 12 or more feet bgs. The concentrations of fluoride in shallow groundwater beneath this segment are expected to be between 0.96 and 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). The maximum concentration of fluoride detected in segment B4 is 2,800 mg/kg and is associated with a sample of impacted surface soil collected at 1 ft bgs.

2.3.9.3 Conclusions and Recommendations

The vertical extent has not been defined at initial RI soil boring SB-BH05. Detected concentrations of fluoride and PAH as HMW exceeded soil screening levels at 2 ft bgs, the deepest depth sampled.

The vertical extent has not been defined at WPA test pits B4-TP29, B4-TP30, B4-TP31, B4-TP32, and B4-TP33. Detected concentrations of fluoride, PAH as TTEC and HMW, and cadmium exceeded soil screening levels at 4 ft bgs, the deepest depth sampled. The maximum concentration of fluoride detected in segment B4 is 2,800 mg/kg and is associated with a sample of impacted surface soil collected at 1 ft bgs.

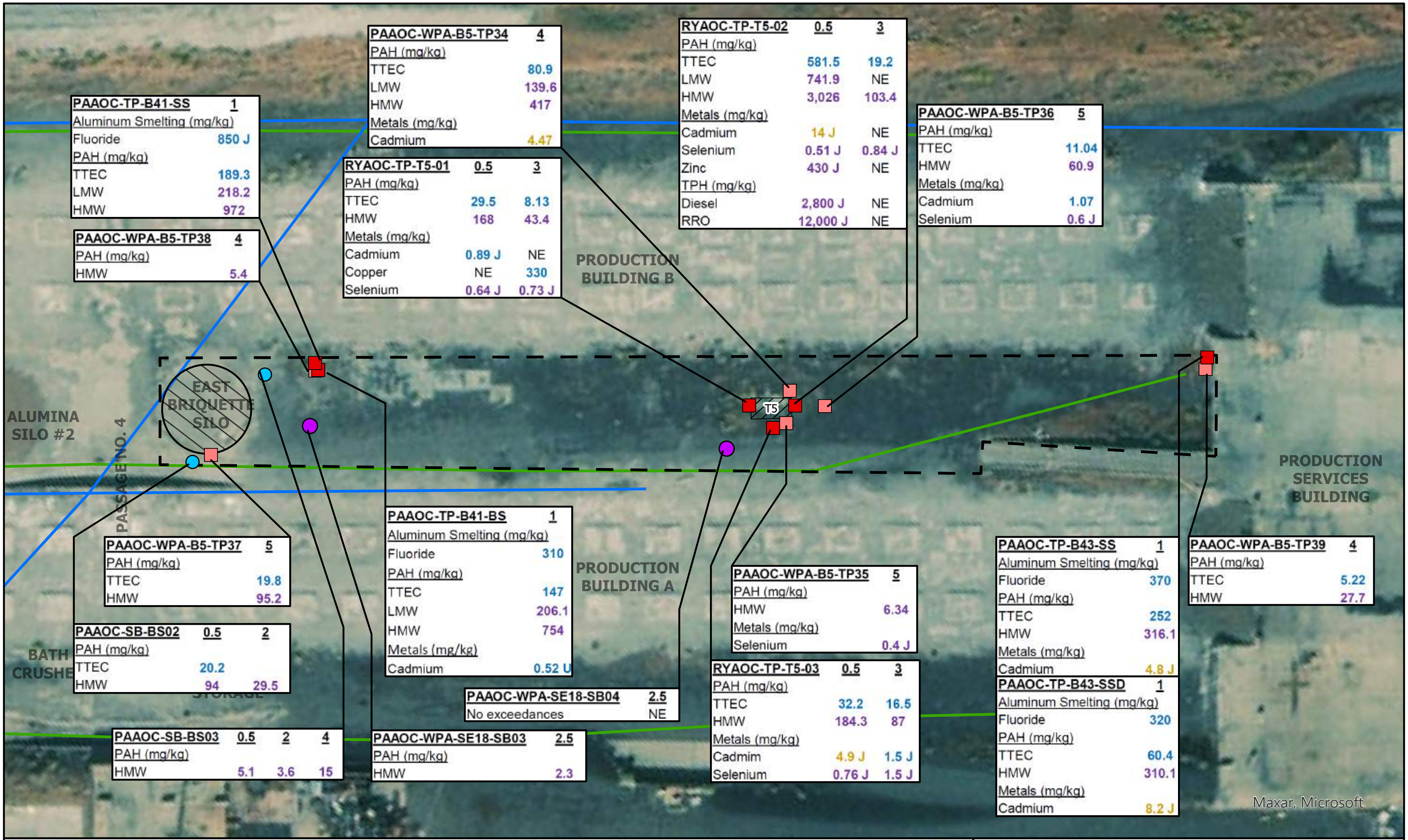
Based on COPC exceedance of soil screening levels to depths up to 4 ft bgs, Segment B4 is recommended for further evaluation in the FS.

2.3.10 Courtyard Segment B5

Courtyard segment B5 is at the east end of Courtyard B. The west end of segment B5 is approximately 58 ft wide, narrowing to approximately 53 ft wide in the eastern portion with an area of approximately 33,904 square feet. This area does not include the approximate 1,850-square-foot footprints of the former East Briquette Silo at the western end of the courtyard segment. The adjusted calculated area segment B5 is approximately 32,054 square feet. Calculated area in segment B5 does not include surfaces such as concrete foundations, sloped areas, or ramps. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. At the western end of segment B5 is a concrete underpass beneath Passage No. 4 to provide access between segments B4 and B5. At the eastern end of segment B5 is a concrete ramp leading up to the Production Storage building.

Several features and structures existed in and adjacent to segment B5 (Figure 2.3.10-1) as follows:

- Transformer Substation T5 (two units on one slab, previously investigated as part of the Rectifier Yard AOC)
- East Briquette Silo (at west end of segment B5)



PAAOC-TP-B41-SS	**1**
Aluminum Smelting (mg/kg)	
Fluoride	850 J
PAH (mg/kg)	
TTEC	189.3
LMW	218.2
HMW	972

PAAOC-WPA-B5-TP38	**4**
PAH (mg/kg)	
HMW	5.4

PAAOC-WPA-B5-TP34	**4**
PAH (mg/kg)	
TTEC	80.9
LMW	139.6
HMW	417
Metals (mg/kg)	
Cadmium	4.47

RYAOC-TP-T5-01	**0.5**	**3**
PAH (mg/kg)		
TTEC	29.5	8.13
HMW	168	43.4
Metals (mg/kg)		
Cadmium	0.89 J	NE
Copper	NE	330
Selenium	0.64 J	0.73 J

RYAOC-TP-T5-02	**0.5**	**3**
PAH (mg/kg)		
TTEC	581.5	19.2
LMW	741.9	NE
HMW	3,026	103.4
Metals (mg/kg)		
Cadmium	14 J	NE
Selenium	0.51 J	0.84 J
Zinc	430 J	NE
TPH (mg/kg)		
Diesel	2,800 J	NE
RRO	12,000 J	NE

PAAOC-WPA-B5-TP36	**5**
PAH (mg/kg)	
TTEC	11.04
HMW	60.9
Metals (mg/kg)	
Cadmium	1.07
Selenium	0.6 J

PAAOC-WPA-B5-TP37	**5**
PAH (mg/kg)	
TTEC	19.8
HMW	95.2

PAAOC-SB-BS02	**0.5**	**2**
PAH (mg/kg)		
TTEC	20.2	
HMW	94	29.5

PAAOC-SB-BS03	**0.5**	**2**	**4**
PAH (mg/kg)			
HMW	5.1	3.6	15

PAAOC-TP-B41-BS	**1**
Aluminum Smelting (mg/kg)	
Fluoride	310
PAH (mg/kg)	
TTEC	147
LMW	206.1
HMW	754
Metals (mg/kg)	
Cadmium	0.52 U

PAAOC-WPA-SE18-SB04	**2.5**
No exceedances	NE

PAAOC-WPA-SE18-SB03	**2.5**
PAH (mg/kg)	
HMW	2.3

PAAOC-WPA-B5-TP35	**5**
PAH (mg/kg)	
HMW	6.34
Metals (mg/kg)	
Selenium	0.4 J

RYAOC-TP-T5-03	**0.5**	**3**
PAH (mg/kg)		
TTEC	32.2	16.5
HMW	184.3	87
Metals (mg/kg)		
Cadmim	4.9 J	1.5 J
Selenium	0.76 J	1.5 J

PAAOC-TP-B43-SS	**1**
Aluminum Smelting (mg/kg)	
Fluoride	370
PAH (mg/kg)	
TTEC	252
HMW	316.1
Metals (mg/kg)	
Cadmium	4.8 J

PAAOC-TP-B43-SSD	**1**
Aluminum Smelting (mg/kg)	
Fluoride	320
PAH (mg/kg)	
TTEC	60.4
HMW	310.1
Metals (mg/kg)	
Cadmium	8.2 J

PAAOC-WPA-B5-TP39	**4**
PAH (mg/kg)	
TTEC	5.22
HMW	27.7

⌜ ⌝	Courtyard Segment B5
●	RI Soil Boring
🟥	RI Test Pit
●	WPA Soil Boring
🟥	WPA Test Pit
—	Groundwater Collection Line
—	Stormwater System Line
▨	Approximate Transformer Pad

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife and for TPH diesel and residual range organics exceeds MTCA Method A
orange: exceeds MTCA Method A
NE: No exceedance
J: Estimated concentration
D: Duplicate sample
RRO: TPH as residual range organics
1: Sample depth in feet bgs

Segment B5 approximate area: 32,054 sq. ft. (33,904 sq. ft. minus 1,850 sq. ft. area of East Briquette Silo)

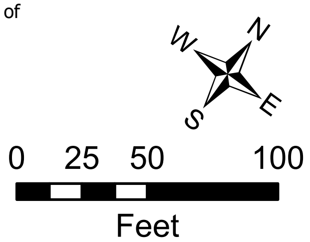


Figure 2.3.10-1

Plant Area AOC

Courtyard Segment B5 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

- Production Services building adjacent to the east
- Stormwater line no. 13 horizontal subsurface pipe and catch basins
- SWMU 7 Decommissioned Pollution Air Control Equipment which was an overhead line the length of B1 with no direct surface contact
- The dry/wet scrubber bleed line piping runs beneath passage no. 4, which is at the west margin of the segment and is a likely source of sulfate
- Pre-RI 2010 soil boring locations (identified for initial RI sampling)
- Surface impacted soil mapped during the initial RI across some portions of B5

These features in and adjacent to Courtyard segment B5 were the focus of the initial RI phase of investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data, and to confirm thickness of impacted surface soil.

2.3.10.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment B5 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included two soil borings and six test pits. The soil borings investigated the former East Briquette Silo while three of the test pits investigated the transformer substation T5, two investigated historic 2010 soil borings, while one investigated suspected black soil. RI boring and test pit locations are shown on Figure 2.3.10-1. Sample depths and analyses are as follows:

- Pre-RI 2010 boring locations test pit vertical composite sample 0-12 inches depth
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, and metals
- East Briquette Silo samples at 0.5, 2, 4 ft bgs
    - ❖ Analytes: PAHs, metals
- Transformer substation samples 0.5, 3.0 ft bgs
    - ❖ Analytes: total cyanide, fluoride, PAHs, PCBs, metals, TPH-Dx

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected RI sample stations where the deepest sample exceeded site soil screen levels (Tetra Tech et al. 2020b). This included two soil borings and six test pits excavated at initial RI-phase sample stations. The two soil borings investigated the occurrence of fluoride and sulfate at depth in initial RI boring SB-SE18 in segment C5 (SE18 Investigation Area, Section 2.2.7). Three test pits were excavated at transformer substation T5 to depths of 4 and 5 ft bgs, two to 3 ft below the previous sample depth. Two test pits were excavated at pre-RI 2010 boring locations to depths of 4 ft bgs, 3 ft below previous sample depths. One test pit was excavated at soil boring SB-BS02 to 5 ft bgs, 3 ft below the previous deepest sample depth. WPA boring soil samples were analyzed for total cyanide, fluoride, sulfate, and PAHs. WPA test pit soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. WPA boring and test pit locations are shown on Figure 2.3.10-1.

2.3.10.2 Investigation Results

Segment B5 soil was investigated with a combined total of four soil borings and eleven test pits in the initial RI and WPA phases of investigation. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.10-1 (PAAOC Courtyard Segment B5 Initial RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in all samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment B5 are compiled and presented on Figure 2.3.10-1. The vertical extent of contamination is not defined at all initial RI locations sampled. WPA sample stations B5-TP34, B5-TP35, B5-TP36, B5-TP37, B5-TP38, and B4-TP39 excavated to define vertical extent at 2010 soil boring locations, East Briquette Silo boring, and transformer substation T5 did not define the vertical extent of contamination to 4 ft bgs, the deepest depth sampled.

Table 2.3.10-1
PAAOC Courtyard Segment B5 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 1 of 2

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results											
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-BS02-0.5**	**PAAOC-SB-BS02-2**	**PAAOC-SB-BS03-0.5**	**PAAOC-SB-BS03-2**	**PAAOC-SB-BS03-4**	**PAAOC-TP-B41-SS (1 ft)**	**PAAOC-TP-B43-SS (1 ft)**	**PAAOC-TP-B43-SSD (1 ft)**	**PAAOC-TP-B41-BS (1 ft)**	**RYAOC-TP-T5-01-0.5**	**RYAOC-TP-T5-01-3**	**RYAOC-TP-T5-02-0.5**
Aluminum Smelting																		
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	NA	NA	NA	NA	NA	0.05 U	0.05 U	0.051	0.05 U	2 U	2 U	1.9 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	NA	NA	NA	NA	NA	**850 J**	**370**	**320**	**310**	7.8	15	140
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	NA	NA	NA	NA	26	21	20	10 U	NA	NA	NA
Polynuclear Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.15 U	0.15 U	0.14 U	0.31 U	0.62 U	0.31	0.75 U	0.75 U	1.4 U	0.11	0.023 J	1.6
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.15 U	0.15 U	0.14 U	0.31 U	0.62 U	0.44	0.75 U	0.75 U	1.4 U	0.16	0.033	2.3
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	1.2	0.51	0.14 U	0.31 U	0.62 U	5.5	3.3	3.3	7.3	1.6	0.36	28
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.15 U	0.15 U	0.14 U	0.31 U	0.62 U	0.15 U	0.75 U	0.75 U	11	0.017 J	0.0025 J	0.26
Anthracene	mg/kg	NA	NE	2,300	NE	NL	1.6	0.5	0.14 U	0.31 U	0.62 U	7.7	4	3.7	10	2.5	0.48	37
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	11	3.1	0.53	0.44	1.7	96	32	32	83	17	4.4	280
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	15	4.3	0.74	0.54	2.1	140	47	45	110	21	5.9	430
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	20	6	0.94	0.73	2.9	190	59	59	140	34	7.3	590
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.15 U	3.3	0.55	0.43	1.6	100	39	38	81	17	4.9	330
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	6.1	1.6	0.31	0.31 U	0.87	63	22	21	51	8.4	2.8	170
Chrysene	mg/kg	NA	NL	NL	NE	NL	12	3.4	0.63	0.49	2	110	38	36	92	17	4.4	290
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	2.5	0.57	0.14 U	0.31 U	0.62 U	23	8.6	8.1	19	3.6	0.92	66
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	19	5.1	0.87	0.31 U	2.6	150	48	46	120	31	7.2	500
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.64	0.21	0.14 U	0.31 U	0.62 U	3.2	1.6	1.6	4.3	0.75	0.15	12
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	11	2.7	0.57	0.37	1.4	110	32	30	68	20	6.4	380
Naphthalene	mg/kg	5	70	4.5	NE	NL	2.4	0.15 U	0.14 U	0.31 U	0.62 U	0.83	0.75 U	0.75 U	1.5	0.34	0.066	4.6
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	8	2.2	0.33	0.31	1.1	51	20	20	52	11	2.3	160
Pyrene	mg/kg	NA	110,000	650	NE	NL	16	4.5	0.79	0.64	2.4	140	43	41	110	30	6.4	490
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**20.2**	5.7	0.98	0.7	2.8	**189.3**	**252**	**60.4**	**147**	**29.5**	**8.13**	**581.5**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	33	8.5	1.2	0.31	3.7	**218.2**	76.9	74.6	**206.1**	45.2	10.6	**741.9**
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**94**	**29.5**	**5.1**	**3.6**	**15**	**972**	**316.1**	**310.1**	**754**	**168**	**43.4**	**3,026**
Polychlorinated Biphenyls (PCBs)																		
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.007 UJ	0.0077 UJ	0.0071 UJ
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0039 U	0.0044 U	0.004 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0046 UJ	0.0051 UJ	0.0047 UJ
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0015 U	0.0017 U	0.0015 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0027 UJ	0.003 UJ	0.0028 UJ
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0014 UJ	0.0016 UJ	0.0014 UJ
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0018 UJ	0.0018 J	0.17 J
Aroclor 1262	mg/kg	NL	NL	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.078	0.00052 U	0.00048 U
Aroclor 1268	mg/kg	NL	NL	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00085 UJ	0.007 J	0.076 J
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.078	0.01	0.25
Metals																		
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	12,000	8,300	6,400	5,300	8,300	30,000	51,000	59,000	19,000	11,000 J	8,600 J	44,000 J
Arsenic	mg/kg	20	87.5	2.9	7.61	132	11 U	11 U	11 U	11 U	12 U	11 U	11 U	11 U	10 U	2	2.1	3
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.56 U	0.56 U	0.56 U	0.57 U	0.58 U	0.62	**4.8 J**	**8.2 J**	**0.52 U**	**0.89 J**	0.4 J	**14 J**
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	6.9	5.7	6	3.9	6.2	12 J	8.2 J	8.2 J	5.6 J	7.2 J	5.6 J	19 J
Copper	mg/kg	NA	140,000	280	28.4	217	13	15	12	12	13	19	24	24	15	19	**330**	100
Lead	mg/kg	1,000	NE	3,000	13.1	118	6.8	6	5.9	5.7 U	5.8 U	7.9	5.6 U	9	5.6	5.3 J	4. J	17 J
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.28 U	0.27 U	0.29 U	0.29 U	0.27 U	0.28 U	0.28 U	0.26 U	0.0056 U	0.0065 U	0.017 J
Nickel	mg/kg	NA	70,000	130	24.54	980	9	6.7	4.1	4.5	5.8	29	19	21	11	9.6 J	6.3 J	41 J
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	11 U	12 U	11 U	11 U	11 U	10 U	**0.64 J**	**0.73 J**	**0.51 J**
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	55	55	190	43	59	130 J	150 J	190 J	78 J	67 J	51 J	**430 J**
Total Petroleum Hydrocarbons (TPHs)																		
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	260	14 J	**2,800 J**
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	670	46 J	**12,000 J**

Notes:

i	Method reporting limit is elevated due to a matrix interference.	B	The sample result is five times less than blank contamination and cross-contamination is suspected.
J	Estimated concentration.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
NA	Not applicable or not analyzed.	LMW PAH	Low molecular weight PAH.
NE	Not established.	HMW PAH	High molecular weight PAH.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.	Detected concentrations shown in **bold** exceed one or more site soil screening levels.	
U	Chemical was not detected. The associated value represents the method detection limit.		
UJ	Chemical was not detected. The associated limit is estimated.		

Table 2.3.10-1
PAAOC Courtyard Segment B5 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 2 of 2

		Screening Levels				Ecological Screening Levels	Initial RI Analytical Results			WPA Analytical Results								
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**RYAOC-TP-T5-02-3**	**RYAOC-TP-T5-03-0.5**	**RYAOC-TP-T5-03-3**	**PAA0C-WPA-SE18-SB03-2.5**	**PAAOC-WPA-SE18-SB04-2.5**	**PAAOC-WPA-B5-TP34-4**	**PAAOC-WPA-B5-TP35-5**	**PAAOC-WPA-B5-TP36-5**	**PAAOC-WPA-B5-TP37-5**	**PAAOC-WPA-B5-TP38-4**	**PAAOC-WPA-B5-TP39-4**
Aluminum Smelting																		
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	2.1 U	2 U	2.4 U	0.2 U	0.19 U	NA	NA	NA	0.21 U	0.19 U	0.19 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	77	60	63	35	15.2	103 J	41.6 J	73.2 J	28.4	111 J	131
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	NA	NA	5.4	4.6	52.8	3.1	14.5	4.7	8.1	13.5
Polynuclear Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.066	0.096	0.068	0.0018 J	0.0052 U	0.48	0.0034 J	0.046	0.067 J	0.0018 J	0.02 J
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.081	0.12	0.086	0.015	0.0052 U	5.5	0.038	0.52	0.97	0.022 B	0.22
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.89	1.4	0.76	0.00044 J	0.0052 U	0.026 J	0.00054 J	0.0038 J	0.3 U	0.0054 U	0.0017 J
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.012 J	0.024	0.013 J	0.037	0.0052 U	7.2	0.058	0.76	2.4	0.046	0.29
Anthracene	mg/kg	NA	NE	2,300	NE	NL	1.2	2.6	1.3	0.24	0.65 J	52	0.64	6.5	12	0.58	2.9
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	10	20	10	0.32	0.0052 U	60	0.79	7.9	15	0.73 J	3.8
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	14	23	12	0.42	0.0052 U	82	1.3	12	16	1 J	5.2
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	20	36	16	0.203	0.0052 U	25	0.57	5.5	7.2	0.5 J	2.6
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	11	18	8.9	0.16	0.0052 U	26	0.44	3.9	5.9	0.37	1.9
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	5.1	9.7	4.2	0.27	0.0052 U	54	0.83	7.7	11	0.73	3.5
Chrysene	mg/kg	NA	NL	NL	NE	NL	10	20	10	0.051	0.0052 U	10	0.16	1.5	2.1	0.13 J	0.72
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	2.3	3.6	1.9	0.0058	0.0052 U	1.7	0.012	0.17	0.35	0.0087	0.071
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	17	34	15	0.34	0.0011 J	82	0.9	9.4	21	0.78 J	4.1
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.4	0.82	0.34	0.0099	0.0052 U	3	0.018	0.28	0.6	0.015	0.11
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	14	21	12	0.25	0.0052 U	34	0.68	6.7	11	0.58 J	3.1
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.18	0.27	0.19	0.0031 J	0.0052 U	0.88	0.0065	0.091	0.18 J	0.0023 JB	0.038
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	5.5	11	5.1	0.15	0.0017 J	41	0.34	4.1	8.9	0.29	1.7
Pyrene	mg/kg	NA	110,000	650	NE	NL	17	33	12	0.35	0.00087 J	74	0.93	9.2	15	0.81 J	4
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**19.2**	**32.2**	**16.5**	0.44	0.07	**80.9**	1.12	**11.04**	**19.8**	1.5	**5.22**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	25.2	50.10	22.7	0.56	0.003	**139.61**	1.36	15.16	34.05	1.16	6.46
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**103.4**	**184.3**	**87**	**2.3**	0.07	**417**	**6.34**	**60.9**	**95.2**	**5.4**	**27.7**
Polychlorinated Biphenyls (PCBs)																		
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.0073 UJ	0.0076 UJ	0.0089 UJ	NA	NA	0.11 U	0.11 U	0.056 U	0.012 U	0.011 U	0.055 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.0041 U	0.0043 U	0.005 U	NA	NA	0.22 U	0.22 U	0.12 U	0.024 U	0.021 U	0.11 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.0048 UJ	0.005 UJ	0.0059 UJ	NA	NA	0.11 Ui	0.11 U	0.056 U	0.012 U	0.011 U	0.055 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.0016 U	0.0016 U	0.0019 U	NA	NA	0.11 U	0.11 U	0.056 U	0.012 U	0.011 U	0.055 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.0029 UJ	0.003 UJ	0.0035 UJ	NA	NA	0.11 U	0.11 U	0.056 U	0.021	0.011 U	0.055 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.0015 UJ	0.0015 UJ	0.0018 UJ	NA	NA	0.11 Ui	0.11 U	0.056 U	0.012 Ui	0.011 U	0.055 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.0019 UJ	0.14 J	0.0023 UJ	NA	NA	0.16 PD	0.011 J	0.062 PD	0.012 Ui	0.011 U	0.055 U
Aroclor 1262	mg/kg	NL	NL	NE	NE	NE	0.032	0.00051 U	0.15	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1268	mg/kg	NL	NL	NE	NE	NE	0.00089 UJ	0.069 J	0.0011 UJ	NA	NA	NA	NA	NA	NA	NA	NA
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	0.032	0.21	0.15	NA	NA	0.16	0.011	0.062	0.021	0.011	0.055
Metals																		
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	9,700 J	19,000 J	12,000 J	NA	NA	20,700	7,950	9,080	9,700	9,310	9,790
Arsenic	mg/kg	20	87.5	2.9	7.61	132	2.6	3.5	5.1	NA	NA	2.22	3.68	4.19	2.41	2.11	2.17
Cadmium	mg/kg	2	3,500	0.69	0.81	14	1.3 J	**4.9 J**	**1.5 J**	NA	NA	**4.47**	0.408	**1.07**	0.237	0.369	0.127
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	5.8 J	13 J	7.8 J	NA	NA	9.75 J	6.64 J	6.17 J	8.49	6.68 J	6.69
Copper	mg/kg	NA	140,000	280	28.4	217	22	29	31	NA	NA	24.3	19.8	27.3	20.4	17.5	20.8
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.8 J	13 J	8 J	NA	NA	12.1	4.56	6.12	6.76	4.56	4.48
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.0065 U	0.013 J	0.0071 U	NA	NA	0.02 U	0.019 U	0.019 U	0.0007 J	0.022 U	0.021 U
Nickel	mg/kg	NA	70,000	130	24.54	980	15 J	60 J	21 J	NA	NA	13.7 J	9.15 J	11.9 J	12	8.32 J	8.68
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	**0.84 J**	**0.76 J**	**1.5 J**	NA	NA	0.2 J	**0.4 J**	**0.6 J**	0.2 J	0.2 J	0.2 J
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	74 J	200 J	110 J	NA	NA	249	65.5	87.8	80	60	71.3
Total Petroleum Hydrocarbons (TPHs)																		
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	220	740	1,600	13 J	8.5 J	370 Z	20 J	190 Z	390 H	19 J	73 H
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	330	1,100	830	60 J	29 JB	1,500 Z	82 J	460 O	1,200 J	66 J	210 O

Notes:

i	Method reporting limit is elevated due to a matrix interference.	B	The sample result is five times less than blank contamination and cross-contamination is suspected.
J	Estimated concentration.		
NA	Not applicable or not analyzed.		
NE	Not established.		
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.		
U	Chemical was not detected. The associated value represents the method detection limit.		
UJ	Chemical was not detected. The associated limit is estimated.		

In initial RI borings SB-BS02 and SB-BS03, detected concentrations of COPCs exceed soil screening levels to 2- and 4-ft bgs depths sampled. Subsequent WPA test pits B5-TP37 investigated initial RI soil boring SB-BS02 and detected PAH as TTEC and HMW at a depth of 5 ft bgs. The vertical extent for BS-SB03 and B5-TP37 has not been defined by initial RI data.

WPA borings SE18-SB03 and SE18-SB04, completed as part of the SE18 Investigation Area (Section 2.2.7), detected a concentration of PAH as HMW at 2.5 ft bgs in boring SE18-SB03 that exceeds the ecological wildlife screening level, but COPCs did not exceed screening levels in SE18-SB04. Soil borings.

In initial RI test pits TP-B41-SS and TP-B43-SS detected concentrations of fluoride, PAH as TTEC, HMW, cadmium, and selenium exceed soil screening levels at 1 ft bgs. In initial RI test pits TP-T5-01, TP-T5-02, and TP-T5-03 detected concentrations of PAH as TTEC, LMW and HMW, cadmium, copper, selenium, zinc, and TPH-Dx as diesel and residual range organics exceed soil screening levels at 0.5 ft bgs and detected concentrations of PAH as TTEC, HMW, cadmium, copper, and selenium exceed soil screening levels at 2 ft bgs. Subsequent WPA test pits B5-TP34, B5-TP35, and B5-TP36 detected concentrations of PAH as TTEC, LMW and HMW, cadmium, and selenium that exceeded soil screening levels at 4 ft bgs, the deepest depth sampled.

Based on water levels measured as part of the Groundwater AOC investigation, the depth to the shallowest groundwater (UA aquifer) beneath B5, if present, is approximately elevation 470 ft or approximately 12 or more ft bgs. The concentration of fluoride in shallow groundwater beneath this segment is expected to be between 0.96 and 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). The maximum concentration of fluoride detected in segment B5 is 850 J collected at 1 ft bgs.

2.3.10.3 Conclusions and Recommendations

The vertical extent of contamination was not defined at all initial RI sample locations, and further was not defined with subsequent WPA test pit data. Detected concentrations of PAH as TTEC and total HMW exceed soil screening levels to depths of 4- and 5-ft bgs, the deepest depth sampled.

The vertical extent of contamination was not defined in initial RI boring SB-BS03 and WPA boring SE18-SB02 with concentrations of PAH as total HMW detected at depths of 4- and 2.5-ft bgs, respectively. The maximum concentration of fluoride detected in segment B5 is 850 J collected at 1 ft bgs.

Based on COPC exceedance of soil screening levels to depths up to 4 ft bgs, Segment B5 is recommended for further evaluation in the FS.

2.3.11 Courtyard Segment C1

Courtyard segment C1 is at the west end of Courtyard C. The west end of segment C1 is approximately 75 ft wide and approximately 510 ft long with an area of approximately 36,084 square feet. Calculated area in segment C1 does not include surfaces such as sloped areas. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. Courtyard segment C1 is bound to the south by the foundation for Production Building B and to the north by the foundation for Production Building C. At the eastern end of segment C1 is a concrete underpass beneath Passage No. 1 to provide access between segments C1 and C2. At the western end of segment C1 is the margin with the Rectifier Yard.

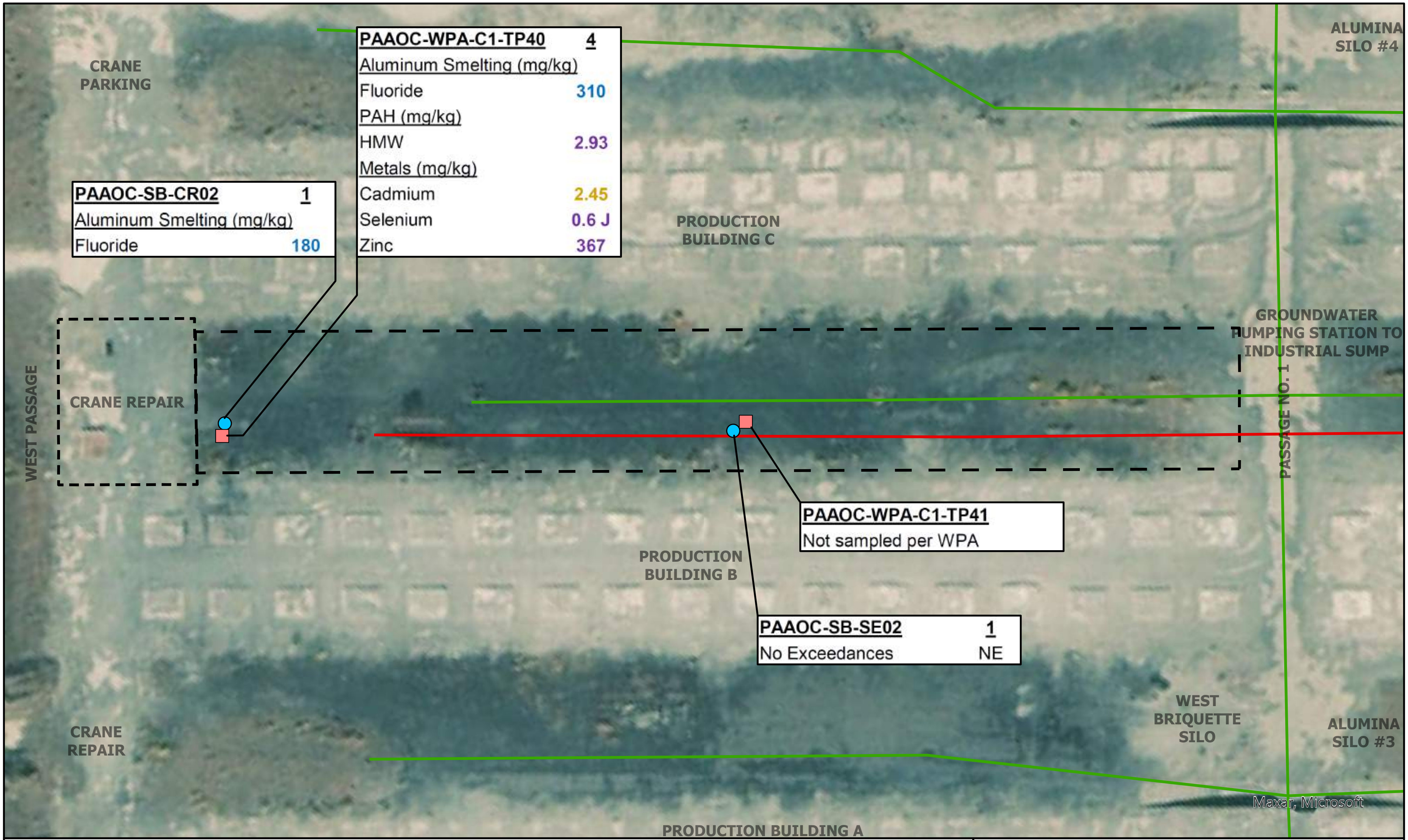
Several features and structures existed in and adjacent to segment C1 (Figure 2.3.11-1) as follows:

- Crane Repair Building (located in the western portion of segment C1)
- Scrubber Effluent System line no. 1 horizontal subsurface pipe and manholes
- Stormwater System line no. 1 horizontal subsurface pipe and catch basins
- Impacted surface soil was mapped during the initial RI across all C1

These features in and adjacent to Courtyard segment C1 were the focus of the initial RI phase of investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data, and to confirm thickness of impacted surface soil.

2.3.11.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment C1 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included two soil borings to investigate the crane repair building and Scrubber Effluent line no. 1. RI boring locations are shown on Figure 2.3.11-1.



PAAOC-WPA-C1-TP40	**4**
Aluminum Smelting (mg/kg)	
Fluoride	310
PAH (mg/kg)	
HMW	2.93
Metals (mg/kg)	
Cadmium	2.45
Selenium	0.6 J
Zinc	367

PAAOC-SB-CR02	**1**
Aluminum Smelting (mg/kg)	
Fluoride	180

PAAOC-WPA-C1-TP41
Not sampled per WPA

PAAOC-SB-SE02	**1**
No Exceedances	NE

Courtyard Segment C1
● RI Soil Boring
🟥 WPA Test Pit
Scrubber Effluent Line
Stormwater System Line

Segment C1 approximate area: 36,084 sq. ft.

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife
orange: exceeds MTCA Method A
NE: No exceedance
J: Estimated concentration
1: Sample depth in feet bgs

N E S W

0 25 50 100
Feet

Figure 2.3.11-1

Plant Area AOC

Courtyard Segment C1 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Sample depths and analyses are as follows:

- Scrubber Effluent line boring samples targeted to above and below pipe invert at approximately 2.5 ft bgs, sample at 1 ft bgs
  - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, and VOCs
- Crane Repair Building sample 1 ft bgs
  - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, and VOCs

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected RI sample stations where the deepest sample exceeded site soil screen levels (Tetra Tech et al. 2020b). This included two test pits that were excavated at the two initial RI-phase locations, to a depth of 4 ft bgs, 3 ft below the previous sample depth. Test pit C1-TP41 was excavated to confirm the thickness of the impacted surface soil and as proposed in the WPA, no samples were collected. WPA soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. The WPA test pit locations are shown on Figure 2.3.11-1.

2.3.11.2 Investigation Results

Segment C1 soil was investigated with a combined total of two soil borings and two test pits in the initial RI and WPA phases of investigation. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.11-1 (PAAOC Courtyard Segment C1 Initial RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in two out of three samples analyzed.

Table 2.3.11-1
PAAOC Courtyard Segment C1 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results		WPA Analytical Results
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-CR02-1**	**PAAOC-SB-SE02-1**	**PAAOC-WPA-C1-TP40-4.0**
Aluminum Smelting									
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.058 J	0.05 UJ	0.2 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**180**	81	**310**
Sulfate	mg/kg	NA	NE	2,150	NE	NE	10 U	10 U	20.3
Polynuclear Aromatic Hydrocarbons (PAHs)									
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0074 U	0.0072 U	0.0019 J
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0074 U	0.0072 U	0.0077
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0074 U	0.0072 U	0.0009 J
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0074 U	0.0072 U	0.052
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0096	0.0072 U	0.28
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.052	0.0072 U	0.35
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.062	0.0072 U	0.63
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.11	0.0072 U	0.62
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.086	0.0072 U	0.19
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.031	0.0072 U	0.36
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.07	0.0072 U	0.11
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.015	0.0072 U	0.0038 J
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.086	0.0072 U	0.45
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0074 U	0.0072 U	0.0064
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.073	0.0072 U	0.65
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0011 U	0.0072 U	0.0035 J
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.014	0.0072 U	0.11
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.085	0.0072 U	0.36
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.09	0.0072	0.54
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.11	0.0072	0.71
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.6	0.0072	**2.93**
Polychlorinated Biphenyls (PCBs)									
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.056 U	0.054 U	0.012 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.054 U	0.023 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.054 U	0.012 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.054 U	0.012 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.054 U	0.012 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.056 U	0.054 U	0.0062 J
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.056 U	0.054 U	0.012 U
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	0.056	0.054	0.0062
Metals									
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	3,800 J	6,300 J	12,300
Arsenic	mg/kg	20	87.5	2.9	7.61	132	11 U	0.054 U	7.19
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.56 U	0.54 U	**2.45**
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	5.1	3.3	11.9
Copper	mg/kg	NA	140,000	280	28.4	217	6.9	12	22.6
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.9	5.4 U	7.79
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.27 U	0.016 J
Nickel	mg/kg	NA	70,000	130	24.54	980	5.7	4.3	38.7
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	5.4 U	**0.6 J**
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	23	41	**367**
Total Petroleum Hydrocarbons (TPHs)									
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	28 U	27 U	11 J
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	82	54 U	51 J
Volatile Organic Compounds (VOCs)									
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.0011 U	0.00092 U	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0054 U	0.0046 U	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.0011 U	0.00092 U	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.0022 U	0.0018 U	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	0.0011 U	0.00092 U	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.0011 U	0.00092 U	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.0011 U	0.00092 U	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.0011 U	0.00092 U	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.0011 U	0.00092 U	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	0.0011 U	0.00092 U	NA

Notes:

J	Estimated concentration.	TTEC	Total Toxicity Equivalent Concenteration for carcinogenic PAHs
NA	Not applicable or not analyzed.		
NE	Not established.	LMW	Low molecular weight PAH
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.	HMW	High molecular weight PAH
U	Chemical was not detected. The associated value represents the method detection limit.		

Detected concentrations shown in **bold** exceed one or more soil screening levels.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment C1 are compiled and presented on Figure 2.3.11-1. The vertical extent of contamination is defined at sample location SB-SE02. The vertical extent of contamination is not defined at sample location C1-TP40 at 4 ft bgs, the deepest depth sampled.

In initial RI boring SB-CR02, fluoride was detected in the 1 ft bgs sample at a concentration that exceed the protection of groundwater soil screening level. Subsequent WPA test pit C1-TP40 detected concentrations of fluoride, PAH as HMW, cadmium, selenium, and zinc that exceed soil screening levels at 4 ft bgs, the deepest depth sampled.

Based on water levels measured as part of the Groundwater AOC investigation, the depth to the shallowest groundwater (UA aquifer) beneath C1, if present, is approximately elevation 470 ft or approximately 12 or more ft bgs. The concentration of fluoride in shallow groundwater beneath this segment is expected to be between 0.96 and 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). The maximum concentration of fluoride detected in segment C1 is 310 mg/kg collected from 4 ft bgs.

2.3.11.3 Conclusions and Recommendations

The vertical extent of contamination has not been defined at WPA test pit C1-TP40 with detected concentrations of fluoride, PAH as HMW, cadmium, and zinc exceeded soil screening levels at 4 ft bgs, the deepest depth sampled. The maximum concentration of fluoride detected in segment C1 is 310 mg/kg collected from 4 ft bgs.

Based on COPC exceedance of soil screening levels at 4 ft bgs, Segment C1 is recommended for further evaluation in the FS.

2.3.12 Courtyard Segment C2

Courtyard segment C2 is in the western portion of Courtyard C, immediately adjacent to the east of courtyard segment C1. The west end of segment C2 is approximately 75 ft wide and approximately 510 ft long with an area of approximately 36,346 square feet. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. Courtyard segment C2 is bound to the south by the foundation for Production Building B and to the north by the foundation for Production

Building C. At the western end of segment C2 is a concrete underpass beneath Passage No. 1 to provide access between segments C1 and C2. At the eastern end of segment C2 is a concrete underpass beneath Passage No. 2 to provide access between segments C2 and C3.

The features and structures existed in and adjacent to segment C2 (Figure 2.3.12-1) as follows:

- Scrubber Effluent System line no. 1 horizontal subsurface pipe and manholes
- Stormwater System line no. 2 horizontal subsurface pipe and catch basins
- Impacted surface soil that was mapped during the initial RI across all C2

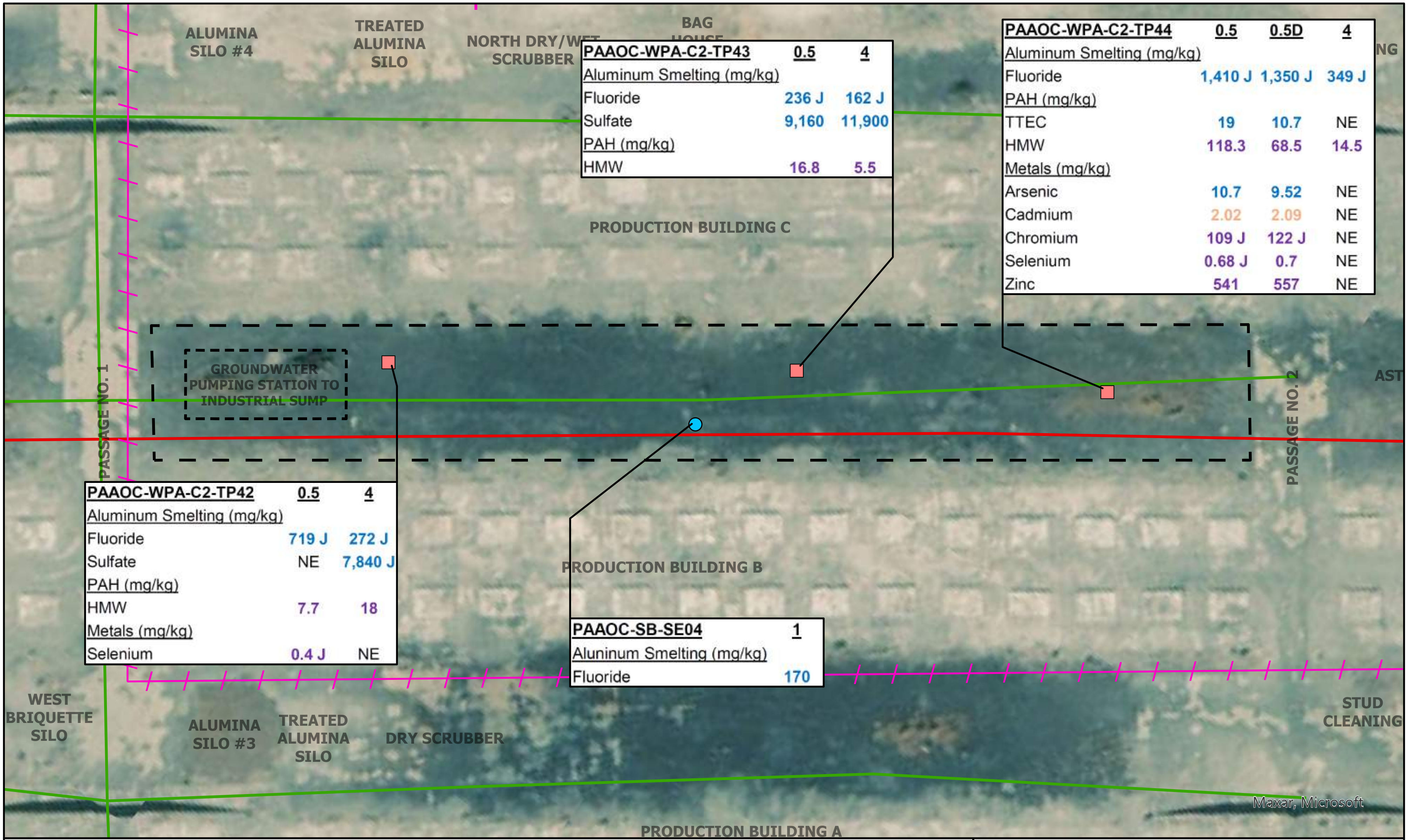
These features in and adjacent to Courtyard segment C2 were the focus of the initial RI phase of investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data, and to confirm thickness of impacted surface soil.

2.3.12.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment C2 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included one soil boring to investigate the Scrubber Effluent line. The RI boring location is shown on Figure 2.3.12-1. Sample depths and analyses are as follows:

- Scrubber Effluent line boring sample targeted to above and below horizontal pipe invert at approximately 5 ft bgs and sampled at 1 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, and VOCs

The WPA phase of investigation was primarily to investigate the western, central, and eastern portion of segment C5 where no previous investigation had occurred, and to confirm the thickness of impacted surface soil. This included three test pits excavated to a depths of 4 ft bgs. WPA soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. The WPA test pit locations are shown on Figure 2.3.12-1.



PAAOC-WPA-C2-TP43	0.5	4
Aluminum Smelting (mg/kg)		
Fluoride	236 J	162 J
Sulfate	9,160	11,900
PAH (mg/kg)		
HMW	16.8	5.5

PAAOC-WPA-C2-TP44	0.5	0.5D	4
Aluminum Smelting (mg/kg)			
Fluoride	1,410 J	1,350 J	349 J
PAH (mg/kg)			
TTEC	19	10.7	NE
HMW	118.3	68.5	14.5
Metals (mg/kg)			
Arsenic	10.7	9.52	NE
Cadmium	2.02	2.09	NE
Chromium	109 J	122 J	NE
Selenium	0.68 J	0.7	NE
Zinc	541	557	NE

PAAOC-WPA-C2-TP42	0.5	4
Aluminum Smelting (mg/kg)		
Fluoride	719 J	272 J
Sulfate	NE	7,840 J
PAH (mg/kg)		
HMW	7.7	18
Metals (mg/kg)		
Selenium	0.4 J	NE

PAAOC-SB-SE04	1
Aluninum Smelting (mg/kg)	
Fluoride	170

Courtyard Segment C2

● RI Soil Boring

🟥 WPA Test Pit

Scrubber Effluent Line

Stormwater System Line

Segment C2 approximate area: 36,346 sq. ft.

Plant SO2 Lines

Existing SO2 Lines

Abandoned SO2 Line

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife
orange: exceeds MTCA Method A
NE: No exceedance
J: Estimated concentration
D: Duplicate sample
4: Sample depth in feet bgs

Figure 2.3.12-1

Plant Area AOC

Courtyard Segment C2 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

2.3.12.2 Investigation Results

Segment C2 soil was investigated with a combined total of one soil boring and three test pits in the initial RI and WPA phases of investigation. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.12-1 (PAAOC Courtyard Segment C2 Initial RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in one out of eight samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment A2 are compiled and presented on Figure 2.3.12-1. The vertical extent of contamination is not defined at all sample locations SB-SE04, C2-TP42, C2-TP43, and C2-TP44.

In initial RI borings SB-SE04, fluoride was detected in the 1 ft bgs sample at a concentration that exceeds the protection of groundwater soil screening level.

In subsequent WPA test pits C2-TP42, C2-TP43, and C2-TP44 detected concentrations of fluoride, sulfate, and PAH as HMW exceeded soil screening levels at 4 ft bgs, the deepest depth sampled. Elevated concentrations of fluoride and sulfate in shallow soil decrease with depth and may represent widespread shallow soil contamination in this segment.

Based on water levels measured as part of the Groundwater AOC investigation, the depth to the shallowest groundwater (UA aquifer) beneath C2, if present, is approximately elevation 470 ft or approximately 12 or more ft bgs. The concentration of fluoride in shallow groundwater beneath this segment is expected to be between 0.96 and 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). The maximum concentration of fluoride in soil in segment C2 is 1,400 mg/kg collected from 0.5 ft bgs, with concentrations decreasing to 349 mg/kg at 4 ft bgs in C2-TP44.

Table 2.3.12-1
PAAOC Courtyard Segment C2 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results	WPA Analytical Results						
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-SE04-1	PAAOC-WPA-C2-TP42-0.5	PAAOC-WPA-C2-TP42-4	PAAOC-WPA-C2-TP43-0.5	PAAOC-WPA-C2-TP43-4	PAAOC-WPA-C2-TP44-0.5	PAAOC-WPA-C2-TP44-0.5D	PAAOC-WPA-C2-TP44-4
Aluminum Smelting														
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.2 U	0.2 U	0.19 U	0.2 U	0.19 U	0.18 U	0.2 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**170**	**719 J**	**272 J**	**236 J**	**162 J**	**1,410 J**	**1,350 J**	**349 J**
Sulfate	mg/kg	NA	NE	2,150	NE	NE	26	662	**7,840 J**	**9,160**	**11,900**	80.9	76.6	654 J
Polynuclear Aromatic Hydrocarbons (PAHs)														
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0074 U	0.0016 J	0.0036 J	0.02	0.0012 J	0.025 J	0.012 J	0.022
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0074 U	0.016 B	0.048	0.16	0.017 B	0.38	0.34	0.13
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0074 U	0.0026 J	0.0054 J	0.0045 J	0.0021 J	0.048	0.027	0.0067
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0074 U	0.056	0.13	0.61	0.071	0.95	1.1	0.28 J
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0074 U	0.77	1.6	2	0.59	10	7.1	1.3
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0074 U	0.79	1.6	1.7	0.61	13	7.3	1.5
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.0074 U	1.5	4.2	3.2	0.96	23	13	2.8 J
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0099	0.78	1.7	1.1	0.45	14	6.7	1.5 J
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.0074 U	0.52	1.1	0.88	0.33	6.5	3.8	0.85 J
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0074 U	1.1	2.7	2.4	0.78	15	9.4	1.9 J
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.0074 U	0.2	0.44	0.33	0.12	2.8	1.6	0.34 J
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0074 U	0.0038 J	0.017	0.049	0.0036 J	0.095	0.08	0.089 J
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.0074 U	1	2	4.3	0.94	17	12	2.1 J
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0074 U	0.0089	0.036	0.15	0.011	0.25	0.25	0.13
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.0074 U	0.88	2	1.4	0.54	16	7.6	1.7 J
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0074 U	0.0027 J	0.0042 J	0.023	0.0017 JB	0.033	0.021 J	0.031
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.0074 U	0.22	0.68	2	0.24	4.1	4.4	1.1 J
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.0074 U	1.2	2.7	3.8	1.1	18	12	2.6 J
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.00099	1.19	2.56	2.51	0.87	**19**	**10.7**	2.22
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.0074	1.31	2.87	7.25	1.28	22.76	18.14	3.78
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.0099	**7.7**	**18**	**16.8**	**5.5**	**118.3**	**68.5**	**14.5**
Polychlorinated Biphenyls (PCBs)														
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.055 U	0.11 Ui	0.012 Ui	0.011 U	0.012 U	0.051 Ui	0.05 Ui	0.013 Ui
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.22 U	0.023 U	0.022 U	0.023 U	0.11 U	0.1 U	0.022 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.11 Ui	0.012 Ui	0.011 U	0.012 U	0.051 Ui	0.05 Ui	0.013 Ui
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.11 Ui	0.012 Ui	0.011 U	0.012 U	0.051 Ui	0.05 U	0.013 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.11 Ui	0.012 Ui	0.011 U	0.012 U	0.051 Ui	0.05 Ui	0.013 Ui
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.055 U	0.11 Ui	0.012 Ui	0.011 U	0.012 U	0.051 Ui	0.05 Ui	0.039 P
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.055 U	0.11 U	0.012 Ui	0.011 U	0.012 U	0.051 Ui	0.05 Ui	0.013 Ui
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	0.055	0.11	0.012	0.011	0.012	0.051	0.05	0.04
Metals														
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	8,300	10,500	8,720	8,460	8,830	28,100 J	22,600 J	10,200
Arsenic	mg/kg	20	87.5	2.9	7.61	132	11 U	3.21	2.25	1.81	2.51	**10.7**	**9.52**	2.46
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.55 U	0.486	0.332	0.175	0.14	**2.02**	**2.09**	0.223
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	5.9	33.1 J	15.9 J	15.5 J	8.46 J	**109 J**	**122 J**	16.1 J
Copper	mg/kg	NA	140,000	280	28.4	217	11	67.8	20.6	18.7	16.1	160	166	30.2
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.5 U	5.31	4.82	4.31	4.6	20.9	17.5	5.25
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.004 J	0.005 J	0.02 U	0.023 U	0.014 J	0.017 J	0.021 U
Nickel	mg/kg	NA	70,000	130	24.54	980	5.8	19.5 J	13.3 J	18.2 J	13.1 J	98.2 J	83.7 J	20.2 J
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	**0.4 J**	0.2 J	0.2 J	0.1 J	**0.68 J**	**0.7**	0.2 J
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	44	126	113	81.4	62.2	**541**	**557**	95
Total Petroleum Hydrocarbons (TPHs)														
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	28 U	98 H	28 J	37 H	6.9 J	300 H	240 H	28 H
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	55 U	870 O	120 O	130 O	19 J	1,300 O	1,100 O	100 J
Volatile Organic Compounds (VOCs)														
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.001 U	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0052 U	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.00 U	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.0021 U	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	0.001 U	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.001 U	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.001 U	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.001 U	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.001 U	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	0.001 U	NA	NA	NA	NA	NA	NA	NA

Notes:

H	Chromatographic fingerprint resembles petroleum product but elution pattern indicates more HMW constituents than calibration standard.
i	Method reporting limit is elevated due to a matrix interference.
J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.

UJ	Chemical was not detected. The associated limit is estimated.
P	GC confirmation criteria exceeded, relative percent difference greater than 40%.
O	Chromatographic fingerprint resembles oil but does not match calibration standard.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW	Low molecular weight PAH.
HMW	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more soil screening levels.

2.3.12.3 Conclusions and Recommendations

The vertical extent has not been defined at initial RI boring SB-SE04, or at WPA test pits C2-TP42, C2-TP43, and C2-TP44. Detected concentrations of fluoride, sulfate, and PAH as HMW exceeded soil screening levels at 4 ft bgs, the deepest depth sampled. The maximum concentration of fluoride in soil in segment C2 is 1,400 mg/kg collected from 0.5 ft bgs, with concentrations decreasing to 349 mg/kg at 4 ft bgs in C2-TP44.

Based on COPC exceedance of soil screening levels to depths up to 4 ft bgs, Segment C2 is recommended for further evaluation in the FS.

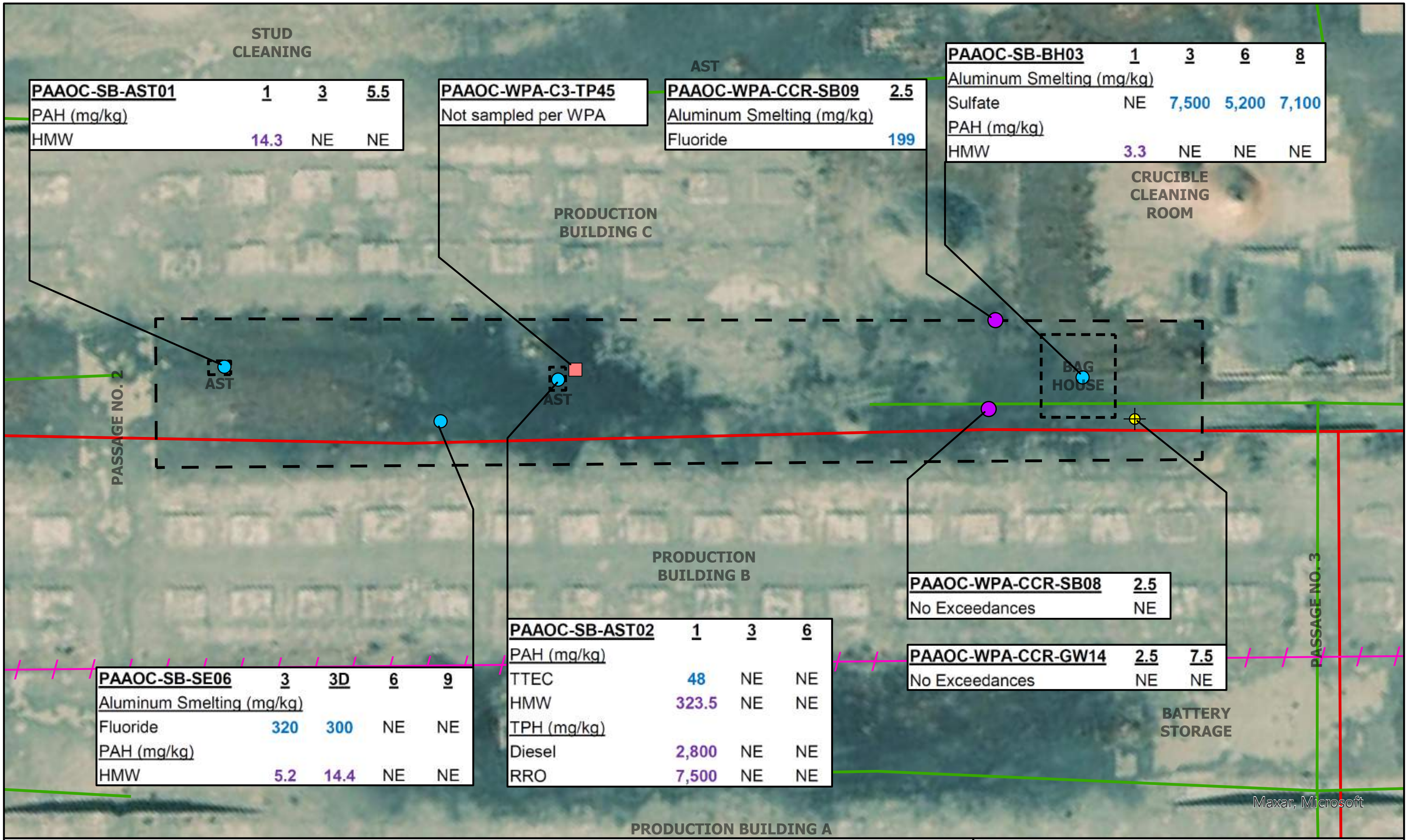
2.3.13 Courtyard Segment C3

Courtyard segment C3 is the central segment of Courtyard C. The west end of segment C3 is approximately 75 ft wide and approximately 510 ft long with an area of approximately 36,877 square feet. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. Courtyard segment C3 is bound to the south by the foundation for Production Building B and to the north by the foundation for Production Building C. At the western end of segment C3 is a concrete underpass beneath Passage No. 2 to provide access between segments C2 and C3. At the eastern end of segment A3 is a concrete underpass beneath Passage No. 3 to provide access between segments C3 and C4.

Several features and structures existed in and adjacent to segment C3 (Figure 2.3.13-1) as follows:

- Two former ASTs located in the west and central portion of segment C3
- A former bag house located in the eastern portion of segment C3
- Scrubber Effluent line no. 1 horizontal subsurface pipe and manholes
- Stormwater System lines no. 2 and no. 10 horizontal subsurface pipe and catch basins
- Impacted surface soil mapped during the initial RI in the southern portion of C3

These features in and adjacent to Courtyard segment C3 were the focus of the initial RI phase of investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data, and to confirm thickness of impacted surface soil.



PAAOC-SB-AST01	1	3	5.5
PAH (mg/kg)			
HMW	14.3	NE	NE

PAAOC-WPA-C3-TP45
Not sampled per WPA

PAAOC-WPA-CCR-SB09	2.5
Aluminum Smelting (mg/kg)	
Fluoride	199

PAAOC-SB-BH03	1	3	6	8
Aluminum Smelting (mg/kg)				
Sulfate	NE	7,500	5,200	7,100
PAH (mg/kg)				
HMW	3.3	NE	NE	NE

PAAOC-WPA-CCR-SB08	2.5
No Exceedances	NE

PAAOC-WPA-CCR-GW14	2.5	7.5
No Exceedances	NE	NE

PAAOC-SB-SE06	3	3D	6	9
Aluminum Smelting (mg/kg)				
Fluoride	320	300	NE	NE
PAH (mg/kg)				
HMW	5.2	14.4	NE	NE

PAAOC-SB-AST02	1	3	6
PAH (mg/kg)			
TTEC	48	NE	NE
HMW	323.5	NE	NE
TPH (mg/kg)			
Diesel	2,800	NE	NE
RRO	7,500	NE	NE

- Courtyard C3
- ● RI Soil Boring
- 🟥 WPA Test Pit
- ● WPA Boring
- ⊕ WPA Monitor Well
- Scrubber Effluent Line
- Stormwater System Line

Plant SO2 Lines

- Abandoned SO2 Line

Segment C3 approximate area: 36,877 sq. ft.

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife and for TPH diesel and residual range organics exceeds MTCA Method A

NE: No exceedance
D: Duplicate sample
RRO: TPH as residual range organics
AST: Above-ground Storage Tank
1: Sample depth in feet bgs

W N E S

0 25 50 100
Feet

Figure 2.3.13-1

Plant Area AOC

Courtyard Segment C3 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

2.3.13.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment C3 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included four soil borings to investigate the former ASTs, the former bag house location, and the Scrubber Effluent line. RI boring locations are shown on Figure 2.3.13-1. Sample depths and analyses are as follows:

- Scrubber Effluent line boring samples targeted to above and below horizontal pipe invert at approximately 7.5 ft bgs with samples at 3, 6, 9 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs
- AST samples 1 3, 5.5, and 1, 3, 6 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, TPH-Dx, BTEX or VOCs
- Bag house samples 1, 3, 6, 8 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected RI sample locations where the deepest sample exceeded site soil screen levels (Tetra Tech et al. 2020b). This included one test pit and three soil borings with one constructed as a shallow groundwater monitoring well. One test pit was excavated at the centrally located AST to a depth of 4 ft bgs to confirm the thickness of the impacted surface soil and, as proposed in the WPA, no samples were collected. The three WPA soil borings with one installed as a well were completed as part of the Crucible Cleaning Room investigation area to investigate boring SB-BH03 to determine the horizontal extent of sulfate detected in SB-BH03 and to determine whether this location is a potential soil source of sulfate contamination to shallow groundwater. WPA soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, and TPH-Dx. WPA boring and test pit locations are shown on Figure 2.3.13-1.

2.3.13.2 Investigation Results

Segment C3 soil was investigated with a combined total of seven soil borings and one test pit in the initial RI and WPA phases of investigation. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.13-1 (PAAOC Courtyard Segment C3 Initial RI and WPA Soil Results

Table 2.3.13-1
PAAOC Courtyard Segment C3 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results														WPA Analytical Results			
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-AST01-1**	**PAAOC-SB-AST01-3**	**PAAOC-SB-AST01-5.5**	**PAAOC-SB-AST02-1**	**PAAOC-SB-AST02-3**	**PAAOC-SB-AST02-6**	**PAAOC-SB-BH03-1**	**PAAOC-SB-BH03-3**	**PAAOC-SB-BH03-6**	**PAAOC-SB-BH03-8**	**PAAOC-SB-SE06-3**	**PAAOC-SB-SE06-3D**	**PAAOC-SB-SE06-6**	**PAAOC-SB-SE06-9**	**PAAOC-WPA-CCR-SB08-2.5**	**PAAOC-WPA-CCR-SB09-2.5**	**PAAOC-WPA-CCR-GW14-2.5**	**PAAOC-WPA-CCR-GW14-7.5**
Aluminum Smelting																								
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	NA	NA	NA	NA	NA	NA	0.05 U	0.062	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.18 U	0.2 U	0.2 U	0.2 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	NA	NA	NA	NA	NA	NA	30 U	14 U	7.7 U	7.6 U	**320**	**300**	110	48 U	67.9	**199**	2.4 J	4.5 U
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	NA	NA	NA	NA	NA	1,800	**7,500**	**5,200**	**7,100**	14 U	25	32 U	42 U	9.6 J	23.1 J	5.5 B	198
Polynuclear Aromatic Hydrocarbons (PAHs)																								
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.14 U	0.008 U	0.007 U	3.6 U	0.0094 U	0.0077 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.15 U	0.15 U	0.0076 U	0.007 U	0.00072 JB	0.00077 J	0.0015 J	0.00075 J
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.14 U	0.008 U	0.007 U	3.6 U	0.0094 U	0.0077 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.15 U	0.15 U	0.0076 U	0.007 U	0.0051 U	0.00077 JB	0.0015 JB	0.0055 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.14 U	0.008 U	0.007 U	3.6 U	0.0094 U	0.0077 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.15 U	0.15 U	0.0076 U	0.007 U	0.0051 U	0.0057 U	0.00051 JB	0.0055 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.14 U	0.008 U	0.007 U	3.6 U	0.0094 U	0.0077 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.15 U	0.15 U	0.0076 U	0.007 U	0.00089 J	0.0015 J	0.00096 J	0.0055 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.18	0.008 U	0.007 U	7.4	0.0094 U	0.0077 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.15 U	0.2	0.0076 U	0.007 U	0.00089 JB	0.008	0.0055 U	0.00094 J
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	1.3	0.008 U	0.007 U	32	0.0094 U	0.01	0.25	0.01 U	0.0087 U	0.0097 U	0.53 J	1.4	0.0076 U	0.007 U	0.0041 J	0.0098	0.0055 U	0.0055 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	1.7	0.0085	0.007 U	32	0.015	0.012	0.33	0.01 U	0.0087 U	0.0097 U	0.47 J	1.4	0.0076 U	0.007 U	0.0065	0.015	0.0055 U	0.0012 J
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	3	0.017	0.007 U	66	0.02	0.024	0.79	0.01 U	0.0087 U	0.0097 U	1.2 J	3.1	0.0076 U	0.007 U	0.0035 J	0.0089	0.0055 U	0.00045 J
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	1.5	0.012	0.007 U	28	0.021	0.011	0.6	0.01 U	0.0087 U	0.0097 U	0.46	1.3	0.0076 U	0.007 U	0.0029 J	0.0056 J	0.0055 U	0.0055 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.85	0.008 U	0.007 U	20	0.0094 U	0.0077 U	0.19	0.01 U	0.0087 U	0.0097 U	0.31	1	0.0076 U	0.007 U	0.005 J	0.0083	0.0055 U	0.00051 J
Chrysene	mg/kg	NA	NL	NL	NE	NL	2	0.011	0.007 U	46	0.012	0.019	0.4	0.01 U	0.0087 U	0.0097 U	0.77 J	2.1	0.0076 U	0.007 U	0.0054 J	0.0016 J	0.0055 U	0.0055 U
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.33	0.008 U	0.007 U	6.5	0.0094 U	0.0077 U	0.091	0.01 U	0.0087 U	0.0097 U	0.15 U	0.3	0.0076 U	0.007 U	0.0051 U	0.0014 J	0.0018 J	0.0011 J
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	3	0.0084	0.007 U	58	0.016	0.022	0.3	0.01 U	0.0087 U	0.0097 U	0.84 J	2.2	0.0076 U	0.007 U	0.0064 B	0.015	0.0042 JB	0.0014 JB
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.14 U	0.008 U	0.007 U	3.6 U	0.0094 U	0.0077 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.15 U	0.15 U	0.0076 U	0.007 U	0.0051 U	0.0016 JB	0.0022 JB	0.0055 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	1.6	0.0092	0.007 U	30	0.012	0.0083	0.36	0.01 U	0.0087 U	0.0097 U	0.41 J	1.4	0.0076 U	0.007 U	0.003 J	0.0082	0.0055 U	0.0055 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.14 U	0.008 U	0.007 U	3.6 U	0.0094 U	0.0077 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.15 U	0.15 U	0.0076 U	0.007 U	0.0011 JB	0.0014 JB	0.0018 JB	0.0013 JB
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.79	0.008 U	0.007 U	19	0.012	0.015	0.082	0.01 U	0.0087 U	0.0097 U	0.26	0.66	0.0076 U	0.007 U	0.0032 JB	0.013 B	0.012 B	0.002 JB
Pyrene	mg/kg	NA	110,000	650	NE	NL	2	0.0086	0.007 U	63	0.02	0.026	0.29	0.01 U	0.0087 U	0.0097 U	0.87 J	2.4	0.0076 U	0.007 U	0.0067	0.014	0.0028 JB	0.0011 JB
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.16	0.01	0.007	**48**	0.02	0.02	0.5	0.01	0.0087	0.0097	0.7	2.14	0.0076	0.007	0.009	0.01	0.006	0.0002
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	4	0.008	0.007	84.4	0.03	0.04	0.4	0.01	0.0087	0.0097	1.1	3.1	0.01	0.01	0.02	0.03	0.02	0.005
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**14.3**	0.07	0.007	**323.5**	0.1	0.11	**3.3**	0.01	0.0087	0.0097	**5.2**	**14.4**	0.01	0.01	0.04	0.08	0.003	0.004
Polychlorinated Biphenyls (PCBs)																								
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.059 U	0.075 U	0.065 U	0.065 U	0.055 U	0.056 U	0.057 U	0.053 U	NA	NA	NA	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.059 U	0.075 U	0.065 U	0.065 U	0.055 U	0.056 U	0.057 U	0.053 U	NA	NA	NA	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.059 U	0.075 U	0.065 U	0.065 U	0.055 U	0.056 U	0.057 U	0.053 U	NA	NA	NA	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.059 U	0.075 U	0.065 U	0.065 U	0.055 U	0.056 U	0.057 U	0.053 U	NA	NA	NA	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.059 U	0.075 U	0.065 U	0.065 U	0.055 U	0.056 U	0.057 U	0.053 U	NA	NA	NA	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	NA	NA	NA	NA	0.059 U	0.075 U	0.065 U	0.065 U	0.055 U	0.056 U	0.057 U	0.053 U	NA	NA	NA	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.059 U	0.075 U	0.065 U	0.065 U	0.055 U	0.056 U	0.057 U	0.053 U	NA	NA	NA	NA
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	NA	NA	NA	NA	0.059	0.075	0.065	0.065	0.055	0.056	0.057	0.053	NA	NA	NA	NA
Metals																								
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	NA	NA	NA	NA	NA	NA	9,500	14,000	11,000	19,000	12,000	13,000	12,000	3,600	NA	NA	NA	NA
Arsenic	mg/kg	20	87.5	2.9	7.61	132	NA	NA	NA	NA	NA	NA	12 U	15 U	13 U	15 U	11 U	11 U	11 U	11 U	NA	NA	NA	NA
Cadmium	mg/kg	2	3,500	0.69	0.81	14	NA	NA	NA	NA	NA	NA	0.59 U	0.75 U	0.65 U	0.73 U	0.55 U	0.56 U	0.57 U	0.53 U	NA	NA	NA	NA
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	NA	NA	NA	NA	NA	NA	1.9	7.9	5.1	3.2	12 J	7.2	11	4	NA	NA	NA	NA
Copper	mg/kg	NA	140,000	280	28.4	217	NA	NA	NA	NA	NA	NA	11	21	16	18	35 J	12	25	14	NA	NA	NA	NA
Lead	mg/kg	1,000	NE	3,000	13.1	118	NA	NA	NA	NA	NA	NA	5.9 U	7.5 U	6.5 U	7.3 U	6.1	5.6 U	7.2	5.3 U	NA	NA	NA	NA
Mercury	mg/kg	2	NE	2.1	0.04	5.5	NA	NA	NA	NA	NA	NA	0.29 U	0.37 U	0.32 U	0.36 U	0.28 U	0.28 U	0.29 U	0.26 U	NA	NA	NA	NA
Nickel	mg/kg	NA	70,000	130	24.54	980	NA	NA	NA	NA	NA	NA	2.9 U	12	5	9.7	14 J	4.5	11	5.4	NA	NA	NA	NA
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	NA	NA	NA	NA	NA	NA	12 U	15 U	13 U	15 U	11 U	11 U	11 U	11 U	NA	NA	NA	NA
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	NA	NA	NA	NA	NA	NA	29	72	46	56	96 J	45	66	41	NA	NA	NA	NA
Total Petroleum Hydrocarbons (TPHs)																								
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	43 U	30 U	26 U	**2,800**	460	120	29 U	38 U	33 U	36 U	28 U	40 U	29 U	26 U	12 J	16 J	7.6 J	64 Z
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	250	60 U	53 U	**7,500**	70 U	58 U	95	75 U	65 U	73 U	130 J	260	62	53 U	49 J	43 J	27 J	56 J
Volatile Organic Compounds (VOCs)																								
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.001 U	0.0013 U	0.0011 U	0.00086 U	0.0015 U	0.0011 U	0.011 U	0.0017 U	0.0014 U	0.0017 U	0.0011 U	0.001 U	0.0012 U	0.00097 U	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0052 U	0.0066 U	0.0053 U	0.0043 U	0.0073 U	0.0054 U	0.0056 U	0.0083 U	0.0072 U	0.0084 U	0.0055 U	0.005 U	0.0059 U	0.0049 U	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.001 U	0.0013 U	0.0011 U	0.00086 U	0.0015 U	0.0011 U	0.011 U	0.0017 U	0.0014 U	0.0017 U	0.0011 U	0.001 U	0.0012 U	0.00097 U	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.0021 U	0.0027 U	0.0021 U	0.0018	0.0029 U	0.0022 U	0.0022 U	0.0033 U	0.0029 U	0.0033 U	0.0022 U	0.002 U	0.0024 U	0.0019 U	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	0.001 U	0.0013 U	0.0011 U	0.0015	0.0015 U	0.0011 U	0.011 U	0.0017 U	0.0014 U	0.0017 U	0.0011 U	0.001 U	0.0012 U	0.00097 U	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	NA	NA	NA	0.00086 U	0.0015 U	0.0011 U	0.011 U	0.0017 U	0.0014 U	0.0017 U	0.0011 U	0.001 U	0.0012 U	0.00097 U	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	NA	NA	NA	0.00086 U	0.0015 U	0.0011 U	0.011 U	0.0017 U	0.0014 U	0.0017 U	0.0011 U	0.001 U	0.0012 U	0.00097 U	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	NA	NA	NA	0.00086 U	0.0015 U	0.0011 U	0.011 U	0.0017 U	0.0014 U	0.0017 U	0.0011 U	0.001 U	0.0012 U	0.00097 U	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	NA	NA	NA	0.00086 U	0.0015 U	0.0011 U	0.011 U	0.0017 U	0.0014 U	0.0017 U	0.0011 U	0.001 U	0.0012 U	0.00097 U	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	NA	NA	NA	0.00086 U	0.0015 U	0.0011 U	0.011 U	0.0017 U	0.0014 U	0.0017 U	0.0011 U	0.001 U	0.0012 U	0.00097 U	NA	NA	NA	NA

Notes:

J	Estimated concentration.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
NA	Not applicable or not analyzed.	LMW PAH	Low molecular weight PAH.
NE	Not established.	HMW PAH	High molecular weight PAH.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.	Detected concentrations shown in **bold** exceed one or more site soil screening levels.	
U	Chemical was not detected. The associated value represents the method detection limit.	B	The sample result is five times less than the blank contamination and cross-contamination is suspected.

Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in all samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment C3 are compiled and presented on Figure 2.3.13-1. The vertical extent of contamination is defined at sample locations SB-AST01, SB-AST02, SB-SE06, CCR-SB08, and CCR-GW14. The vertical extent of contamination is not defined at sample locations SB-BH03 and CCR-SB09.

In initial RI borings SB-AST01 and SB-AST02, detected concentrations of COPCs exceed soil screening levels to 1 ft bgs but not in the deeper depths sampled. The vertical extent for these borings has been defined.

In initial RI borings SB-SE06 detected fluoride and PAH as total HMW were detected at concentrations that exceed soil screening levels to 3 ft bgs but not in the deeper depths sampled. The vertical extent for this boring has been defined.

In WPA borings CCR-SB08 and CCR-GW14 COPCs were not detected at concentrations that exceed soil screening levels and the vertical extent of contamination is defined for these two borings.

In initial RI boring SB-BH03 detected concentrations of sulfate exceeds the protection of groundwater soil screening level in the 1 ft bgs sample but not in deeper samples, and sulfate does not exceed soil screening levels at 1 ft bgs, but exceeds at 3, 6, and 8 ft bgs, the deepest depths sampled. In WPA boring CCR-SB09 fluoride was detected at a concentration that exceeds the protection of groundwater soil screening level at 2.5 ft bgs, the deepest depth sampled. The vertical extent of contamination for soil boring CCR-SB09 has not been defined. Elevated concentrations of fluoride and sulfate in these borings is likely associated with leaks from underground piping in the vicinity of the Tertiary Treatment Plant (refer to Figure 2.1.2-1). Soil borings SB-BH03 and CCR-SB09 are part of the Crucible Cleaning Room investigation area and discussed in Section 2.2.1.

Basalt flow top was encountered in the western portion of C3 at depths of potentially 3 to 10 ft bgs. Based on the water level measured in CCR-GW14 at the time of well installation, shallow groundwater in the UA is approximately 11.5 ft bgs in the western portion of C3. The concentration of fluoride in shallow groundwater beneath this segment is expected to be between 0.96 and 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). The maximum concentration of fluoride detected in segment C3 is 320 mg/kg collected from 3 ft bgs in the western portion of the segment. The maximum concentration of sulfate detected in segment C3 is 7,500 mg/kg collected from 3 ft bgs in the eastern portion of the segment, with sulfate concentrations remaining elevated to 8 ft bgs which is likely below the water table. Sulfate detected in deeper soil in C3 is likely associated with underground piping leaks in the Crucible Cleaning Room investigation area and localized elevated concentration of sulfate in shallow groundwater.

2.3.13.3 Conclusions and Recommendations

The vertical extent has not been defined at initial RI soil boring SB-BH03. Detected concentrations of sulfate exceed the protection of groundwater soil screening levels at 8 ft bgs, the deepest depth sampled. The maximum concentration of sulfate detected in segment C3 is 7,500 mg/kg collected from 3 ft bgs in the eastern portion of the segment, with sulfate concentrations remaining elevated to 8 ft bgs which is likely below the water table. Sulfate detected in deeper soil in C3 is likely associated with underground piping leaks in the Crucible Cleaning Room investigation area and localized elevated concentration of sulfate in shallow groundwater.

The vertical extent has not been defined at WPA soil boring CCR-SB09. Detected concentrations of fluoride slightly exceeds the protection of groundwater soil screening levels at 2.5 ft bgs, the deepest depth sampled. The maximum concentration of fluoride detected in segment C3 is 320 mg/kg collected from 3 ft bgs in the western portion of the segment.

Based on COPC exceedance of soil screening levels to depths up to 8 ft bgs, Segment C3 is recommended for further evaluation in the FS.

2.3.14 Courtyard Segment C4

Courtyard segment C4 is in the eastern portion of Courtyard C, adjacent east of segment C3 and adjacent west of segment C5. Segment C4 is approximately 30 ft wide, and approximately 565 ft long with an approximate area of 16,954 square feet. Calculated area in segment C4 does not include surfaces such as sloped areas. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. Courtyard segment C4 is bound to the south by the foundation for Production Building B and to the north by a steep approximately 12-foot slope. At the western end of segment C4 is a concrete underpass beneath Passage No. 2 to provide access between segments C3 and C4. At the eastern end of segment C4 is a concrete underpass beneath Passage No. 3 to provide access between segments C4 and C5.

Several features and structures existed in and adjacent to segment C4 (Figure 2.3.14-1) as follows:

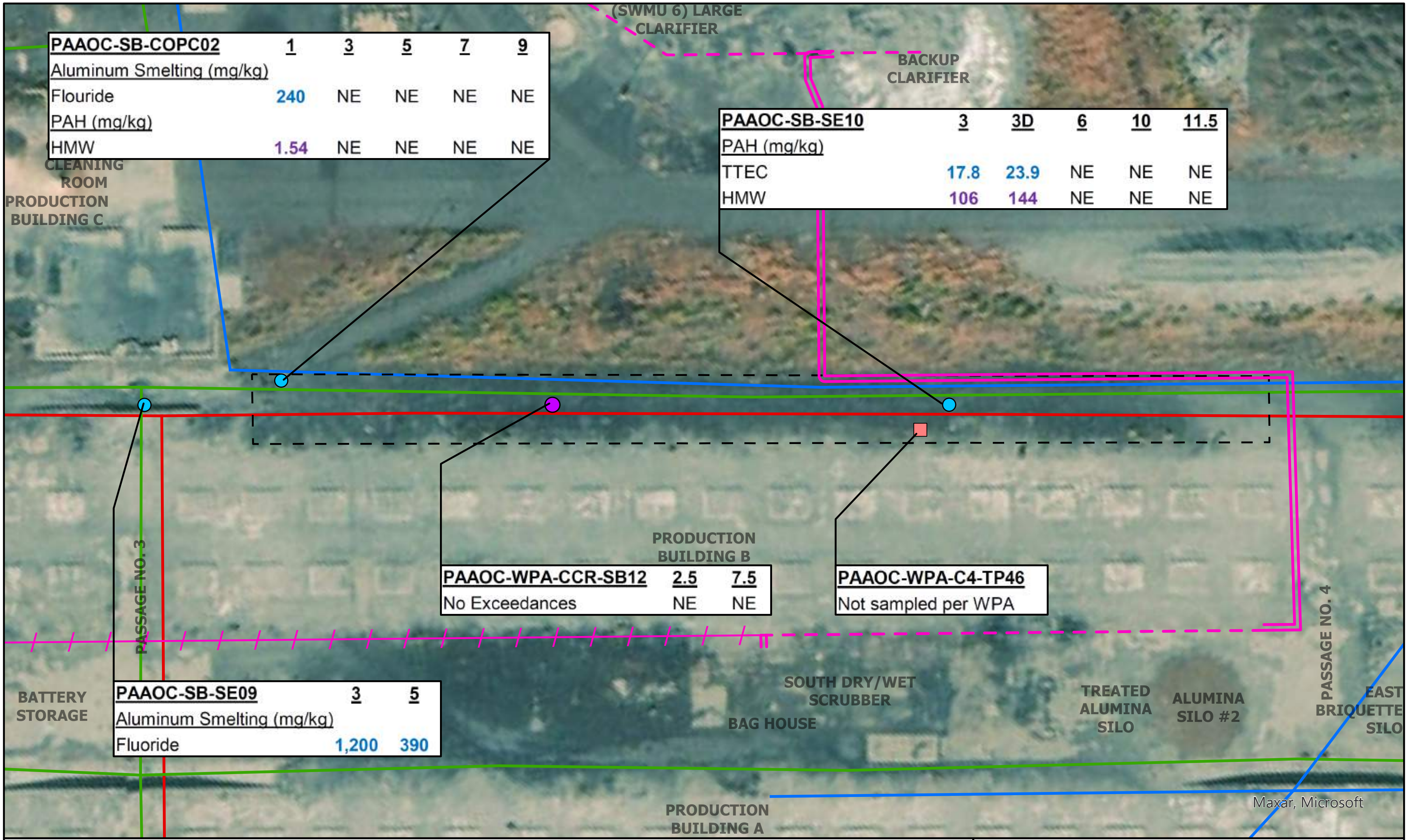
- Pre-RI 2010 soil boring (identified for initial RI sampling)
- Scrubber Effluent System line no. 2 horizontal subsurface pipe and manholes
- Stormwater System lines no. 10 and no. 11 horizontal subsurface pipe and catch basins
- Impacted surface soil mapped during the initial RI at the western and eastern ends of C4

These features in and adjacent to Courtyard segment C4 were the focus of the initial RI phase of investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data, and to confirm thickness of impacted surface soil.

2.3.14.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment C4 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included three soil borings to investigate one pre-RI 2010 soil boring located in the western end of segment C4, and the Scrubber Effluent line. RI boring locations are shown on Figure 2.3.14-1. Sample depths and analyses are as follows:

- Pre-RI 2010 boring location for COPC analyses samples 1, 3, 5, 7, 9 ft bgs
  - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs
- Scrubber Effluent line boring samples targeted to above and below horizontal pipe invert at 7 to 8 ft bgs with samples 3, 5 ft bgs, and 3, 6, 10, 11.5 ft bgs
  - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs



PAAOC-SB-COPC02	1	3	5	7	9
Aluminum Smelting (mg/kg)					
Flouride	240	NE	NE	NE	NE
PAH (mg/kg)					
HMW	1.54	NE	NE	NE	NE

PAAOC-SB-SE10	3	3D	6	10	11.5
PAH (mg/kg)					
TTEC	17.8	23.9	NE	NE	NE
HMW	106	144	NE	NE	NE

PAAOC-WPA-CCR-SB12	2.5	7.5
No Exceedances	NE	NE

PAAOC-WPA-C4-TP46
Not sampled per WPA

PAAOC-SB-SE09	3	5
Aluminum Smelting (mg/kg)		
Fluoride	1,200	390

⌐ ¬	Courtyard Segment C4
●	RI Soil Boring
●	WPA Boring
🟥	WPA Test Pit
—	Scrubber Effluent Line
—	Stormwater System Line
—	Groundwater Collection Line

Plant SO2 Lines

═	Existing SO2 Line, entrenched w/spare
- -	Elevated SO2 Line
+	Abandoned SO2 Line

Segment C4 approximate area: 16,954 sq. ft.

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife
NE: No exceedance
D: Duplicate sample
1: Sample depth in feet bgs

W N E S

0 25 50 100
Feet

Figure 2.3.14-1

Plant Area AOC

Courtyard Segment C4 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected RI sample stations where the deepest sample exceeded site soil screen levels (Tetra Tech et al. 2020b). This included one test pit excavated at an initial RI-phase sample station and one soil boring in central portion of segment C4. The test pit was excavated near SB-SE10 to a depth of 4 ft bgs to confirm the upper 2 ft of soil profile and as proposed in the WPA, no samples were collected. WPA soil samples were analyzed for total cyanide, fluoride, sulfate, and PAHs. WPA test pit and soil boring locations are shown on Figure 2.3.14-1.

2.3.14.2 Investigation Results

Segment C4 soil was investigated with a combined total of four soil borings and one test pit in the initial RI and WPA phases of investigation. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.14-1 (PAAOC Courtyard Segment C4 Initial RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in all samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment C4 are compiled and presented on Figure 2.3.14-1. The vertical extent of contamination is defined at sample locations SB-COPC02, CCR-SB12, and SB-SE10 with initial RI data. The vertical extent of contamination is not defined at sample location SB-SE09.

In initial RI borings SB-COCP02 and SB-SE10, detected concentrations of COPCs exceed soil screening levels to 1 ft bgs and 3 ft bgs, respectively, but not in the deeper depth samples. In WPA boring CCR-SB12, COPCs were not detected at concentrations that exceeded screening levels in the 2.5 and 7.5 sample depths.

In initial RI borings SB-SE09 detected fluoride at concentrations that exceed the protection of groundwater soil screening levels to 5 ft bgs, the deepest depth sampled. The vertical extent of contamination for SB-SE09 has not been defined.

Table 2.3.14-1
PAAOC Courtyard Segment C4 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results												WPA Analytical Results	
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-COPC02-1**	**PAAOC-SB-COPC02-3**	**PAAOC-SB-COPC02-5**	**PAAOC-SB-COPC02-7**	**PAAOC-SB-COPC02-9**	**PAAOC-SB-SE09-3**	**PAAOC-SB-SE09-5**	**PAAOC-SB-SE10-3**	**PAAOC-SB-SE10-3D**	**PAAOC-SB-SE10-6**	**PAAOC-SB-SE10-10**	**PAAOC-SB-SE10-11.5**	**PAAOC-WPA-CCR-SB12-2.5**	**PAAOC-WPA-CCR-SB12-7.5**
Aluminum Smelting																				
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.1	0.05 U	0.05 U	0.05 U	0.19 U	0.19 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**240**	66	27 U	39 U	24 U	**1,200**	**390**	22 U	15	5.5 U	8.1 U	16 U	19.3 J	4.4 UJ
Sulfate	mg/kg	NA	NE	2,150	NE	NE	18 U	81	57 U	74	140	75	87	20 UJ	91	300	430	260	160 J	66.5 J
Polynuclear Aromatic Hydrocarbons (PAHs)																				
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0072 U	0.0074 U	0.0075 U	0.0075 U	0.0073 U	0.018 U	0.0081 U	7.3 U	7.4 U	0.0074 U	0.015 U	0.007 U	0.0005 J	0.00059 J
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0072 U	0.0074 U	0.0075 U	0.0075 U	0.0073 U	0.018 U	0.0081 U	7.3 U	7.4 U	0.0074 U	0.015 U	0.007 U	0.0054 U	0.00087 J
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0072 U	0.0074 U	0.0075 U	0.0075 U	0.0073 U	0.018 U	0.0081 U	7.3 U	7.4 U	0.0074 U	0.023	0.007 U	0.0054 U	0.0055 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0072 U	0.0074 U	0.0075 U	0.0075 U	0.0073 U	0.018 U	0.0081 U	7.3 U	7.4 U	0.0074 U	0.015 U	0.007 U	0.00032 J	0.00063 J
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.019	0.0074 U	0.0075 U	0.0094	0.0073 U	0.018 U	0.0081 U	11	14	0.0074 U	0.055	0.007 U	0.001 J	0.00063 JB
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.11	0.0074 U	0.0075 U	0.053	0.0073 U	0.023	0.0081 U	13	17	0.0074 U	0.085	0.037	0.00051 J	0.0015 JB
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.15	0.0074 U	0.0075 U	0.067	0.0073 U	0.048	0.0081 U	14	18	0.0074 U	0.092	0.057	0.0014 J	0.0013 JB
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.3	0.0074 U	0.0075 U	0.15	0.0073 U	0.082	0.0081 U	15	20	0.0074 U	0.12	0.082	0.00063 J	0.0022 JB
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.26	0.0074 U	0.0075 U	0.099	0.0073 U	0.018 U	0.0081 U	9.3	11	0.0074 U	0.087	0.056	0.00059 J	0.0055 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.088	0.0074 U	0.0075 U	0.042	0.0073 U	0.029	0.0081 U	7.3 U	8	0.0074 U	0.034	0.025	0.00088 J	0.0014 J
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.21	0.0074 U	0.0075 U	0.091	0.0073 U	0.038	0.0081 U	14	18	0.0074 U	0.097	0.05	0.0054 U	0.0055 U
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.043	0.0074 U	0.0075 U	0.015	0.0073 U	0.018 U	0.0081 U	7.3 U	7.4 U	0.0074 U	0.015 U	0.011	0.0054 U	0.001 J
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.19	0.0074 U	0.0075 U	0.084	0.0073 U	0.037	0.0081 U	34	42	0.0074 U	0.18	0.061	0.0013 J	0.0041 J
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0072 U	0.0074 U	0.0075 U	0.0075 U	0.0073 U	0.018 U	0.0081 U	7.3 U	7.4 U	0.0074 U	0.02	0.007 U	0.0054 U	0.001 JB
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.2	0.0074 U	0.0075 U	0.066	0.0073 U	0.069	0.0081 U	8.7	12	0.0074 U	0.063	0.052	0.007 J	0.0011 JB
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0072 U	0.0074 U	0.0075 U	0.0075 U	0.0073 U	0.018 U	0.0081 U	7.3 U	7.4 U	0.0074 U	0.0011	0.007 U	0.00089 JXB	0.086 JB
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.051	0.0074 U	0.0075 U	0.0075 U	0.0073 U	0.018 U	0.0081 U	29	38	0.0074 U	0.14	0.025	0.0011 J	0.0072 B
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.18	0.0074 U	0.0075 U	0.076	0.0073 U	0.036	0.0081 U	32	40	0.0074 U	0.17	0.057	0.0013 JXB	0.0032 JXB
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.23	0.0074	0.0075	0.1	0.0073	0.07	0.0081	**17.8**	**23.9**	0.0074	0.15	0.08	0.002	0.002
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.26	0.0074	0.0075	0.1	0.0073	0.04	0.0081	74	94	0.0074	0.42	0.09	0.004	0.1
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**1.54**	0.0074	0.0075	0.7	0.0073	0.33	0.0081	**106**	**144**	0.0074	0.75	0.43	0.01	0.01
Polychlorinated Biphenyls (PCBs)																				
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.054 U	0.056 U	0.056 U	0.056 U	0.055 U	0.068 U	0.06 U	0.054 U	0.055 U	0.056 U	0.056 U	0.052 U	NA	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.054 U	0.056 U	0.056 U	0.056 U	0.055 U	0.068 U	0.06 U	0.054 U	0.055 U	0.056 U	0.056 U	0.052 U	NA	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.054 U	0.056 U	0.056 U	0.056 U	0.055 U	0.068 U	0.06 U	0.054 U	0.055 U	0.056 U	0.056 U	0.052 U	NA	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.054 U	0.056 U	0.056 U	0.056 U	0.055 U	0.068 U	0.06 U	0.054 U	0.055 U	0.056 U	0.056 U	0.052 U	NA	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.054 U	0.056 U	0.056 U	0.056 U	0.055 U	0.068 U	0.06 U	0.054 U	0.055 U	0.056 U	0.056 U	0.052 U	NA	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.054 U	0.056 U	0.056 U	0.056 U	0.055 U	0.068 U	0.06 U	0.054 U	0.055 U	0.056 U	0.056 U	0.052 U	NA	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.054 U	0.056 U	0.056 U	0.056 U	0.055 U	0.068 U	0.06 U	0.054 U	0.055 U	0.056 U	0.056 U	0.052 U	NA	NA
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	0.054	0.056	0.056	0.056	0.055	0.068	0.06	0.054	0.055	0.056	0.056	0.052	NA	NA
Metals																				
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	6,900	5,100	6,500	7,300	5,400	12,000	6,700	8,100	7,800	7,200	7,600	3,000	NA	NA
Arsenic	mg/kg	20	87.5	2.9	7.61	132	11 U	11 U	11 U	11 U	11 U	14 U	12 U	11 U	11 U	11 U	11 U	10 U	NA	NA
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.54 U	0.56 U	0.56 U	0.56 U	0.55 U	0.68 U	0.6 U	0.54 U	0.55 U	0.56 U	0.56 U	0.52 U	NA	NA
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	12	2.1	5.9	6.2	7.6	6.1	3.8	13 J	7.5	5.6	5.2	7	NA	NA
Copper	mg/kg	NA	140,000	280	28.4	217	13	9.1	15	14	19	24	91	14	13	11	20	20	NA	NA
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.6	5.6 U	5.6 U	5.7	5.5 U	6.8 U	6 U	6.7	8.9	5.6 U	5.6 U	5.2 U	NA	NA
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.27 U	0.28 U	0.28 U	0.28 U	0.27 U	0.34 U	0.3 U	0.27 U	0.28 U	0.28 U	0.28 U	0.26 U	NA	NA
Nickel	mg/kg	NA	70,000	130	24.54	980	8.6	2.8 U	5	6.1	3.7	5.5	8.3	7.4	5.8	5.1	7.5	4.3	NA	NA
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	11 U	11 U	14 U	12 U	11 U	11 U	11 U	11 U	10 U	NA	NA
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	49	27	48	42	36	39	140	54	55	35	38	42	NA	NA
Total Petroleum Hydrocarbons (TPHs)																				
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	27 U	28 U	28 U	28 U	27 U	34 U	30 U	620 U	280 U	28 U	28 U	26 U	NA	NA
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	93	56 U	56 U	56 U	55 U	68 U	60 U	2,800 J	1,400	56 U	80	52 U	NA	NA
Volatile Organic Compounds (VOCs)																				
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.00097 U	0.0011 U	0.0011 U	0.0011 U	0.001 U	0.0014 U	0.0013 U	0.0013 U	0.0009 U	0.00096 U	0.0011 U	0.00095 U	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0048 U	0.0055 U	0.0054 U	0.0054 U	0.0051 U	0.007 U	0.0064 U	0.0065 U	0.0045 U	0.0048 U	0.0053 U	0.0048 U	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.00097 U	0.0011 U	0.0011 U	0.0011 U	0.001 U	0.0014 U	0.0013 U	0.0013 U	0.0009 U	0.00096 U	0.0011 U	0.00095 U	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.0019 U	0.0022 U	0.0022 U	0.0022 U	0.002 U	0.0028 U	0.0026 U	0.0026 U	0.0018 U	0.0019 U	0.0021 U	0.0019 U	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	0.00097 U	0.0011 U	0.0011 U	0.0011 U	0.001 U	0.0014 U	0.0013 U	0.0013 U	0.0009 U	0.00096 U	0.0011 U	0.00095 U	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.00097 U	0.0011 U	0.0011 U	0.0011 U	0.001 U	0.0014 U	0.0013 U	0.0013 U	0.0009 U	0.00096 U	0.0011 U	0.00095 U	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.00097 U	0.0011 U	0.0011 U	0.0011 U	0.001 U	0.0014 U	0.0013 U	0.0013 U	0.0009 U	0.00096 U	0.0011 U	0.00095 U	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.00097 U	0.0011 U	0.0011 U	0.0011 U	0.001 U	0.0014 U	0.0013 U	0.0013 U	0.0009 U	0.00096 U	0.0011 U	0.00095 U	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.00097 U	0.0011 U	0.0011 U	0.0011 U	0.001 U	0.0014 U	0.0013 U	0.0013 U	0.0009 U	0.00096 U	0.0011 U	0.00095 U	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	0.00097 U	0.0011 U	0.0011 U	0.0011 U	0.001 U	0.0014 U	0.0013 U	0.0013 U	0.0009 U	0.00096 U	0.0011 U	0.00095 U	NA	NA

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
X	Matrix interference may have caused slight high bias in result.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Basalt flow top was encountered at a depth of approximately 10 ft bgs in the western portion of the segment. Based on water levels measured as part of the Groundwater AOC investigation, the depth to the shallowest groundwater (UA aquifer) beneath C4, if present, is approximately elevation 470 ft or approximately 12 or more feet bgs. The concentration of fluoride in shallow groundwater beneath this segment is expected to be between 0.96 and 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). The maximum concentration of fluoride detected in segment C4 is 1,200 mg/kg detected in SB-SE09 collected at approximately 8 ft below the surface of exposed soil in C4. SB-SE09 was completed through the concrete underpass at the western end of C4, in the Passage No. 3 alignment, potentially collected below the water table, and likely associated with underground piping leaks in the Crucible Cleaning Room investigation area and Passage No. 3, a major underground pipe corridor.

2.3.14.3 Conclusions and Recommendations

The vertical extent has not been defined at initial RI soil boring SB-SE09. Detected concentrations of fluoride exceeded the protection of groundwater soil screening levels at 5 ft bgs, the deepest depth sampled. The maximum concentration of fluoride detected in segment C4 is 1,200 mg/kg detected in SB-SE09 collected at approximately 8 ft below the surface of exposed soil in C4. SB-SE09 was completed through the concrete underpass at the western end of C4, in the Passage No. 3 alignment, potentially collected below the water table, and likely associated with underground piping leaks in the Crucible Cleaning Room investigation area and Passage No. 3, a major underground pipe corridor.

Based on fluoride and PAH exceedance of soil screening levels depths of 1 and 3 ft bgs in the western portion of the segment, Segment C4 is recommended for further evaluation in the FS.

2.3.15 Courtyard Segment C5

Courtyard segment C5 is at the east end of Courtyard C. Segment C5 is approximately 30 ft wide, and approximately 560 ft long with an area of approximately 16,859 square feet. Calculated area in segment C5 does not include surfaces such as sloped areas. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. Courtyard segment C5 is bound to the south by the foundation for Production Building B and to the north by a steep approximately 12-foot slope up to a paved access road south of the North SPL Storage Containment Building (SWMU 14).

At the western end of segment C5 is a concrete underpass beneath Passage No. 4 to provide access between segments C4 and C5. At the eastern end of segment C5 is the Production Services building.

The features and structures existed in and adjacent to segment C5 (Figure 2.3.15-1) as follows:

- Scrubber Effluent System line no. 2 horizontal subsurface pipe and manholes
- Groundwater Collection line no. 5 subsurface perforated pipe and manholes
- Stormwater System line no. 11 horizontal subsurface pipe and catch basins
- Impacted surface soil was mapped during the initial RI in most of C5
- The dry/wet scrubber bleed line piping runs beneath passage no. 4, which is at the west margin of the segment and is a likely source of sulfate

These features in and adjacent to Courtyard segment C5 were the focus of the initial RI phase of investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data, and to confirm thickness of impacted surface soil.

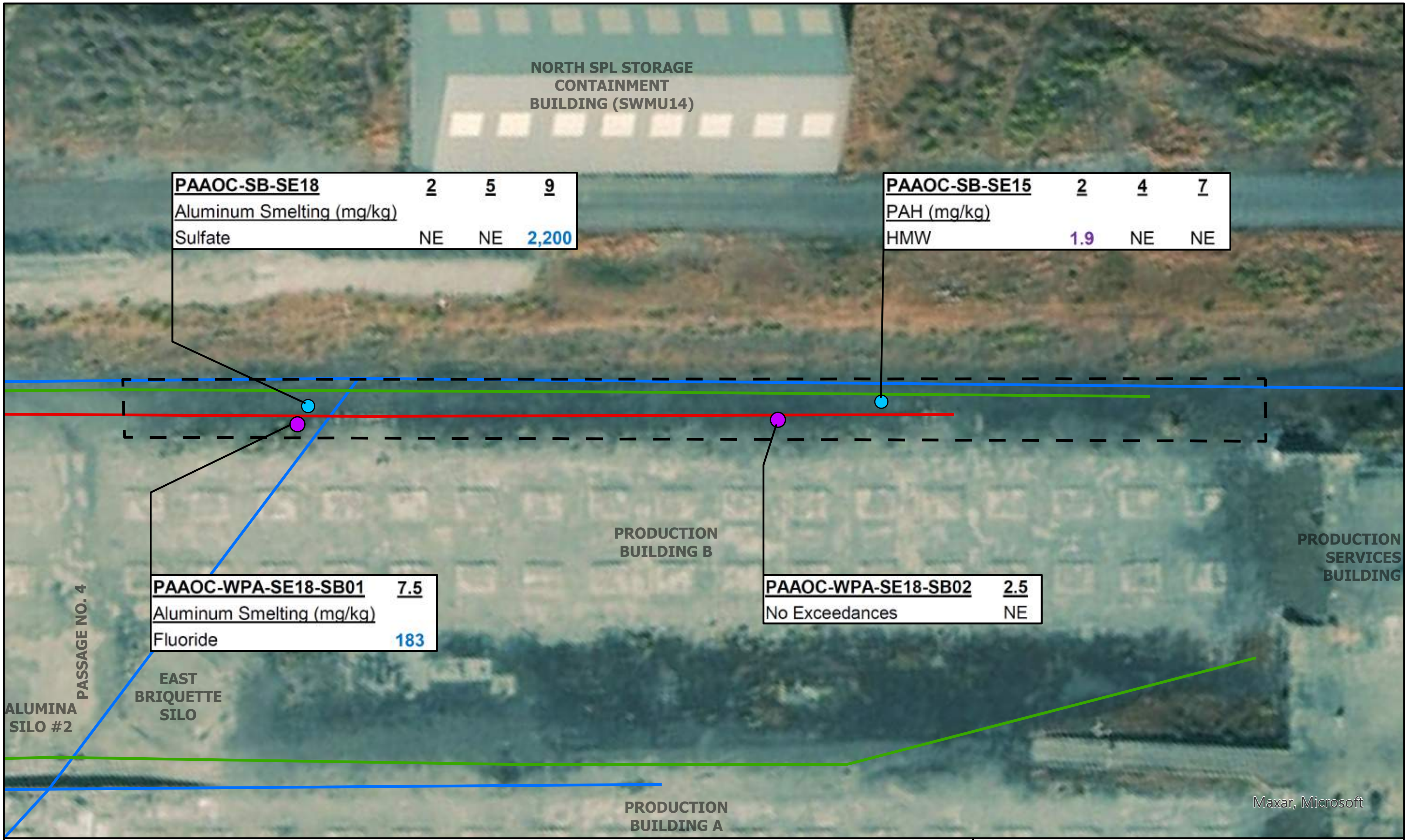
2.3.15.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment A5 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included two soil borings to investigate the Scrubber Effluent line. RI boring locations are shown on Figure 2.3.15-1.

Sample depths and analyses are as follows:

- Scrubber Effluent line boring samples targeted to above- and below-horizontal pipe invert at approximately 5.5 to 4.5 ft bgs with samples at 2, 5, 9 ft bgs and 2, 4, 7 ft bgs
  - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, and VOCs

The WPA phase of investigation was primarily part of the SE18 Investigation Area with two soil borings located in segment C5 as specified in the WPA (Tetra Tech et al. 2020b). One of the two soil borings (SE18-SB01) was completed at initial RI sample location SB-SE18 and the second boring was installed farther east in the segment. A temporary groundwater monitoring well screen was installed in SE18-SB01 for collection of a grab groundwater sample. WPA soil samples were analyzed for total cyanide, fluoride, sulfate, and PAHs. WPA boring locations are shown on Figure 2.3.15-1.



PAAOC-SB-SE18	2	5	9
Aluminum Smelting (mg/kg)			
Sulfate	NE	NE	2,200

PAAOC-SB-SE15	2	4	7
PAH (mg/kg)			
HMW	1.9	NE	NE

PAAOC-WPA-SE18-SB01	7.5
Aluminum Smelting (mg/kg)	
Fluoride	183

PAAOC-WPA-SE18-SB02	2.5
No Exceedances	NE

- ┏ ┓ Courtyard Segment C5
- ● RI Soil Boring
- ● WPA Soil Boring
- ― Groundwater Collection Line
- ― Scrubber Effluent Line
- ― Stormwater System Line

Segment C5 approximate area: 16,859 sq. ft.

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife
NE: No exceedance
2: Sample depth in feet bgs

Figure 2.3.15-1

Plant Area AOC

Courtyard Segment C5 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Sample depths and analyses are as follows:

- Scrubber Effluent line boring samples targeted to above- and below-horizontal pipe invert at approximately 5.5 to 4.5 ft bgs with samples at 2, 5, 9 ft bgs and 2, 4, 7 ft bgs
  - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, and VOCs

The WPA phase of investigation was primarily part of the SE18 Investigation Area with two soil borings located in segment C5 as specified in the WPA (Tetra Tech et al. 2020b). One of the two soil borings (SE18-SB01) was completed at initial RI sample location SB-SE18 and the second boring was installed farther east in the segment. A temporary groundwater monitoring well screen was installed in SE18-SB01 for collection of a grab groundwater sample. WPA soil samples were analyzed for total cyanide, fluoride, sulfate, and PAHs. WPA boring locations are shown on Figure 2.3.15-1.

2.3.15.2 Investigation Results

Segment C5 soil was investigated with a combined total of four soil borings in the initial RI and WPA phases of investigation. The soil was described and characterized, and logs of borings are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.15-1 (PAAOC Courtyard Segment C5 Initial RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in all samples analyzed.

Analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment C5 are compiled and presented on Figure 2.3.15-1. The vertical extent of contamination is defined at sample locations SB-SE15 and SE18-SB02 with initial RI and WPA data. The vertical extent of contamination is not defined at sample locations SB-SE18 and SE18-SB01.

Table 2.3.15-1
PAAOC Courtyard Segment C5 Initial RI and WPA Soil Results Summary
Columbmia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results						WPA Analytical Results	
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-SE15-2**	**PAAOC-SB-SE15-4**	**PAAOC-SB-SE15-7**	**PAAOC-SB-SE18-2**	**PAAOC-SB-SE18-5**	**PAAOC-SB-SE18-9**	**PAAOC-WPA-SE18-SB01-7.5**	**PAAOC-WPA-SE18-SB02-2.5**
Aluminum Smelting														
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.086	0.05 U	0.059	0.05 U	0.05 U	0.05 U	0.23 U	0.2 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	26 U	5 U	82	5 U	7 U	5 U	**183**	22.4
Sulfate	mg/kg	NA	NE	2,150	NE	NE	44 U	50 UJ	10 U	180	400	**2,200**	101	94
Polynuclear Aromatic Hydrocarbons (PAHs)														
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.015 U	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.00065 J	0.0053 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.015 U	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.00096 J	0.0053 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.015 U	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.00097 J	0.0053 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.015 U	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.0020 J	0.0053 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.11	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.012	0.00084 J
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.23	0.0074 U	0.0074 U	0.018	0.0072 U	0.0074 U	0.02	0.0053 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.24	0.0074 U	0.0074 U	0.021	0.0072 U	0.0074 U	0.11	0.00079 J
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.26	0.0074 U	0.0074 U	0.049	0.0072 U	0.0074 U	0.24	0.0006 J
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.13	0.0074 U	0.0074 U	0.021	0.0072 U	0.0074 U	0.022	0.00043 J
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.098	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.017	0.00039 J
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.23	0.0074 U	0.0074 U	0.051	0.0072 U	0.0074 U	0.024	0.0053 U
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.034	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.00078 J	0.0053 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.54	0.0074 U	0.0074 U	0.056	0.0072 U	0.0074 U	0.018	0.0053 U
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.015 U	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.00086 J	0.0053 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.15	0.0074 U	0.0074 U	0.019	0.0072 U	0.0074 U	0.14	0.00039 J
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.015 U	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U	0.00094 J	0.00053 J
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.28	0.0074 U	0.0074 U	0.015	0.0072 U	0.0074 U	0.0075	0.0053 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.51	0.0074 U	0.0074 U	0.054	0.0072 U	0.0074 U	0.019	0.00065 J
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.34	0.0074	0.0074	0.03	0.0072	0.0074	0.05	0.001
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.90	0.0074	0.0074	0.07	0.0072	0.0074	0.03	0.0005
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**1.9**	0.0074	0.0074	0.23	0.0072	0.0074	0.6	0.004
Polychlorinated Biphenyls (PCBs)														
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U	NA	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U	NA	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U	NA	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U	NA	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U	NA	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U	NA	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U	NA	NA
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	0.056	0.056	0.056	0.055	0.054	0.056	NA	NA
Metals														
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	7,000	7,600	7,000	8,300	4,200	8,800	NA	NA
Arsenic	mg/kg	20	87.5	2.9	7.61	132	11 U	11 U	11 U	11 U	11 U	11 U	NA	NA
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.56 U	0.56 U	0.56 U	0.55 U	0.54 U	0.56 U	NA	NA
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	5.3	5	6.9	7.7	4.1	6.2	NA	NA
Copper	mg/kg	NA	140,000	280	28.4	217	11	10	13	16	11	13	NA	NA
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.6 U	5.6 U	5.6 U	5.5 U	5.4 U	5.6 U	NA	NA
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.28 U	0.28 U	0.27 U	0.27 U	0.28 U	NA	NA
Nickel	mg/kg	NA	70,000	130	24.54	980	4.9	4.2	6.8	9.1	6.7	6.3	NA	NA
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	11 U	11 U	11 U	NA	NA
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	39	42	44	45	34	40	NA	NA
Total Petroleum Hydrocarbons (TPHs)														
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	28 U	28 U	28 U	110 U	27 U	28 U	6.2 J	8.0 J
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	56 U	56 U	56 U	710	54 U	56 U	21 JB	33 JB
Volatile Organic Compounds (VOCs)														
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0051 U	0.0049 U	0.0054 U	0.0052 U	0.0052 U	0.0054 U	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.002 U	0.002 U	0.0022 U	0.0021 U	0.0021 U	0.0022 U	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	0.001 U	0.00099 U	0.0011 U	0.0012	0.001 U	0.0011 U	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U	NA	NA

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

In initial RI boring SB-SE15, a detected concentration of PAHs as total HMW exceeds the ecological wildlife soil screening levels in the 2 ft bgs sample, but not in the deeper depths sampled. In WPA boring SE18-SB02 no COPCs were detected at concentrations that exceeded soil screening levels.

Initial RI boring SB-SE18 detected concentrations of COPCs did not exceed soil screening levels above 9 ft bgs, where sulfate was detected at concentration of 2,200 mg/kg that exceeds the ecological wildlife soil screening level, the deepest depth sampled. In nearby WPA boring SE18-SB01, fluoride was detected at a concentration of 183 mg/kg that exceeds the protection of groundwater screening levels at 7.5 ft bgs, the deepest depth sampled. The vertical extent of contamination for borings SB-SE18 and SE18-SB01 has not been defined. Soil borings SB-SE18 and SE18-SB01 are further addressed in SE18 Investigation Area (Section 2.2.7).

Basalt flow top was encountered at approximately 7.5 ft bgs in the western and central portions of segment C5. Based on measurements from the temporary well screen installed in SE18-SB01 during drilling the shallow groundwater in the UA was measured at 10.8 ft bgs. The concentration of fluoride in shallow groundwater beneath this segment were expected to be between 0.96 and 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC), but was detected in the SE18-SB01 grab groundwater sample at a concentration of 14.6 mg/L (SE18 Investigation Area, Section 2.2.7).

2.3.15.3 Conclusions and Recommendations

The vertical extent has not been defined at initial RI soil boring SB-SE18 and at WPA soil boring SE18-SB01. Detected concentrations of fluoride slightly exceeds the protection of groundwater soil screening levels at 7.5 ft bgs, the deepest depth sampled. Sulfate was detected at a deeper depth in SB-SE18 that exceeds the ecological wildlife soil screening level and may have been collected from below the water table and likely reflects localized area of elevated sulfate levels in shallow groundwater. Sulfate exceedance may likely be related to the previous dry/wet scrubbers and associated piping in passage no. 4.

Soil borings SB-SE18 and SE18-SB01 are further addressed in the SE18 Investigation Area (Section 2.2).

Based on COPC exceedance of soil screening levels at depths up to 7.5 ft bgs, Segment C5 is recommended for further evaluation in the FS.

2.3.16 Courtyard Segment D1

Courtyard segment D1 is at the west end of Courtyard D. The west end of segment D1 is approximately 75 ft wide and narrows to 55 ft wide in the eastern portion with an area of approximately 38,073 square feet. Calculated area in segment D1 does not include surfaces such as sloped areas. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. At the eastern end of segment D1 is a concrete underpass beneath Passage No. 1 to provide access between segments D1 and D2. At the western end of the segment D1 is the West Passage between production buildings, and beyond is the Rectifier Yard AOC.

The structures that existed in and adjacent to segment D1 (Figure 2.3.16-1) are as follows:

- Transformer substation T20A/T20B (two units on one slab, sampled in 2011 pre- RI, not included in the Rectifier Yard AOC initial RI sampling)
- Pre-RI 2010 soil boring locations (identified for initial RI sampling)
- Stormwater System line (no number) horizontal subsurface pipe and catch basins
- Impacted surface soil mapped during initial RI not observed in D1

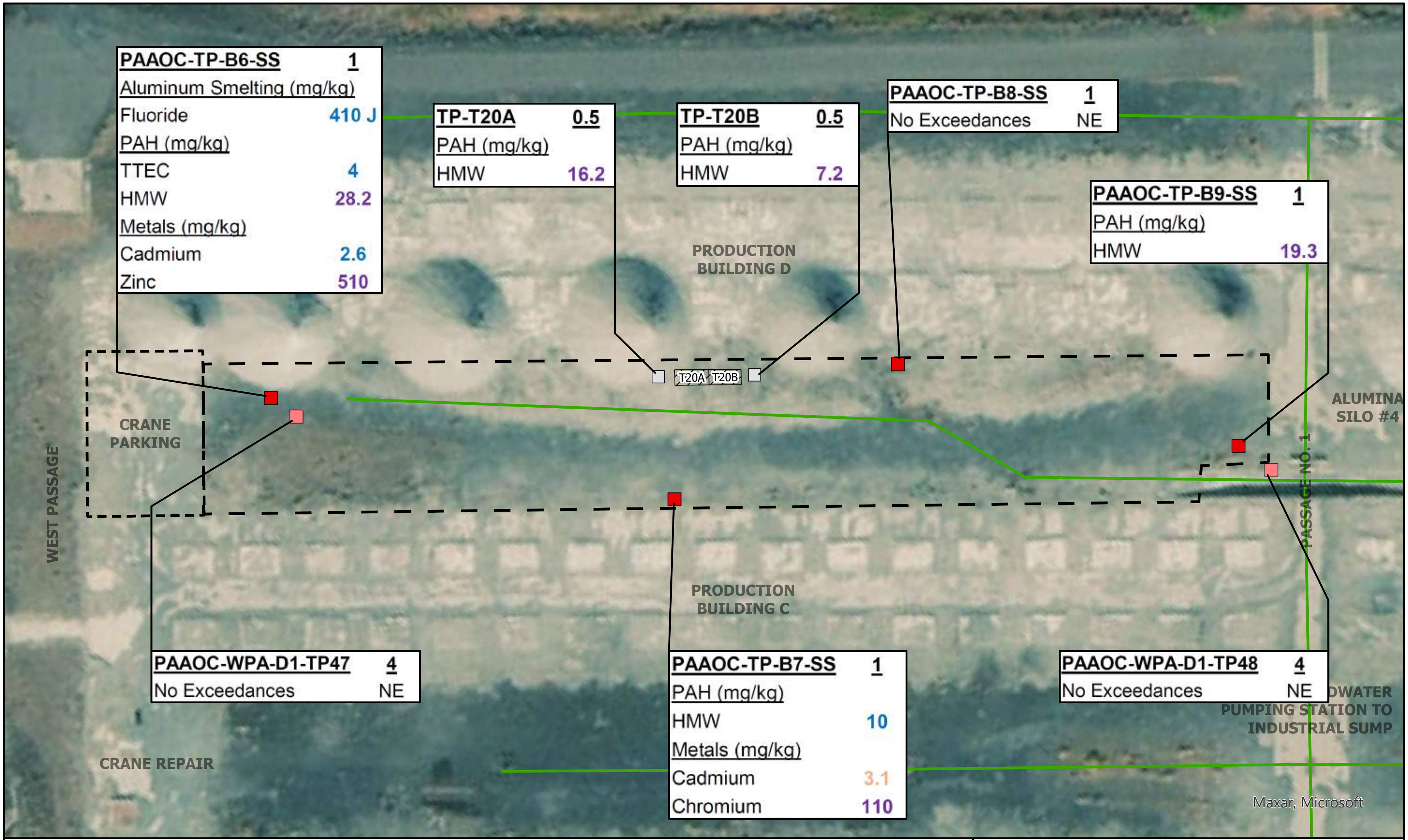
These features in and adjacent to Courtyard segment D1 were the focus of the initial RI phase of investigation. Transformer T20A/T20B was investigated during pre-RI limited investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data and confirm thickness of impacted surface soil, if present.

2.3.16.1 Investigation Scope

The initial RI phase of investigation, including pre-RI sampling, was to characterize the nature and extent of contamination associated with the structures that existed in and adjacent to segment D1 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included six test pits, four excavated at pre-RI 2010 boring locations to investigate surface soil, and two excavated during pre-RI limited investigation at transformer substation T20A/T20B. Test pit locations are shown on Figure 2.3.16-1.

Sample depths and analyses are as follows:

- Pre-RI 2010 boring locations test pit vertical composite samples 0-12 inches depth
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, and metals
- (Pre-RI) Transformer substation T20A/T20B sample 0.5 ft bgs
    - ❖ Analytes: PAHs, PCBs, TPH-Dx



┏━┓ Courtyard Segment D1
⬜ Pre-RI Test Pit
🟥 RI Test Pit
🟥 WPA Test Pit
━ Stormwater System Line
▨ Approximate Transformer Pad

Segment D1 approximate area: 38,073 sq. ft.

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife
orange: exceeds MTCA Method A
NE: No exceedance
1: Sample depth in feet bgs

Figure 2.3.16-1

Plant Area AOC

Courtyard Segment D1 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected initial RI sample test pit locations where the deepest test pit sample exceeded site soil screen levels (Tetra Tech et al. 2020b). This included two test pits excavated at initial RI 2010 boring locations to a depth of 4 ft bgs, 3 ft below the previous sample depth. WPA soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. WPA test pit locations are shown on Figure 2.3.16-1.

2.3.16.2 Investigation Results

Segment D1 soil was investigated with a combined total of eight test pits in the pre-RI, initial RI and WPA phases of investigation. The soil was described and characterized, and logs of initial RI and WPA test pits are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.16-1 (PAAOC Courtyard Segment D1 Initial RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Pre-RI analytical results have not been validated. Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in four out of six samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment D1 are compiled and presented on Figure 2.3.16-1. The vertical extent of contamination is defined at sample locations TP-B6-SS, TP-B8-SS, and TP-B9-SS with initial RI and WPA data. The vertical extent of contamination is not defined at sample locations TP-T20A/T20B and TP-B7-SS.

In initial RI test pit TP-B8-SS, no detected concentrations exceed the soil screening levels at 1 ft bgs. The vertical extent of contamination has been defined.

In initial RI test pits TP-B6-SS, TP-B7-SS, and TP-B9-SS, detected concentrations of COPCs exceed soil screening levels at 1 ft bgs. Subsequent WPA test pits D1-TP47 and D1-TP48 did not detect COPCs at concentrations that exceed soil screening levels at 4 ft bgs, and the vertical extent of contamination is defined with WPA data.

Table 2.3.16-1
PAAOC Courtyard Segment D1 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Pre-RI Analytical Results		Initial RI Analytical Results				WPA Analytical Results	
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**TP-TB20A (0.5 ft) (2/11/2011)**	**TP-T20B (0.5 ft) (2/11/2011)**	**PAAOC-TP-B6-SS (1 ft)**	**PAAOC-TP-B7-SS (1 ft)**	**PAAOC-TP-B8-SS (1 ft)**	**PAAOC-TP-B9-SS (1 ft)**	**PAAOC-WPA-D1-TP47-4**	**PAAOC-WPA-D1-TP48-4**
Aluminum Smelting														
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	0.2 U	0.18 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	NA	NA	**410 JD**	48 JD	6.6 U	80 J	27.5 J	26.5 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	NA	39	28	21 U	18 U	19.7	3.4
Polynuclear Aromatic Hydrocarbons (PAHs)														
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.089 U	0.089 U	0.14 U	0.074 U	0.0075 U	0.15 U	0.0011 JB	0.00099 JB
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.089 U	0.089 U	0.14 U	0.074 U	0.0075 U	0.15 U	0.00079 J	0.0048 J
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.089 U	0.089 U	0.14 U	0.074 U	0.0075 U	0.046	0.0055 U	0.00066 J
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.089 U	0.089 U	0.14 U	0.074 U	0.0075 U	0.03	0.0025 J	0.0082
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.096	0.089 U	0.14 U	0.084	0.0075 U	0.19	0.027	0.078
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	1.1	0.5	2.5	0.72	0.056	1.8	0.034	0.079
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	1.4	0.77	2.4	0.63	0.064	1.5	0.11	0.2
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	2.4	1.4	6.5	2.3	0.15	4.9	0.06	0.12
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	1.7	0.92	3.5	1.3	0.068	2.4	0.045	0.061
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	1.6	0.82	2.4	0.59	0.44	1.3	0.037	0.12
Chrysene	mg/kg	NA	NL	NL	NE	NL	5.1	1.1	4	1.8	0.097	3.8	0.018	0.028
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.4	0.22	0.85	0.27	0.018	0.6	0.0017 J	0.0023 J
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	1.3	0.92	2.5	1.4	0.087	2.5	0.04	0.15
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.089 U	0.089 U	0.14 U	0.074 U	0.0075 U	0.035	0.0019 J	0.0032 J
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	1.3	0.71	3.6	1.2	0.067	2.5	0.07	0.14
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.089 U	0.089 U	0.14 U	0.074 U	0.0075 U	0.15 U	0.0015 JB	0.0022 JB
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.49	0.34	0.63	0.27	0.026	0.53	0.017	0.047
Pyrene	mg/kg	NA	110,000	650	NE	NL	1.2	0.77	2.4	1.2	0.08	2.5	0.031	0.1
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	2.1	1.1	**4**	1.2	0.14	2.6	0.06	0.13
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	1.9	1.3	3.10	1.8	0.1	3.3	0.07	0.22
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**16.2**	**7.2**	**28.2**	**10**	1	**19.3**	0.4	0.9
Polychlorinated Biphenyls (PCBs)														
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.22 U	0.22 U	NA	NA	NA	NA	0.011 U	0.011 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.22 U	0.22 U	NA	NA	NA	NA	0.022 U	0.021 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.22 U	0.22 U	NA	NA	NA	NA	0.011 U	0.011 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.22 U	0.22 U	NA	NA	NA	NA	0.011 U	0.011 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.22 U	0.22 U	NA	NA	NA	NA	0.011 U	0.011 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.22 U	0.22 U	NA	NA	NA	NA	0.011 U	0.011 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.22 U	0.22 U	NA	NA	NA	NA	0.011 U	0.011 U
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	0.22	0.22	NA	NA	NA	NA	0.011	0.011
Metals														
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	NA	NA	17,000	12,000	9,900	9,200	5,870	8,420
Arsenic	mg/kg	20	87.5	2.9	7.61	132	NA	NA	11 U	11 U	11 U	11 U	1.8	3.15
Cadmium	mg/kg	2	3,500	0.69	0.81	14	NA	NA	**2.6**	**3.1**	0.57 U	0.55 U	0.113	0.349
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	NA	NA	22	**110**	7.7	6.7	4.65	13.6
Copper	mg/kg	NA	140,000	280	28.4	217	NA	NA	21	47	16	14	15.7	20
Lead	mg/kg	1,000	NE	3,000	13.1	118	NA	NA	12	12	6.5	6.6	3.3	4.63
Mercury	mg/kg	2	NE	2.1	0.04	5.5	NA	NA	0.27 U	0.28 U	0.28 U	0.27 U	0.022 U	0.018 U
Nickel	mg/kg	NA	70,000	130	24.54	980	NA	NA	35	20	8.8	18	6.16	14.7
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	NA	NA	5.4 U	5.6 U	5.7 U	5.5 U	0.14 J	0.14 J
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	NA	NA	**510**	270	56	250	56.7	147
Total Petroleum Hydrocarbons (TPHs)														
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	110 U	110 U	NA	NA	NA	NA	3.7 J	16 J
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	220 U	220 U	NA	NA	NA	NA	19 J	66 J

Notes:

B	The sample result is five times less than blank contamination and cross-contamination is suspected.
D	The reported value is from a dilution.
J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Pre-RI samples have not been data validated.

In pre-RI test pits TP-T20A and TP-T20B detected concentrations of PAH as total HMW exceed the ecological wildlife soil screening level at 0.5 ft bgs the deepest depth sampled. The vertical extent of contamination is not defined at transformer substation T20A/T20B.

In initial RI test pit TP-B7-SS PAHs as total HMW, cadmium, and chromium were detected at concentrations that exceed soil screening levels at 1 ft bgs. No additional samples were collected at this location.

Based on water levels measured as part of the Groundwater AOC investigation, the depth to the shallowest groundwater (UA aquifer) beneath D1, if present, is approximately elevation 470 ft or approximately 12 or more feet bgs. The concentration of fluoride in shallow groundwater beneath this segment is expected to be between 0.96 and 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). Fluoride was not detected in any sample in segment D1 at concentrations that exceeded soil screening levels.

2.3.16.3 Conclusions and Recommendations

The vertical extent of contamination has not been defined at pre- RI test pits TP-T20A/T20B. Detected concentrations of PAH as HMW exceeded soil screening levels at 0.5 ft bgs, the deepest depth sampled.

The vertical extent has not been defined at initial RI test pit TP-B7. Detected concentrations of PAH as HMW, cadmium, and chromium, exceeded soil screening levels at 1 ft bgs, the deepest depth sampled.

Based on COPC exceedance of soil screening levels to depths up to 1 ft bgs, Segment D1 is recommended for further evaluation in the FS.

2.3.17 Courtyard Segment D2

Courtyard segment D2 is in the central portion of Courtyard D. Segment D2 is approximately 60 ft wide and approximately 520 ft long with an area of approximately 34,459 square feet. This area does not include the combined approximate 3,116-square-foot footprints of the former Treated Alumina Silo and Alumina Silo #4 at the western end of the courtyard segment. The adjusted calculated area segment D2 is approximately 31,343 square feet. Calculated area in segment D2 does not include surfaces such as concrete foundations. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. At the eastern end of segment D2 is the concrete underpass beneath Passage No. 2 to provide access between segments D2 and D3. At the western end of segment D2 is a concrete underpass beneath Passage No. 1 to provide access between segments D1 and D2.

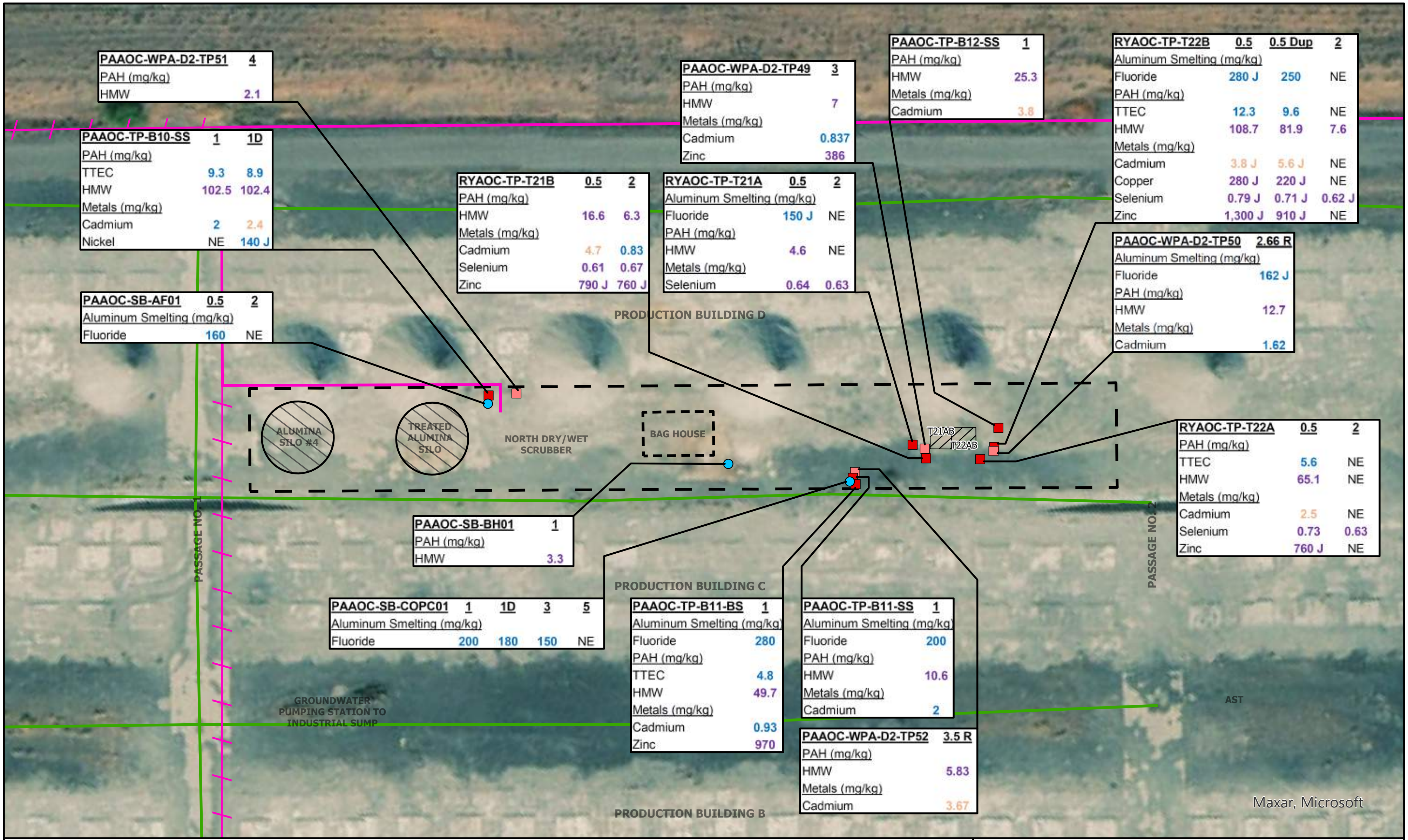
The features and/or structures existed in and adjacent to segment D2 (Figure 2.3.17-1) are as follows:

- Transformer Substations T21A/TP21B, and TP22A/T22B (each are two units on one slab, previously investigated as part of the Rectifier Yard AOC)
- Treated alumina silo and alumina silo #4 (western portion of D2)
- Former Bag House used during plant operation (central portion of D2)
- Dry/Wet Scrubber Air Pollution Control Unit (north) located in the western end of courtyard segment
- Pre-RI 2010 soil boring locations (identified for initial RI sampling)
- Stormwater line (no number) horizontal subsurface pipe and catch basins
- Impacted surface soil mapped during initial RI not observed in segment D2

These features in and adjacent to Courtyard segment D2 were the focus of the initial RI phase of investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data and to confirm the thickness of surface impacted soil, if present.

2.3.17.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment D2 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included three soil borings to investigate the treated aluminum silo, the bag house location, and one pre-RI 2010 soil boring location. Eight test pits were excavated to investigate surface soil at locations of pre-RI 2010 soil borings, two transformer substations, and impacted surface soil. RI boring and test pit locations are shown on Figure 2.3.17-1.



PAAOC-WPA-D2-TP51	4
PAH (mg/kg)	
HMW	2.1

PAAOC-TP-B10-SS	1	1D
PAH (mg/kg)		
TTEC	9.3	8.9
HMW	102.5	102.4
Metals (mg/kg)		
Cadmium	2	2.4
Nickel	NE	140 J

PAAOC-SB-AF01	0.5	2
Aluminum Smelting (mg/kg)		
Fluoride	160	NE

RYAOC-TP-T21B	0.5	2
PAH (mg/kg)		
HMW	16.6	6.3
Metals (mg/kg)		
Cadmium	4.7	0.83
Selenium	0.61	0.67
Zinc	790 J	760 J

PAAOC-WPA-D2-TP49	3
PAH (mg/kg)	
HMW	7
Metals (mg/kg)	
Cadmium	0.837
Zinc	386

RYAOC-TP-T21A	0.5	2
Aluminum Smelting (mg/kg)		
Fluoride	150 J	NE
PAH (mg/kg)		
HMW	4.6	NE
Metals (mg/kg)		
Selenium	0.64	0.63

PAAOC-TP-B12-SS	1
PAH (mg/kg)	
HMW	25.3
Metals (mg/kg)	
Cadmium	3.8

RYAOC-TP-T22B	0.5	0.5 Dup	2
Aluminum Smelting (mg/kg)			
Fluoride	280 J	250	NE
PAH (mg/kg)			
TTEC	12.3	9.6	NE
HMW	108.7	81.9	7.6
Metals (mg/kg)			
Cadmium	3.8 J	5.6 J	NE
Copper	280 J	220 J	NE
Selenium	0.79 J	0.71 J	0.62 J
Zinc	1,300 J	910 J	NE

PAAOC-WPA-D2-TP50	2.66 R
Aluminum Smelting (mg/kg)	
Fluoride	162 J
PAH (mg/kg)	
HMW	12.7
Metals (mg/kg)	
Cadmium	1.62

RYAOC-TP-T22A	0.5	2
PAH (mg/kg)		
TTEC	5.6	NE
HMW	65.1	NE
Metals (mg/kg)		
Cadmium	2.5	NE
Selenium	0.73	0.63
Zinc	760 J	NE

PAAOC-SB-BH01	1
PAH (mg/kg)	
HMW	3.3

PAAOC-SB-COPC01	1	1D	3	5
Aluminum Smelting (mg/kg)				
Fluoride	200	180	150	NE

PAAOC-TP-B11-BS	1
Aluminum Smelting (mg/kg)	
Fluoride	280
PAH (mg/kg)	
TTEC	4.8
HMW	49.7
Metals (mg/kg)	
Cadmium	0.93
Zinc	970

PAAOC-TP-B11-SS	1
Aluminum Smelting (mg/kg)	
Fluoride	200
PAH (mg/kg)	
HMW	10.6
Metals (mg/kg)	
Cadmium	2

PAAOC-WPA-D2-TP52	3.5 R
PAH (mg/kg)	
HMW	5.83
Metals (mg/kg)	
Cadmium	3.67

⌜⌝ Courtyard Segment D2
● RI Soil Boring
■ RI Test Pit
■ WPA Test Pit
— Stormwater System Line
▨ Plant Area Transformers

Plant SO2 Lines
— Existing SO2 Lines
+ Abandoned SO2 Line

Segment D2 approximate area: 31,343 sq. ft.
(34,459 sq. ft. minus combined 3,116 sq. ft. of Alumina silos)

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife
orange: exceeds MTCA Method A
NE: No exceedance
J: Estimated concentration
D: Duplicate sample
R: Refusal at bedrock
1: Sample depth in feet bgs

Figure 2.3.17-1

Plant Area AOC

Courtyard Segment D2 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Sample depths and analyses are as follows:

- Bag House (SB-BH01) sample 1 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs
- Alumina fluoride silo (SB-SF01) samples 0.5, 2 ft bgs
    - ❖ Analytes: fluoride, metals
- Pre-RI 2010 boring location (SB-COPC01) for COPC analyses samples at 1, 3, 5 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, VOCs
- Pre-RI 2010 soil boring locations test pit vertical composite samples 0-12 inches depth
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals
- Impacted surface soil (TP-B-11-BS) soil sample 1 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, metals
- Transformer substation samples 0.5, 2 ft bgs
    - ❖ Analytes: total cyanide, fluoride, PAHs, PCBs, metals, TPH-Dx

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected initial RI test pit sample locations (Tetra Tech et al. 2020b). Four test pits were excavated to depths of 4 ft bgs, or refusal, where samples were planned to be collected 2 ft below the previous sample depth. Two test pits were excavated at transformer locations T21B and T22B, and two were excavated at pre-RI 2010 boring locations TP-B11-SS and TP-B10-SS. WPA samples were analyzed for total cyanide, fluoride, sulfate, PAHs, and metals. WPA test pit locations are shown on Figure 2.3.17-1.

2.3.17.2 Investigation Results

Segment D2 soil was investigated with a combined total of three soil borings and twelve test pits in the initial RI and WPA phases of investigation. The soil was described and characterized, and logs of the borings and test pits are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.17-1 (PAAOC Courtyard Segment D2 Initial RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in

Table 2.3.17-1
PAAOC Courtyard Segment D2 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 1 of 2

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results											
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAA0C-SB-AF01-0.5	PAAOC-SB-AF01-2	PAAOC-SB-BH01-1	PAAOC-SB-COPC01-1	PAAOC-SB-COPC01-1D	PAAOC-SB-COPC01-3	PAAOC-SB-COPC01-5	PAAOC-TP-B10-SS (1 ft)	PAAOC-TP-B10-SSD (1 ft)	PAAOC-TP-B11-SS (1 ft)	PAAOC-TP-B12-SS (1 ft)	PAAOC-TP-B11-BS (1 ft)
Aluminum Smelting																		
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**160**	61	30 U	**200**	**180**	**150**	140	97	82	**200**	130	**280**
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	NA	1,800	56 UJ	76 J	10 U	10 U	180	100	23 U	59	30 U
Polynuclear Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	NA	NA	0.039 U	0.0074 U	0.015U	0.038 U	0.015 U	0.016	0.014	0.071 U	0.0097	0.15 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	NA	NA	0.039 U	0.0074 U	0.015U	0.038 U	0.015 U	0.021	0.017	0.071 U	0.01	0.15 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	NA	NA	0.039 U	0.0074 U	0.015U	0.038 U	0.015 U	0.21	0.17	0.071 U	0.084	0.15 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	NA	NA	0.039 U	0.0074 U	0.015U	0.038 U	0.015 U	0.048	0.059	0.071 U	0.026	0.15 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	NA	NA	0.039 U	0.0074 U	0.015U	0.038 U	0.015 U	0.45	0.42	0.093	0.18	0.36
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	NA	NA	0.25	0.024 J	0.041 J	0.13	0.033	8.3	8.9	0.72	2.1	3.7
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	NA	NA	0.33	0.016 J	0.032 J	0.082	0.02	4.2	3.6	0.54	1.6	2.1
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	NA	NA	0.79	0.12 J	0.2 J	0.64	0.16	25	27	3	6.2	12
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	NA	NA	0.6	0.051 J	0.14 J	0.26	0.063	6.5	6.1	1.4	2.2	5.4
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	NA	NA	0.19	0.027 J	0.048 J	0.19	0.038	5.5	5.3	0.87	1.5	3.2
Chrysene	mg/kg	NA	NL	NL	NE	NL	NA	NA	0.4	0.073 J	0.13 J	0.51	0.13	31	32	2.1	5	10
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	NA	NA	0.091	0.01	0.023	0.061	0.015 U	1.9	1.8	0.37	0.57	1.3
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	NA	NA	0.3	0.038 J	0.69 J	0.21	0.055	12	9.9	1.1	4	6.3
Fluorene	mg/kg	NL	140,000	100	NE	NL	NA	NA	0.039 U	0.0074 U	0.015U	0.038 U	0.015 U	0.11	0.11	0.071 U	0.055	0.15 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	NA	NA	0.36	0.038 J	0.1 J	0.21	0.049	7.1	6.7	1.5	2.3	5.6
Naphthalene	mg/kg	5	70	4.5	NE	NL	NA	NA	0.039 U	0.0074 U	0.015U	0.038 U	0.015 U	0.04	0.032	0.071 U	0.02	0.15 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	NA	NA	0.082	0.0074 U	0.015U	0.038 U	0.015 U	1.7	1.2	0.14	0.83	0.71
Pyrene	mg/kg	NA	110,000	650	NE	NL	NA	NA	0.29	0.039 J	0.069 J	0.21	0.057	13	11	1.2	3.8	6.4
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	NA	NA	0.5	0.05	0.1	0.2	0.05	**9.3**	**8.9**	1.2	2.9	**4.8**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	NA	NA	0.4	0.04	0.7	0.2	0.06	14.6	11.9	1.3	5	7.4
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	NA	NA	**3.3**	0.4	0.8	2.3	0.6	**102.5**	**102.4**	**10.6**	**25.3**	**49.7**
Polychlorinated Biphenyls (PCBs)																		
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	0.059 U	0.055 U	0.055 U	0.058 U	0.05 U	NA	NA	NA	NA	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	0.059 U	0.055 U	0.055 U	0.058 U	0.05 U	NA	NA	NA	NA	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	0.059 U	0.055 U	0.055 U	0.058 U	0.05 U	NA	NA	NA	NA	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	0.059 U	0.055 U	0.055 U	0.058 U	0.05 U	NA	NA	NA	NA	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	0.059 U	0.055 U	0.055 U	0.058 U	0.05 U	NA	NA	NA	NA	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	0.059 U	0.055 U	0.055 U	0.058 U	0.05 U	NA	NA	NA	NA	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	0.059 U	0.055 U	0.055 U	0.058 U	0.05 U	NA	NA	NA	NA	NA
Aroclor 1262	mg/kg	NL	NL	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1268	mg/kg	NL	NL	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	0.059	0.055	0.055	0.058	0.05	NA	NA	NA	NA	NA
Metals																		
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	11,000	7,200	9,500	6,000	6,000	5,100	3,200	17,000 J	21,000 J	21,000	24,000	9,800
Arsenic	mg/kg	20	88	2.9	7.61	132	13 U	12 U	12 U	11 U	11 U	12 U	11 U	11 U	11 U	11 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.63 U	0.59 U	0.59 U	0.55 U	0.55 U	0.58 U	0.55 U	**2**	**2.4**	**2**	**3.8**	**0.93**
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	7.1	9.4	1.9	8.6	9.4	6.9	5	37	38	36	33	30
Copper	mg/kg	NA	140,000	280	28.4	217	17	17	11	11	12	14	11	95 J	38 J	36	82	28
Lead	mg/kg	1,000	NE	3,000	13.1	118	6.3 U	7.5	5.9 U	5.5 U	5.5 U	5.8 U	5.5 U	8.7 J	24 J	19	32	7.6
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.31 U	0.3 U	0.29 U	0.28 U	0.29 U	0.29 U	0.27 U	0.29 U	0.29 U	0.26 U	0.28 U	0.28 U
Nickel	mg/kg	NA	70,000	130	24.54	980	8.4	9.8	2.9 U	7.5	7.9	6.6	4	58 J	**140 J**	19	25	54
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	13 U	12 U	12 U	11 U	11 U	12 U	11 U	5.7 U	5.7 U	5.3 U	5.5 U	5.5 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	49	43	29	36	39	44	32	280	320	260	120	**970**
Total Petroleum Hydrocarbons (TPHs)																		
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	29 U	28 U	28 U	29 U	NA	NA	NA	NA	NA	NA
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	95	55 U	56 U	61	NA	NA	NA	NA	NA	NA
Volatile Organic Compounds (VOCs)																		
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	NA	NA	0.011 U	0.0011 U	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	NA	NA	0.0056 U	0.0054 U	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	NA	NA	0.011 U	0.0011 U	NA	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	0.0022 U	0.0021 U	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	0.011 U	0.0011 U	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	NA	NA	0.011 U	0.0011 U	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	NA	NA	0.011 U	0.0011 U	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	NA	NA	0.011 U	0.0011 U	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	NA	NA	0.011 U	0.0011 U	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	NA	NA	0.011 U	0.0011 U	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

B	The sample result is five times the blank contamoination and cross-contamination is suspected.
J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
H	Chromatographic fingerprint resembles a petroleum product but elution patterns indicates more HMW constituents than calibration standard
O	Chromatographic fingerprint resembles an oil but does not match calibration standard.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.3.17-1
PAAOC Courtyard Segment D2 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 2 of 2

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results									WPA Analytical Results			
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**RYAOC-TP-T21A-0.5**	**RYAOC-TP-T21A-2**	**RYAOC-TP-T21B-0.5**	**RYAOC-TP-T21B-2**	**RYAOC-TP-T22A-0.5**	**RYAOC-TP-T22A-2**	**RYAOC-TP-T22B-0.5**	**RYAOC-TP-T22B-0.5 (Dup 0.5)**	**RYAOC-TP-T22B-2**	**PAAOC-WPA-D2-TP49-3**	**PAAOC-WPA-D2-TP50-2.66**	**PAAOC-WPA-D2-TP51-4**	**PAAOC-WPA-D2-TP52-3.5**
Aluminum Smelting																			
Cyanide	mg/kg	NA	2,200	1.9	NE	5	1.9 U	2 U	2.1 U	2 U	2 U	2 U	2.3 U	2 U	2 U	NA	NA	NA	0.2 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**150 J**	19 J	80 J	81 J	110 J	110 J	**280 J**	**250**	99 J	103 J	**162 J**	37 J	146 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	24.5	20	7.7	12.6
Polynuclear Aromatic Hydrocarbons (PAHs)																			
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0026 J	0.0011 J	0.0054 J	0.0019 J	0.0081 J	0.00059 U	0.058	0.044	0.003 J	0.0032 J	0.0034 J	0.001 J	0.001 J
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0037 J	0.0014 J	0.0054 J	0.0034 J	0.01 J	0.00042 U	0.066	0.052	0.0046 J	0.02	0.014	0.0019 JB	0.0033 JB
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.022	0.0048 J	0.074	0.018	0.087	0.0048	0.49	0.41	0.025	0.0016 J	0.0025 J	0.0004 J	0.00089 J
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0015 J	0.00049 U	0.014 J	0.0029 J	0.002 J	0.00046 U	0.069 J	0.039 J	0.0052	0.029	0.33	0.0039 J	0.01
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.021	0.0069	0.31	0.04	0.33	0.012	1	0.74	0.064	0.49	0.97	0.12	0.37
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.18	0.036	1.3	0.36	5.6	0.079	8	6.2	0.57	0.36	0.45	0.084	0.18
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.23	0.034	1	0.35	2.1	0.07	6.9	5.6	0.39	1.6	3.2	0.58	1.3
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.54	0.075	3.3	1.4	17	0.26	21	17	1.6	0.57	0.83	0.25	0.53
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.36	0.039	1.8	0.79	4	0.11	10	7.8	0.6	0.47	0.6	0.16	0.37
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.22	0.03	1.1	0.52	5.1	0.093	8 J	4.5 J	0.5	1.5	3.1	0.43	1.5
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.51	0.061	3.3	1.1	17	0.26	24	18	2	0.16	0.23	0.0065	0.14
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.061	0.0058	0.24	0.13	0.94	0.017	1.8	1.4	0.1	0.0073	0.0058	0.0019 J	0.0019 J
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.35	0.071	3.2	0.77	11	0.19	19	14	1.3	1.1	2.6	0.16	0.96
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0069	0.0025 J	0.05	0.0077	0.037	0.0023 J	0.24	0.19	0.013	0.012	0.0096	0.0021 J	0.0024 J
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.39	0.043	1.8	0.91	4.8	0.12	13	9.4	0.74	0.64	0.95	0.27	0.59
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0047	0.0044 J	0.011 J	0.0034 J	0.017 J	0.0014 J	0.11	0.075	0.007	0.0043 J	0.0044 J	0.0016 JB	1.4 JB
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.1	0.034	1	0.16	1.9	0.04	4.7	3.5	0.22	0.22	0.2	0.029	0.062
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.33	0.063	2.8	0.7	8.6	0.16	16	12	1.1	1.2	2.4	0.17	0.85
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.4	0.054	1.8	0.7	**5.6**	0.13	**12.3**	**9.6**	0.8	0.71	1.08	0.21	0.47
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.50	0.1	4.7	1	13.1	0.3	25.6	19	1.6	1.39	3.16	0.2	2.44
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**4.6**	0.4	**16.6**	**6.3**	**65.1**	1.1	**108.7**	**81.9**	**7.6**	**7**	**12.7**	**2.1**	**5.83**
Polychlorinated Biphenyls (PCBs)																			
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.0071 U	0.0069 U	0.0081 U	0.0075 U	0.0065 U	0.0077 UJ	0.008 UJ	0.0073 UJ	0.0074 UJ	0.011 U	0.011 U	0.011 U	0.012 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.004 U	0.0039 U	0.0046 U	0.0042 U	0.0037 U	0.0044 U	0.0045 U	0.0041 U	0.0042 U	0.022 U	0.021 U	0.022 U	0.023 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.0047 U	0.0046 U	0.0053 U	0.0049 U	0.0043 U	0.0051 UJ	0.0053 UJ	0.0048 UJ	0.0049 UJ	0.011 U	0.011 U	0.011 U	0.012 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.0015 U	0.0015 U	0.0017 U	0.0016 U	0.0014 U	0.0017 U	0.0017 U	0.0016 U	0.0016 U	0.011 U	0.011 U	0.011 U	0.012 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.0028 U	0.0027 U	0.0032 U	0.0029 U	0.0025 U	0.003 UJ	0.0031 UJ	0.0029 UJ	0.0029 UJ	0.011 U	0.011 U	0.011 U	0.012 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.0014 U	0.0014 U	0.0016 U	0.0015 U	0.0013 U	0.0016 UJ	0.0016 U	0.0015 UJ	0.0015 UJ	0.011 U	0.011 U	0.011 U	0.012 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.0018 U	0.0018 U	0.0021 U	0.0019 U	0.0017 U	0.002 UJ	0.002 UJ	0.0019 UJ	0.0019 UJ	0.011 U	0.011 U	0.011 U	0.012 U
Aroclor 1262	mg/kg	NL	NL	NE	NE	NE	0.00048 U	0.00047 U	0.00055 U	0.0005 U	0.00044 U	0.00052 U	0.00054 U	0.00049 U	0.0005 U	NA	NA	NA	NA
Aroclor 1268	mg/kg	NL	NL	NE	NE	NE	0.00086 U	0.00084 U	0.00098 U	0.00091 U	0.00079 U	0.00094 UJ	0.0041 J	0.0018 J	0.0016 J	NA	NA	NA	NA
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	0.00048	0.00047	0.00055	0.0005	0.00044	0.00052	0.0041	0.0018	0.0016	0.011	0.011	0.011	0.012
Metals																			
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	9,300 J	6,000 J	13,000 J	9,100 J	22,000 J	5,600 J	54,000 J	45,000 J	7,500 J	10,000	11,100	7,360	9,310
Arsenic	mg/kg	20	88	2.9	7.61	132	1.6 J	1.2 J	2.6 J	1.6 J	3.4 J	1.1 J	8.6 J	5.4 J	1.8	3.12	3.27	2.15	1.99
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.58	0.29	**4.7**	**0.83**	**2.5**	0.23	**3.8 J**	**5.6 J**	0.67 J	**0.837**	**1.62**	0.244	**3.67**
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	15 J	9 J	14 J	13 J	24 J	8.9 J	59 J	42 J	13 J	19.2 J	24.3 J	11.8 J	13.1 J
Copper	mg/kg	NA	140,000	280	28.4	217	28 J	21 J	31 J	31 J	80 J	13 J	**280 J**	**220 J**	21	30.9	34.7	17.3	22.6
Lead	mg/kg	1,000	NE	3,000	13.1	118	6.9 J	3 J	14 J	6.9 J	13 J	2.6 J	34 J	28 J	4.3 J	7.9	50.1	9.35	5.49
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.0064 U	0.0061 U	0.036	0.0059 U	0.0013 J	0.0056 U	0.057 J	0.034 J	0.006 U	0.018 U	0.021 U	0.02 U	0.023 U
Nickel	mg/kg	NA	70,000	130	24.54	980	9.5 J	5.7 J	23 J	12 J	33 J	5.3 J	88 J	67 J	10 J	18.4 J	21.8 J	12.4 J	14.6 J
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	**0.64**	**0.63**	**0.61**	**0.67**	**0.73**	**0.63**	**0.79 J**	**0.71 J**	**0.62 J**	0.2 J	0.3 J	0.1 J	0.3 J
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	120 J	59 J	**790 J**	**760 J**	**760 J**	57 J	**1,300 J**	**910 J**	99 J	**386**	186	91.2	154
Total Petroleum Hydrocarbons (TPHs)																			
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	13 J	9.5 U	33	21 J	50	25 J	150	170	16 J	40 H	55 H	6.6 J	11 J
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	56	14 J	160	5	170	130	420	950	68	210 O	320 O	22 J	72 J
Volatile Organic Compounds (VOCs)																			
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

B	The sample result is five times the blank contamoination and cross-contamination is suspected.
J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
H	Chromatographic fingerprint resembles a petroleum product but elution patterns indicates more HMW constituents than calibration standard
O	Chromatographic fingerprint resembles an oil but does not match calibration standard.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in half of samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment D2 are compiled and presented on Figure 2.3.17-1. The vertical extent of contamination is defined borings SB-AF01 and SB-COPC01 with initial RI data. The vertical extent of contamination is not defined at initial RI soil boring SB-BH01, and at four WPA test pits D2-TP49 through D2-TP52.

In initial RI boring SB-AF01, detected a low concentration of fluoride that exceeds the protection of groundwater screening levels at 0.5 ft bgs, but not in the deeper depth sampled at 2 ft bgs. In initial RI boring SB-COPC01, detected concentrations of fluoride that exceeds the protection of groundwater screening levels at 1 and 3 ft bgs, but not in the deeper depth sampled at 5 ft bgs. The vertical extent of contamination for these boring has been defined.

Initial RI boring SB-BH01 detected PAH as HMW at concentrations exceed the ecological wildlife soil screening levels at 1 ft bgs. No deeper samples were collected, and the vertical extent of contamination is not defined.

In initial RI test pits TP-T21A, TP-T21B, TP-T22A, and TP-T22B, detected concentrations of COPCs that exceed soil screening levels at 0.5 ft bgs, with PAH as total HMW, cadmium, selenium, and zinc still exceeding soil screening levels and 2 ft bgs the deepest depth sampled. Subsequent WPA test pits D2-TP49 and D2-TP50 excavated to depths of 3 and 2.66 ft bgs (shallow bedrock was encountered in this segment), respectively, COPCs including fluoride, PAH as total HMW, cadmium, and zinc still exceeded soil screening levels. The vertical extent of contamination is not defined for these two transformer substations.

In initial RI test pits TP-B10-SS, TP-B11-SS, TP-B11-BS (impacted surface soil), and TP-B12-SS, detected concentrations of COPCs exceed soil screening levels at 1 ft bgs. Subsequent WPA test pits D2-TP50, D2-TP51, and D2-TP52 excavated at these initial RI 2010 boring locations detected concentrations of COPCs including fluoride, PAH as TTEC and total HMW, and cadmium at concentrations that still exceed soil screening levels at the total depth of the test pits. The vertical extent of contamination for these locations has not been defined.

Based on water levels measured as part of the Groundwater AOC investigation, the depth to the shallowest groundwater (UA aquifer) beneath D2, if present, is approximately elevation 470 ft or approximately 12 or more feet bgs. The concentration of fluoride in shallow groundwater beneath this segment is expected to be between 0.96 and 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). The maximum concentration of fluoride detected in segment D2 is 280 J mg/kg collected at the east end of the segment at 0.5 ft bgs.

2.3.17.3 Conclusions and Recommendations

The vertical extent has not been defined at initial RI soil boring SB-BH01, WPA test pits D2-TP49 through D2-TP52 that investigated 2010 boring locations and two transformer substations. In the test pits, concentrations of PAH as HMW, cadmium, and zinc exceeded soil screening levels at the deepest depth sampled ranging from 2.66 to 4 ft bgs. The maximum concentration of fluoride detected in segment D2 is 280 J mg/kg collected at the east end of the segment at 0.5 ft bgs.

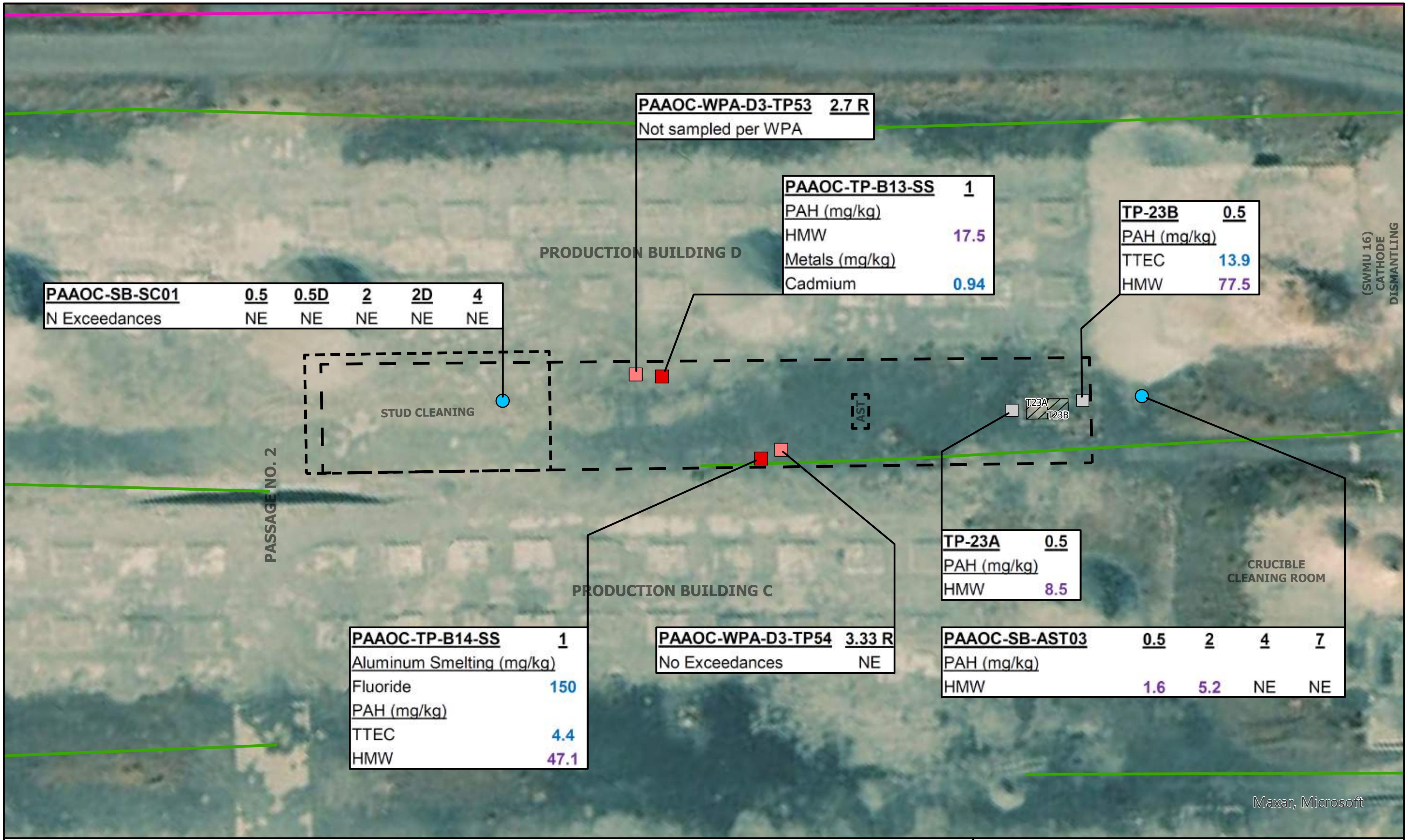
Based on COPC exceedance of soil screening levels to depths up to 4 ft bgs, Segment D2 is recommended for further evaluation in the FS.

2.3.18 Courtyard Segment D3

Courtyard segment D3 is at the east end of Courtyard D. Segment D3 is approximately 55 ft wide and approximately 370 ft long with an area of approximately 20,193 square feet. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. At the western end of segment D3 is a concrete underpass beneath Passage No. 2 to provide access between segments D2 and D3.

The features and/or structures that existed in and adjacent to segment D3 (Figure 2.3.18-1) are as follows:

- Stud cleaning repair area used during plant operation in the western portion of D3
- An AST in the eastern portion of D3



- ⌜ ⌟ Courtyard Segment D3
- ● RI Soil Boring
- 🟥 RI Test Pit
- 🟥 WPA Test Pit
- — Stormwater System Line
- ▨ Approximate Transformer Pad

Plant SO2 Lines

- — Existing SO2 Lines

Segment D3 approximate area: 20,193 sq. ft.

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife

NE: No exceedance
D: Duplicate sample
R: Refusal at bedrock
AST: Above-ground Storage Tank
1: Sample depth in feet bgs

Figure 2.3.18-1

Plant Area AOC

Courtyard Segment D3 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

- Pre-RI 2010 soil boring locations (identified for initial RI sampling)
- Transformer substation T23A/T23B in the eastern portion of D3 (two units on one slab, sampled in pre-RI limited investigations, not sampled in initial RI)
- Stormwater line (no number) horizontal subsurface pipe and catch basins
- Impacted surface soil mapped during initial RI in a small area at southwest corner of D3

These features in and adjacent to Courtyard segment D3 were the focus of the initial RI phase of investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data and to confirm the thickness of impacted surface soil.

2.3.18.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment D3 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included two soil borings and four test pits, including two test pits excavated at 2010 boring locations, and two test pits that investigated transformer substation T23A/T23B. The soil borings investigated the Stud Cleaning area and the location of a former AST. RI boring and test pit locations are shown on Figure 2.3.18-1.

Sample depths and analyses are as follows:

- Stud cleaning (SB-SC01) samples 0.5, 2, 4 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, and VOCs
- AST (SB-AST03) samples 0.5, 2, 4, 7 ft bgs
    - ❖ Analytes: PAHs, metals, TPH-Dx
- (Pre-FI) Transformer Substation T23A/T23B sample 0.5 ft bgs
    - ❖ Analytes: PAHs, PCBs, TPH-Dx
- Pre-RI 2010 boring locations (TP-B13-SS, TP-TB14-SS) test pit vertical composite samples 0-12 inches depth
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, metals

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected RI sample locations where the deepest sample exceeded site soil screen levels (Tetra Tech et al. 2020b). Two test pits were excavated at initial RI-phase 2010 boring locations that targeted 4 ft bgs, 2 ft below the previous sample depth, but met with refusal at 2.7 and 3.3 ft bgs. Test pit D3-TP53 was excavated to 2.7 ft bgs to confirm the thickness of impacted surface soil and as proposed in the WPA, no samples were collected. WPA sample analytes included total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. WPA test pit locations are shown on Figure 2.3.18-1.

2.3.18.2 Investigation Results

Segment D3 soil was investigated with a combined total of two soil borings and six test pits in the pre-RI, initial RI and WPA phases of investigation. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.18-1 (PAAOC Courtyard Segment D3 Initial RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in most samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in are compiled and presented on the following Figure 2.3.18-1. The vertical extent of contamination is defined at borings SB-SC01 and SB-AST03 with initial RI data, and at TP-B14-SS with subsequent WPS data from test pit D3-TP54. The vertical extent of contamination is not defined at test pit TP-B13-SS.

In initial RI boring SB-SC01, COPCs were not detected at concentrations that exceed screening levels to a depth of 4 ft bgs, the deepest depth sampled. In initial RI boring SB-AST03, detected concentrations of PAH as HMW exceeds the ecological wildlife soil screening level at 0.5 and 2 ft

Table 2.3.18-1
PAAOC Courtyard Segment D3 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington

		Screening Levels				Ecological Screening Levels	Pre-RI Analytical Results		Initial RI Analytical Results											WPA Analytical Results
Parameter Name	Units	MTCS Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	TP-T23A (0.5 ft) 2/11/3011	TP-T23B (0.5 ft) 2/11/2011	PAAOC-SB-AST03-0.5	PAAOC-SB-AST03-2	PAAOC-SB-AST03-4	PAAOC-SB-AST03-7	PAAOC-SB-SC01-0.5	PAAOC-SB-SC01-0.5D	PAAOC-SB-SC01-2	PAAOC-SB-SC01-2D	PAAOC-SB-SC01-4	PAAOC-TP-B13-SS (1 ft)	PAAOC-TP-B14-SS (1 ft)	PAAOC-WPA-D3-TP54-3.33
Aluminum Smelting																				
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	NA	NA	NA	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	0.05	0.05 U	0.056	0.98
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	NA	NA	NA	NA	NA	NA	41 U	21 U	7 U	13 U	17 U	95	**150**	32.9 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	NA	NA	NA	NA	NA	64 U	56 U	31 UJ	82 J	32 U	38 U	34 U	47.5
Polynuclear Aromatic Hydrocarbons (PAHs)																				
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.089 U	0.089 U	0.078 U	0.03 U	0.009 U	0.0093 U	0.0074 U	0.0074 U	0.0082 U	0.0079 U	0.009 U	0.072 U	0.15 U	0.00088 J
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.089 U	0.089 U	0.078 U	0.03 U	0.009 U	0.0093 U	0.0074 U	0.0074 U	0.0082 U	0.0079 U	0.009 U	0.072 U	0.15 U	0.0014 JB
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.089 U	0.13	0.078 U	0.03 U	0.009 U	0.0093 U	0.0074 U	0.0074 U	0.0082 U	0.0079 U	0.009 U	0.072 U	0.15 U	0.0061 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.089 U	0.089 U	0.078 U	0.03 U	0.009 U	0.0093 U	0.0074 U	0.0074 U	0.0082 U	0.0079 U	0.009 U	0.072 U	0.15 U	0.0018 J
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.11	0.73	0.078 U	0.054	0.009 U	0.0093 U	0.0074 U	0.0074 U	0.0082 U	0.0079 U	0.009 U	0.1	0.17	0.049
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.78	7.9	0.16	0.46	0.009 U	0.0093 U	0.017	0.023	0.0082 U	0.015	0.009 U	1.5	3.8	0.034
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	1.1	10	0.19	0.56	0.009 U	0.0093 U	0.019	0.025	0.0082 U	0.011	0.009 U	1.4	1.6	0.23
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	1.4	13	0.29	1	0.009 U	0.0093 U	0.028	0.036	0.0082 U	0.015	0.0091	4	15	0.067
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.95	7.7	0.17	0.59	0.009 U	0.0093 U	0.018	0.02	0.0082 U	0.0079 U	0.009 U	2.3	3.6	0.059
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.9	8.4	0.1	0.29	0.009 U	0.0093 U	0.0082	0.011	0.0082 U	0.0079 U	0.009 U	1.2	2.8	0.13
Chrysene	mg/kg	NA	NL	NL	NE	NL	1.1	11	0.2	0.72	0.009 U	0.0093 U	0.019	0.024	0.0082 U	0.01	0.009 U	2.5	10	0.019
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.23	2.1	0.078 U	0.15	0.009 U	0.0093 U	0.0074 U	0.0074 U	0.0082 U	0.0079 U	0.009 U	0.49	1.1	0.001 J
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	1.6	14	0.34	0.87	0.009 U	0.0093 U	0.034	0.047	0.0084	0.015	0.009 U	2.2	4.7	0.076
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.089 U	0.56	0.078 U	0.03 U	0.009 U	0.0093 U	0.0074 U	0.0074 U	0.0082 U	0.0079 U	0.009 U	0.072 U	0.15 U	0.001 J
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.75	6.4	0.17	0.61	0.009 U	0.0093 U	0.014	0.017	0.0082 U	0.0079 U	0.009 U	2.2	3.9	0.076
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.089 U	0.17	0.078 U	0.03 U	0.009 U	0.0093 U	0.0074 U	0.0074 U	0.0082 U	0.0079 U	0.009 U	0.072 U	0.15 U	0.001 JB
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.76	6	0.22	0.27	0.009 U	0.0093 U	0.02	0.031	0.0082 U	0.0079 U	0.009 U	0.53	0.6	0.015
Pyrene	mg/kg	NA	110,000	650	NE	NL	1.3	11	0.31	0.84	0.009 U	0.0093 U	0.028	0.038	0.0082 U	0.014	0.009 U	1.9	5.3	0.095
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	1.5	**13.9**	0.3	0.8	0.009	0.0093	0.03	0.03	0.0084	0.01	0.00091	2.4	**4.4**	0.08
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	2.5	21.6	0.6	1.2	0.009	0.0093	0.05	0.08	0.0084	0.02	0.009	2.8	5.5	0.1
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**8.5**	**77.5**	**1.6**	**5.2**	0.009	0.0093	0.2	0.2	0.0082	0.07	0.0091	**17.5**	**47.1**	0.8
Polychlorinated Biphenyls (PCBs)																				
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.22 U	0.22 U	NA	NA	NA	NA	0.056 U	0.056 U	0.061 U	0.059 U	0.068 U	NA	NA	0.013 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.22 U	0.22 U	NA	NA	NA	NA	0.056 U	0.056 U	0.061 U	0.059 U	0.068 U	NA	NA	0.025 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.22 U	0.22 U	NA	NA	NA	NA	0.056 U	0.056 U	0.061 U	0.059 U	0.068 U	NA	NA	0.013 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.22 U	0.22 U	NA	NA	NA	NA	0.056 U	0.056 U	0.061 U	0.059 U	0.068 U	NA	NA	0.013 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.22 U	0.22 U	NA	NA	NA	NA	0.056 U	0.056 U	0.061 U	0.059 U	0.068 U	NA	NA	0.013 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.22 U	0.22 U	NA	NA	NA	NA	0.056 U	0.056 U	0.061 U	0.059 U	0.068 U	NA	NA	0.013 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.22 U	0.22 U	NA	NA	NA	NA	0.056 U	0.056 U	0.061 U	0.059 U	0.068 U	NA	NA	0.013 U
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	0.22	0.22	NA	NA	NA	NA	0.056	0.056	0.061	0.059	0.068	NA	NA	0.013
Metals																				
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	NA	NA	NA	NA	9,900	NA	7,300	6,800	12,000	9,900	15,000	12,000	15,000	8,960
Arsenic	mg/kg	20	88	2.9	7.61	132	NA	NA	NA	NA	14 U	NA	11 U	11 U	12 U	11 U	14 U	11 U	11 U	1.09
Cadmium	mg/kg	2	3,500	0.69	0.81	14	NA	NA	NA	NA	0.68 U	NA	0.56 U	0.56 U	0.061 U	0.59 U	0.068 U	**0.94**	1.1	0.122
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	NA	NA	NA	NA	2.7	NA	9	9	9.5	15	10	21	38	3.32 J
Copper	mg/kg	NA	140,000	280	28.4	217	NA	NA	NA	NA	16	NA	15	15	16	14	18	31	51	17.6
Lead	mg/kg	1,000	NE	3,000	13.1	118	NA	NA	NA	NA	6.8 U	NA	5.6 U	5.6 U	6.2	7.8	6.8 U	7	9.5	3.57
Mercury	mg/kg	2	NE	2.1	0.04	5.5	NA	NA	NA	NA	0.34 U	NA	0.28 U	0.28 U	0.31 U	0.29 U	0.34 U	0.27 U	0.28 U	0.021 U
Nickel	mg/kg	NA	70,000	130	24.54	980	NA	NA	NA	NA	5.7	NA	5.3	5.3	8	7.5	8.2	24	23	6.8 J
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	NA	NA	NA	NA	14 U	NA	11 U	11 U	12 U	12 U	14 U	5.4 U	5.6 U	0.2 J
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	NA	NA	NA	NA	36	NA	56	48	53	50	64	250	330	64.6
Total Petroleum Hydrocarbons (TPHs)																				
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	220 U	450	29 U	140 U	34 U	35 U	28 U	28 U	31 U	30 U	34 U	NA	NA	3.5 J
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	110 U	110 U	59 U	770	68 U	70 U	56 U	56 U	61 U	59 U	68 U	NA	NA	11 J
Volatile Organic Compounds (VOCs)																				
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	NA	NA	NA	NA	NA	NA	0.001 U	0.00094 U	0.0012 U	0.0011 U	0.0013 U	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	NA	NA	NA	NA	NA	NA	0.0055 U	0.0047 U	0.0058 U	0.0056 U	0.0066 U	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	NA	NA	NA	NA	NA	NA	0.001 U	0.00094 U	0.0012 U	0.0011 U	0.0013 U	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	NA	NA	0.0022 U	0.0019 U	0.0023 U	0.0022 U	0.0026 U	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	NA	NA	0.001 U	0.00094 U	0.0012 U	0.0011 U	0.0013 U	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	NA	NA	NA	NA	NA	NA	0.001 U	0.00094 U	0.0012 U	0.0011 U	0.0013 U	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	NA	NA	NA	NA	NA	NA	0.001 U	0.00094 U	0.0012 U	0.0011 U	0.0013 U	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	NA	NA	NA	NA	NA	NA	0.001 U	0.00094 U	0.0012 U	0.0011 U	0.0013 U	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	NA	NA	NA	NA	NA	NA	0.001 U	0.00094 U	0.0012 U	0.0011 U	0.0013 U	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	NA	NA	NA	NA	NA	NA	0.001 U	0.00094 U	0.0012 U	0.0011 U	0.0013 U	NA	NA	NA

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.
B	The sample result is five times less than the blank contamination and cross-contamination is suspected.

Detected concentrations shown in bold exceed one or more site soil screening levels.

bgs, but not in the deeper depths sampled at 4 and 7 ft bgs. The vertical extent of contamination for these borings has been defined.

In initial RI test pits TP-B13-SS and TB14-SS, COPCs including fluoride, PAH as TTEC and HMW, and cadmium that were detected at concentrations that exceed soil screening levels at 1 ft bgs. Subsequent WPA test pit D3-TP54 investigated TP-B14-SS and did not detect COPCs at concentrations that exceed soil screening levels to a depth of 4 ft bgs. No WPA samples were collected at deeper depths for test pit TP-B13-SS and the vertical extent of contamination has not been defined.

Bedrock was likely encountered in segment D3 at shallow depths as seen in refusal in WPA test pits. Based on water levels measured as part of the Groundwater AOC investigation, the depth to the shallowest groundwater (UA aquifer) beneath D3, if present, is approximately elevation 470 ft or approximately 12 or more feet bgs. The concentration of fluoride in shallow groundwater beneath this segment is expected to be between 0.96 and 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). The highest concentration of fluoride detected in segment D3 is 150 mg/kg collected at a depth of 1 ft bgs in the central portion of the segment.

2.3.18.3 Conclusions and Recommendations

The vertical extent of contamination has not been defined at initial RI test pit TP-B13. Detected concentrations of PAH as HMW and cadmium exceeded soil screening levels at 1 ft bgs, the deepest depth sampled. The highest concentration of fluoride detected in segment D3 is 150 mg/kg collected at a depth of 1 ft bgs in the central portion of the segment.

Based on COPC exceedance of soil screening levels to depths up to 1 ft bgs, Segment D3 is recommended for further evaluation in the FS.

2.3.19 Courtyard Segment E1

Courtyard segment E1 is at the west end of Courtyard E. Segment E1 is approximately 45 ft wide and approximately 610 ft long with an area of approximately 14,790 square feet. Calculated area in segment E1 does not include surfaces such as sloped areas. The ground surface is mainly unpaved exposed soil. At the eastern end of segment E1 is a concrete underpass beneath Passage No. 1 to provide access between segments E1 and E2. At the western end of the segment E1 is the West Passage and beyond is the edge of the Rectifier Yard AOC.

The features and/or structures existed in and adjacent to segment E1 (Figure 2.3.19-1) are as follows:

- Pre-RI 2010 boring locations (identified for initial RI sampling)
- Impacted soil mapped in mapped during the initial RI but not observed in E1
- Stormwater line (no number) horizontal subsurface pipe and catch basins

These features in and adjacent to Courtyard segment E1 were the focus of the initial RI phase of investigation. The focus of the WPA phase was to define the vertical extent of contamination and confirm the presence and thickness of surface impacted soil, if present.

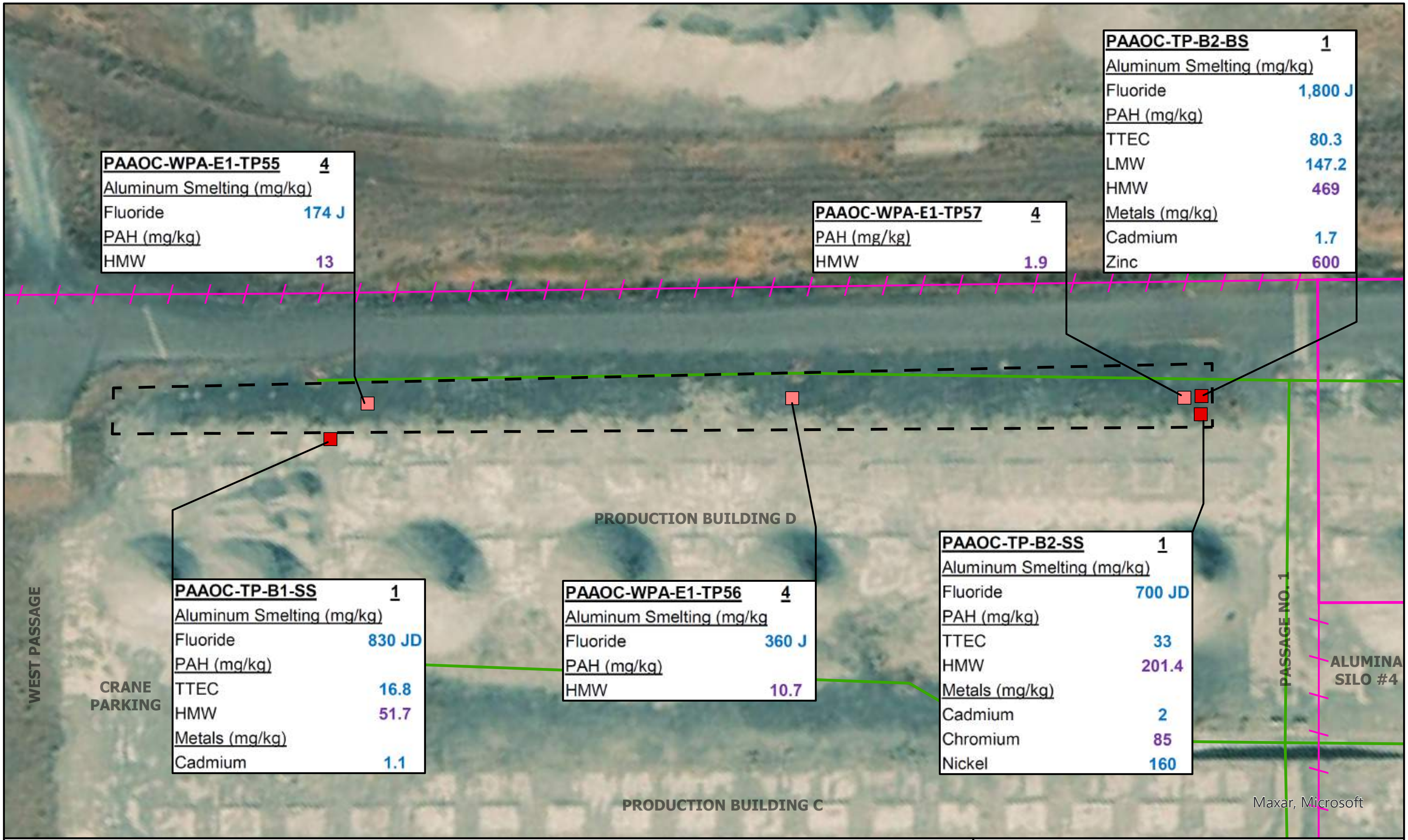
2.3.19.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment E1 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included two test pits excavated at 2010 soil boring locations, and one test pit excavated to sample impacted surface soil. Initial RI test pit locations are shown on Figure 2.3.19-1.

Sample depths and analyses are as follows:

- Pre-RI 2010 soil boring locations test pit vertical composite samples 0-12 inches depth
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, and metals
- Surface impacted soil sample 1 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, and metals

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected RI sample stations where the deepest test pit sample exceeded site soil screening levels (Tetra Tech et al. 2020b). This included three test pits, two that were excavated at initial RI-2010 boring locations, and a third excavated in the center of the segment that was not previously sampled. The test pits were excavated to a depth of 4 ft bgs, 3 ft below the previous sample. The WPA samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. WPA test pit locations are shown on Figure 2.3.19-1.



PAAOC-WPA-E1-TP55	4
Aluminum Smelting (mg/kg)	
Fluoride	174 J
PAH (mg/kg)	
HMW	13

PAAOC-WPA-E1-TP57	4
PAH (mg/kg)	
HMW	1.9

PAAOC-TP-B2-BS	1
Aluminum Smelting (mg/kg)	
Fluoride	1,800 J
PAH (mg/kg)	
TTEC	80.3
LMW	147.2
HMW	469
Metals (mg/kg)	
Cadmium	1.7
Zinc	600

PAAOC-TP-B1-SS	1
Aluminum Smelting (mg/kg)	
Fluoride	830 JD
PAH (mg/kg)	
TTEC	16.8
HMW	51.7
Metals (mg/kg)	
Cadmium	1.1

PAAOC-WPA-E1-TP56	4
Aluminum Smelting (mg/kg	
Fluoride	360 J
PAH (mg/kg)	
HMW	10.7

PAAOC-TP-B2-SS	1
Aluminum Smelting (mg/kg)	
Fluoride	700 JD
PAH (mg/kg)	
TTEC	33
HMW	201.4
Metals (mg/kg)	
Cadmium	2
Chromium	85
Nickel	160

Courtyard Segment E1
🟥 RI Test Pit
🟥 WPA Test Pit
Stormwater System Line

Plant SO2 Lines

Existing SO2 Lines
Abandoned SO2 Line

Segment E1 approximate area: 14,790 sq. ft.

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife
NE: No exceedance
J: Estimated concentration
D: Result from a dilution, with analytical result
1: Sample result in feet bgs

N E S W

0 25 50 100
Feet

Figure 2.3.19-1

Plant Area AOC

Courtyard Segment E1 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

2.3.19.2 Investigation Results

Segment E1 soil was investigated with a combined total of six test pits in the initial RI and WPA phases of investigation. The soil was described and characterized, and logs of test pits are included in Volume 5, Appendix G-1. Soil analytical results are summarized in Table 2.3.19-1 (PAAOC Courtyard Segment E1 Initial RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in half of samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment E1 are compiled and presented on the following Figure 2.3.19-1. The vertical extent of contamination is not defined at all sample stations E1-TP55, E1-TP56, and E1-TP57.

In initial RI test pits TP-B1-SS, TP-B2-SS, and TP-B2-BS, COPCs including fluoride, PAH as TTEC and total LMW and HMW, cadmium, chromium and zinc were detected at concentrations that exceed soil screening levels at 1 ft bgs. Subsequent WPA test pits E1-TP55, and E1-TP57 detected concentrations of fluoride and PAH as HMW that still exceeds soil screening levels to 4 ft bgs the deepest depth sampled. The vertical extent of contamination has not been defined with WPA data.

WPA test pit E1-TP56 was excavated in the center of the segment that was not previously sampled. Fluoride and PAH as HMW were detected at concentrations that exceed soil screening levels at 4 ft bgs the deepest depth sampled at this location.

Based on water levels measured as part of the Groundwater AOC investigation, the depth to the shallowest groundwater (UA aquifer) beneath E1, if present, is approximately elevation 470 ft or approximately 12 or more feet bgs. The concentration of fluoride in shallow groundwater beneath

Table 2.3.19-1
PAAOC Courtyard Segment E1 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results			WPA Analytical Results		
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-TP-B1-SS (1 ft)	PAAOC-TP-B2-SS (1 ft)	PAAOC-TP-B2-BS (1 ft)	PAAOC-WPA-E1-TP55-4	PAAOC-WPA-E1-T56-4	PAAOC-WPA-E1-T57-4
Aluminum Smelting												
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.3	0.11	0.05 U	0.2 U	0.2 U	0.19 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**830 JD**	**700 JD**	**1,800 J**	**174 J**	**360 J**	36.6 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	21	16	11 U	198	26.5	4.2
Polynuclear Aromatic Hydrocarbons (PAHs)												
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.016	0.37 U	0.29 U	0.0036 J	0.0071	0.00065 J
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.011	0.37 U	0.29 U	0.064	0.048	0.0044 J
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.21	0.8	2.7	0.0067	0.003 J	0.00078 J
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.059	0.37 U	0.44	0.26	0.2	0.021
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.59	3	11	1.8	1.1	0.21
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	5.5	21	53	1.7	1.1	0.24
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	5.7	23	57	2.5	2.2	0.35
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	10	37	88	1.2	0.88	0.18
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	5.2	20	42	0.86	0.68	0.12
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	3.1	11	26	1.7	1.5	0.23
Chrysene	mg/kg	NA	NL	NL	NE	NL	6.5	25	57	0.36	0.29	0.051
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	1.4	5.4	12	0.015	0.016	0.0011 J
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	9.9	40	98	3.7	2.1	0.38
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.17	0.68	2.1	0.048	0.04	0.0033 J
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	5.6	23	48	1.7	1.3	0.24
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.022	0.37 U	0.29 U	0.0063	0.014	0.0013 J
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	3	13	33	0.88	0.74	0.074
Pyrene	mg/kg	NA	110,000	650	NE	NL	8.70	36	86	2.5	1.6	0.3
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**16.8**	**33**	**80.3**	2.44	1.67	0.34
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	14	57.5	**147.2**	4.97	3.15	0.49
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**51.7**	**201.4**	**469**	**13**	**10.7**	**1.9**
Polychlorinated Biphenyls (PCBs)												
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	0.011 U	0.012 U	0.011 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	0.021 U	0.023 U	0.021 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	0.011 U	0.012 U	0.011 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	0.011 U	0.012 U	0.011 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	0.011 U	0.012 U	0.011 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	NA	0.011 U	0.012 U	0.011 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	NA	0.011 U	0.012 U	0.011 U
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	NA	0.011	0.012	0.011
Metals												
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	16,000	14,000	12,000	8,120	8,020	6,050
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	11 U	3.13	2.5	4.16
Cadmium	mg/kg	2	3,500	0.69	0.81	14	**1.1**	**2**	**1.7**	0.353	0.357	0.165
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	20	**85**	13	13.1	14.3	12.6
Copper	mg/kg	NA	140,000	280	28.4	217	21	34	30	15.6	18.7	16.6
Lead	mg/kg	1,000	NE	3,000	13.1	118	8.3	16	5.7	4.96	4.2	4.16
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.28 U	0.27 U	0.021 U	0.021 U	0.003 J
Nickel	mg/kg	NA	70,000	130	24.54	980	24	**160**	140	12	21.8	12.6
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	5.6 U	5.5 U	5.5 U	0.15 J	0.27 J	0.13 J
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	170	350	**600**	96.1	89.4	65.8
Total Petroleum Hydrocarbons (TPHs)												
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	41 H	46 H	14 J
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	110 O	150 O	31 J

Notes:

D	The reported value is from a dilution.	O	Chromatograph fingerprint of sample resembles an oil but does not match the calibration standard.
H	Chromatograph fingerprint of sample resembles petroleum product but elution pattern indicates more HMW constituents than calibration standard.	U	Chemical was not detected. The associated value represents the method detection limit.
J	Estimated concentration.		
NA	Not applicable or not analyzed.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
NE	Not established.	LMW PAH	Low molecular weight PAH.
NL	Not listed or not shown for this chemical but detected concentration	HMW PAH	High molecular weight PAH.
NL	accounted for by the summation process.		

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

this segment is expected to be between 0.96 and 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). The maximum concentration of fluoride detected in segment E1 is 1,800 J mg/kg in a sample collected at 1 ft bgs at the eastern end of the segment and associated with impacted surface soil.

2.3.19.3 Conclusions and Recommendations

The vertical extent of contamination has not been defined in segment E1 to 4 ft bgs, the deepest depth sampled. The maximum concentration of fluoride detected in segment E1 is 1,800 J mg/kg in a sample collected at 1 ft bgs at the eastern end of the segment and associated with impacted surface soil.

Based on COPC exceedance of soil screening levels to depths up to 4 ft bgs, Segment E1 is recommended for further evaluation in the FS.

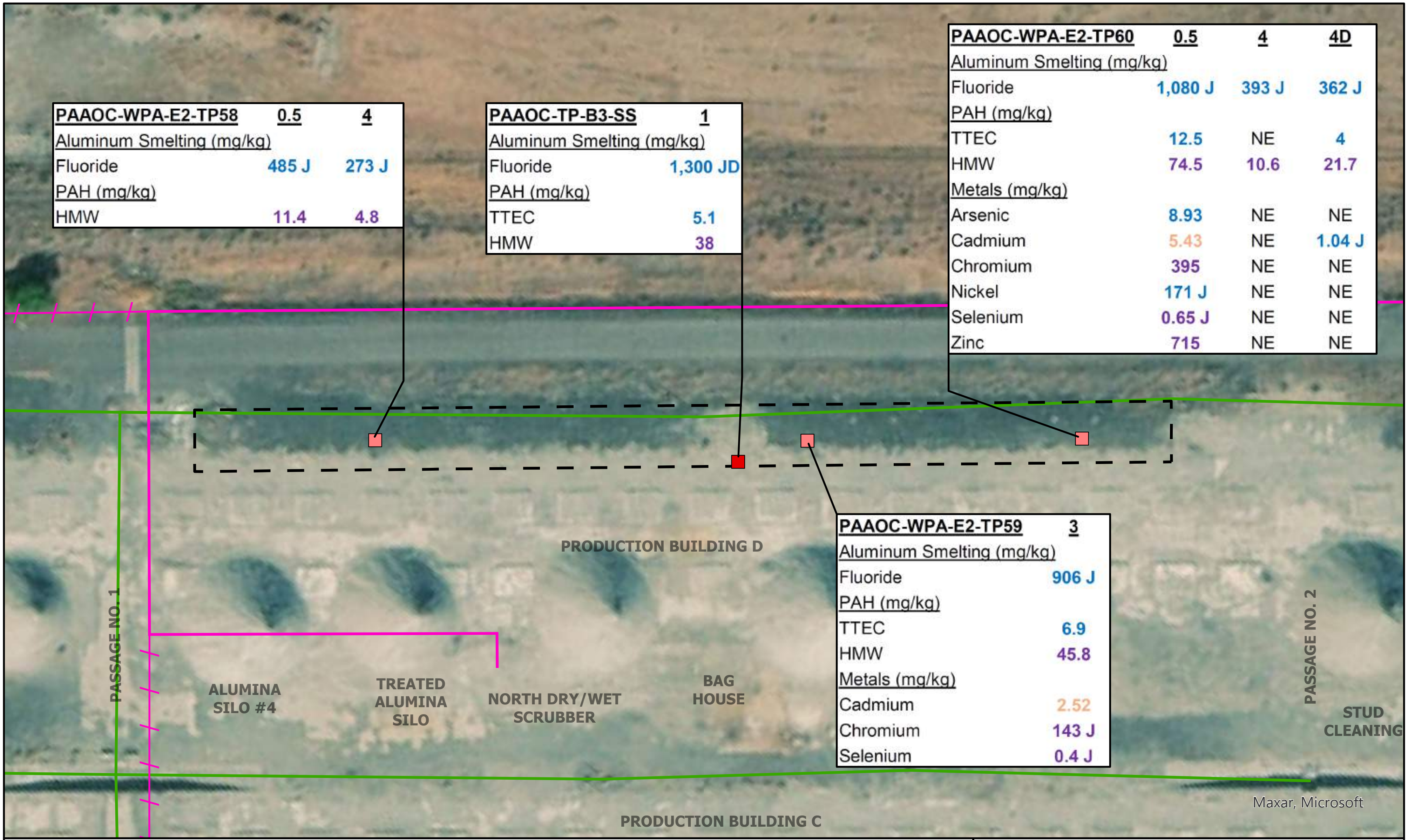
2.3.20 Courtyard Segment E2

Courtyard segment E2 is in the central portion of Courtyard E. Segment E2 is approximately 50 ft wide and approximately 620 ft long with an area of approximately 14,653 square feet. Calculated area in segment E2 does not include surfaces such as concrete foundations. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. At the eastern end of segment E2 is the concrete underpass beneath Passage No. 2 to provide access between segments E2 and E3. At the western end of segment E2 is a concrete underpass beneath Passage No. 1 to provide access between segments E1 and E2.

The features and/or structures existed in and adjacent to segment E2 (Figure 2.3.20-1) are as follows:

- Pre-RI 2010 boring location (identified for initial RI sampling)
- Stormwater line (not numbered) horizontal subsurface pipe and catch basins
- Impacted surface soil mapped during the initial RI

These features in and adjacent to Courtyard segment E2 were the focus of the initial RI phase of investigation. The focus of the WPA phase was to investigate vertical extent of contamination where not defined by initial RI data and to confirm the thickness of impacted surface soil.



PAAOC-WPA-E2-TP58	0.5	4
Aluminum Smelting (mg/kg)		
Fluoride	485 J	273 J
PAH (mg/kg)		
HMW	11.4	4.8

PAAOC-TP-B3-SS	1
Aluminum Smelting (mg/kg)	
Fluoride	1,300 JD
PAH (mg/kg)	
TTEC	5.1
HMW	38

PAAOC-WPA-E2-TP60	0.5	4	4D
Aluminum Smelting (mg/kg)			
Fluoride	1,080 J	393 J	362 J
PAH (mg/kg)			
TTEC	12.5	NE	4
HMW	74.5	10.6	21.7
Metals (mg/kg)			
Arsenic	8.93	NE	NE
Cadmium	5.43	NE	1.04 J
Chromium	395	NE	NE
Nickel	171 J	NE	NE
Selenium	0.65 J	NE	NE
Zinc	715	NE	NE

PAAOC-WPA-E2-TP59	3
Aluminum Smelting (mg/kg)	
Fluoride	906 J
PAH (mg/kg)	
TTEC	6.9
HMW	45.8
Metals (mg/kg)	
Cadmium	2.52
Chromium	143 J
Selenium	0.4 J

Courtyard Segment E2
🟥 RI Test Pit
🟥 WPA Test Pit
Stormwater System Line

Plant SO2 Lines
Existing SO2 Lines
Abandoned SO2 Line

Segment E2 approximate area: 14,653 sq. ft.
Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife
orange: exceeds MTCA Method A
NE: No exceedance
J: Estimated concentration
D: Result from a dilution, with analytical result
4D: Duplicate sample
1: Sample depth in feet bgs

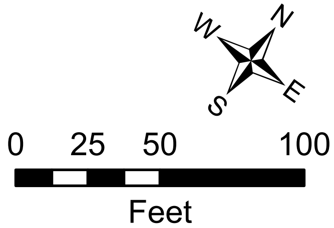


Figure 2.3.20-1

Plant Area AOC

Courtyard Segment E2 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

2.3.20.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment E2 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included one test pit to investigate One Pre-RI 2010 boring location. RI test pit locations are shown on Figure 2.3.20-1. Sample depths and analyses are as follows:

- Pre-RI 2010 boring location test pit vertical composite sample 0-12 inches
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, and metals

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected RI test pit sample location and to excavate additional test pit locations that were not previously sampled to better soil contamination in segment E2 (Tetra Tech et al. 2020b). This included three test pits excavated to a planned depth of 4 ft bgs, 3 ft below the previous sample depth. The WPA samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. WPA test pit locations are shown on Figure 2.3.20-1.

2.3.20.2 Investigation Results

Segment E2 soil was investigated with a combined total of four test pits in the initial RI and WPA phases of investigation. The soil was described and characterized, and logs of the test pits are included in Volume 5, Appendix G-1 and G-2. Soil analytical results are summarized in Table 2.3.20-1 (PAAOC Courtyard Segment E2 Initial RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in one out of seven samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment E2 are compiled and presented on the following Figure 2.3.20-1. The vertical extent of contamination is not defined at all sample locations E2-TP58, E2-TP59, and E2-TP60.

Table 2.3.20-1
PAAOC Courtyard Segment E2 Initial RI and WPA Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results	WPA Analytical Results					
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-TP-B3-SS (1 ft)	PAAOC-WP-E2-TP58-0.5	PAAOC-WP-E2-TP58-4	PAAOC-WPA-E2-TP59-3	PAAOC-WPA-E2-TP60-0.5	PAAOC-WPA-E2-TP60-4	PAAOC-WPA-E2-TP60-4D
Aluminum Smelting													
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.2 U	0.2 U	0.18 U	0.18 U	0.23 U	0.23 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**1,300 JD**	**485 J**	**273 J**	**906 J**	**1,080 J**	**393 J**	**362 J**
Sulfate	mg/kg	NA	NE	2,150	NE	NE	19	14	83.7	26.2	20	25.9	21.7
Polynuclear Aromatic Hydrocarbons (PAHs)													
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.007 U	0.0014 JB	0.0012 JB	0.0089 JB	0.0049 J	0.0023 J	0.0048 J
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.007 U	0.025	0.011	0.16	0.17	0.027	0.078
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.052	0.0051 J	0.0034 J	0.033	0.016 J	0.0023 J	0.004 J
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.034	0.1	0.03	0.51	0.8	0.13	0.37
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.19	1.1	0.44	4.6	8.6	1.3 J	2.7 J
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	2.9	1.3	0.5	4.6	8.6	1.4	2.9 J
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	2.9	2.2	0.99	8.6	15	1.8 J	3.8 J
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	11	1.1	0.5	4.2	5.7	0.88 J	1.6 J
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	3.6	0.74	0.36	3	4.4	0.66 J	1.2 J
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	2.9	1.5	0.49	6.4	9.4	1.3 J	2.8 J
Chrysene	mg/kg	NA	NL	NL	NE	NL	5.9	0.28	0.13	1.1	1.7	0.25 J	0.48 J
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.96	0.0057	0.0046 J	0.054	0.038	0.0055 J	0.018 J
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	4.3	1.7	0.77	8.3	15	2 J	5.3 J
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.05	0.017	0.0086	0.14	0.12	0.019 J	0.06 J
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	3.9	1.3	0.59	5	8.1	1.2	2.2 J
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.012	0.0032 J	0.0025 J	0.017 J	0.01 J	0.0045 J	0.0089
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	1.1	0.46	0.25	2.9	2.8	0.43 J	1.2 J
Pyrene	mg/kg	NA	110,000	650	NE	NL	3.9	1.9	0.78	8.3	13	1.8 J	4 J
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**5.1**	1.9	0.8	**6.9**	**12.5**	1.9	**4**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	5.7	2.3	1.1	12.1	18.9	2.6	7
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**38**	**11.4**	**4.8**	**45.8**	**74.5**	**10.6**	**21.7**
Polychlorinated Biphenyls (PCBs)													
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	0.011 U	0.011 Ui	0.052 U	0.1 U	0.013 U	0.013 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	0.022 U	0.022 U	0.11 U	0.2 U	0.026 U	0.025 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	0.011 U	0.011 Ui	0.052 U	0.1 U	0.013 U	0.013 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	0.011 U	0.011 Ui	0.052 U	0.1 U	0.013 U	0.013 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	0.011 U	0.012 Ui	0.052 U	0.1 U	0.013 U	0.013 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	0.011 U	0.016 Ui	0.052 U	0.1 U	0.013 U	0.013 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	0.011 U	0.011 U	0.052 U	0.1 U	0.013 U	0.013 U
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	NA	0.011	0.011	0.052	0.1	0.013	0.013
Metals													
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	9,100	9,220	9,910	8,850	11,700	15,200 J	12,200 J
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	2.96	3.19	4.71	**8.93**	2.13	1.89
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.53 U	0.655	0.402	**2.52**	**5.43**	0.581 J	**1.04 J**
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	7.8	32.8 J	25.8 J	**143 J**	**395**	37.2	42
Copper	mg/kg	NA	140,000	280	28.4	217	27	23.9	21	34.1	85.3	30.6 J	23.2 J
Lead	mg/kg	1,000	NE	3,000	13.1	118	7.3	5.29	5.03	6.43	10.4	5.15	5.25
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.26 U	0.021 U	0.02 U	0.02 U	0.02 U	0.023 U	0.025 U
Nickel	mg/kg	NA	70,000	130	24.54	980	56	21.3 J	15.6 J	287 J	**171 J**	20 J	23.1 J
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	5.3 U	0.2 J	0.2 J	**0.4 J**	**0.65 J**	0.3 J	0.2 J
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	160	176	107	293	**715**	128	119
Total Petroleum Hydrocarbons (TPHs)													
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	45 H	31 Y	110 H	510 H	55 H	49 H
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	150 O	55 J	350 O	1,200 O	140 O	150 O

Notes:

D	The reported value is from a dilution,
J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more soil screening levels.

B	The sample result is five times less than blank contamination and cross-contamination is suspected.

In initial RI test pit TP-B3-SS, that investigated a pre-RI 2010 soil boring location, detected concentrations of fluoride, PAH as TTEC and HMW that exceed soil screening levels at 1 ft bgs. Subsequent WPA test pit E2-TP59 detected concentrations of fluoride, PAH as TTEC and HMW, cadmium, chromium, and selenium that exceeds soil screening levels to 3 ft bgs, the deepest depth sampled.

WPA test pits E3-TP58 and E2-TP60, were excavated in the western and eastern portions of the segment, respectively. The test pits were excavated to depths of 4 ft bgs with samples collected at 0.5 and 4 ft bgs. Fluoride, PAH as TTEC and total HMW, arsenic, cadmium, chromium, nickel, selenium, and zinc were detected at concentrations that exceed soil screening levels at 0.5 ft bgs, with fluoride, PAH as TTEC and total HMW, and cadmium detected at concentrations that still exceed soil screening levels at 4 ft bgs.

Based on water levels measured as part of the Groundwater AOC investigation, the depth to the shallowest groundwater (UA aquifer) beneath E2, if present, is approximately elevation 470 ft or approximately 12 or more feet bgs. The concentration of fluoride in shallow groundwater beneath this segment is expected to be between 0.96 and 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). The maximum concentration of fluoride detected in segment E2 is 1,300 JD mg/kg in the central portion of the segment in a sample collected at 1 ft bgs.

2.3.20.3 Conclusions and Recommendations

The vertical extent has not been defined at all WPA test pits E2-TP58, E2-TP59, and E2-TP60 to a depth of 4 ft bgs. The maximum concentration of fluoride detected in segment E2 is 1,300 JD mg/kg in the central portion of the segment in a sample collected at 1 ft bgs.

Based on COPC exceedance of soil screening levels to depths up to 4 ft bgs, Segment E2 is recommended for further evaluation in the FS.

2.3.21 Courtyard Segment E3

Courtyard segment E3 is at the east end of Courtyard E. The west end of segment E3 is approximately 30 ft wide and approximately 555 ft long with an area of approximately 11,180 square feet. Its size is irregular due to the shape of the eastern margin of the previous SPL Handling Containment Building (SWMU 16). Calculated area in segment E3 does not include surfaces such as sloped areas. The ground surface is mainly unpaved exposed soil with a narrow, weathered asphalt access road. At the western end of segment E3 is a concrete underpass beneath Passage No. 2 to provide access between segments E2 and E3.

The features and/or structures that existed in and adjacent to segment E3 (Figure 2.3.21-1) are as follows:

- Former Bag House used during plant operation (eastern portion of E3)
- Pre-RI 2010 boring locations (identified for initial RI sampling)
- Stormwater line (not numbered) horizontal subsurface pipe and catch basins
- Impacted surface soil mapped during the initial RI not observed in E3

These features in and adjacent to Courtyard segment E3 were the focus of the initial RI phases of investigation. The focus of the WPA phase was to define the vertical extent of contamination and confirm the presence and thickness of surface impacted soil, if present.

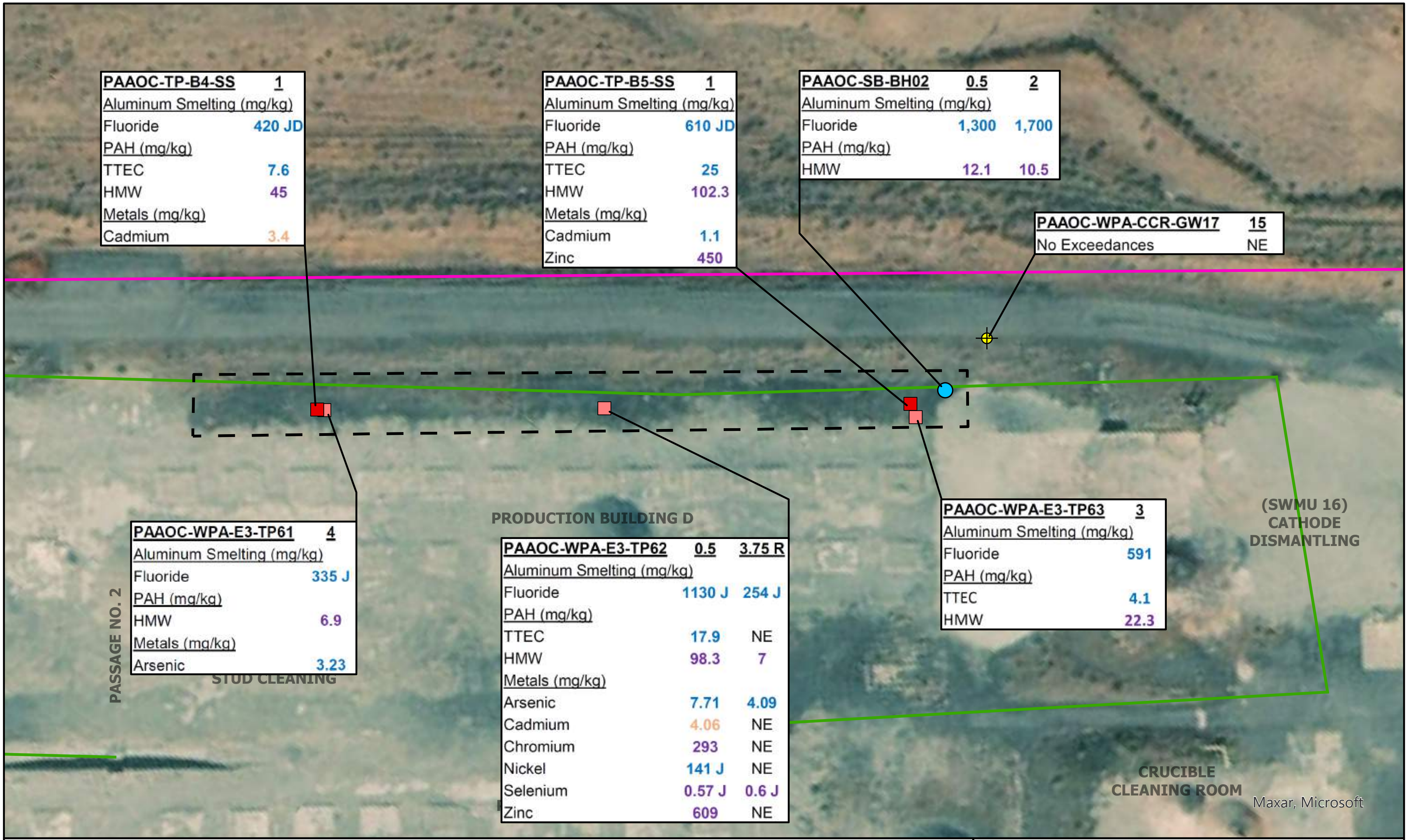
2.3.21.1 Investigation Scope

The initial RI phase of investigation was to characterize the nature and extent of contamination associated with the features and structures that existed in and adjacent to segment E3 [Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. This included one soil boring and two test pits. The soil borings investigated the Bag House and the two test pits investigated pre-RI 2010 soil boring locations. RI boring and test pit locations are shown on Figure 2.3.21-1.

Sample depths and analyses are as follows:

- Bag House samples 0.5, 2 ft bgs
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, metals, and PCBs, TPH-Dx, VOCs
- Pre-RI 2010 soil boring locations test pits vertical composite samples 0-12 inches
    - ❖ Analytes: total cyanide, fluoride, sulfate, PAHs, metals

The WPA phase of investigation was primarily to define the vertical extent of contamination at selected RI sample stations where the deepest sample exceeded site soil screen levels (Tetra Tech et al. 2020b). This included two test pits excavated at initial RI 2010 boring locations to a depth of



PAAOC-TP-B4-SS	1
Aluminum Smelting (mg/kg)	
Fluoride	420 JD
PAH (mg/kg)	
TTEC	7.6
HMW	45
Metals (mg/kg)	
Cadmium	3.4

PAAOC-TP-B5-SS	1
Aluminum Smelting (mg/kg)	
Fluoride	610 JD
PAH (mg/kg)	
TTEC	25
HMW	102.3
Metals (mg/kg)	
Cadmium	1.1
Zinc	450

PAAOC-SB-BH02	0.5	2
Aluminum Smelting (mg/kg)		
Fluoride	1,300	1,700
PAH (mg/kg)		
HMW	12.1	10.5

PAAOC-WPA-CCR-GW17	15
No Exceedances	NE

PAAOC-WPA-E3-TP61	4
Aluminum Smelting (mg/kg)	
Fluoride	335 J
PAH (mg/kg)	
HMW	6.9
Metals (mg/kg)	
Arsenic	3.23

PAAOC-WPA-E3-TP62	0.5	3.75 R
Aluminum Smelting (mg/kg)		
Fluoride	1130 J	254 J
PAH (mg/kg)		
TTEC	17.9	NE
HMW	98.3	7
Metals (mg/kg)		
Arsenic	7.71	4.09
Cadmium	4.06	NE
Chromium	293	NE
Nickel	141 J	NE
Selenium	0.57 J	0.6 J
Zinc	609	NE

PAAOC-WPA-E3-TP63	3
Aluminum Smelting (mg/kg)	
Fluoride	591
PAH (mg/kg)	
TTEC	4.1
HMW	22.3

⌐¬ Courtyard Segment E3
● RI Boring
🟥 RI Test Pit
⊕ WPA Monitor Well
🟥 WPA Test Pit
— Stormwater System Line

Plant SO2 Lines
— Existing SO2 Lines

Segment E3 approximate area: 11,180 sq. ft.

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds ecological wildlife
orange: exceeds MTCA Method A
NE: No exceedance
J: Estimated concentration
D: Result from a dilution, with analytical result
R: Refusal at bedrock
1: Sample depth in feet bgs

W N E S
0 25 50 100
Feet

Figure 2.3.21-1

Plant Area AOC

Courtyard Segment E3 Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

4 ft bgs, 2 ft below the previous sample depth, and one test pit in the central portion of the segment that had not been previously sampled that was excavated to refusal at 3.75 ft bgs. A shallow groundwater monitoring well that was part of the Crucible Cleaning Room Investigation Area was installed near the soil boring SB-BH02 to evaluate the potential impact of fluoride detected in soil at depth in SB-BH02 on shallow groundwater (Section 2.2.1). The WPA samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx, except for CCR-GW17 soil samples which were analyzed for total cyanide, fluoride, PAHs, and TPH-Dx. WPA boring and test pit locations are shown on Figure 2.3.21-1.

2.3.21.2 Investigation Results

Segment E3 soil was investigated with a combined total of two soil borings (one soil boring installed as groundwater monitoring well) and five test pits in the initial RI and WPA phases of investigation. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1. Soil analytical results are summarized in Table 2.3.21-1 (PAAOC Courtyard Segment E3 Initial RI and WPA Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. The most restrictive screening level was used to define vertical extent of contamination. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and WPA (Tetra Tech et al. 2020b). Reporting limits for arsenic exceed the protection of groundwater soil screening level and for selenium exceed the protection of groundwater and ecological wildlife screening levels in four out of eight samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels in Segment E3 are compiled and presented on the following Figure 2.3.21-1. The vertical extent of contamination is not defined at sample stations SB-BH02, E3-TP61, E3-TP62, and E3-TP63. WPA monitoring well boring CCR-GW17 was drilled to 15 ft bgs (through the access road fill) to the approximate elevation of segment E3 near SB-BH02 with the first sample collected at 15 ft bgs. Basalt flow top was encountered at 15 ft bgs therefore no additional samples were collected. COPCs in the 15 ft bgs samples were not detected at concentrations that exceed soil screening levels so vertical extent of soil contamination is defined at that sample location.

Table 2.3.21-1
PAAOC Courtyard Segment E3 Initial RI and WPA Soil Results Summary
Columbmia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Initial RI Analytical Results				WPA Analytical Results				
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-BH02-0.5**	**PAAOC-SB-BH02-2**	**PAAOC-TP-B4-SS (1 ft)**	**PAAOC-TP-B5-SS (1 ft)**	**PAAOC-WPA-CCR-GW17-15**	**PAAOC-WPA-E3-TP61-4**	**PAAOC-WPA-E3-TP62-0.5**	**PAAOC-WPA-E3-TP62-3.75**	**PAAOC-WPA-E3-TP63-3**
Aluminum Smelting															
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	1.2	0.05 U	0.24 U	0.2 U	0.18 U	0.22 U	0.2 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**1,300**	**1,700**	**420 JD**	**610 JD**	1.9 J	**335 J**	**1,130 J**	**254 J**	**591**
Sulfate	mg/kg	NA	NE	2,150	NE	NE	30	46	36	21	5.7	16.8	56 J	792 J	166 J
Polynuclear Aromatic Hydrocarbons (PAHs)															
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.041 U	0.069 U	0.15 U	0.15 U	0.0065 U	0.007	0.014 J	0.0021 J	0.003 J
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.041 U	0.069 U	0.15 U	0.15 U	0.0065 U	0.054	0.31	0.029	0.051
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.041 U	0.069 U	0.15 U	0.43	0.0065 U	0.0015 J	0.048	0.0036 J	0.0064
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.041 U	0.069 U	0.15 U	0.29	0.0065 U	0.2	1.1	0.077	0.29
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.11	0.077	0.42	1.5	0.0017 J	0.88	11	0.84	2.6
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	1.1	0.8	4.7	16	0.001 J	0.87	13	0.93	2.9
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	1.5	1.3	5.3	18	0.0029 J	1.2	17	1.2	4.2
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	2.6	2.3	8.4	23	0.0015 J	0.52	8.1	0.56	1.6
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	1.4	1.2	4.4	15	0.001 J	0.4	6.5	0.44	1.2
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.72	0.75	2.8	9	0.0014 J	0.87	12	0.88	2.9
Chrysene	mg/kg	NA	NL	NL	NE	NL	1.5	1.2	5.8	18	0.0065 U	0.15	2.7	0.17	0.53
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.31	0.29	1.2	3.5	0.0065 U	0.022	0.079	0.0095	0.015
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	1.9	1.5	7.7	22	0.002 J	1.5	23	1.5	5.1
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.041 U	0.069 U	0.15 U	0.38	0.0065 U	0.051	0.23	0.022	0.04
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	1.2	1.3	4.9	16	0.0013 J	0.74	11	0.8	2.7
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.041 U	0.069 U	0.15 U	0.15 U	0.00064 J	0.017	0.028	0.0041 J	0.0069
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.49	0.31	2	7.8	0.0019 J	0.64	5.2	0.5	1.2
Pyrene	mg/kg	NA	110,000	650	NE	NL	1.8	1.4	7.4	20	0.0023 JX	1.3	17	1.2	3.7
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	2.11	2	**7.6**	**25**	0.002	1.22	**17.9**	1.28	**4.1**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	2.5	1.9	10.1	32.4	0.005	2.5	29.9	2.14	6.69
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**12.1**	**10.5**	**45**	**102.3**	0.01	**6.9**	**98.3**	**7**	**22.3**
Polychlorinated Biphenyls (PCBs)															
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.062 U	0.052 U	NA	NA	NA	0.012 U	0.11 U	0.013 U	0.057 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.062 U	0.052 U	NA	NA	NA	0.023 U	0.21 U	0.025 U	0.12 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.062 U	0.052 U	NA	NA	NA	0.012 U	0.11 U	0.013 U	0.057 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.062 U	0.052 U	NA	NA	NA	0.012 U	0.11 U	0.013 U	0.057 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.062 U	0.052 U	NA	NA	NA	0.012 U	0.11 U	0.013 U	0.057 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.062 U	0.052 U	NA	NA	NA	0.012 U	0.11 U	0.013 U	0.057 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.062 U	0.052 U	NA	NA	NA	0.012 U	0.11 U	0.013 U	0.057 U
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	0.062	0.052	NA	NA	NA	0.012	0.011	0.013	0.057
Metals															
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	8,400	3,300	8,100	8,800	NA	7,410	15,400	12,400	11,500
Arsenic	mg/kg	20	88	2.9	7.61	132	12 U	10 U	11 U	11 U	NA	**3.23**	**7.71**	**4.09**	**2.87**
Cadmium	mg/kg	2	3,500	0.69	0.81	**14**	0.64	0.52 U	**3.4**	**1.1**	NA	0.204	**4.06**	0.493	0.688
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	14	11	45	41	NA	19.2	**293**	31.7	64.8
Copper	mg/kg	NA	140,000	280	28.4	217	16	16	24	19	NA	21.5	41	25	22.5
Lead	mg/kg	1,000	NE	3,000	13.1	118	6.9	5.2 U	5.5 U	5.6 U	NA	3.69	10.4	5.32	5.72
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.31 U	0.26 U	0.28 U	0.28 U	NA	0.02 U	0.003 J	0.022 U	0.022 U
Nickel	mg/kg	NA	70,000	130	24.54	980	20	12	39	130	NA	13.4 J	**141 J**	21.8 J	46.6 J
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	12 U	10 U	5.5 U	5.6 U	NA	0.2 J	**0.57 J**	**0.6 J**	0.2 J
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	99	81	230	**450**	NA	63.3	**609**	100	171
Total Petroleum Hydrocarbons (TPHs)															
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	52 U	26 U	NA	NA	25 J	20 J	460 H	51 H	97 J
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	280	52 U	NA	NA	46 J	56 J	1,500 O	150 O	260 J
Volatile Organic Compounds (VOCs)															
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.011 U	0.00096 U	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0057 U	0.0048 U	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.011 U	0.00096 U	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.0023 U	0.0019	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	0.011 U	0.00096 U	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.011 U	0.00096 U	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.011 U	0.00096 U	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.011 U	0.00096 U	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.011 U	0.00096 U	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	0.011 U	0.00096 U	NA	NA	NA	NA	NA	NA	NA

Notes:

D	The reported value is from a dilution.	U	Chemical was not detected. The associated value represents the method detection limit.
J	Estimated concentration.	UJ	Chemical was not detected. The associated limit is estimated.
NA	Not applicable or not analyzed.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
NE	Not established.	LMW PAH	Low molecular weight PAH.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.	HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

In initial RI soil boring SB-BH02, detected concentrations of fluoride and PAH as HMW exceed soil screening levels at 0.5 and 2 ft bgs. The vertical extent of contamination is not defined in SB-BH02. Soil boring SB-BH02 is further addressed in Crucible Cleaning Room Investigation Area (Section 2.2).

In initial RI test pits, TP-B4-SS and TP-B5-SS, detected concentrations of COPCs that exceed soil screening levels at 1 ft bgs, the deepest depth sampled. Subsequent WPA test pits E3-TP61, and E3-TP63 detected concentrations of fluoride, PAH as TTEC and HMW, cadmium, and zinc that exceed soil screening levels to depths of 4 and 3 ft bgs, respectively. A third WPA test pit E3-TP62 was excavated in the central portion of the segment in an area not previously sampled. COPCs including fluoride, PAH at TTEC and total HMW, cadmium, chromium, nickel, selenium, and zinc were detected at concentrations that exceed soil screening levels at 0.5 ft bgs, and fluoride, PAH as total HMW, and selenium were detected at concentrations that still exceed soil screening levels at 3.75 ft bgs, the deepest depth sampled. The vertical extent of contamination is not defined at the three WPA test pit locations.

Basalt flow top was encountered at a depth of approximately 4 to 5 ft below the surface level in segment E3 in CCR-GW17. Based on water levels measured in CCR-GW17 at the time of well installation, the water level in the UA at the eastern end of E3 is approximately 12 ft below the surface level in segment E3. The concentration of fluoride in shallow groundwater beneath this segment is expected to be between 0.96 and 4 mg/L based on groundwater data (Volume 4, Section 2, Groundwater AOC). The highest concentration of fluoride detected in segment E3 soil is 1,700 mg/kg in a sample collected from SB-BH02 at a depth of 2 ft bgs and may be associated with the Crucible Cleaning Room Investigation Area (Section 2.2.1).

2.3.21.3 Conclusions and Recommendations

The vertical extent has not been defined at initial RI soil boring SB-BH02 and WPA test pit locations E3-TP61 through E3-TP63. The highest concentration of fluoride detected in segment E3 soil is 1,700 mg/kg in a sample collected from SB-BH02 at a depth of 2 ft bgs and may be associated with the Crucible Cleaning Room Investigation Area (Section 2.2.1).

Based on COPC exceedance of soil screening levels to depths up to 4 ft bgs or greater, Segment E3 is recommended for further evaluation in the FS.

2.3.22 RI Investigation Conclusions and Recommendations

Twenty-one courtyard segments were investigated during the initial RI and WPA phases of investigation, including limited pre-RI investigations where applicable, and the data is compiled and assessed in terms of distribution and vertical extent of contamination. The data assessment included all soil sample collection locations in each courtyard segment that are within an identified perimeter for exposed soil in the segment. Conclusions and recommendations for each courtyard segment are in terms of distribution and vertical extent of contamination that would be consistent with considering soil contamination in layers. The assessment also anticipates that each courtyard segment will be evaluated separately in the FS based on large size and unique features and plant operations that occurred resulting in differing contaminant profiles and distribution.

All twenty-one of the courtyard segments have been recommended for evaluation in the FS based upon COPC exceedance of Plant Area AOC soil screening levels. In some cases, the vertical extent of contamination is relatively shallow at 1 to 2 ft depth, and other cases can be deeper to 6 ft depth or more. The objective for considering each courtyard segment separately in the RI report and providing distribution and vertical extent is to provide flexibility in the FS evaluation.

Table 2.3.22-1 (PAAOC Courtyard Segment Estimated Soil Excavation Volumes) summarizes the distribution and vertical extent of soil contamination in terms of layers as may be evaluated in the FS for consideration of potential remedial options. The table lists each segment within Courtyards A through E with a calculated area in square feet, potential layers or depths of excavation, and COPCs that exceed Plant Area AOC soil screening levels in each soil layer. The table also lists COPCs that exceed soil screening levels below a potential excavation depth of 6 ft bgs and whether no exceedances were found, or no samples were collected. Comments are provided regarding source of some COPC exceedances where conclusions can be drawn, and other pertinent information.

A perimeter of exposed soil was identified for each segment based on direct visual observation and measurement which forms the basis for the area calculation. Using the area in square feet, a volume was calculated for each segment for the three potential excavation depth cases of 2 ft, 4 ft, and 6 ft for in situ volumes estimates. Volumes for each segment are calculated in terms of cubic yards (yd^3) for each of the three potential excavation cases with a cumulative volume in cubic yards for each courtyard.

Table 2.3.22-1
PAAOC Courtyard Segment Estimated Soil Excavation Volumes
Columbia Gorge Aluminum Smelter Site, Goldendale Washington

Courtyard Segment	Estimated Excavation Volumes for Three Potential Depth Cases								Surface Impacted Soil Average Thickness (ft)	Comments
	Area (sq ft)	Case 1 Volume (cu yd) 0-2 ft depth	COPCs > SLs (0-2 ft depth)	Case 2 Volume (cu yd) 0-4 ft depth	COPCs >SL (2-4 ft depth)	Case 3 Volume (cu yd) 0-6 ft depth	COPCs > SL (4-6 ft depth)	COPCs > SL (> 6 ft depth)		
Courtyard A										
A1	26,327	1950	F, TTEC, LMW, HMW, Se, Zn, RRO	3,900	F, TTEC, HMW, Zn	5,850	Ni	NS	0.5	240 Kv line (south), 2-4 ft exceedance at SB-SE01, shallow bedrock
A2	13,416	994	F, TTEC, LMW, HMW, Ar, Cd, Cr, Cu, Ni, Se, Zn, D, RRO	1,988	F, Sulfate, TTEC, HMW, Cd, Se, Zn	2,981	F, TTEC, HMW, Ar, Cd, Cr, Ni, Zn	NE	0.8	240 Kv line (south), F/PAH exceedance in impacted surface soil and transformer substation
A3	17,028	1261	F, TTEC, HMW, Ar, Cd, Pb, Ni, Se, Zn, RRO	2,523	F, TTEC, HMW	3,784	HMW, Cd	Sulfate	0.2	240 Kv line (south), 8 ft bgs at SB-SE05
A4	19,701	1459	NS	2,919	F, Sulfate, TTEC, LMW, HMW, RRO	4,378	TTEC, HMW	F, TTEC, HMW	0.5	240 Kv line (south), no samples 0-2 ft assume same COPCs as 2-4 ft, COPCs > 6 ft at SE08 IA
A5	22,656	1678	F, TTEC, LMW, HMW, RRO	3,356	F, TTEC, HMW	5,035	Se	F, TTEC, LMW, HMW, RRO, Se	1.2	240 Kv line (south), COPCs > 6 ft at VS01 IA
Courtyard A Volumes		7,343		10,785		22,028				
Courtyard B										
B1	35,073	2,598	F, TTEC, LMW, HMW, Cd, Hg, Se, Total PCB	5,196	F, TTEC, HMW, Cd, Se	7,794	TTEC, HMW	HMW	0.8	LMW in impacted surface soil, PCB and Se at transformer substation
B2	30,028	2,224	F, TTEC, LMW, HMW, Ar, Cd, Cr, Ni, Pb, Zn	4,449	F, HMW	6,673	HMW	NE	0.2	Area of silo foundations subtracted
B3	33,390	2,473	F, TTEC, LMW, HMW, Cd, Cr	4,947	HMW	7,420	F, TTEC, HMW, Ar	NS	1.5	F in impacted surface soil
B4	28,552	2,115	F, TTEC, LMW, HMW, Ar, Cd, Cr, Ni, Se, Zn, D, RRO	4,230	F, TTEC, LMW, HMW, Cd, Cr, Se, Zn, D, RRO	6,345	F, TTEC, HMW, Cd, Se	NS	0.8	High F/PAH in impacted surface soil and transformer substation, area of silo foundations subtracted
B5	32,054	2,374	F, TTEC,LMW, HMW, Cd, Se, Zn, D, RRO	4,749	TTEC, HMW, Cd, Cu, Se	7,123	TTEC, LMW, HMW, Cd, Se	NS	0.9	High F/PAH at transformer substation, area of briquette silo subtracted
Courtyard B Volumes		11,785		23,570		35,355				
Courtyard C										
C1	36,084	2,673	F	5,346	NS	8,019	F, HMW, Cd, Se, Zn	NS	2	
C2	36,346	2,692	F, Sulfate, TTEC, HMW, Ar, Cd, Cr, Se, Zn	5,385	NS	8,077	F, Sulfate, HMW	NS	0.8	C2 adjacent to west from Crucible Cleaning Room IA
C3	36,877	2,732	TTEC, HMW, D, RRO	5,463	F, Sulfate, HMW	8,195	Sulfate	Sulfate	1.5	Sulfate exceedance in Crucible Cleaning Room IA
C4	16,954	1,256	F, HMW	2,512	F, HMW	3,768	NE	NE	1.5	F exceedance in Crucible Cleaning Room IA
C5	16,859	1,249	NS	2,498	HMW	3,746	NE	F, Sulfate	1.0	F and Sulfate exceedance in SE18 IA
Courtyard C Volumes		10,601		21,203		31,804				
Courtyard D										
D1	38,073	2,820	F, TTEC, HMW, Cd, Cr	5,640	NS	8,461	HMW	NS	0.5	Shallow bedrock
D2	31,343	2,322	F, TTEC, HMW, Cd, Cu, Ni, Se, Zn	4,643	F, HMW, Cd, Se, Zn	6,965	HMW	NS	1.2	
D3	20,193	1,496	F, TTEC, HMW, Cd	2,992	HMW	4,487	NE	NE	1.9	
Courtyard D Volumes		6,638		13,275		19,913				
Courtyard E										
E1	14,790	1,096	F, TTEC, LMW, HMW, Cd, Cr, Ni, Zn	2,191	NS	3,287	F, HMW	NS	0.8	Shallow bedrock
E2	14,653	1,085	F, TTEC, HMW, Ar, Cd, Cr, Ni, Se, Zn	2,171	F, TTEC, HMW, Cd, Cr, Se	3,256	F, TTEC, HMW, Cd	NS	1.2	Shallow bedrock
E3	11,180	828	F, TTEC, HMW, Cd, Cr, Ni, Se, Zn	1,656	F, TTEC, HMW, Se	2,484	F, HMW	NS	1.2	Shallow bedrock
Courtyard E Volumes		3,009		6,018		9,027				
Total Courtyard Volumes		39,376		74,852		118,128				

Notes:

sq ft	Area in square feet	Ar	Arsenic
cu yd	Volume in cubic yards for potential excavation depths of 2, 4, and 6 feet.	Cd	Cadmium
D	Total petroleum hydrocarbons as diesel range organics.	Cr	Chromium
IA	Investigation Area for further investigation during WPA Phase.	Cu	Coopper
NE	No exceedances.	Ni	Nickel
NS	Not sampled.	Pb	Lead
TTEC	Total Toxicity Equivalent Concentrations for carcinogenic PAHs.	Hg	Mercury
LMW	Low molecular weight PAH.	Se	Selenium
HMW	High molecular weight PAH.	Zn	Zinc
RRO	Total petroleum hydrocarbons as residual range organics.		

0-2 ft COPCs> SL	COPCs within the 0-2 ft layer that exceed Plant Area AOC soil screening levels.
2-4 ft COPCs>SL	COPCs within the 2-4 ft layer that exceed Plant Area AOC soil screening levels, in addition to COPCs in 0-2 ft layer.
4-6 ft COPCs>SL	COPCs within the 4-6 ft layer that exceed Plant Area AOC soil screening levels, in addition to COPCs in 0-2 and 2-4 ft layers.
>6 ft COPCs>SL	COPCs deeper that 0-6 ft potential excavation depth that exceed Plant Area AOC soil screening levels.

Surface impacted soil average thickness refers to direct measurement of surface impacted soil (previously black soil) in borings and test pits.

Calculated soil volumes are for insitu soil.

COPCs that exceed Plant Area AOC soil screening levels are listed for each segment, for each of the three potential excavation cases, as well as COPCs that exceed screening levels at depths greater than 6 ft bgs. The COPCs that exceed soil screening levels are also compiled on Figures 2.3.1-1 through 2.3.21-1 and were discussed in the previous sections. Fluoride and sulfate have been the focus of WPA investigations into potential soil sources of contamination to shallow groundwater including the Crucible Cleaning Room Investigation Area that includes segments C2 through C4, the SE08 Investigation Area that includes segment A4, the SE18 Investigation Area that includes segments C5 and B5, and VS01 Investigation Area in segments A4 and A5. Conclusions with respect to the Investigation Areas regarding potential for soil sources of contamination to shallow groundwater are addressed in Sections 2.2.1, 2.2.2, 2.2.6, and 2.2.7. Highest detected concentrations of fluoride, sulfate, PAHs, and metals are frequently associated with either surface impacted soil, transformer substations, or one of the investigation areas mentioned above.

Thickness of impacted surface soil, previously termed black soil, is shown as an average for each segment based upon direct measurement during initial RI and WPA phases of investigation. In many cases highest detected concentrations of COPCs, particularly PAHs and metals, are associated with the impacted surface soil. During development of the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b), a mapping and sampling program was proposed to determine whether the surface impacted soil could be visually identified in the field for a case where the Scrubber Effluent lines in Courtyards A and C would be removed and the most contaminated soil could be separated by visual observation and stockpiled during excavation. The thickness data reported in Table 2.3.22-1 results from the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) proposed mapping and sampling program.

2.4 AREAS OUTSIDE OF THE PLANT PRODUCTION FOOTPRINT

The following sections discuss the southern portion of the Plant Area AOC, south of the production area footprint and north of the southern plant fence line, and also includes one area west of the BPA Substation and production building foundations (Figure 2.1.2-1). These areas were investigated during the initial RI phase of investigation and no data gaps were identified for further investigation in the WPA (Tetra Tech et al. 2020b). Each of the following areas are identified on the index map of Figure 2.1.2-1.

2.4.1 Gasoline USTs West of BPA Substation

One gasoline UST located east of the BPA Substation was decommissioned and removed in 1990 (Westinghouse 1990). The tank excavation was reportedly 17 ft long, 13 ft wide, and 6 ft deep.

2.4.1.1 Investigation Scope

The former UST excavation was investigated with two soil borings located at the approximate margins of the excavation. The borings were completed to depths of 15 ft bgs or refusal and soil samples were collected at 4 ft and 6 ft bgs, and at 15 ft bgs based on field observations.

Soil samples collected from boring SB-UST01 were analyzed for lead, TPH-Gx, TPH Dx, and BTEX, and samples collected from boring SB-UST02 were analyzed for metals, TPH-GX, TPH-Dx, and VOCs.

Investigation of the UST west of the BPA Substation was conducted during the initial RI phase of investigation. No further investigation was proposed in the WPA.

2.4.1.2 Investigation Results

The former UST excavation was investigated with two soil borings. The soil was described and characterized, and logs of borings are included in Volume 5, Appendix G-1. Soil analytical results are summarized in Table 2.4.1-1. Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC soil screening levels. Natural background concentrations for the site have also been used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendix H-2, and data validation reports are included in Volume 5, Appendix I-2. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). For the UST west of the BPA Substation, reporting limits for arsenic exceed the protection of groundwater screening level, and selenium exceeds the protection of groundwater and ecological wildlife screening levels, in all samples analyzed.

All sample analytical results for COPCs are compiled and presented on Figure 2.4.1-1. Results of the initial RI investigation indicate that all COPCs analyzed, including metals, TPH-Gx, TPH-Dx, BTEX, and VOCs do not exceed Plant Area AOC soil screening levels.

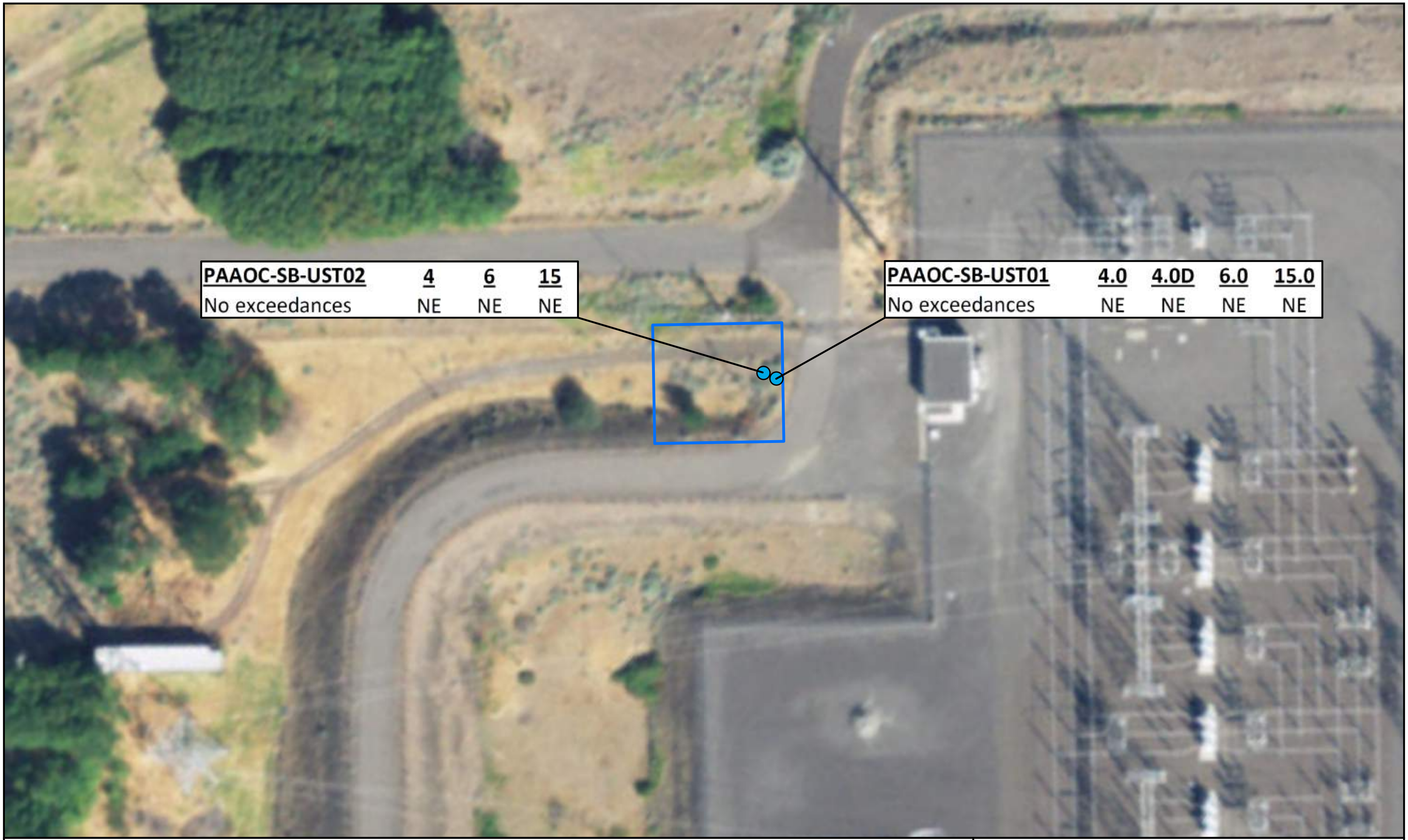
Table 2.4.1-1
PAAOC UST at BPA Station RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	RI Analytical Results						
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-UST01-4**	**PAAOC-SB-UST01-4D**	**PAAOC-SB-UST01-6**	**PAAOC-SB-UST01-15**	**PAAOC-SB-UST02-4**	**PAAOC-SB-UST02-6**	**PAAOC-SB-UST02-15**
Metals													
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	NA	NA	NA	NA	11,000	7,900	6,900
Arsenic	mg/kg	20	88	2.9	7.61	132	NA	NA	NA	NA	11 U	13 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	NA	NA	NA	NA	0.56 U	0.67 U	0.56 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	NA	NA	NA	NA	12	4.4	2.3
Copper	mg/kg	NA	140,000	280	28.4	217	NA	NA	NA	NA	8.4	3.3	5.3
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.9 U	5.7 U	6.8	5.6 U	6.2	7	6.3
Mercury	mg/kg	2	NE	2.1	0.04	5.5	NA	NA	NA	NA	0.28 U	0.34 U	0.28 U
Nickel	mg/kg	NA	70,000	130	24.54	980	NA	NA	NA	NA	7.4	3.4 U	3.4
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	NA	NA	NA	NA	11 U	13 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	NA	NA	NA	NA	51	38	57
Total Petroleum Hydrocarbons (TPHs)													
Gasoline Range Organics	mg/kg	100	NE	NA	NA	1,000	NA	NA	5.5 U	5.6 U	4.9 U	7.7 U	6.2 U
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	29 UJ	28 UJ	28 UJ	28 UJ	NA	NA	28 UJ
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	59 UJ	57 UJ	55 UJ	56 UJ	NA	NA	56 UJ
Petroleum Hydrocarbons (BTEX)													
Benzene	mg/kg	0.03	33,000	0.027	NE	0.255	0.02 U	0.02 U	0.02 U	0.02 U	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.065 U	0.064 U	0.055 U	0.056 U	NA	NA	NA
Ethyl Benzene	mg/kg	6	350,000	5.9	NE	5.16	0.065 U	0.064 U	0.055 U	0.056 U	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.065 U	0.064 U	0.055 U	0.056 U	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	0.065 U	0.064 U	0.055 U	0.056 U	NA	NA	NA
Gasoline	mg/kg	100	NE	NA	NA	1,000	6.5 U	6.4 U	5.5 U	5.6 U	NA	NA	NA
Volatile Organic Chemicals (VOCs)													
Benzene	mg/kg	0.03	33,000	0.027	NE	0.255	NA	NA	NA	NA	0.0011 U	0.0014 U	0.0011 U
Toluene	mg/kg	7	280,000	4.5	NE	5.45	NA	NA	NA	NA	0.0056 U	0.0068 U	0.0057 U
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	NA	NA	NA	NA	0.0011 U	0.0014 U	0.0011 U
m,p-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	0.0022 U	0.0027 U	0.0023 U
o-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	0.0011 U	0.0014 U	0.0011 U
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	NA	NA	NA	NA	0.0011 U	0.0014 U	0.0011 U
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	NA	NA	NA	NA	0.0011 U	0.0014 U	0.0011 U
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	NA	NA	NA	NA	0.0011 U	0.0014 U	0.0011 U
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	NA	NA	NA	NA	0.0011 U	0.0014 U	0.0011 U
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	NA	NA	NA	NA	0.0011 U	0.0014 U	0.0011 U

Notes:

J	Estimated Concentration.
NA	Not applicable or not analyzed.
NE	Not established.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
TTEC	Total ToxicityEquivalent Concentration for carcinogenic PAHs.

Concentrations shown in **bold** exceed one or more site soil screening levels.



PAAOC-SB-UST02	4	6	15
No exceedances	NE	NE	NE

PAAOC-SB-UST01	4.0	4.0D	6.0	15.0
No exceedances	NE	NE	NE	NE

● RI Boring

▭ Gasoline UST Area Outline

NE: No exceedance

Sample depths in feet bgs.

Figure 2.4.1-1

Plant Area AOC

Gasoline UST Near BPA Substation Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

2.4.1.3 *Conclusions and Recommendations*

COPCs analyzed for the UST west of the BPA Substation do not exceed Plant Area AOC soil screening levels. The UST is not recommended for evaluation in the FS.

2.4.2 Administration and Plant Lab Building

The Administration and Plant Laboratory Building is in the southwest portion of the Plant Area AOC (Figure 2.1.2-1). The administrative offices are in the western half of the building, and the former plant laboratory was in the eastern half of the building. Along the northeast side of the building there is a loading/unloading area with a roll-up bay door that was used for vehicle parking. Testing conducted in the laboratory was typical for a large industrial facility including for process materials, air, and discharge waters. The administrative offices are still being used, and the laboratory is no longer in use.

2.4.2.1 *Investigation Scope*

The Administration and Plant Laboratory Building was investigated with three soil borings completed up to 10 ft bgs or refusal. Soil samples were collected at 0.5 and 2 ft bgs in SB-AL01, and at 0.5, 2, 4, and 6 ft bgs in borings SB-AL02 and SB-AL03. According to the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b), samples collected below 2 ft bgs would be analyzed if COPCs exceed screening levels in 0.5 or 2 ft bgs samples. Only the 0.5 and 2 ft bgs samples were analyzed in the three Administration and Plant Laboratory Building borings. The sewer outlet cleanout leading from the laboratory could not be located for sediment sampling. Soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH.

Investigation of the Administration and Plant Laboratory Building was conducted during the initial RI phase of investigation. No further investigation was proposed in the WPA.

2.4.2.2 *Investigation Results*

The Administration and Plant Laboratory Building was investigated with three soil borings. The soil was described and characterized, and logs of borings are included in Volume 5, Appendix G-1. Soil analytical results are summarized on Table 2.4.2-1. Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC soil screening levels. Natural background concentrations for the site have also been used to adjust

Table 2.4.2-1
PAAOC Plant Administration and Laboratory Building RI Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	RI Analytical Results						
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-AL01-0.5**	**PAAOC-SB-AL01-2**	**PAAOC-SB-AL02-0.5**	**PAAOC-SB-AL02-2**	**PAAOC-SB-AL03-0.5**	**PAAOC-SB-AL03-0.5D**	**PAAOC-SB-AL03-2**
Aluminum Smelting													
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 UJ	0.083 J	0.05 UJ	0.05 UJ	0.05 UJ	0.05 U	0.05 UJ
Fluoride	mg/kg	NA	210,000	146.7	14.11	NE	7.9 J	13 J	32 J	22 J	7.3 J	5.8	9.6 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	10 U	10 U	13	20	24	10 U	23
Polynuclear Aromatic Hydrocarbons (PAHs)													
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0074 U	0.0077 U	0.29 U	0.15 U	0.015 U	0.15 U	NA
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0074 U	0.0077 U	0.29 U	0.15 U	0.015 U	0.15 U	NA
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.012	0.0077 U	0.33	0.15 U	0.015 U	0.15 U	NA
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0074 U	0.0077 U	0.29	0.15 U	0.015 U	0.15 U	NA
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0091	0.0077 U	0.3	0.15 U	0.015	0.028	NA
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.12	0.0077 U	2.4	0.99	0.078 J	0.15	NA
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.2	0.0077 U	3.6	1.5	0.1 J	0.19	NA
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.27	0.0077 U	5.1	2.2	0.14 J	0.23	NA
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.17	0.0077 U	3.3	1.4	0.08	0.13	NA
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.07	0.0077 U	1.6	0.64	0.04	0.074	NA
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.15	0.0077 U	3.2	1.4	0.093 J	0.15	NA
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.034	0.0077 U	0.68	0.29	0.019	0.03	NA
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.18	0.0077 U	3.6	1.6	0.13 J	0.24	NA
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0074 U	0.0077 U	0.29 U	0.15 U	0.015 U	0.15 U	NA
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.14	0.0077 U	3.3	1.3	0.082	0.12	NA
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0074 U	0.0077 U	0.29 U	0.15 U	0.015 U	0.15 U	NA
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.062	0.0077 U	1.6	0.72	0.056	0.11	NA
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.17	0.0077 U	3.3	1.5	0.12 J	0.21	NA
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.26	0.0077	**4.94**	**2.1**	0.14	0.26	NA
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.26	0.0077	6.1	2.06	0.2	0.32	NA
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**1.3**	0.0077	**26.5**	**11.2**	0.71	**1.3**	NA
Polychlorinated Biphenyls (PCBs)													
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.055 U	0.058 U	0.055 UJ	0.056 UJ	0.055 U	0.055 U	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.058 U	0.055 UJ	0.056 UJ	0.055 U	0.055 U	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.058 U	0.055 UJ	0.056 UJ	0.055 U	0.055 U	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.058 U	0.055 UJ	0.056 UJ	0.055 U	0.055 U	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.058 U	0.055 UJ	0.056 UJ	0.055 U	0.055 U	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.055 U	0.058 U	0.055 UJ	0.056 UJ	0.055 U	0.055 U	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.055 U	0.058 U	0.055 UJ	0.056 UJ	0.055 U	0.055 U	NA
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.055	0.058	0.055	0.056	0.055	0.055	NA
Metals													
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	5,000	7,100	5,700	5,100	6,700	5,700	3,400
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	12 U	11 U	11 U	11 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.55 U	0.58 U	0.55 U	0.56 U	0.55 U	0.55 U	0.55 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	5.1	5	8.6	6.2	5.2	5.9	5.4
Copper	mg/kg	NA	140,000	280	28.4	217	13	13	15	11	16	17	12
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.5 U	5.8 U	8.4	5.6 U	5.5 U	5.5 U	5.5 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.29 U	0.27 U	0.28 U	0.28 U	0.27 U	0.28 U
Nickel	mg/kg	NA	70,000	130	24.54	980	4.1	5.1	9.5	8.3	5.5	5.4	3.7
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	12 U	11 U	11 U	11 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	43	44	94	80	48	41	29
Total Petroleum Hydrocarbons (TPHs)													
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	55 U	29 U	550 U	560 U	55 U	27 U	NA
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	270	58 U	**6,200**	**4,500**	190	120	NA

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.

TTEC	Total Toxicity Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

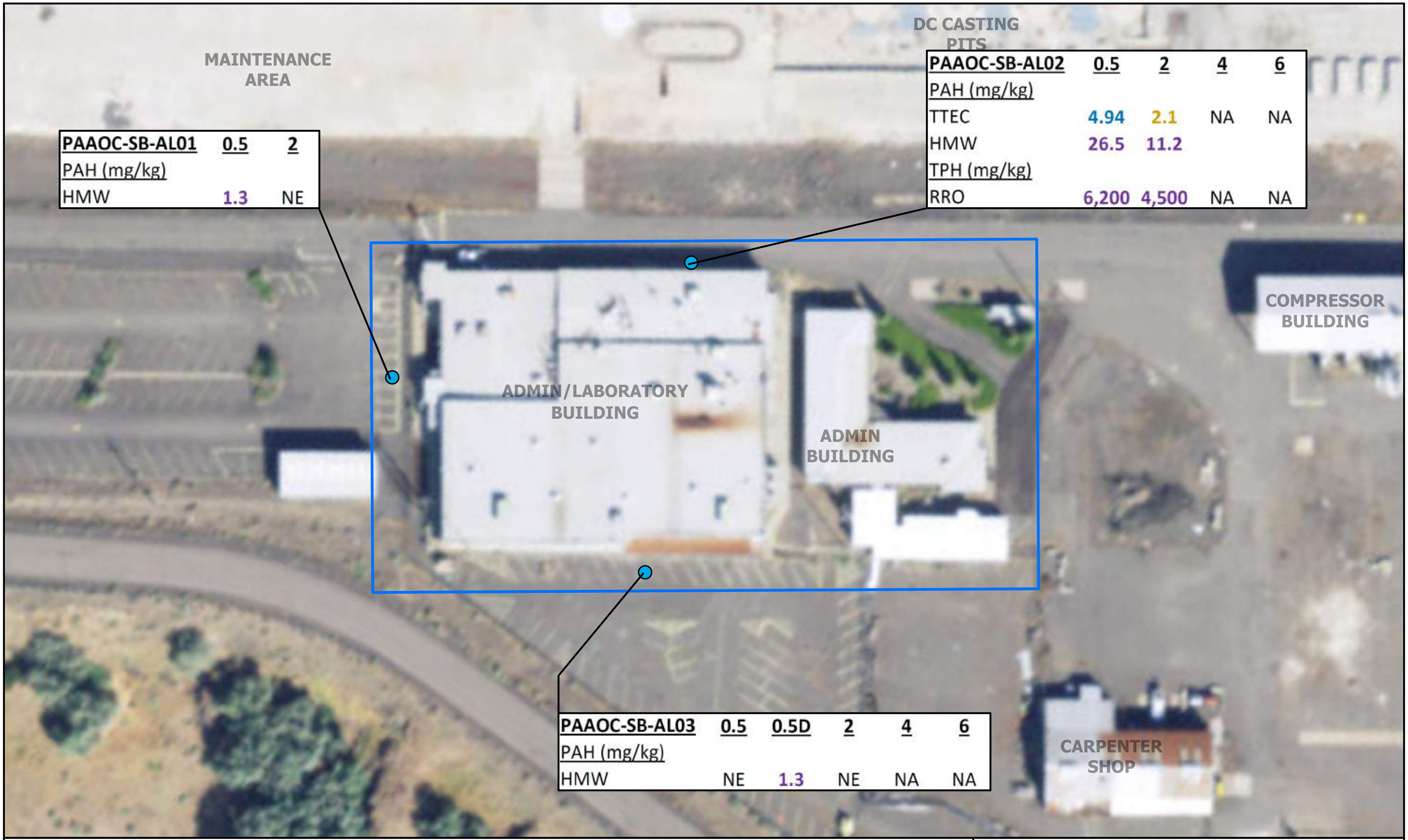
screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendix H-2, and data validation reports are included in Volume 5, Appendix I-2. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). For the Administration and Plant Laboratory Building investigation reporting limits for arsenic exceed the protection of groundwater screening level, and for selenium exceed the protection of groundwater and ecological wildlife soil screening levels, in all samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels are compiled and presented on Figure 2.4.2-1. Results of the initial RI phase indicate that total cyanide, fluoride, sulfate, PCBs, and metals do not exceed soil screening levels. Only PAH as TTEC, calculated total HMW PAH, and TPH-Dx as residual range organics exceed soil screening levels. Calculated concentrations of TTEC exceeds the protection of groundwater screening level of 3.9 mg/kg in only one sample, SB-AL02-0.5 but does not exceed the screening level in that soil boring in the deeper sample at 2 ft bgs. Detected concentrations of calculated total HMW PAH exceeds the ecological wildlife screening level at 0.5 ft bgs in all three borings, and at 2 ft bgs in SB-AL02. TPH as residual range organics was detected at concentrations of 6,200 and 4,500 mg/kg in boring SB-AL02 at 0.5 ft bgs and 2 ft bgs, respectively, which exceeds MTCA Method A Industrial and the ecological wildlife soil screening levels of 2,000 mg/kg. These elevated COPCs in SB-AL02 could potentially be associated with vehicle parking near the roll-up bay door.

2.4.2.3 Conclusions and Recommendations

PAH as TTEC and calculated total HMW PAH exceeds soil screening levels in shallow soil, but TTEC does not exceed at a depth of 2 ft bgs, and total HMW PAH exceeds in one sample at 2 ft bgs. TPH as residual range organics exceeds MTCA Method A Industrial and the ecological wildlife soil screening level in boring SB-AL02 at 0.5 and 2 ft bgs sample depths. Soil analytical results exceeding the ecological wildlife screening levels was not a driver for the need to analyze deeper samples in SB-AL02.

Based on the results of the initial RI phase of investigation the Administration and Plant Laboratory Building, SB-AL02 is recommended for further evaluation in the FS.



PAAOC-SB-AL01	0.5	2
PAH (mg/kg)		
HMW	1.3	NE

PAAOC-SB-AL02	0.5	2	4	6
PAH (mg/kg)				
TTEC	4.94	2.1	NA	NA
HMW	26.5	11.2		
TPH (mg/kg)				
RRO	6,200	4,500	NA	NA

PAAOC-SB-AL03	0.5	0.5D	2	4	6
PAH (mg/kg)					
HMW	NE	1.3	NE	NA	NA

● RI Boring
▭ Admin/Lab Building Outline

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds Ecological Wildlife
orange: exceeds MTCA Method A
NE: No exceedance
NA: Not analyzed
D: Duplicate sample
RRO: Residual Range Organics
2: Sample depth in feet bgs

Figure 2.4.2-1

Plant Area AOC

Administration and Laboratory Building Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

2.4.3 Carpenter Shop Building

The Carpenter Shop Building is located southeast of the Administration Building and is still in use for storage of vehicles and associated equipment (Figure 2.1.2-1). The area surrounding the Carpenter Shop Building is paved with asphalt.

2.4.3.1 Investigation Scope

The Carpenter Shop was investigated with two soil borings completed to refusal. Soil samples were collected at depths of 0.5, 2, and 4 ft bgs in boring SB-AP01, and 0.5, 2, 4, and 6 ft bgs in boring SB-AP02. In accordance with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) samples collected below 2 ft bgs would be analyzed if COPCs exceed screening levels in 0.5 or 2 ft bgs samples. No exceedances were detected in the samples collected at 0.5 ft bgs and 2 ft bgs samples, therefore, no additional analysis was performed. Soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH.

Investigation of the Carpenter Shop Building was conducted during the initial RI phase of investigation. No further investigation was proposed in the WPA.

2.4.3.2 Investigation Results

The Carpenter Shop Building was investigated with two soil borings. The soil was described and characterized, and logs of borings are included in Volume 5, Appendix G-1. Soil analytical results are summarized in Table 2.4.3-1. Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC soil screening levels. Natural background concentrations for the site have also been used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendix H-2, and data validation reports are included in Volume 5, Appendix I-2. All samples were collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). For the Carpenter Shop investigation, reporting limits for arsenic exceed the protection of groundwater screening level, and for selenium exceed the protection of groundwater and ecological wildlife screening levels, in all samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels are compiled and presented on Figure 2.4.3-1. Results of the initial RI investigation indicate that total cyanide, fluoride, sulfate, PCBs, metals, and TPH do not exceed soil screening levels. Only PAH as

Table 2.4.3-1
PAAOC Carpenter Shop RI Soil Results Summary
Colubmia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Analytical Results					
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-AP01-0.5**	**PAAOC-SB-AP01-0.5D**	**PAAOC-SB-AP01-2**	**PAAOC-SB-AP02-0.5**	**PAAOC-SB-AP02-0.5D**	**PAAOC-SB-AP02-2**
Aluminum Smelting												
Cyanide, total	mg/kg	NA	2,100	1.9	NE	5	0.05 UJ	0.05 U	0.05 UJ	0.05 UJ	0.05 U	0.05 UJ
Fluoride	mg/kg	NA	210,000	146.7	14.11	NE	15 J	14	13 J	18 J	7.8	10 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	13	11	15	20	15	10 U
Polynuclear Aromatic Hydrocarbons (PAHs)												
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0075 U	0.0075 U	0.029 U	0.15 U	0.15 U	0.0073 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0075 U	0.0075 U	0.029	0.15 U	0.15 U	0.0073 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0075 U	0.0075 U	0.029 U	0.15 U	0.15 U	0.0073 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0075 U	0.0075 U	0.029 U	0.15 U	0.15 U	0.0073 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0075 U	0.0075 U	0.029 U	0.15 U	0.15 U	0.0073 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.019	0.017	0.039	0.27	0.31	0.0073 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.021	0.022	0.054	0.35	0.38	0.0074
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.037	0.033	0.081	0.43	0.49	0.01
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.023	0.023	0.058	0.28	0.31	0.0073 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0095	0.01	0.029 U	0.17	0.18	0.0073 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.025	0.022	0.087	0.34	0.38	0.014
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0075 U	0.0075 U	0.029 U	0.15 U	0.15 U	0.0073 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.034	0.023	0.069	0.46	0.53	0.019
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0075 U	0.0075 U	0.029 U	0.15 U	0.15 U	0.0073 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.019	0.019	0.031	0.27	0.29	0.0073 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0075 U	0.0075 U	0.029 U	0.15 U	0.15 U	0.0073 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.017	0.0087	0.054	0.26	0.28	0.02
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.033	0.022	0.072	0.47	0.51	0.021
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.03	0.03	0.07	0.5	0.71	0.02
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.05	0.03	0.12	0.31	0.81	0.04
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.19	0.17	0.42	**2.6**	**2.85**	0.05
Polychlorinated Biphenyls (PCBs)												
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.056 U	0.056 U	0.054 U	0.055 U	0.055 U	0.055 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.056 U	0.054 U	0.055 U	0.055 U	0.055 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.056 U	0.054 U	0.055 U	0.055 U	0.055 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.056 U	0.054 U	0.055 U	0.055 U	0.055 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.056 U	0.054 U	0.055 U	0.055 U	0.055 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.056 U	0.056 U	0.054 U	0.055 U	0.055 U	0.055 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.056 U	0.056 U	0.054 U	0.055 U	0.055 U	0.055 UJ
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.056	0.056	0.064	0.055	0.055	0.055
Metals												
Aluminum	mg/kg	NA	3,500,000	4,890,000	28,299	NE	9,400	7,900	6,200	7,000	7,100	4,300
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	11 U	11 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.56 U	0.56 U	0.54 U	0.55 U	0.55 U	0.55 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	8.4	8.8	8.7	8.4 J	6.6	3.7
Copper	mg/kg	NA	140,000	280	28.4	217	14	15	14	17	16	10
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.8	5.8	5.4 U	9.9	5	5.5 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.28	0.27 U	0.28 U	0.28 U	0.28 U
Nickel	mg/kg	NA	70,000	130	24.54	980	5.7	5.8	6.4	7	5.8	3.5
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	11 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	80.9	54	50	46	49	51	34
Total Petroleum Hydrocarbons (TPHs)												
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	28 U	28 U	270 U	280 U	280 U	140 U
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	110	82	1,500	810	1,400	510

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.

TTEC	Total Toxicity Concentration for carcinogenic PAHs.
LMW	Low molecular weight PAH.
HMW	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

PAAOC-SB-AP01	0.5	0.5D	2	4
No exceedances	NE	NE	NE	NA

PAAOC-SB-AP02	0.5	0.5D	2	4	6
PAH (mg/kg)					
HMW	2.6	2.85	NE	NA	NA

● RI Boring

▭ Carpenter Shop Outline

Soil Screening Levels
purple: exceeds Ecological Wildlife

NE: No exceedance
NA: Not analyzed
D: Duplicate sample
2: Sample depth in feet bgs

Figure 2.4.3-1

Plant Area AOC

Carpenter Shop Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

calculated total HMW slightly exceeds the ecological wildlife screening level in one boring, SB-AP02, at the sample depth of 0.5 ft bgs but does not exceed at the deeper sample depth of 2 ft bgs.

2.4.3.3 Conclusions and Recommendations

Only calculated total HMW PAH slightly exceeded the ecological wildlife soil screening level at 0.5 ft in SB-AP02. Based on the low concentration and limited occurrence of total HMW PAH, the Carpenter Shop is not recommended for evaluation in the FS.

2.4.4 Compressor Building and Associated Features

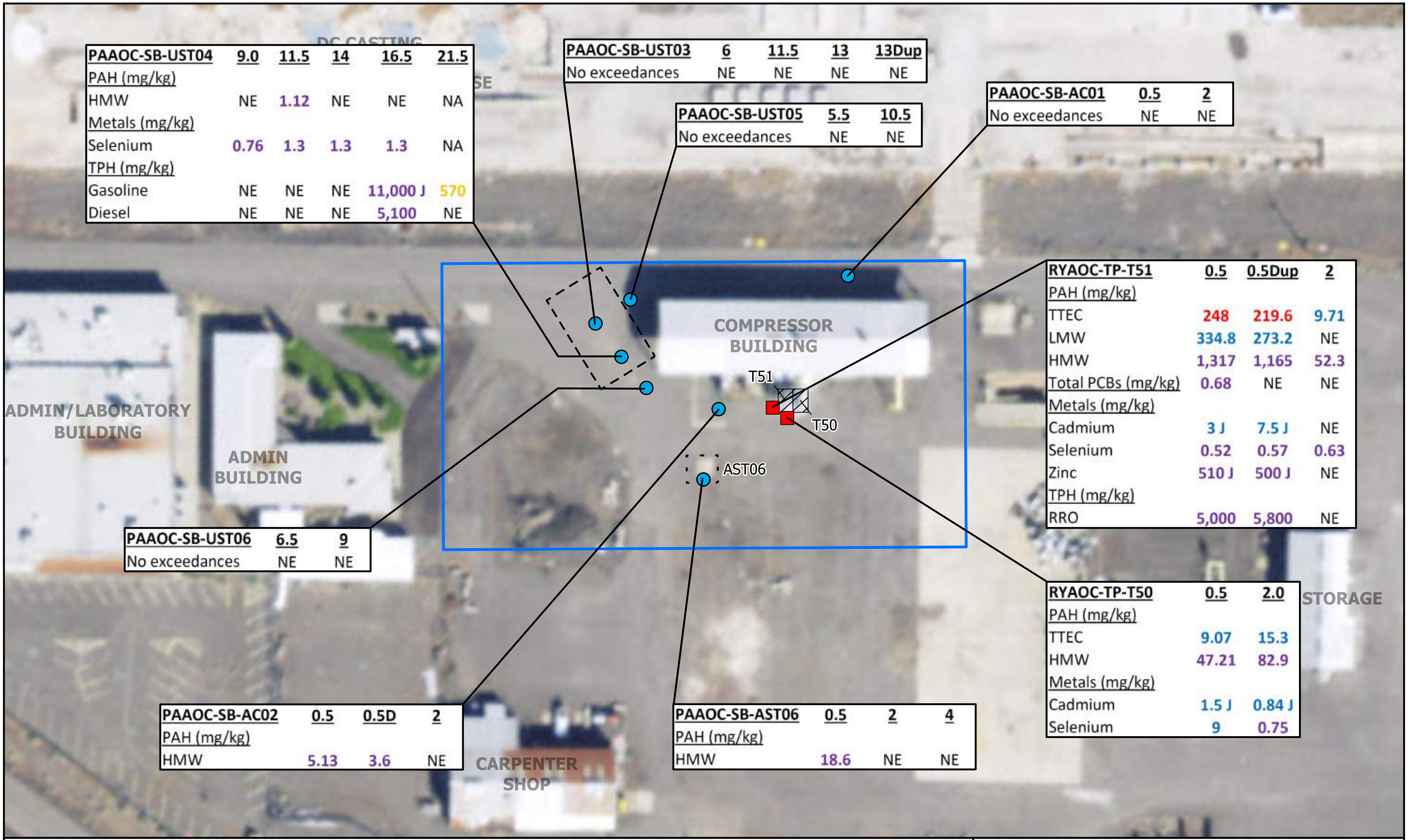
The Compressor Building is located east of the main Administration Building and is currently used for storage (Figure 2.1.2-1). The building housed compressors and related equipment in the eastern half and served as a fuel station in the western half. Three USTs (two-diesel and one-gasoline) located near the west end of the Compressor Building were decommissioned and removed in 1990 (Westinghouse 1990). One single excavation was made for the removal and was reportedly 33-ft long, 21-ft wide, and 10-ft deep (Westinghouse 1990).

Other structures near the Compressor Building that were investigated in the initial RI phase include one above ground storage tank (AST06) and two transformer substations (investigated as part of the Rectifier Yard AOC). AST06 was located approximately 60 ft south of the Compressor Building but had been removed at the time of the initial RI phase of investigation. Two transformer substations, T50 and T51, were located along the southern wall of the Compressor Building and were in place during the initial RI phase.

2.4.4.1 Investigation Scope

The Compressor Building and associated features were investigated with seven soil borings and four test pits. The location of the borings and test pits are shown on Figure 2.4.4-1. Sample depths and analyses are as follows:

- **Compressor Building**: two soil borings SB-AC01 and SB-AC02, drilled to depths of 4 ft bgs and 7 ft bgs, samples collected at 0.5 and 2 ft bgs in boring SB-SC01, and at 0.5 ft bgs, 2 ft bgs, 4 ft bgs, and 6 ft bgs in SB-AC02. Samples collect in SB-AC02 at 4 ft bgs and 6 ft bgs were not analyzed as per the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). Analytes included: total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx.



PAAOC-SB-UST04	9.0	11.5	14	16.5	21.5
PAH (mg/kg)					
HMW	NE	1.12	NE	NE	NA
Metals (mg/kg)					
Selenium	0.76	1.3	1.3	1.3	NA
TPH (mg/kg)					
Gasoline	NE	NE	NE	11,000 J	570
Diesel	NE	NE	NE	5,100	NE

PAAOC-SB-UST03	6	11.5	13	13Dup
No exceedances	NE	NE	NE	NE

PAAOC-SB-UST05	5.5	10.5
No exceedances	NE	NE

PAAOC-SB-AC01	0.5	2
No exceedances	NE	NE

RYAOC-TP-T51	0.5	0.5Dup	2
PAH (mg/kg)			
TTEC	248	219.6	9.71
LMW	334.8	273.2	NE
HMW	1,317	1,165	52.3
Total PCBs (mg/kg)	0.68	NE	NE
Metals (mg/kg)			
Cadmium	3 J	7.5 J	NE
Selenium	0.52	0.57	0.63
Zinc	510 J	500 J	NE
TPH (mg/kg)			
RRO	5,000	5,800	NE

PAAOC-SB-UST06	6.5	9
No exceedances	NE	NE

RYAOC-TP-T50	0.5	2.0
PAH (mg/kg)		
TTEC	9.07	15.3
HMW	47.21	82.9
Metals (mg/kg)		
Cadmium	1.5 J	0.84 J
Selenium	9	0.75

PAAOC-SB-AC02	0.5	0.5D	2
PAH (mg/kg)			
HMW	5.13	3.6	NE

PAAOC-SB-AST06	0.5	2	4
PAH (mg/kg)			
HMW	18.6	NE	NE

●	RI Boring
🟥	RI Test Pit
▭	Compressor Building Outline
⬚	UST Removal Excavation Limits (Westinghouse 1990)
▨	Approximate Transformer Pad

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds Ecological Wildlife and for TPH diesel and residual range organics exceeds MTCA Method A
red: exceeds MTCA Method C
orange: exceeds MTCA Method A
NE: No exceedance
NA: Not analyzed
D/Dup: Duplicate sample
RRO: Residual range organics
2: Sample depth in feet bgs

Figure 2.4.4-1

Plant Area AOC

Compressor Building Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

- **Compressor Building USTs**: four soil borings SB-UST03 through SB-UST06, with samples collected at 6 ft bgs and the approximate base of former tank excavation at 10 ft bgs, and additional samples were taken where evidence of contamination was present at or below 10 ft bgs. These soil borings were located based upon the tank locations in the removal report (Westinghouse 1990). Boring SB-UST04 was completed as shallow groundwater monitoring well RI-GW6 to determine if a release to shallow groundwater had occurred and is discussed in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC. Analytes included: PAHs, metals, TPH, and BTEX.

- **Compressor Building AST**: one soil boring SB-AST06, with samples collected at 0.5, 2 and 4 ft bgs. Analytes included: PAHs, lead, TPH, and BTEX.

- **Transformer Substations**: four test pits, two at substations T50 and T51, with samples collected at 0.5 and 2 ft bgs. Analytes included: total cyanide, fluoride, PAHs, PCBs, metals, and TPH-Dx.

Investigation of the Compressor Building and associated USTs, AST, and transformer substations was conducted during the initial RI phase of investigation. No further investigation was proposed in the WPA.

2.4.4.2 Investigation Results

Soil boring and test pit soil sample results are summarized on Table 2.4.4-1. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1. Analytical results are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC soil screening levels. Natural background concentrations for the site have also been used to adjust screening levels where applicable in the screening process. Laboratory reports are included in Volume 5, Appendices H-1 and H-2, and data validation reports are included in Volume 5, Appendices I-1 and I-2. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The reporting limits for selenium exceed the protection of groundwater and ecological wildlife screening levels in five out of 26 soil samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC site soil screening levels are compiled and presented on Figure 2.4.4-1. While four discrete site structures were investigated in the Compressor Building portion of the southern plant area, the initial RI results for the four structures are discussed as one group.

Table 2.4.4-1
PAAOC Compressor Building RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 1 of 2

	Screening Levels					Ecological Screening Levels	RI Analytical Results												
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-AC01-0.5**	**PAAOC-SB-AC01-2**	**PAAOC-SB-AC02-0.5**	**PAAOC-SB-AC02-0.5D**	**PAAOC-SB-AC02-2**	**PAAOC-SB-AST06-0.5**	**PAAOC-SB-AST06-2**	**PAAOC-SB-AST06-4**	**PAAOC-SB-UST03-6**	**PAAOC-SB-UST03-11.5**	**PAAOC-SB-UST03-13**	**PAAOC-SBUST41-13.0 (Duplicate)**	**PAAOC-SB-UST04-9.0**
Aluminum Smelting																			
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.6	0.05 U	0.05 U	0.05 U	0.052	NA	NA	NA	NA	NA	NA	NA	NA
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	5 U	8.3	22	22	5 U	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	mg/kg	NA	NE	2,150	NE	NE	10 U	10 U	11	10 U	10 U	NA	NA	NA	NA	NA	NA	NA	NA
Polynuclear Aromatic Hydrocarbongs (PAHs)																			
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.054	0.15	0.015 U	0.074 U	0.0078 U	0.15 U	0.015 U	0.036 U	NA	NA	NA	NA	0.0017 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.052	0.15	0.015 U	0.074 U	0.0078 U	NA	NA	NA	NA	NA	NA	NA	0.0023 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0074 U	0.015 U	0.058	0.074 U	0.0078 U	0.26	0.015 U	0.036 U	NA	NA	NA	NA	0.0029 J
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0074 U	0.015 U	0.015 U	0.074 U	0.0078 U	NA	NA	NA	NA	NA	NA	NA	0.00057 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0074 U	0.015 U	0.053	0.074 U	0.0078 U	0.4	0.015 U	0.036 U	NA	NA	NA	NA	0.0028 J
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.01	0.024	0.5	0.37	0.0078 U	2.2 J	0.038	0.11	NA	NA	NA	NA	0.033
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.011	0.028	0.69	0.54	0.0078 U	2.9 J	0.044	0.15	NA	NA	NA	NA	0.045
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.013	0.042	1	0.71	0.0078 U	4.2 J	0.061	0.2	NA	NA	NA	NA	0.063
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.0087	0.026	0.62	0.46	0.0078 U	NA	NA	NA	NA	NA	NA	NA	0.041
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0074 U	0.015 U	0.29	0.22	0.0078 U	NA	NA	NA	NA	NA	NA	NA	0.018
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.016	0.049	0.61	0.4	0.0078 U	2.8 J	0.039	0.13	NA	NA	NA	NA	0.038
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0074 U	0.015 U	0.13	0.088	0.0078 U	0.6 J	0.015 U	0.036 U	NA	NA	NA	NA	0.009
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.019	0.059	0.74	0.53	0.0078 U	3.9 J	0.055	0.18	NA	NA	NA	NA	0.054
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0078	0.018	0.019	0.074 U	0.0078 U	0.15 U	0.015 U	0.036 U	NA	NA	NA	NA	0.0014 J
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.0074 U	0.023	0.61	0.37	0.0078 U	2.5 J	0.032	0.13	NA	NA	NA	NA	0.034
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.02	0.037	0.015 U	0.074 U	0.0078 U	0.15 U	0.015 U	0.036 U	NA	NA	NA	NA	0.0017 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.019	0.046	0.27	0.23	0.0078 U	NA	NA	NA	NA	NA	NA	NA	0.016
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.018	0.054	0.68	0.49	0.0078 U	3.4 J	0.048	0.16	NA	NA	NA	NA	0.05
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.03	0.04	0.95	0.72	0.0078	**3.9**	0.06	0.2	NA	NA	NA	NA	0.06
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.07	0.2	1.14	0.8	0.0078	4.6	0.06	0.2	NA	NA	NA	NA	0.08
Total HMW PAH (calc)	mg/kg	NA	NE	NL	NE	1.1	0.08	0.25	**5.13**	**3.6**	0.0078	**18.6**	0.26	0.9	NA	NA	NA	NA	0.33
Polychlorinated Biphenyls (PCBs)																			
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.055 U	0.055 U	0.057 U	0.056 U	0.059 U	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.055 U	0.057 U	0.056 U	0.059 U	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.055 U	0.057 U	0.056 U	0.059 U	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.055 U	0.057 U	0.056 U	0.059 U	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.055 U	0.057 U	0.056 U	0.059 U	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.055 U	0.055 U	0.057 U	0.056 U	0.059 U	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.055 U	0.055 U	0.057 U	0.056 U	0.059 U	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1262	mg/kg	NL	NL	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1268	mg/kg	NL	NL	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PCBs	mg/kg	10	66	NE	NE	0.65	0.055	0.055	0.057	0.056	0.059	NA	NA	NA	NA	NA	NA	NA	NA
Metals																			
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	6,800	5,600	11,000	12,000	9,800	NA	NA	NA	NA	NA	NA	NA	4,700
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	11 U	11 U	12 U	NA	NA	NA	NA	NA	NA	NA	1.4
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.55 U	0.55 U	0.57 U	0.56 U	0.59 U	NA	NA	NA	NA	NA	NA	NA	0.097
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	6.4	9.1	8.5	10	8.5	NA	NA	NA	NA	NA	NA	NA	8.6 J
Copper	mg/kg	NA	140,000	280	28.4	217	7.4	8	11	12	9.2	NA	NA	NA	NA	NA	NA	NA	7.6
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.5 U	5.5 U	5.7 U	5.6 U	5.9 U	5.9	5.5 U	5.4 U	4.1	5.9	2.3	2.8	2.5
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.28 U	0.29 U	0.28 U	0.29 U	NA	NA	NA	NA	NA	NA	NA	0.0069 U
Nickel	mg/kg	NA	70,000	130	24.54	980	5.3	4.3	7.6	8.2	8	NA	NA	NA	NA	NA	NA	NA	4.3 J
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	11 U	12 U	NA	NA	NA	NA	NA	NA	NA	**0.76**
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	44	41	48	49	53	NA	NA	NA	NA	NA	NA	NA	26
Total Petroleum Hydrocarbons (TPHs)																			
Gasoline Range Organics	mg/kg	100	NE	NA	NA	1,000	NA	NA	NA	NA	NA	5.5 U	5.9 U	3.5 UJ	1.9 B	1.8 B	1.2 B	3.8 B	1.8 B
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	28 U	28 U	57 U	28 U	29 U	270	28 U	27 UJ	3.8 U	20 J	4.1 U	4.1 U	4.1 U
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	190	410	580	200	83	1,000 J	56 U	82 J	29 J	230	14 J	10 U	29 J
Volatile Organic Chemicals (VOCs)																			
Benzene	mg/kg	0.03	2,400	0.027	NE	0.25	NA	NA	NA	NA	NA	0.02 U	0.02 U	0.02 UJ	0.010 U	0.0071 U	0.0085 U	0.0099 U	0.00029 U
Toluene	mg/kg	7	280,000	4.5	NE	5.45	NA	NA	NA	NA	NA	0.055 U	0.059 U	0.035 UJ	0.0075 U	0.0053 U	0.0063 U	0.0073 U	0.00029 U
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	NA	NA	NA	NA	NA	0.055 U	0.059 U	0.035 UJ	0.0058 U	0.000 U	0.0049 U	0.0056 U	0.00038 U
m,p-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	NA	0.055 U	0.059 U	0.035 UJ	0.0087 U	0.0061 U	0.0073 U	0.0085 U	0.00019 U
o-Xylene	mg/kg	9	700,000	14	NE	10	NA	NA	NA	NA	NA	0.055 U	0.059 U	0.035 UJ	0.0087 U	0.0061 U	0.0073 U	0.0085 U	0.00025 U
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00029 U
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00029 U
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00038 U
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00029 U
Vinyl Chloride	mg/kg	NE	87.50	0.0017	NE	6.46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00033 U

Notes:

J	Estimated Concentration.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
NA	Not applicable or not analyzed.	LMW PAH	Low molecular weight PAH.
NE	Not established.	HMW PAH	High molecular weight PAH.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.	B	Analyte found in associated method blank at a level significant relative to the sample result.
U	Chemical was not detected. The associated value represents the method detection limit.	R	Sample rejected due to serious deficiencies in the ability to analyze and meet QC criteria.
UJ	Chemical was not detected. The associated limit is estimated.	Detected concentrations shown in **bold** exceed one or more site soil screening levels.	

Table 2.4.4-1
PAAOC Compressor Building RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 2 of 2

	Screening Levels					Ecological Screening Levels	RI Analytical Results												
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-UST04-11.5**	**PAAOC-SB-UST04-14**	**PAAOC-SB-UST04-16.5**	**PAAOC-SB-UST04-21.5**	**PAAOC-SB-UST05-5.5**	**PAAOC-SB-UST05-10.5**	**PAAOC-SB-UST06-6.5**	**PAAOC-SB-UST06-9**	**RYAOC-TP-T50-0.5**	**RYAOC-TP-T50-2.0**	**RYOC-TP-T51-0.5**	**RYOC-TP-T51-0.5 (Duplicate)**	**RYOC-TP-T51-2**
Aluminum Smelting																			
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	NA	NA	NA	NA	NA	NA	NA	NA	2 U	1.9 U	1.8 U	1.8 U	NA
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	NA	NA	NA	NA	NA	NA	NA	NA	28	33	20	22	NA
Sulfate	mg/kg	NA	NE	2150	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Polynuclear Aromatic Hydrocarbons (PAHs)																			
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0084 U	0.0017 U	1.5	NA	NA	NA	NA	NA	0.024	0.069	0.99	0.79	0.039
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.011 U	0.0023 U	0.046	NA	NA	NA	NA	NA	0.029	0.089	1.4	1.1	0.048
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0088 J	0.0067	0.79	NA	NA	NA	NA	NA	0.33	0.68	15	13	0.5
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0028 U	0.0089	0.38	NA	NA	NA	NA	NA	0.0024 U	0.0025 U	13	0.13	0.0024 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0079 J	0.00068 U	0.58	NA	NA	NA	NA	NA	0.62	1.3	15	13	0.78
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.11	0.0017 U	0.0054 J	NA	NA	NA	NA	NA	4.4	8.2	110	90	5.1
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.15	0.00046 U	0.0013 J	NA	NA	NA	NA	NA	6.6	11	180	160	7
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.21	0.0017 U	0.0023 J	NA	NA	NA	NA	NA	9.5	16	250	220	9.9
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.15	0.00093 J	0.00097 J	NA	NA	NA	NA	NA	4.4	7.8	150	140	5.3
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.063	0.00068 U	0.00071 U	NA	NA	NA	NA	NA	3.1	5.2	84	73	3.3
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.13	0.0021 J	0.029	NA	NA	NA	NA	NA	5.2	9.1	130	110	5.6
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.03	0.00023 U	0.00024 U	NA	NA	NA	NA	NA	0.91	1.6	23	22	0.98
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.19	0.026	0.073	NA	NA	NA	NA	NA	7.4	14	210	180	8.6
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0043 J	0.0045 J	2.7	NA	NA	NA	NA	NA	0.15	0.34	6.4	5.3	0.23
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.11	0.00068 U	0.00082 J	NA	NA	NA	NA	NA	6.3	11	200	180	7.3
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0015 U	0.0024 U	0.0017 UJ	NA	NA	NA	NA	NA	0.053	0.16	2.4	1.8	0.085
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.055 J	0.021	3.4	NA	NA	NA	NA	NA	2.6	5.1	73	60	3.1
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.17	0.024	0.29	NA	NA	NA	NA	NA	6.8	13	190	170	7.8
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.2	0.005	0.002	NA	NA	NA	NA	NA	**9.07**	**15.3**	**248**	**219.6**	**9.71**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.27	0.06	7.92	NA	NA	NA	NA	NA	11.15	21.6	**334.8**	**273.23**	13.3
Total HMW PAH (calc)	mg/kg	NA	NE	NL	NE	1.1	**1.12**	0.027	0.33	NA	NA	NA	NA	NA	**47.21**	**82.9**	**1,317**	**1,165**	**52.3**
Polychlorinated Biphenyls (PCBs)																			
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.007 U	0.0067 U	0.007 U	0.0073 U	0.0078 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.004 UJ	0.0038 UJ	0.004 UJ	0.0041 UJ	0.0044 UJ
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.0046 U	0.0044 U	0.0046 U	0.0048 U	0.0051 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.0015 U	0.0014 U	0.0015 U	0.0016 U	0.0017 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.0027 U	0.0026 U	0.0027 U	0.0028 U	0.003 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.0014 UJ	0.0014 UJ	0.0014 UJ	0.0015 U	0.0016 UJ
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.0018 UJ	0.013 J	0.68 J	0.56 J	0.061 J
Aroclor 1262	mg/kg	NL	NL	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.00047 UJ	0.00045 UJ	0.00047 UJ	0.00049 UJ	0.00052 UJ
Aroclor 1268	mg/kg	NL	NL	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.00085 UJ	0.00081 UJ	0.00085 UJ	0.00088 UJ	0.00094 UJ
Total PCBs	mg/kg	10	66	NE	NE	0.65	NA	NA	NA	NA	NA	NA	NA	NA	0.00047	0.013	**0.68**	0.56	0.061
Metals																			
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	8,700	7,000	8,300	NA	NA	NA	NA	NA	16,000 J	7,900 J	42,000 J	38,000 J	9,000
Arsenic	mg/kg	20	88	2.9	7.61	132	1.9	1.6	1.8	NA	NA	NA	NA	NA	2.3	1.4	2.5	2.7	2.4
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.21	0.13	0.16	NA	NA	NA	NA	NA	**1.5 J**	**0.84 J**	**3 J**	**7.5 J**	0.5 J
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	6.9 J	3.6 J	7.5 J	NA	NA	NA	NA	NA	16 J	7.4 J	33 J	28 J	10 J
Copper	mg/kg	NA	140,000	280	28.4	217	16	12	14	NA	NA	NA	NA	NA	44 J	28 J	49 J	61 J	19 J
Lead	mg/kg	1,000	NE	3,000	13.1	118	4.6	3.1	4.1	6.2	4.8	3.6	1.7	4	17 J	7.6 J	57 J	49 J	12 J
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.0063 U	0.0066 U	0.0067 U	NA	NA	NA	NA	NA	0.035	0.038	0.052 J	0.061 J	0.037 J
Nickel	mg/kg	NA	70,000	130	24.54	980	8.8 J	4.1 J	6.6 J	NA	NA	NA	NA	NA	15 J	8.9 J	34 J	34 J	9.5 J
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	**1.3**	**1.3**	**1.3**	NA	NA	NA	NA	NA	**9**	**0.75**	**0.52**	**0.57**	**0.63**
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	51	37	43	NA	NA	NA	NA	NA	210 J	97 J	**510 J**	**500 J**	99 J
Total Petroleum Hydrocarbons (TPHs)																			
Gasoline Range Organics	mg/kg	100	NE	NA	NA	1,000	3 B	1.3 B	**11,000 J**	**570**	3.5 B	1.7 B	3.5 B	15 J	NA	NA	NA	NA	NA
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	5.4 J	60	**5,100**	1,100	4.3 R	3.9 U	3.9 U	4.1 U	110	50	1,400	1,700	39
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	61	10 U	70	14 J	45 R	30 J	9.9 U	10 J	330	160 J	**5,000**	**5,800**	110
Volatile Organic Chemicals (VOCs)																			
Benzene	mg/kg	0.03	2,400	0.027	NE	0.25	0.00026 U	0.0004 U	0.00028 UJ	0.0076 U	0.012 U	0.0078 U	0.008 U	0.039 U	NA	NA	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.00026 U	0.0004 U	0.00037 J	0.0056 U	0.0092 U	0.0058 U	0.0059 U	0.029 U	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.00034 U	0.0004 U	0.00038 UJ	0.0043 U	0.0071 U	0.0044 U	0.0046 U	0.022 U	NA	NA	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.00017 U	0.00027 U	0.00019 UJ	0.0065 U	0.011 U	0.0066 U	0.0068 U	0.033 U	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NE	10	0.00022 U	0.00035 U	0.00024 UJ	0.0065 U	0.011 U	0.0066 U	0.0068 U	0.033 U	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.00026 U	0.0004 U	0.00028 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.00026 U	0.0004 U	0.00028 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.00034 U	0.00054 U	0.00038 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.00026 U	0.0004 U	0.00028 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	87.50	0.0017	NE	6.46	0.00032 U	0.00033 UJ	0.00026 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

J	Estimated Concentration.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
NA	Not applicable or not analyzed.	LMW PAH	Low molecular weight PAH.
NE	Not established.	HMW PAH	High molecular weight PAH.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.	B	Analyte found in associated method blank at a level significant relative to the sample result.
U	Chemical was not detected. The associated value represents the method detection limit.	R	Sample rejected due to serious deficiencies in the ability to analyze and meet QC criteria.
UJ	Chemical was not detected. The associated limit is estimated.	Detected concentrations shown in bold exceed one or more site soil screening levels.	

The initial RI results for the Compressor Building indicate that detected concentrations of total cyanide, fluoride, sulfate, and most metals do not exceed their MTCA Method A Industrial, MTCA Method C, protection of groundwater, or ecological wildlife screening levels in the 26 soil samples analyzed.

Detected concentrations of PAHs as TTEC, and calculated total LMW PAH and HMW PAH, exceed soil screening levels at all depths in transformer substation TP-T50 and TP-T51 test pits, and total HMW PAH in one sample for the Compressor Building AST. Calculated concentrations of PAHs as TTEC ranging from 9.07 to 248 mg/kg exceed protection of groundwater screening levels at all sample depths in the transformer substation test pits. Calculated concentrations of total LMW PAH of 334.8 and 273.23 mg/kg in sample TP-T51-0.5 and its duplicate, respectively, exceed the ecological wildlife screening level. Calculated concentrations of total HMW PAH ranging from 47.21 to 1,317 mg/kg exceed the ecological wildlife screening level at all sample depths. A calculated concentration of total HMW PAH exceeds the ecological wildlife screening level in one AST sample, SB-AST06-0.5, but not at the deeper depth sample at 2 ft bgs.

Detected concentrations of calculated total PCBs slightly exceeded the ecological wildlife screening level in one sample, TP-T51-0.5, at 0.65 mg/kg but did not exceed at the next deeper sample at 2 ft bgs.

Three metals including cadmium, selenium, and zinc, exceeded soil screening levels in the collected Compressor Building samples. Detected concentrations of cadmium ranged from 1.5 to 7.5 J mg/kg in test pits TP-T50 and TP-T51, respectively, and exceeded the protection of groundwater screening level in TP-T50 at 0.5 and 2 ft depth samples, and in TP-T51 at the 0.5 ft depth sample. Detected concentrations of selenium ranged from 1.3 to 9 mg/kg in boring SB-UST04, and test pits TP-T50 and TP-T51, exceeding the ecological wildlife screening level in four of five samples from SB-UST04 and all samples from TP-T50 and TP-T51, and exceeding the protection of groundwater screening level in one sample TP-T50-0.5. Detected concentrations of zinc of 510 J and 500 J mg/kg in sample TP-T51-0.5 and its duplicate sample exceeded the ecological wildlife screening level but did not exceed and the deeper sample at 2 ft bgs.

Detected concentrations of TPH-Gx in boring SB-UST04 of 11,000 J mg/kg at 16.5 ft bgs and of 570 mg/kg at 21.5 ft bgs in the former gasoline UST removal area exceeds the ecological wildlife soil screening level of 1,000 mg/kg and MTCA Method A Industrial screening level of 100 mg/kg, respectively. Detected concentrations of TPH-Dx as diesel range organics exceed MTCA Method A Industrial and the ecological wildlife soil screening levels of 2,000 mg/kg in one sample, SB-UST04-16.5, in the former gasoline UST removal area. These gasoline and diesel range organic concentrations that exceed screening levels occur in a 3 to 4 ft thick smear zone at the water table (refer to boring logs and well logs in Appendices G-1 and D-1, respectively). Detected concentrations of residual range organics of 5,000 and 5,800 mg/kg in sample TP-T51-0.5 and its duplicate sample, respectively, exceed MTCA Method A Industrial and the ecological wildlife screening levels but do not exceed at the deeper sample depth of 2 ft bgs.

2.4.4.3 Conclusions and Recommendations

Results of the initial RI indicate detected concentrations of PAHs, PCBs, cadmium, selenium, and zinc exceed either protection of groundwater and/or ecological wildlife screening levels in shallow soil. TPH-Dx as residual range organics exceeds MTCA Method A Industrial and ecological wildlife screening levels in all 0.5 and 2 ft bgs samples at transformer substations T50 and T51. The vertical extent of contamination of transformer substations at T50 and T51 is not defined.

At the Compressor Building UST excavation location, TPH-Gx and TPH-Dx exceed soil screening levels in a 3 to 4 ft thick smear zone at a depth in boring SB-UST04 (monitor well RI-GW6) that may have, or may, impact shallow groundwater.

Based on the results of the initial RI phase of investigation the Compressor Building and associated features will be recommended for further evaluation in the FS for TPH in soil and PAH contamination at the transformer substations. Groundwater near the Compressor Building was characterized during the initial RI, and the results and conclusions and recommendations are summarized in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC.

2.4.5 Dross Storage Building

The Dross Storage Building is located to the southeast of the Compressor Building. The building was used to store dross skimmed from the surface of the molten aluminum in the furnace. Dross impurities may include aluminum oxides, metals, and fluoride. The building is currently used to store aluminum siding scrap metal and former Cast House pulverized materials (Figure 2.1.2-1).

2.4.5.1 Investigation Scope

The Dross Storage Building was investigated with two soil borings, SB-AD01 and SB-AD02. The borings were completed to 6 ft bgs and soil samples were collected at 0.5, 2, 4 and 6 ft bgs. Based on criteria in the Supplemental Remedial Investigation Work Plan (PGG 2017), samples collected at 4 and 6 ft bgs were not analyzed. Samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH.

Investigation of the Dross Storage Building was conducted during the initial RI phase of investigation. No further investigation was proposed in the WPA.

2.4.5.2 Investigation Results

Two soil borings were completed, one on the west side (SB-AD01) and one on the north side (SB-AD02) of the Dross Storage Building (Figure 2.4.5-1). The soil was described and characterized, and logs of borings are included in Volume 5, Appendix G-1. Soil boring soil sample results are summarized on Table 2.4.5-1. Analytical results are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC soil screening levels. Natural background concentrations for the site have also been used to adjust screening levels where applicable in the screening process. Laboratory reports are included in Volume 5, Appendix H-2, and data validation reports are included in Volume 5, Appendix I-2. All samples were collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). For the Dross Storage Building, reporting limits for arsenic exceed the protection of groundwater screening level, and for selenium exceeds the protection of groundwater and ecological wildlife screening levels, in all soil samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels are compiled and presented on Figure 2.4.5-1. The initial RI results indicate that detected concentrations of sulfate, PCBs, and metals do not exceed Plant Area AOC soil screening levels. Detected concentrations of fluoride exceed the protection of groundwater screening level in sample SB-AD02-0.5 and the next deeper sample SB-AD02-2. Detected concentrations of total cyanide exceeds the ecological wildlife screening level in one soil sample, SB-AD02-0.5 but not in the next deeper sample SB-AD02-2. Detected concentrations of PAHs as calculated total HMW PAH exceed ecological wildlife screening level in three of four soil samples. TPH as residual range organics were detected at 4,300 mg/kg in sample SB-AD02-0.5 which exceed MTCA Method A Industrial

PAAOC-SB-AD02	0.5	2
Aluminum Smelting (mg/kg)		
Cyanide, total	9.4	NE
Fluoride	620	190
PAH (mg/kg)		
HMW	8.9	NE
TPH (mg/kg)		
RRO	4,300	NE

PAAOC-SB-AD01	0.5	2
PAH (mg/kg)		
HMW	3.7	4.13

● RI Boring

▭ Dross Storage Building Outline

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds Ecological Wildlife and for TPH diesel and residual range organics exceeds MTCA Method A

NE: No exceedance
RRO: Residual Range Organics
2: Sample depth in feet bgs

0 30 60 120
Feet

Figure 2.4.5-1

Plant Area AOC

Dross Storage Building Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Table 2.4.5-1
PAAOC Dross Storage Building RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Level	RI Analytical Results			
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-AD01-0.5**	**PAAOC-SB-AD01-2**	**PAAOC-SB-AD02-0.5**	**PAAOC-SB-AD02-2**
Aluminum Smelting										
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	**9.4**	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	47	23	**620**	**190**
Sulfate	mg/kg	NA	NE	2,150	NE	NE	13	14	51	15
Polynuclear Aromatic Hydrocarbons (PAHs)										
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.015 U	0.07 U	0.29 U	0.015 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.015 U	0.07 U	0.29 U	0.015 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.044	0.07 U	0.29 U	0.015 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.015 U	0.07 U	0.29 U	0.015 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.065	0.07 U	0.29 U	0.015 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.39	0.43	0.76	0.08
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.55	0.61	1.1	0.12
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.68	0.77	1.8	0.16
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.44	0.49	1.3	0.11
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.21	0.22	0.61	0.044
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.37	0.47	1.1	0.085
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.087	0.093	0.29 U	0.021
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.64	0.69	1.1	0.12
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.024	0.07 U	0.29 U	0.015 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.37	0.43	1.2	0.089
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.015 U	0.07 U	0.29 U	0.015 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.3	0.31	0.41	0.047
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.58	0.62	1	0.11
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.73	0.81	1.5	0.16
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	1.07	1	1.5	0.17
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**3.7**	**4.13**	**8.9**	0.82
Polychlorinated Biphenyls (PCBs)										
Aroclor 1016	mg/kg	NA	NL	NE	NE	NE	0.055 U	0.053 U	0.054 U	0.055 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.053 U	0.054 U	0.055 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.053 U	0.054 U	0.055 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.053 U	0.054 U	0.055 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.053 U	0.054 U	0.055 U
Aroclor 1254	mg/kg	NA	NL	NL	NE	NE	0.055 U	0.053 U	0.054 U	0.055 U
Aroclor 1260	mg/kg	NA	NL	NE	NE	NE	0.055 U	0.053 U	0.054 U	0.055 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.055	0.053	0.054	0.055
Metals										
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	8,400	5,400	150,000	9,000
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.55 U	0.53 U	0.54 U	0.55 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	9.7	9	71	7.3
Copper	mg/kg	NA	140,000	280	28.4	217	12	12	90	12
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.5 U	5.3 U	5.4 U	5.5 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.26 U	0.27 U	0.27 U
Nickel	mg/kg	NA	70,000	130	24.54	980	7.3	6.5	32	5.9
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	52	37	46	49
Total Petroleum Hydrocarbons (TPHs)										
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	28 U	53 U	540 U	28 U
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	120	510	**4,300**	55 U

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

and the ecological wildlife screening level of 2,000 mg/kg, but not in the next deeper sample SB-AD02-2.

2.4.5.3 Conclusions and Recommendations

Results of the RI investigation indicated that detected concentrations of calculated total HMW PAH and total cyanide exceed ecological wildlife screening levels in both soil borings, and fluoride exceeds the protection of groundwater screening level in both sample depths in boring SB-AD02. The vertical extent of fluoride in SB-AD02 is not defined but is not expected to exceed at depth based on nearby boring SB-AD01. TPH-Dx as residual range organics exceeds MTCA Method A Industrial and ecological wildlife screening levels in SB-AD02 at 0.5 ft bgs sample but not a deeper sample depths.

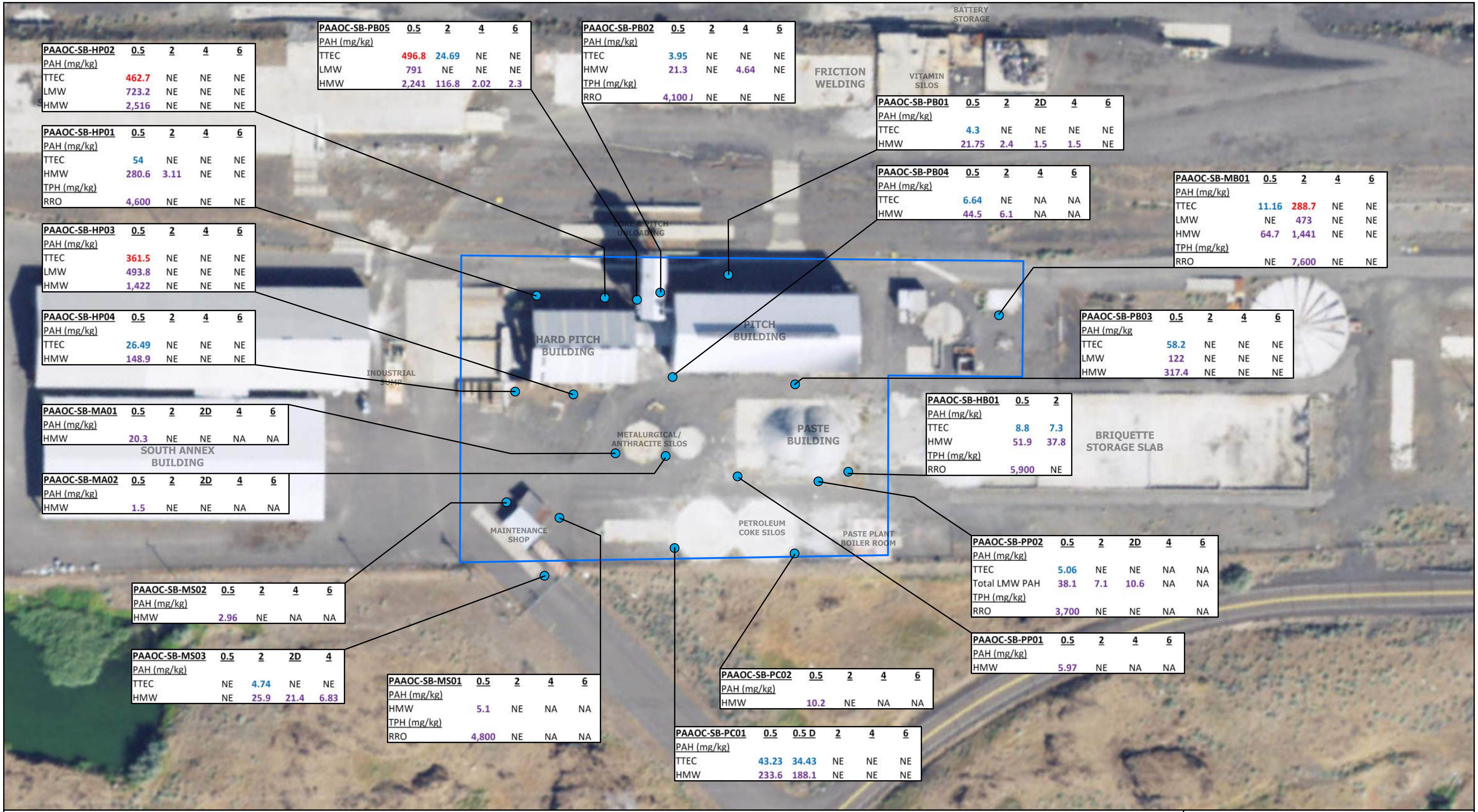
Based on the results of the initial RI investigation the Dross Storage Building is recommended for further evaluation in the FS.

2.4.6 Pitch Building Group

The Pitch Building Group consists of several structures that were used for handling and storing raw materials used in manufacturing hard briquettes for the aluminum production process. This area of the southern portion of the Plant Area AOC is located east of SWMU 15 South SPL Storage Building (Figure 2.1.2-1). The structures included in the Pitch Building Group are as follows and their locations are shown on Figure 2.4.6-1.

- Hard Pitch Storage Building
- Pitch Building (pitch remains between the building aluminum siding and foundation walls)
- Paste Plant where raw materials were blended to form hard briquettes
- Two Petroleum Coke Silos
- Metallurgical Coke Silo and Anthracite Coal Silo
- Maintenance Shop
- Maintenance Building (also used as lunchroom)
- HEAF Building housing the Paste Plant Building air emissions control unit

This part of the southern portion of the Plant Area AOC was paved with concrete and/or asphalt through most of the plant operation.



PAAOC-SB-HP02	0.5	2	4	6
PAH (mg/kg)				
TTEC	462.7	NE	NE	NE
LMW	723.2	NE	NE	NE
HMW	2,516	NE	NE	NE

PAAOC-SB-HP01	0.5	2	4	6
PAH (mg/kg)				
TTEC	54	NE	NE	NE
HMW	280.6	3.11	NE	NE
TPH (mg/kg)				
RRO	4,600	NE	NE	NE

PAAOC-SB-HP03	0.5	2	4	6
PAH (mg/kg)				
TTEC	361.5	NE	NE	NE
LMW	493.8	NE	NE	NE
HMW	1,422	NE	NE	NE

PAAOC-SB-HP04	0.5	2	4	6
PAH (mg/kg)				
TTEC	26.49	NE	NE	NE
HMW	148.9	NE	NE	NE

PAAOC-SB-MA01	0.5	2	2D	4	6
PAH (mg/kg)					
HMW	20.3	NE	NE	NA	NA

PAAOC-SB-MA02	0.5	2	2D	4	6
PAH (mg/kg)					
HMW	1.5	NE	NE	NA	NA

PAAOC-SB-PB05	0.5	2	4	6
PAH (mg/kg)				
TTEC	496.8	24.69	NE	NE
LMW	791	NE	NE	NE
HMW	2,241	116.8	2.02	2.3

PAAOC-SB-PB02	0.5	2	4	6
PAH (mg/kg)				
TTEC	3.95	NE	NE	NE
HMW	21.3	NE	4.64	NE
TPH (mg/kg)				
RRO	4,100 J	NE	NE	NE

PAAOC-SB-PB01	0.5	2	2D	4	6
PAH (mg/kg)					
TTEC	4.3	NE	NE	NE	NE
HMW	21.75	2.4	1.5	1.5	NE

PAAOC-SB-PB04	0.5	2	4	6
PAH (mg/kg)				
TTEC	6.64	NE	NA	NA
HMW	44.5	6.1	NA	NA

PAAOC-SB-MB01	0.5	2	4	6
PAH (mg/kg)				
TTEC	11.16	288.7	NE	NE
LMW	NE	473	NE	NE
HMW	64.7	1,441	NE	NE
TPH (mg/kg)				
RRO	NE	7,600	NE	NE

PAAOC-SB-PB03	0.5	2	4	6
PAH (mg/kg				
TTEC	58.2	NE	NE	NE
LMW	122	NE	NE	NE
HMW	317.4	NE	NE	NE

PAAOC-SB-HB01	0.5	2
PAH (mg/kg)		
TTEC	8.8	7.3
HMW	51.9	37.8
TPH (mg/kg)		
RRO	5,900	NE

PAAOC-SB-PP02	0.5	2	2D	4	6
PAH (mg/kg)					
TTEC	5.06	NE	NE	NA	NA
Total LMW PAH	38.1	7.1	10.6	NA	NA
TPH (mg/kg)					
RRO	3,700	NE	NE	NA	NA

PAAOC-SB-PP01	0.5	2	4	6
PAH (mg/kg)				
HMW	5.97	NE	NA	NA

PAAOC-SB-MS02	0.5	2	4	6
PAH (mg/kg)				
HMW	2.96	NE	NA	NA

PAAOC-SB-MS03	0.5	2	2D	4
PAH (mg/kg)				
TTEC	NE	4.74	NE	NE
HMW	NE	25.9	21.4	6.83

PAAOC-SB-MS01	0.5	2	4	6
PAH (mg/kg)				
HMW	5.1	NE	NA	NA
TPH (mg/kg)				
RRO	4,800	NE	NA	NA

PAAOC-SB-PC02	0.5	2	4	6
PAH (mg/kg)				
HMW	10.2	NE	NA	NA

PAAOC-SB-PC01	0.5	0.5 D	2	4	6
PAH (mg/kg)					
TTEC	43.23	34.43	NE	NE	NE
HMW	233.6	188.1	NE	NE	NE

● RI Boring
▭ Pitch Building Group Outline

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds Ecological Wildlife and for TPH diesel and residual range organics exceeds MTCA Method A
red: exceeds MTCA Method C

NE: No exceedance
NA: Not analyzed
D: Duplicate sample
RRO: Residual Range Organics
2: Sample depth in feet bgs

W N S E

0 30 60 120
Feet

Figure 2.4.6-1

Plant Area AOC

Pitch Building Group Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

The Coke and Pitch Unloading Structure, while also used for handling raw materials for briquette manufacture, was investigated during the initial RI phase and subsequently identified as an Investigation Area under the WPA (Tetra Tech et al. 2020b). The Coke and Pitch Unloading Structure is discussed separately in Section 2.2.4.

2.4.6.1 Investigation Scope

Structures in the Pitch Building Group were investigated during the initial RI phase with a total of 20 soil borings as specified in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). Each of the Pitch Building Group structures was investigated as follows.

- **HEAF Building**: one soil boring SB-HB01 completed to 2 ft bgs, sampled at 0.5 and 2 ft bgs.
- **Hard Pitch Storage Building**: four soil borings SB-HP01 through SB-HP04 completed to 6 ft bgs, sampled at 0.5, 2, 4, and 6 ft bgs.
- **Metallurgical and Anthracite Coal Silos**: two soil borings SB-MA01 and SB-MA02 completed to 6 ft bgs, sampled at 0.5, 2, 4, and 6 ft bgs.
- **Maintenance Building**: one soil boring SB-MB01 completed to 6 ft bgs, sampled at 0.5, 2, 4, and 6 ft bgs.
- **Maintenance Shop**: three soil borings, SB-MS01 and SB-MS03 completed to 6 ft bgs, sampled at 0.5, 2, 4, and 6 ft bgs, and SB-MS03 completed to 4 ft bgs, sampled at 0.5, 2, and 4 ft bgs.
- **Pitch Building**: five soil borings SB-PB01 through SB-PB05 completed to 6 ft, sampled at 0.5, 2, 4, and 6 ft bgs.
- **Petroleum Coke Silos**: two soil borings SB-PC01 and SB-PC02 completed to 6 ft bgs, sampled at 0.5, 2, 4, and 6 ft bgs.
- **Paste Plant**: two soil borings SB-PP01 and SB-PP02 completed to 6 ft bgs, sampled at 0.5, 2, 4, and 6 ft bgs.

Samples collected from the Hard Pitch Storage Building, Metallurgical and Anthracite Silos, Pitch Building, Petroleum Coke Silos, and Paste Plant Building were analyzed for PAHs and metals.

Samples from the Maintenance Building, Maintenance Shop, and Pitch Building, and from one boring of each of the Hard Pitch Building, Petroleum Coke Silos, and Paste Plant borings were analyzed for total cyanide, fluoride, sulfate, PCBs and TPH-Dx in addition to PAHs and metals.

Investigation of the Pitch Building Group was conducted during the initial RI phase of investigation. No further investigation was proposed in the WPA.

2.4.6.2 Investigation Results

The Pitch Building Group was investigated with a total of 20 soil borings. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1. Soil analytical results are summarized on Table 2.4.6-1. Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC soil screening levels. Natural background concentrations for the site have also been used to adjust screening levels where applicable in the screening process. Laboratory reports are included in Volume 5, Appendix H-2, and data validation reports are included in Volume 5, Appendix I-2. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). For the Pitch Building Group, reporting limits for arsenic exceed the protection of groundwater screening level, and for selenium exceed the protection of groundwater and ecological wildlife screening levels, in all samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels are compiled and presented on Figure 2.4.6-1. Analytical results indicate that total cyanide, fluoride, sulfate, metals, and PCBs do not exceed soil screening levels.

PAHs as TTEC, and calculated total LMW and HMW PAH, exceed soil screening levels in all borings in the shallowest depths sampled. Detected concentrations of TTEC exceed the protection of groundwater soil screening level of 3.9 mg/kg in 15 out of 20 borings to a maximum depth of 2 ft bgs. Detected concentrations of calculated total LMW PAH exceed the ecological wildlife soil screening level in 5 out of 20 borings to a maximum depth of 2 ft bgs. Detected concentrations of calculated total HMW PAH exceed the ecological wildlife soil screening level in all 20 borings to a depth of 0.5 or 2 ft bgs, in five out of 20 borings to a depth of 4 ft bgs, and in one out of 20 borings to a depth of 6 ft bgs.

Detected concentrations of TPH as residual range organics exceeds MTCA Method A Industrial and the ecological wildlife soil screening level at a depth of 0.5 ft bgs in five out of 20 borings, and at a depth of 2 ft bgs in one out of 20 borings. Detected concentrations range from 3,700 to 7,600 mg/kg. Elevated concentrations of TPH as residual range organics are present where PAHs also exceed soil screening levels.

Table 2.4.6-1
PAAOC Pitch Building Group RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale Washington
Page 1 of 4

		Screening Levels				Ecological Screening Levels	RI Analytical Results																
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-HB01-0.5	PAAOC-SB-HB01-2	PAAOC-SB-HP01-0.5	PAAOC-SB-HP01-2	PAAOC-SB-HP01-4	PAAOC-SB-HP01-6	PAAOC-SB-HP02-0.5	PAAOC-SB-HP02-2	PAAOC-SB-HP02-4	PAAOC-SB-HP02-6	PAAOC-SB-HP03-0.5	PAAOC-SB-HP03-2	PAAOC-SB-HP03-4	PAAOC-SB-HP03-6	PAAOC-SB-HP04-0.5	PAAOC-SB-HP04-2	PAAOC-SB-HP04-4
Aluminum Smelting																							
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	NA	NA	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	NA	NA	52	20	9.2	6.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	NA	13	10 U	16	28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Polynuclear Aromatic Hydrocarbons (PAHs)																							
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	1.4 U	0.15 U	0.29 U	0.015 U	0.0071 U	0.0069 U	7.2 U	0.015 U	0.0076 U	0.0077 U	7.1 U	0.015 U	0.0075 U	0.0072 U	0.29 U	0.015 U	0.0077 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	1.4 U	0.15 U	0.29 U	0.015 U	0.0071 U	0.0069 U	7.2 U	0.015 U	0.0076 U	0.0077 U	7.1 U	0.015 U	0.0075 U	0.0072 U	0.29 U	0.015 U	0.0077 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	1.4 U	0.39	2.1	0.027	0.0071 U	0.0069 U	27	0.015 U	0.0076 U	0.0077 U	20	0.015 U	0.0075 U	0.0072 U	1.9	0.015 U	0.0077 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	1.4 U	0.15 U	0.294	0.015 U	0.0071 U	0.0069 U	7.24	0.015 U	0.0076 U	0.0077 U	7.14	0.015 U	0.0075 U	0.0072 U	0.29 U	0.015 U	0.0077 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	1.4 U	0.47	3.1	0.049	0.0071 U	0.0069 U	38	0.015 U	0.0076 U	0.0077 U	17	0.015 U	0.0075 U	0.0072 U	1.9	0.015 U	0.0077 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	4.7	3.6	29	0.32	0.0071 U	0.012	270	0.095	0.0076 U	0.015	190	0.048	0.0075 U	0.047	16	0.064	0.01
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	6.3	5.4	40	0.42	0.0071 U	0.016	340	0.12	0.0076 U	0.02	270	0.065	0.0075 U	0.066	19	0.075	0.013
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	10	7.5	56	0.58	0.0071 U	0.022	460	0.17	0.0076 U	0.028	370	0.093	0.0075 U	0.096	29	0.11	0.017
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	6	4.3	28	0.34	0.0071 U	0.013	250	0.091	0.0076 U	0.016	200	0.056	0.0075 U	0.054	14	0.057	0.0098
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	3.5	2.1	16	0.2	0.0071 U	0.0074	150	0.058	0.0076 U	0.0088	120	0.03	0.0075 U	0.028	9.7	0.039	0.0077 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	7.5	4.4	34	0.37	0.0071 U	0.014	310	0.12	0.0076 U	0.018	230	0.054	0.0075 U	0.06	20	0.082	0.011
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	1.4 U	0.98	6.6	0.067	0.0071 U	0.0069 U	56	0.018	0.0076 U	0.0077 U	42	0.015 U	0.0075 U	0.0097	3.2	0.015 U	0.0077 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	7.6	5.6	47	0.51	0.0071 U	0.019	470	0.16	0.0076 U	0.023	320	0.073	0.0075 U	0.077	28	0.1	0.015
Fluorene	mg/kg	NL	140,000	100	NE	NL	1.4 U	0.16	0.95	0.015 U	0.0071 U	0.0069 U	11	0.015 U	0.0076 U	0.0077 U	9.7	0.015 U	0.0075 U	0.0072 U	0.96	0.015 U	0.0077 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	6.1	4.4	29	0.35	0.0071 U	0.012	260	0.093	0.0076 U	0.014	170	0.049	0.0075 U	0.046	15	0.059	0.0082
Naphthalene	mg/kg	5	70	5	NE	NL	1.4 U	0.15 U	0.29 U	0.015 U	0.0071 U	0.0069 U	7.2 U	0.015 U	0.0076 U	0.0077 U	7.1 U	0.015 U	0.0075 U	0.0072 U	0.45	0.015 U	0.0077 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	2.5	2.3	15	0.2	0.0071 U	0.0074	170	0.056	0.0076 U	0.0091	120	0.026	0.0075 U	0.03	0.29 U	0.043	0.0077 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	7.8	5.1	42	0.46	0.0071 U	0.017	420	0.15	0.0076 U	0.02	270	0.064	0.0075 U	0.066	23	0.093	0.013
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**8.8**	**7.3**	**54**	0.58	0.0071	0.02	**462.7**	0.17	0.0076	0.03	**361.5**	0.09	0.0075	0.09	**26.49**	0.1	0.02
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	10.1	8.9	68.4	0.8	0.0071	0.26	**723.2**	0.22	0.0076	0.03	**493.8**	0.1	0.0075	0.11	33.2	0.14	0.02
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**51.9**	**37.8**	**280.6**	**3.11**	0.0071	0.11	**2,516**	0.91	0.0076	0.14	**1,422**	0.46	0.0075	0.47	**148.9**	0.58	0.08
Polychlorinated Biphenyls (PCBs)																							
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	0.055 U	0.056 U	0.053 U	0.051 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	0.055 U	0.056 U	0.053 U	0.051 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	0.055 U	0.056 U	0.053 U	0.051 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	0.055 U	0.056 U	0.053 U	0.051 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	0.055 U	0.056 U	0.053 U	0.051 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	0.055 U	0.056 U	0.053 U	0.051 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	0.055 U	0.056 U	0.053 U	0.051 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	0.055	0.056	0.053	0.051	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals																							
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	8,300	12,000	9,000	8,900	4,200	3,100	10,000	9,600	7,100	7,700	11,000	6,800	6,400	4,200	7,500	7,300	8,600
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	11 U	11 U	11 U	10 U	11 U	11 U	11 U	12 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.54 U	0.55 U	0.55 U	0.56 U	0.53 U	0.51 U	0.54 U	0.57 U	0.57 U	0.58 U	0.53 U	0.55 U	0.56 U	0.54 U	0.54 U	0.55 U	0.58 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	24	13	12	9.5	2.3	3.6	6.6	7.7	3.1	3	6.7	5.6 J	6.4	4	18	5.3	8
Copper	mg/kg	NA	140,000	280	28.4	217	210	15	21	18	14	22	18	20	16	18	19	14	15	12	19	16	17
Lead	mg/kg	1,000	NE	3,000	13.1	118	13	5.5 U	5.5 U	5.6 U	5.3 U	5.1 U	14	5.7 U	5.7 U	5.8 U	14	5.5 U	5.6 U	5.4 U	5.4 U	5.5 U	5.8 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.27 U	0.27 U	0.27 U	0.28 U	0.27 U	0.26 U	0.27 U	0.28 U	0.28 U	0.29 U	0.27 U	0.28 U	0.28 U	0.27 U	0.27 U	0.28 U	0.29 U
Nickel	mg/kg	NA	70,000	130	24.54	980	21	9.1	8.6	6.9	2.7 U	3	9.3	7.9	3.9	5.4	16	5.3	3.9	2.7 U	9.5	5.2	8
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	11 U	11 U	10 U	11 U	11 U	11 U	12 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	130	37	47	52	41	40	56	59	46	42	67 J	45 J	48 J	30 J	40 J	52 J	50 J
Total Petroleum Hydrocarbons (TPHs)																							
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	540 U	140 U	550 U	28 U	27 U	26 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Residuall Range Organics	mg/kg	2,000	NE	NA	NA	2,000	**5,900**	430	**4,600**	56 U	53 U	51 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not rstablished.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.

TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW	Low molecular weight PAHs.
HMW	High molecular weight PAHs.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.4.6-1
PAAOC Pitch Building Group RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale Washington

	Screening Levels					Ecological Screening Levels	RI Analytical Results																
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-HP04-6	PAAOC-SB-MA01-0.5	PAAOC-SB-MA01-2	PAAOC-SB-MA01-2D	PAAOC-SB-MA02-0.5	PAAOC-SB-MA02-2	PAAOC-SB-MA02-2D	PAAOC-SB-MB01-0.5	PAAOC-SB-MB01-2	PAAOC-SB-MB01-4	PAAOC-SB-MB01-6	PAAOC-SB-MS01-0.5	PAAOC-SB-MS01-2	PAAOC-SB-MS02-0.5	PAAOC-SB-MS02-2	PAAOC-SB-MS03-0.5	PAAOC-SB-MS03-2
Aluminum Smelting																							
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	NA	NA	NA	NA	NA	NA	NA	0.05 U	0.05 U	0.63	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	NA	NA	NA	NA	NA	NA	NA	11	110	71	12	8.1	14	20	41	8	57
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	NA	NA	NA	NA	NA	NA	10 U	10 U	10 U	10 U	22	10 U	68	10 U	58	39
Polynuclear Aromatic Hydrocarbons (PAHs)																							
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0071 U	0.69 U	0.0073 U	0.0074 U	0.071 U	0.0076 U	0.0072 U	1.4 U	7.6 U	0.0076 U	0.0076 U	0.15 U	0.0073 U	0.072 U	0.0076 U	0.014 U	0.31 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0071 U	0.69 U	0.0073 U	0.0074 U	0.071 U	0.0095	0.0072 U	1.4 U	7.6 U	0.0076 U	0.0076 U	0.15 U	0.0073 U	0.072 U	0.0076 U	0.014 U	0.31 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0071 U	0.69 U	0.0073 U	0.11	0.071 U	0.039 J	0.0072 U	1.4 U	15	0.0076 U	0.0076 U	0.15 U	0.0073 U	0.072 U	0.0076 U	0.014 U	0.31 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0071 U	0.69 U	0.0073 U	0.0074 U	0.071 U	0.0076 U	0.0072 U	1.4 U	7.6 U	0.0076 U	0.0076 U	0.15 U	0.0073 U	0.072 U	0.0076 U	0.014 U	0.31 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0071 U	0.69 U	0.0073 U	0.0074 U	0.071 U	0.0076 U	0.0072 U	1.4 U	36	0.0076 U	0.0076 U	0.15 U	0.0073 U	0.072 U	0.0076 U	0.014 U	0.31 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0085	1.7	0.0073 U	0.0074 U	0.15	0.0076 U	0.0072 U	7.7	160	0.0076 U	0.0076 U	0.53	0.0073 U	0.31	0.076	0.014 U	2.6
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.011	2.6	0.0079	0.0074 U	0.2	0.0076 U	0.0072 U	8.1	220	0.0076 U	0.0076 U	0.72	0.0073 U	0.46	0.11	0.017	3.5
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.015	3.9	0.011	0.0093	0.29	0.0076 U	0.0072 U	13	270	0.0076 U	0.0076 U	1	0.0073 U	0.31	0.16	0.023	4.8
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.0091	2.8	0.0073 U	0.0074 U	0.17	0.039 J	0.0072 U	5.8	160	0.0076 U	0.0076 U	0.66	0.0073 U	0.38	0.094	0.016	2.7
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.00714	1.4	0.0073 U	0.0074 U	0.099	0.0076 U	0.0072 U	4.1	82	0.0076 U	0.0076 U	0.28	0.0073 U	0.21	0.046	0.014 U	1.8
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.0098	2.4	0.0083	0.0074 U	0.19	0.0076 U	0.0072 U	9.1	160	0.0076 U	0.0076 U	0.62	0.0073 U	0.4	0.093	0.015	3.3
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0071 U	0.69 U	0.0073 U	0.0074 U	0.071 U	0.0076 U	0.0072 U	1.4 U	29	0.0076 U	0.0076 U	0.15 U	0.0073 U	0.083	0.018	0.014 U	0.53
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.014	2.8	0.014	0.011	0.26	0.0076 U	0.0072 U	14	270	0.0076 U	0.0076 U	0.8	0.0073 U	0.44	0.1	0.02	4.3
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0071 U	0.69 U	0.0073 U	0.0074 U	0.071 U	0.01	0.0072 U	1.4 U	12	0.0076 U	0.0076 U	0.15 U	0.0073 U	0.072 U	0.0076 U	0.014 U	0.31 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.0073	2.7	0.0073 U	0.0074 U	0.17	0.0076 U	0.0072 U	4.9	130	0.0076 U	0.0076 U	0.55	0.0073 U	0.38	0.078	0.014 U	2.8
Naphthalene	mg/kg	5	70	5	NE	NL	0.0071 U	0.69 U	0.0073 U	0.0074 U	0.071 U	0.0076 U	0.0072 U	1.4 U	7.6 U	0.0076 U	0.0076 U	0.15 U	0.0073 U	0.072 U	0.0076 U	0.014 U	0.31 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.0071 U	0.91	0.0073 U	0.0083	0.12	0.012	0.0072 U	3.1	140	0.0076 U	0.0076 U	0.32	0.0073 U	0.17	0.038	0.021	1.4
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.012	2.8	0.013	0.0097	0.22	0.0076 U	0.0072 U	12	230	0.0076 U	0.0076 U	0.7	0.0073 U	0.43	0.1	0.018	3.9
TTEC (calc)	mg/kg	2	130	3.9	NE	NE	0.01	**3.44**	0.02	0.0009	0.27	0.0076 U	0.0072	**11.16**	**288.7**	0.0076	0.0076	1.16	0.0073	0.6	0.74	0.02	**4.74**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.01	3.71	0.01	0.13	0.4	0.06	0.0072	17.1	**473**	0.0076	0.0076	1.12	0.0073	0.61	0.14	0.04	5.7
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.08	**20.3**	0.04	0.02	**1.5**	0.04	0.0072	**64.7**	**1,441**	0.0076	0.0076	**5.1**	0.0073	**2.96**	0.8	0.09	**25.9**
Polychlorinated Biphenyls (PCBs)																							
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	0.053 U	0.057 U	0.057 U	0.057 U	0.055 U	0.054 U	0.054 U	0.057 U	0.053 U	0.059 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	0.053 U	0.057 U	0.057 U	0.057 U	0.055 U	0.054 U	0.054 U	0.057 U	0.053 U	0.059 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	0.053 U	0.057 U	0.057 U	0.057 U	0.055 U	0.054 U	0.054 U	0.057 U	0.053 U	0.059 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	0.053 U	0.057 U	0.057 U	0.057 U	0.055 U	0.054 U	0.054 U	0.057 U	0.053 U	0.059 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	0.053 U	0.057 U	0.057 U	0.057 U	0.055 U	0.054 U	0.054 U	0.057 U	0.053 U	0.059 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	NA	NA	NA	NA	NA	0.053 U	0.057 U	0.057 U	0.057 U	0.055 U	0.054 U	0.054 U	0.057 U	0.053 U	0.059 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	0.053 U	0.057 U	0.057 U	0.057 U	0.055 U	0.054 U	0.054 U	0.057 U	0.053 U	0.059 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	NA	NA	NA	NA	NA	0.053	0.057	0.057	0.057	0.055	0.054	0.054	0.057	0.053	0.059
Metals																							
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	4,300	4,000	11,000 J	8,200	5,300	11,000 J	5,400	11,000	22,000	6,700	9,000	5,300	4,900	4,800	8,700	3,200	8,900
Arsenic	mg/kg	20	88.00	2.9	7.61	132	11 U	10 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.53 U	0.52 U	0.55 U	0.55 U	0.54 U	0.57 U	0.54 U	0.53 U	0.57 U	0.57 U	0.57 U	0.56 U	0.54 U	0.54 U	0.57 U	0.53 U	0.59 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	3.3	4.4	11	9.8	3.5	7.5 J	5	4.1	8.5	8.3	13	3.2	4.1	3.4	4.9	5.6	6.1
Copper	mg/kg	NA	140,000	280	28.4	217	16	16	12	12	15	15 J	12	26	16	12	13	13	11	12	10	17	19
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.3 U	5.2 U	5.5 U	0.55 U	5.4 U	6.5	6.1	5.3 U	12	5.7 U	5.7 U	5.5 U	5.4 U	5.4 U	5.7 U	5.3 U	5.9 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U	0.29 U	0.27 U	0.27 U	0.28	0.29 U	0.29 U	0.28 U	0.27 U	0.27 U	0.29 U	0.26 U	0.29 U
Nickel	mg/kg	NA	70,000	130	24.54	980	3.5	5.9	8.2	5.8	6	7.7	4.1	18	36	8.4	9.7	6.7	3.4	4.7	5.3	5.8	6.8
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	10 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	12 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	43 J	45	59	54	40	68 J	45	33	63	36	43	32	44	35	48	36	46
Total Petroleum Hydrocarbons (TPHs)																							
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	NA	NA	270 U	1,000 U	29 U	29 U	550 U	27 U	27 U	29 U	26 U	80
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	NA	NA	890	**7,600**	57 U	57 U	**4,800**	55 U	180	57 U	61	390

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW	Low molecular weight PAH.
HMW	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.4.6-1
PAAOC Pitch Building Group RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale Washington

		Screening Levels				Ecological Screening Levels	RI Analytical Results																
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-MS03-2D	PAAOC-SB-MS03-4	PAAOC-SB-PB01-0.5	PAAOC-SB-PB01-2	PAAOC-SB-PB01-2D	PAAOC-SB-PB01-4	PAAOC-SB-PB01-6	PAAOC-SB-PB02-0.5	PAAOC-SB-PB02-2	PAAOC-SB-PB02-4	PAAOC-SB-PB02-6	PAAOC-SB-PB03-0.5	PAAOC-SB-PB03-2	PAAOC-SB-PB03-4	PAAOC-SB-PB03-6	PAAOC-SB-PB04-0.5	PAAOC-SB-PB04-2
Aluminum Smelting																							
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	NA	NA	NA	NA	NA	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	NA	NA	NA	NA	NA	NA
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	66	20	NA	NA	NA	NA	NA	5.5 J	5 UJ	5 UJ	5 UJ	NA	NA	NA	NA	NA	NA
Sulfate	mg/kg	NA	NE	2150	NE	NE	32	10 U	NA	NA	NA	NA	NA	10 UJ	10 UJ	12 J	13 J	NA	NA	NA	NA	NA	NA
Polynuclear Aromatic Hydrocarbons (PAHs)																							
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.03 U	0.078 U	0.29 U	0.0074 U	0.0075 U	0.015 U	0.0071 U	0.58 U	0.0076 U	0.015 U	0.0073 U	1.4 U	0.0075 U	0.0074 U	0.0072 U	1.4 U	0.076 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.03 U	0.078 U	0.29 U	0.0074 U	0.0075 U	0.015 U	0.0071 U	0.58 U	0.0076 U	0.015 U	0.0073 U	1.4 U	0.0075 U	0.0074 U	0.0072 U	1.4 U	0.076 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.03 U	0.078 U	0.29 U	0.023	0.014	0.018	0.0094	0.58 U	0.0076 U	0.049	0.0073 U	2.9	0.0075 U	0.0074 U	0.0072 U	1.4 U	0.1
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.03 U	0.078 U	0.29	0.00744	0.0075 U	0.015 U	0.0071 U	0.58 U	0.0076 U	0.015 U	0.0073 U	1.4 U	0.0075 U	0.0074 U	0.0072 U	1.4 U	0.076 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.36	0.092	0.29 U	0.042	0.031	0.026	0.021	0.58 U	0.0076 U	0.11	0.0073 U	8.8	0.0075 U	0.0074 U	0.0072 U	1.4 U	0.13
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	2.2	0.68	2.3	0.27 J	0.15	0.16	0.095	2.3	0.0097	0.53	0.018	36	0.0075 U	0.0074 U	0.015	3.7	0.62
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	2.8	1	3.2	0.36 J	0.23	0.23	0.14	2.9	0.011	0.74	0.024	44	0.0078	0.0074 U	0.021	4.8	0.93
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	4	1.2	4.2	0.47 J	0.27	0.28	0.17	4.3	0.014	0.84	0.029	53	0.0097	0.0074 U	0.026	8	1.1
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	2.2	0.76	2.4	0.27	0.16	0.17	0.095	2.4	0.0091	0.5	0.018	30	0.0075 U	0.0074 U	0.016	4.3	0.7
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	1.4	0.47	1.4	0.14	0.089	0.096	0.046	1.5	0.0076 U	0.28	0.0099	18	0.0075 U	0.0074 U	0.0087	2.6	0.34
Chrysene	mg/kg	NA	NL	NL	NE	NL	2.8	0.86	2.7	0.25 J	0.16	0.17	0.1	2.8	0.0094	0.48	0.019	33	0.0075 U	0.0074 U	0.015	5.6	0.59
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.43	0.14	0.45	0.051 J	0.029	0.027	0.015	0.58 U	0.0076 U	0.09	0.0073 U	5.4	0.0075 U	0.0074 U	0.0072 U	1.4 U	0.12
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	3.7	1.2	3.4	0.39 J	0.24	0.24	0.16	3.5	0.014	0.84	0.029	82	0.011	0.0074 U	0.025	13	1.2
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.03 U	0.078 U	0.29 U	0.016	0.0098	0.015 U	0.0071 U	0.58 U	0.0076 U	0.038	0.0073 U	2.3	0.0075 U	0.0074 U	0.0072 U	1.4 U	0.076 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	2.3	0.62	2.1	0.24 J	0.15	0.15	0.086	2.1	0.0077	0.44	0.015	26	0.0075 U	0.0074 U	0.014	3.5	0.6
Naphthalene	mg/kg	5	70	5	NE	NL	0.03 U	0.078 U	0.29 U	0.0074 U	0.0075 U	0.015 U	0.0071 U	0.58 U	0.0076 U	0.015 U	0.0073 U	1.4 U	0.0075 U	0.0074 U	0.0072 U	1.4 U	0.076 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	1.3	0.39	1.3	0.18	0.11	0.099	NA	1.2	0.0076 U	0.49	0.014	26	0.0075 U	0.0074 U	0.014	3.5	0.59
Pyrene	mg/kg	NA	110,000	650	NE	NL	3.3	1.1	3	0.35 J	0.22	0.21	0.071	3	0.013	0.74	0.026	72	0.0098	0.0074 U	0.021	12	1.1
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**3.7**	1.34	**4.3**	0.48	0.3	0.3	0.18	**3.95**	0.01	0.96	0.03	**58.2**	0.02	0.0074	0.03	**6.64**	1.21
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	5	1.7	4.99	0.7	0.4	0.4	0.2	4.7	0.01	1.53	0.04	**122**	0.01	0.0074	0.04	16.5	2.02
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**21.4**	**6.83**	**21.75**	**2.4**	**1.5**	**1.5**	0.82	**21.3**	0.07	**4.64**	0.16	**317.4**	0.03	0.0074	0.14	**44.5**	**6.1**
Polychlorinated Biphenyls (PCBs)																							
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.057 U	0.059 U	NA	NA	NA	NA	NA	0.054 U	0.057 U	0.055 U	0.055 U	NA	NA	NA	NA	NA	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.057 U	0.059 U	NA	NA	NA	NA	NA	0.054 U	0.057 U	0.055 U	0.055 U	NA	NA	NA	NA	NA	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.057 U	0.059 U	NA	NA	NA	NA	NA	0.054 U	0.057 U	0.055 U	0.055 U	NA	NA	NA	NA	NA	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.057 U	0.059 U	NA	NA	NA	NA	NA	0.054 U	0.057 U	0.055 U	0.055 U	NA	NA	NA	NA	NA	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.057 U	0.059 U	NA	NA	NA	NA	NA	0.054 U	0.057 U	0.055 U	0.055 U	NA	NA	NA	NA	NA	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.057 U	0.059 U	NA	NA	NA	NA	NA	0.054 U	0.057 U	0.055 U	0.055 U	NA	NA	NA	NA	NA	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.057 U	0.059 U	NA	NA	NA	NA	NA	0.054 U	0.057 U	0.055 U	0.055 U	NA	NA	NA	NA	NA	NA
Total CPBs (calc)	mg/kg	10	66	NE	NE	0.65	0.057	0.059	NA	NA	NA	NA	NA	0.054	0.057	0.055	0.055	NA	NA	NA	NA	NA	NA
Metals																							
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	8,400	12,000	7,200 J	5,900 J	7,700	7,000 J	4,500 J	4,600 J	7,600 J	5,200 J	5,800 J	4,400	7,100	7,000	3,700	2,600	7,300
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	12 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.57 U	0.59 U	0.54 U	0.56 U	0.56 U	0.56 U	0.53 U	0.54 U	0.57 U	0.55 U	0.55 U	0.54 U	0.57 U	0.55 U	0.54 U	0.53 U	0.57 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	6.6	8.2	5.3	5.7	5.3	2.6	2.1	3.9	4.4	20	3.2	5	5.6	4.7	2.5	4	7.5
Copper	mg/kg	NA	140,000	280	28.4	217	19	19	6.9	13	12	12	4.6	11	10	11	7.4	17	15	16	11	17	16
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.7 U	5.9 U	5.4 U	5.6 U	0.56 U	5.6 U	5.3 U	5.4 U	5.7 U	5.5 U	5.5 U	5.4 U	5.7 U	5.5 U	5.4 U	5.3 U	5.7 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.29 U	0.27 U	0.28 U	0.28 U	0.28 U	0.27 U	0.27 U	0.28 U	0.27 U	0.28 U	0.27 U	0.28 U	0.28 U	0.27 U	0.26 U	0.28 U
Nickel	mg/kg	NA	70,000	130	24.54	980	7	8	4.1	6.2	5.9	3.6	2.7 U	6.3	5.3	5.5	3.7	5.4	5.4	4.3	2.7 U	5.7	6.3
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	12 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	48	47	38	57	51	35	41	31	49	40	49	34 J	45 J	47 J	32 J	45	57
Total Petroleum Hydrocarbons (TPHs)																							
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	47	29 U	NA	NA	NA	NA	NA	250 U	29 U	27 U	28 U	NA	NA	NA	NA	NA	NA
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	300	59 U	NA	NA	NA	NA	NA	**4,100 J**	57 U	55 U	55 U	NA	NA	NA	NA	NA	NA

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.

TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW	Low molecular weight PAH.
HMW	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.4.6-1
PAAOC Pitch Building Group RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale Washington

	Screening Levels					Ecological Screening Levels	RI Analytical Results															
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-PB05-0.5	PAAOC-SB-PB05-2	PAAOC-SB-PB05-4	PAAOC-SB-PB05-6	PAAOC-SB-PC01-0.5	PAAOC-SB-PC01-0.5D	PAAOC-SB-PC01-2	PAAOC-SB-PC01-4	PAAOC-SB-PC01-6	PAAOC-SB-PC02-0.5	PAAOC-SB-PC02-2	PAAOC-SB-PP01-0.5	PAAOC-SB-PP01-2	PAAOC-SB-PP02-0.5	PAAOC-SB-PP02-2	PAAOC-SB-PP02-2D
Aluminum Smelting																						
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05 UJ	0.05 UJ	NA	NA	0.059 J	0.05 UJ	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	17 J	18 J	NA	NA	28 J	8 J	10
Sulfate	mg/kg	NA	NE	2150	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	27 J	10 UJ	NA	NA	1400 J	270 J	240
Polynuclear Aromatic Hydrocarbons (PAHs)																						
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	7.4 U	0.3 U	0.015 U	0.015 U	1.5 U	1.4 U	0.0078 U	0.0075 UJ	0.0073 UJ	0.15 U	0.0076 U	0.069 U	0.015 U	0.15 U	0.075 U	0.075 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	7.4 U	0.3 U	0.015 U	0.015 U	1.5 U	1.4 U	0.0078 U	0.0075 UJ	0.0073 UJ	0.15 U	0.0076 U	0.069 U	0.015 U	0.15 U	0.075 U	0.075 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	27	1.1	0.018	0.018	2.3	3.1	0.0078 U	0.0075 UJ	0.0073 UJ	0.15 U	0.0076 U	0.069 U	0.03	0.17	0.075 U	0.075 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	7.4 U	0.34	0.015 U	0.015 U	1.5 U	1.4 U	0.0078 U	0.0075 UJ	0.0073 UJ	0.15 U	0.0076 U	0.069 U	0.015 U	0.15 U	0.075 U	0.075 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	56	3	0.047	0.049	3.2	3.3	0.0078 U	0.0075 UJ	0.0073 UJ	0.15 U	0.0076 U	0.084	0.018	1	0.24 J	0.78
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	270	12	0.23	0.22	25	23	0.0078 U	0.0075 UJ	0.0073 UJ	1	0.0076 U	0.55	0.048	4.3	0.65 J	1.2
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	380	19	0.36	0.36	32	25	0.0078 U	0.0075 UJ	0.0073 UJ	1.3	0.0076 U	0.74	0.072	3.3	0.51 J	0.79
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	440	22	0.41	0.41	43	37	0.0078 U	0.0075 UJ	0.0073 UJ	2	0.0076 U	1.1	0.11	6.8	1.3	1.7
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	260	13	0.015 U	0.28	25	18	0.0078 U	0.0075 UJ	0.0073 UJ	1.1	0.0076 U	0.68	0.064	2.8	0.55	0.68
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	160	7.2	0.15	0.15	14	12	0.0078 U	0.0075 UJ	0.0073 UJ	0.64	0.0076 U	0.31	0.034	2.1	0.38	0.47
Chrysene	mg/kg	NA	NL	NL	NE	NL	270	11	0.24	0.25	27	22	0.0078 U	0.0075 UJ	0.0073 UJ	1.3	0.0076 U	0.77	0.065	7.4	1.5 J	2.7
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	51	2.6	0.046	0.045	4.6	4.1	0.0078 U	0.0075 UJ	0.0073 UJ	0.25	0.0076 U	0.15	0.015 U	0.67	0.12	0.14
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	470	22	0.38	0.37	47	37	0.0078 U	0.0075 UJ	0.0073 UJ	1.7	0.0076 U	1	0.098	10	2.3	3.2
Fluorene	mg/kg	NL	140,000	100	NE	NL	18	0.89	0.015 U	0.015 U	1.5 U	1.8	0.0078 U	0.0075 UJ	0.0073 UJ	0.15 U	0.0076 U	0.069 U	0.015 U	0.15 U	0.075 U	0.075 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	220	12	0.25	0.24	23	16	0.0078 U	0.0075 UJ	0.0073 UJ	1.1	0.0076 U	0.67	0.054	3	0.57	0.58
Naphthalene	mg/kg	5	70	5	NE	NL	7.4 U	0.3 U	0.015 U	0.015 U	1.5 U	1.4 U	0.0078 U	0.0075 UJ	0.0073 UJ	0.15 U	0.0076 U	0.069 U	0.031	0.15 U	0.075 U	0.075 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	220	0.3 U	0.15	0.15	0.012	17	0.0078 U	0.0075 UJ	0.0073 UJ	0.67	0.0076 U	0.43	0.085	1.1	0.28	0.49
Pyrene	mg/kg	NA	110,000	650	NE	NL	410	18	0.33	0.33	40	31	0.0078 U	0.0075 UJ	0.0073 UJ	1.5	0.0076 U	1	0.086	7.7	1.5 J	2.3
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**496.8**	**24.69**	0.47	0.47	**43.23**	**34.43**	0.0078	0.0075	0.0073	**2.39**	0.0076	1.03	0.01	**5.06**	0.24	1.23
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	**791**	27.33	0.6	0.6	52.5	62.2	0.0078	0.0075	0.0073	2.4	0.0076	1.5	0.26	12.3	2.8	4.5
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**2,241**	**116.8**	**2.02**	**2.3**	**233.6**	**188.1**	0.0078	0.0075	0.0073	**10.2**	0.0076	**5.97**	0.53	**38.1**	**7.1**	**10.6**
Polychlorinated Biphenyls (PCBs)																						
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.055 U	0.057 U	NA	NA	0.056 U	0.056 U	0.056 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.055 U	0.057 U	NA	NA	0.056 U	0.056 U	0.056 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.055 U	0.057 U	NA	NA	0.056 U	0.056 U	0.056 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.055 U	0.057 U	NA	NA	0.092	0.056 U	0.056 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.055 U	0.057 U	NA	NA	0.056 U	0.056 U	0.056 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.055 U	0.057 U	NA	NA	0.056 U	0.056 U	0.056 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.055 U	0.057 U	NA	NA	0.056 U	0.056 U	0.056 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.055	0.057	NA	NA	0.092	0.056	0.056
Metals																						
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	27,000	6,200	5,700 J	6,400 J	8,100 J	6,400	9,700	8,100	13,000	6,300	9,700	4,200	9,000	8,300	8,600	7,600
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	11 U	11 U	11 U	11 U	12 U	11 U	11 U	11 U	11 U	10 U	11 U	11 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.55 U	0.57 U	0.56 U	0.56 U	0.55 U	0.55 U	0.58 U	0.56 U	0.55 U	0.55 U	0.57 U	0.52 U	0.57 U	0.56 U	0.56 U	0.56 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	17	3.3	2.6	2.6	9.2	8.6	10	5.2	46	4.8	7.6	5.2	5.4	19	10	11
Copper	mg/kg	NA	140,000	280	28.4	217	39	16	10	10	17 J	24	13	14	12	16	14	20	14	29	18	19
Lead	mg/kg	1,000	NE	3,000	13.1	118	17	5.7 U	5.6 U	5.6 U	14	23	9	5.6 U	5.5 U	5.5 U	5.7 U	5.2 U	5.7 U	5.6 U	5.6 U	0.56 U
Mercury	mg/kg	2	NE	2	0.04	5.5	0.28 U	0.29 U	0.28 U	0.28 U	0.28 U	0.27 U	0.29 U	0.28 U	0.27 U	0.27 U	0.28 U	0.26 U	0.28 U	0.28 U	0.28 U	0.287 U
Nickel	mg/kg	NA	70,000	130	24.54	980	35	4	4	3.9	19 J	35	6.6	4.8	36	12	6.9	7.3	5.2	18	9.1	10
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	11 U	11 U	11 U	12 U	11 U	11 U	11 U	11 U	10 U	11 U	11 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	160	38	44	44	80	90	58	56	30	37	51	41	44	99	56	62
Total Petroleum Hydrocarbons (TPHs)																						
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	550 U	28 U	NA	NA	260 U	280 U	280 U
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,500	57 U	NA	NA	**3,700**	1,300	1,700

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not rstablished.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.

TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

2.4.6.3 Conclusions and Recommendations

COPCs that exceed either MTCA Method A Industrial, protection of groundwater, and/or ecological wildlife Plant Area AOC soil screening levels in the Pitch Building Group include PAH as TTEC, calculated total LMW and total HMW PAH, and TPH as residual range organics. These compounds exceed soil screening levels to a maximum depth of 2 ft bgs, except for calculated total HMW PAH which exceeds the ecological wildlife screening level to depths of 4 ft bgs in five out of 20 borings, and 6 ft bgs in one out of 20 borings. Pitch remains between the aluminum siding and foundation walls.

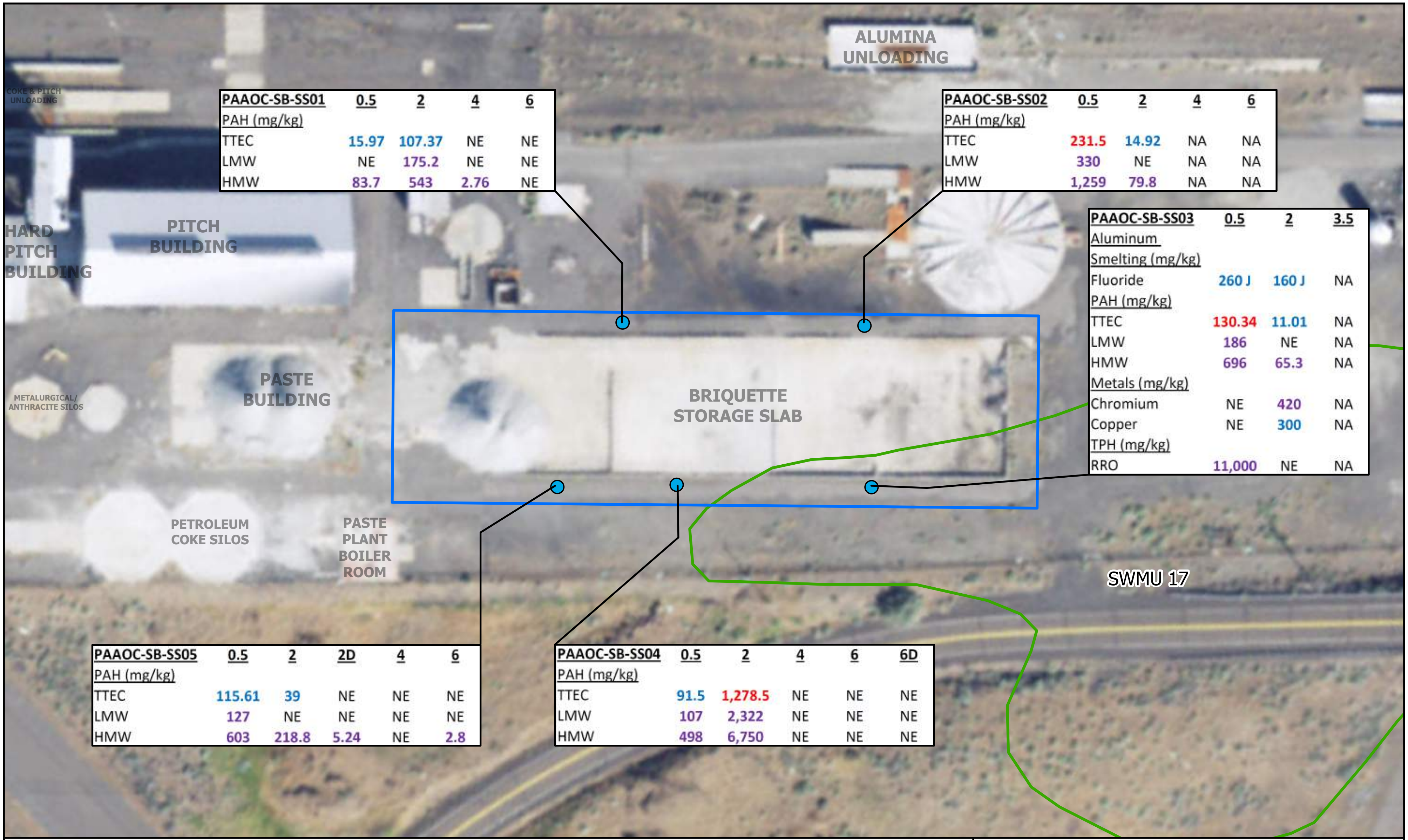
Based on the results of the initial RI phase of investigation the Pitch Building Group is recommended for further evaluation in the FS for PAH and TPH-Dx soil contamination.

2.4.7 Briquette Storage Slab

A concrete slab located east of the paste plant building was used for storage of finished hard briquettes prior to distribution into the plant production area (Figure 2.1.2-1). Sometime prior to 2006, the original Briquette Storage Slab was approximately doubled to its present size. Briquettes were stored in piles on the slab before distribution. Based on investigation of the nearby SWMU 17 East End Landfill (Volume 2, Section 17), a portion of the landfill mass is located beneath the southeastern portion of the Briquette Storage Slab (Figure 2.4.7-1). SWMU 17 soil borings detected landfill materials up to 7.5 ft in thickness and within 3.5 ft of ground surface near and/or beneath the Briquette Storage Slab. Results of the East End Landfill (SWMU 17) are detailed in Volume 2, Section 17.

2.4.7.1 Investigation Scope

The Briquette Storage Slab was investigated during the initial RI phase with five soil borings SB-SS01 through SB-SS05 (Figure 2.4.7-1). The borings were drilled adjacent to the north and south sides of the slab to depths of 6 ft bgs. Soil samples were planned to be collected at 0.5 ft bgs, 2 ft bgs, 4 ft bgs, and 6 ft bgs with analysis of the 4 and 6 ft samples based on whether COPCs exceeded SLs in the 0.5 and 2 ft samples per the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b).



PAAOC-SB-SS01	0.5	2	4	6
PAH (mg/kg)				
TTEC	15.97	107.37	NE	NE
LMW	NE	175.2	NE	NE
HMW	83.7	543	2.76	NE

PAAOC-SB-SS02	0.5	2	4	6
PAH (mg/kg)				
TTEC	231.5	14.92	NA	NA
LMW	330	NE	NA	NA
HMW	1,259	79.8	NA	NA

PAAOC-SB-SS03	0.5	2	3.5
Aluminum Smelting (mg/kg)			
Fluoride	260 J	160 J	NA
PAH (mg/kg)			
TTEC	130.34	11.01	NA
LMW	186	NE	NA
HMW	696	65.3	NA
Metals (mg/kg)			
Chromium	NE	420	NA
Copper	NE	300	NA
TPH (mg/kg)			
RRO	11,000	NE	NA

PAAOC-SB-SS05	0.5	2	2D	4	6
PAH (mg/kg)					
TTEC	115.61	39	NE	NE	NE
LMW	127	NE	NE	NE	NE
HMW	603	218.8	5.24	NE	2.8

PAAOC-SB-SS04	0.5	2	4	6	6D
PAH (mg/kg)					
TTEC	91.5	1,278.5	NE	NE	NE
LMW	107	2,322	NE	NE	NE
HMW	498	6,750	NE	NE	NE

● RI Boring
▭ Briquette Storage Slab Outline
▭ SWMU 17 Outline

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds Ecological Wildlife and for TPH diesel and residual range organics exceeds MTCA Method A
red: exceeds MTCA Method C

NE: No exceedance
NA: Not analyzed
D: Duplicate sample
RRO: Residual Range Organics
2: Sample depth in feet bgs

Figure 2.4.7-1

Plant Area AOC

Briquette Storage Slab Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Soil samples from borings SB-SS01 through SB-SS05 were analyzed for PAHs and metals. According to the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) some borings in each area investigated in the southern portion of the Plant Area AOC were analyzed for additional COPCs. Soil samples from boring SB-SS03, located on the southeast side of the slab, were also analyzed for total cyanide, fluoride, sulfate, PCBs, and TPH-Dx.

Investigation of the Briquette Storage Slab was conducted during the initial RI phase of investigation. No further investigation was proposed in the WPA.

2.4.7.2 Investigation Results

The Briquette Storage Slab was investigated with five soil borings. The soil was described and characterized, and logs of borings and test pits are included in Volume 5, Appendix G-1. Soil analytical results are summarized on Table 2.4.7-1. Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC soil screening levels. Natural background concentrations for the site have also been used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendix H-2, and data validation reports are included in Volume 5, Appendix I-2. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). For the Briquette Storage Slab investigation, the reporting limits for arsenic exceed the protection of groundwater screening, and for selenium exceeds the protection of groundwater and ecological wildlife screening levels, in all samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels are compiled and presented on Figure 2.4.7-1. Results of the initial RI indicate that total cyanide, sulfate, PCBs, and most metals do not exceed Plant Area AOC soil screening levels. Several COPCs exceed soil screening levels in boring SB-SS03 (located at the southeastern margin of the storage slab in an area underlain by the SWMU 17 landfill), including fluoride, PAH as TTEC, calculated total LMW PAH and total HMW PAH, chromium, copper, and TPH-Dx. Fluoride was detected at concentrations of 260 J and 160 J mg/kg at 0.5 and 2 ft bgs, respectively, that exceed the protection of groundwater screening level. Samples in the boring collected at 4 and 6 ft bgs were not analyzed. PAH as calculated TTEC was detected at concentrations of 130.34 and 11.01 mg/kg that exceed the MTCA Method C and protection of groundwater screening levels at 0.5 ft bgs, and protection of

Table 2.4.7-1
PAAOC Briquette Storage Slab RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 1 of 2

	Screening Levels					Ecological Screening Levels	RI Analytical Results								
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-SS01-0.5**	**PAAOC-SB-SS01-2**	**PAAOC-SB-SS01-4**	**PAAOC-SB-SS01-6**	**PAAOC-SB-SS02-0.5**	**PAAOC-SB-SS02-2**	**PAAOC-SB-SS03-0.5**	**PAAOC-SB-SS03-2**	**PAAOC-SB-SS04-0.5**
Aluminum Smelting															
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	NA	NA	NA	NA	NA	NA	0.05 UJ	0.05 UJ	NA
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	NA	NA	NA	NA	NA	NA	**260 J**	**160 J**	NA
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	NA	NA	NA	NA	NA	37 J	92 J	NA
Polynuclear Aromatic Hydrocarbons (PAHs)															
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	1.4 U	1.5 U	0.013 J	0.0072 UJ	15 U	0.28 U	15 U	0.3 U	7.2 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	1.4 U	1.5 U	0.021	0.0072 UJ	15	0.28 U	15 U	0.3 U	7.2 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	1.4 U	5.2	0.075 J	0.0072 UJ	15 U	1.5	15 U	0.3 U	7.2 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	1.4 U	1.5 U	0.0075 U	0.0072 UJ	15 U	0.28 U	15 U	0.3 U	7.2 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	1.4 U	10	0.066 J	0.0072 UJ	20	1.4	15 U	0.78	7.2 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	8.8	59	0.3 J	0.008 J	140	8.2	80	5	53
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	12	82	0.4 J	0.01 J	170	11	98	7.6	67
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	15	93	0.47 J	0.013 J	230	15	130	14	87
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	9.5	58	0.25	0.0074	120	8.2	70	8.8	53
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	5	33	0.17	0.0072 UJ	72	4.6	43	3.8	35
Chrysene	mg/kg	NA	NL	NL	NE	NL	9.4	57	0.29 J	0.0084 J	160	9.3	94	7.5	60
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	2	12	0.053 J	0.0072 UJ	27	1.9	15 U	2.1	11
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	16	110	0.61 J	0.014 J	230	16	140	8.2	82
Fluorene	mg/kg	NL	140,000	100	NE	NL	1.4 U	3	0.031 J	0.0072 UJ	15 U	0.81	15 U	0.3 U	7.2 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	8	51	0.3 J	0.0082 J	130	8.6	61	8.4	53
Naphthalene	mg/kg	5	70	5	NE	NL	1.4 U	1.5 U	0.059 J	0.021 J	15 U	0.55	15 U	0.3 U	7.2 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	5.8	47	0.36	0.0072 UJ	80	7.5	46	3.1	25
Pyrene	mg/kg	NA	110,000	650	NE	NL	14	98	0.53 J	0.013 J	210	13	120	8.1	79
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**15.97**	**107.37**	0.73	0.015	**231.5**	**14.92**	**130.34**	**11.01**	**91.5**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	21.8	**175.2**	1.2	0.07	**330**	27.76	**186**	12.1	**107**
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**83.7**	**543**	**2.76**	0.07	**1,259**	**79.8**	**696**	**65.3**	**498**
Polychlorinated Biphenyls (PCBs)															
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.055 UJ	0.057 U	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.055 UJ	0.057 U	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.055 UJ	0.057 U	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.055 UJ	0.057 U	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.055 UJ	0.057 U	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	NA	NA	NA	NA	0.055 UJ	0.057 U	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.055 UJ	0.057 U	NA
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	NA	NA	NA	NA	0.055	0.057	NA
Metals															
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	3,900	6,800	6,100	5,800	22,000	5,800	17,000	230,000	7,400
Arsenic	mg/kg	20	88	2.9	7.61	132	10 U	11 U	11 U	11 U	11 U	10 U	11 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.52 U	0.55 U	0.56 U	0.54 U	0.55 U	0.52 U	0.55 U	0.57 U	0.54 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	4.1	9.3	3.7	3.5	13	3.7	21	**420**	8.4
Copper	mg/kg	NA	140,000	280	28.4	217	18	13	18	10	15	5.5	31	**300**	20
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.2 U	13	5.6 U	5.4 U	16	5.2 U	15	5.7 U	5.8
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.26 U	0.27 U	0.28 U	0.27 U	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U
Nickel	mg/kg	NA	70,000	130	24.54	980	7.9	12	4.2	3	24	3.8	37	47	13
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	10 U	11 U	11 U	11 U	11 U	10 U	11 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	39	99	49	48	60	15	69	32	37
Total Petroleum Hydrocarbons (TPHs)															
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	NA	1,700 U	140 U	NA
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	NA	**11,000**	650	NA

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shwon for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in bold exceed one or more site soil screening levels.

Table 2.4.7-1
PAAOC Briquette Storage Slab RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 2 of 2

	Screening Levels					Ecological Screning Levels	RI Analytical Results								
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-SS04-2	PAAOC-SB-SS04-4	PAAOC-SB-SS04-6	PAAOC-SB-SS04-6D	PAAOC-SB-SS05-0.5	PAAOC-SB-SS05-2	PAAOC-SB-SS05-2D	PAAOC-SB-SS05-4	PAAOC-SB-SS05-6
Aluminum Smelting															
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Polynuclear Aromatic Hydrocarbons (PAHs)															
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	30 U	0.0074 UJ	0.0073 UJ	0.0074 U	14 U	2.8 U	0.075 U	0.0076 UJ	0.0072 UJ
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	30 U	0.0074 UJ	0.0073 UJ	0.0074 U	14 U	2.8 U	0.075 U	0.0076 UJ	0.015 J
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	42	0.0074 UJ	0.0073 UJ	0.0074 U	14 U	2.8 U	0.075 U	0.0076 UJ	0.015 J
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	30 U	0.0074 UJ	0.0073 UJ	0.0074 U	14 U	2.8 U	0.075 U	0.0076 UJ	0.0072 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	110	0.012 J	0.0073 UJ	0.0074 U	14 U	3.8	0.089	0.014 J	0.042 J
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	780	0.065 J	0.023 J	0.032	61	23 J	0.56	0.11 J	0.3 J
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	970	0.087 J	0.028 J	0.042	87	29 J	0.69	0.14 J	0.39 J
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	1,200	0.099 J	0.036 J	0.052	120	37 J	0.87	0.17 J	0.48 J
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	620	0.056	0.02	0.029	71	21	0.5	0.089	0.25
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	370	0.038	0.012	0.017	37	12	0.28	0.053	0.14
Chrysene	mg/kg	NA	NL	NL	NE	NL	750	0.067 J	0.024 J	0.033	71	27 J	0.64	0.12 J	0.32 J
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	120	0.01 J	0.0073 UJ	0.0074 U	14 U	3.8	0.092	0.016 J	0.045 J
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	1,600	0.11 J	0.041 J	0.056	98	50 J	1.2	0.22 J	0.62 J
Fluorene	mg/kg	NL	140,000	100	NE	NL	30 U	0.0074 UJ	0.0073 UJ	0.0074 U	14 U	2.8 U	0.075 U	0.0076 UJ	0.0098 J
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	540	0.063 J	0.022 J	0.032	61	21 J	0.51	0.097 J	0.28 J
Naphthalene	mg/kg	5	70	5	NE	NL	30 U	0.0074 UJ	0.0073 UJ	0.0074 U	14 U	2.8 U	0.075 U	0.0076 UJ	0.0072 UJ
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	570	0.047	0.016	0.021	29	18	0.43	0.077	0.22
Pyrene	mg/kg	NA	110,000	650	NE	NL	1,400	0.097 J	0.037 J	0.051	95	45 J	1.1	0.19 J	0.55 J
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**1,278.5**	0.12	0.04	0.06	**115.61**	**39**	0.93	0.21	0.52
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	**2,322**	0.17	0.06	0.08	**127**	71.8	1.72	0.31	0.91
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**6,750**	0.58	0.2	0.29	**603**	**218.8**	**5.24**	0.99	**2.8**
Polychlorinated Biphenyls (PCBs)															
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals															
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	4,600	5,600	6,200	5,900	14,000	7,200	6,000	7,700	5,300
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	11 U	11 U	11 U	10 U	11 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.57 U	0.56 U	0.55 U	0.54 U	0.54 U	0.52 U	0.56 U	0.57 U	0.54 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	4.8	6.3	3	2.4	10	5.7	6.3	4.7	3.2
Copper	mg/kg	NA	140,000	280	28.4	217	10	16	12	0.54 U	28	14	17	15	10
Lead	mg/kg	1,000	NE	3,000	13.1	118	27	5.6 U	5.5 U	0.54 U	20	5.2 U	0.56 U	5.7 U	5.4 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.28 U	0.28 U	0.27 U	0.27 U	0.26 U	0.28 U	0.28 U	0.27 U
Nickel	mg/kg	NA	70,000	130	24.54	980	44	6.2	3.1	2.7 U	30	7.7	6	5	3.3
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	11 U	11 U	10 U	11 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	67	37	50 J	38	61	34 J	43	50	42
Total Petroleum Hydrocarbons (TPHs)															
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	NA	NA	NA	NA
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

groundwater screening level at 2 ft bgs. The calculated concentration of total LMW PAH of 186 mg/kg exceeds the ecological wildlife screening level at 0.5 ft bgs but not at 2 ft bgs. Calculated concentrations of total HMW PAH of 696 and 65.3 mg/kg at 0.5 and 2 ft bgs, respectively, exceeds the ecological wildlife screening level. TPH as residual range organics was detected at 11,000 mg/kg at 0.5 ft bgs exceeding MTCA Method A Industrial and the ecological wildlife screening level but did not exceed at 2 ft bgs.

In the other four soil borings completed outside the interpreted footprint of the SWMU 17, PAHs were the only COPCs detected at concentrations that exceed site soil screening levels. PAHs as calculated TTEC, was detected at concentrations up to 1,278.5 mg/kg in soil borings SB-SS01, SB-SS02, SB-SS04 and SB-SS05 in the 0.5 and/or 2 ft bgs samples exceeding the MTCA Method C and protection of groundwater screening levels but did not exceed in deeper soil samples from the borings except in SB-SS02 where the 2 and 4 ft bgs samples were not analyzed. Similarly, calculated total LMW PAH concentrations exceeding ecological wildlife screening levels were detected in shallow soil samples, but did not exceed the screening level in deeper samples from the borings. Calculated concentrations of total HMW PAH exceed the ecological wildlife screening level in the 0.5 and 2 ft bgs samples from all borings but did not exceed the screening level in deeper samples, except in boring SB-SS05 with a concentration of 2.8 mg/kg at 6 ft bgs.

2.4.7.3 Conclusions and Recommendations

Results of the initial RI phase of investigation indicate that several COPCs were detected at concentrations that exceed MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels in soil boring SB-SS03 located at the southeastern margin of the Briquette Storage Slab. This soil boring location overlaps the edge of the East End Landfill (SWMU 17). COPCs in SB-SS03 that exceed screening levels include fluoride, PAHs as TTEC, calculated total LMW and total HMW PAHs, chromium, copper, and TPH as residual range organics. Otherwise, PAHs as TTEC and calculated total LMW and total HMW PAHs were detected at concentrations that exceed MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife screening levels in shallow soil samples, but did not exceed in deeper samples except in soil boring SB-SS05-6.

Based on the results of the initial RI the Briquette Storage Slab is recommended for further evaluation in the FS for PAH contamination associated with briquette storage. Potential recommendations for fluoride detected in SB-SS03 are addressed in the East End Landfill (SWMU 17) in Volume 2, Section 17.

2.4.8 Bath Recycle Building and Cryolite Storage Silo

The Bath Recycle Building was used for cleaning and recycling bath residual and the unloading of cryolite and is located east of the Briquette Storage Slab (Figure 2.1.2-1). The building and foundation are in satisfactory condition and will be retained for future use. A cryolite storage silo was located at the northwest corner of the Bath Recycle Building and was investigated along with the Bath Recycle Building. The silo has been demolished and no demolition debris remains onsite.

2.4.8.1 Investigation Scope

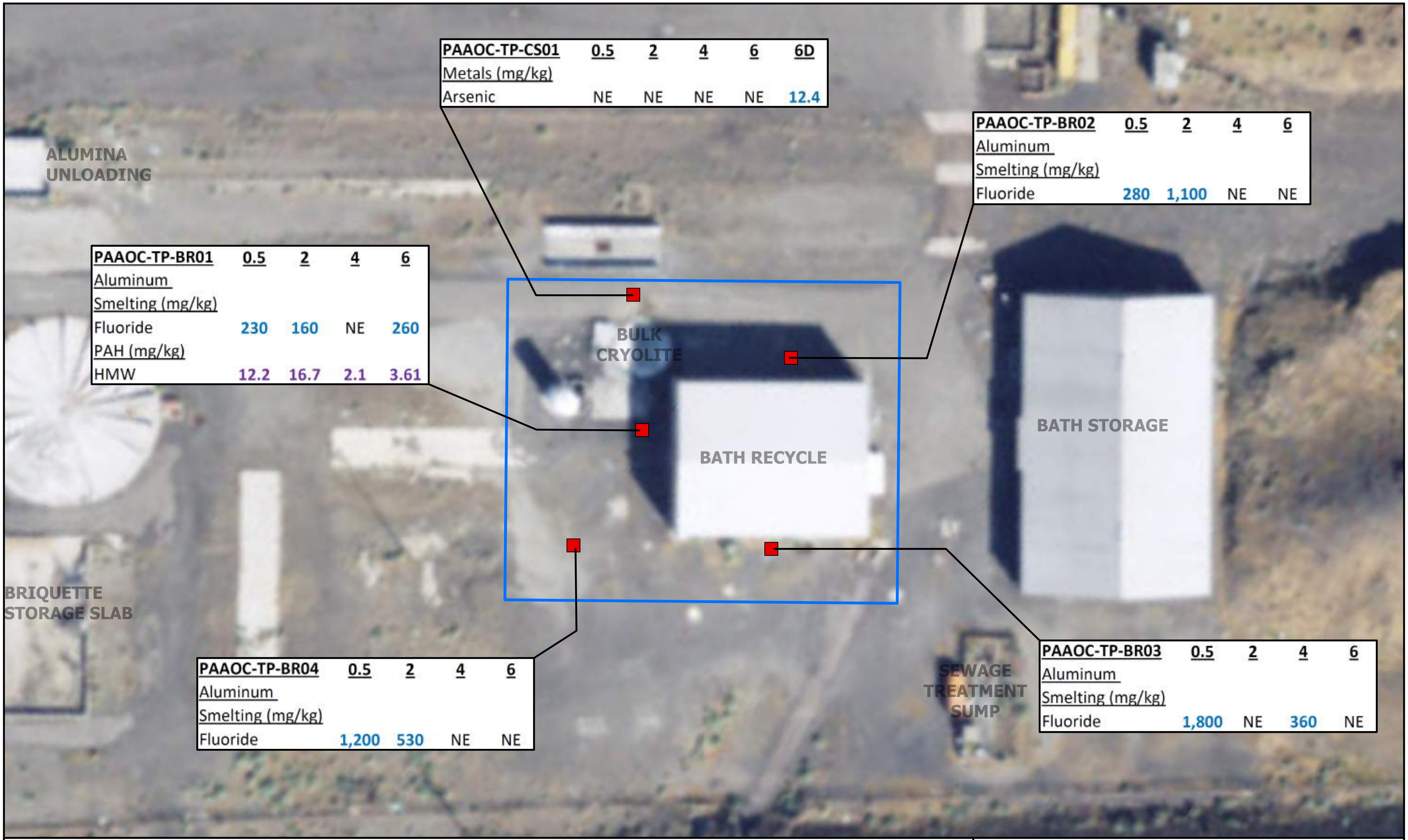
The Bath Recycle Building was investigated with four test pits, TP-BR01 through TP-BR04 and the cryolite storage silo was investigated with one test pit, TP-CS01 (Figure 2.4.8-1). The five test pits are located on the south and southwest sides of the building, one test pit is located west of the building, one test pit located to the north of the cryolite storage silo, and one test pit located to the north of the building. Soil samples were collected from the test pits at depths of 0.5 ft bgs, 2 ft bgs, 4 ft bgs, and 6 ft bgs.

Soil samples collected from test pits TP-BR02, TP-BR03, and TP-BR04 on the south and north sides of the building, and TP-CS01 north of the silo, were analyzed for fluoride and metals. Soil samples from TP-BR01, located to the west of the building, were analyzed for total cyanide, fluoride, PAHs, PCBs, metals, and TPH-Dx.

Investigation of the Bath Recycle Building was conducted during the initial RI phase of investigation. No further investigation was proposed in the WPA.

2.4.8.2 Investigation Results

The Bath Recycle Building and cryolite silo were investigated with a total of five test pits in the initial RI phase of investigation. The soil was described and characterized, and logs of test pits are included in Volume 5, Appendix G-1. Soil analytical results are summarized on Table 2.4.8-1. Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC soil screening levels. Natural background concentrations



PAAOC-TP-CS01	0.5	2	4	6	6D
Metals (mg/kg)					
Arsenic	NE	NE	NE	NE	12.4

PAAOC-TP-BR02	0.5	2	4	6
Aluminum Smelting (mg/kg)				
Fluoride	280	1,100	NE	NE

PAAOC-TP-BR01	0.5	2	4	6
Aluminum Smelting (mg/kg)				
Fluoride	230	160	NE	260
PAH (mg/kg)				
HMW	12.2	16.7	2.1	3.61

PAAOC-TP-BR04	0.5	2	4	6
Aluminum Smelting (mg/kg)				
Fluoride	1,200	530	NE	NE

PAAOC-TP-BR03	0.5	2	4	6
Aluminum Smelting (mg/kg)				
Fluoride	1,800	NE	360	NE

🟥 RI Test Pit

▭ Bath Recycle Building Outline

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds Ecological Wildlife

NE: No exceedance
D: Duplicate sample
2: Sample depth in feet bgs

W N E S

0 25 50 100
Feet

Figure 2.4.8-1

Plant Area AOC

Bath Recycle Building and Cryolite Silo Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Table 2.4.8-1
PAAOC Bath Recycle Building and Cryolite Silo RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 1 of 2

		Screening Levels				Ecological Screening Levels	RI Analytical Results										
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-TP-BR01-0.5**	**PAAOC-TP-BR01-2**	**PAAOC-TP-BR01-4**	**PAAOC-TP-BR01-6**	**PAAOC-TP-BR02-0.5**	**PAAOC-TP-BR02-2**	**PAAOC-TP-BR02-4**	**PAAOC-TP-BR02-6**	**PAAOC-TP-BR03-0.5**	**PAAOC-TP-BR03-2**	**PAAOC-TP-BR03-4**
Aluminum Smelting																	
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.68	0.05 U	NA	NA	NA	NA	NA	NA	NA
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**230**	**160**	63	**260**	**280**	**1,100**	32	13	**1,800**	9.3	**360**
Polynuclear Aromatic Hydrocarbons (PAHs)																	
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.039 U	0.038 U	0.0078 U	0.0079 U	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.039 U	0.038 U	0.0078 U	0.0079 U	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.094	0.3	0.0095	0.033	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.039 U	0.038 U	0.0078 U	0.0079 U	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.14	0.57	0.016	0.041	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	1.3	1.9	0.11	0.37	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	1.7	2.4	0.14	0.49	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	2.3	2.7	0.18	0.63	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	1.4	1.7	1.2	0.46	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.8	1.1	0.062	0.24	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/kg	NA	NL	NL	NE	NL	1.5	2	0.13	0.41	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.33	0.4	0.025	0.1	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	1.9	3.5	0.17	0.58	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.046	0.21	0.0078 U	0.018	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	1.2	1.5	0.097	0.38	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.039 U	0.059	0.0078 U	0.0079 U	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.74	2.4	0.078	0.25	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/kg	NA	110000	650	NE	NL	1.7	3	0.16	0.53	NA	NA	NA	NA	NA	NA	NA
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	2.38	3.2	0.19	0.7	NA	NA	NA	NA	NA	NA	NA
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	2.92	7.04	0.27	0.9	NA	NA	NA	NA	NA	NA	NA
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**12.23**	**16.7**	**2.1**	**3.61**	NA	NA	NA	NA	NA	NA	NA
Metals																	
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	14,000	8,000	11,000	12,000	23,000	24,000	9,200	9,200	72,000	13,000	12,000
Arsenic	mg/kg	20	88	2.9	7.61	132	12 U	11 U	12 U	12 U	11 U	12 U	12 U	12 U	11 U	12 U	12 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.58 U	0.57 U	0.59 U	0.59 U	0.57 U	0.61 U	0.6 U	0.58 U	0.56 U	0.58 U	0.58 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	7.9 J	4.3 J	8 J	6.8 J	15 J	7.3 J	9.2	9.5	10	11	6.2
Copper	mg/kg	NA	140,000	280	28.4	217	15	13	18	15	19	16	12	12	21	12	15
Lead	mg/kg	1,000	NE	3,000	13.1	118	7.9	6	6.8	7.1	9.7	7.3	7	5.8 U	7.1	5.8 U	6.2
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.29 U	0.28 U	0.29 U	0.29 U	0.28 U	0.3 U	0.3 U	0.29 U	0.28 U	0.29 U	0.29 U
Nickel	mg/kg	NA	70,000	130	24.54	980	9.3	5.2	7.3	7.9	22	11	8.6	9.5	25	8.7	7.1
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	12 U	11 U	12 U	12 U	11 U	12 U	12 U	12 U	11 U	12 U	12 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	49 J	38 J	39 J	56 J	61 J	47 J	43	39	50	58	41
Total Petroleum Hydrocarbons (TPHs)																	
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	29 U	28 U	29 U	29 U	NA	NA	NA	NA	NA	NA	NA
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	96	120	59 U	59 U	NA	NA	NA	NA	NA	NA	NA

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.

TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.4.8-1
PAAOC Bath Recycle Building and Cryolite Silo RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 2 of 2

		Screening Levels				Ecological Screening Levels	RI Analytical Results									
Parameter Name	**Units**	**MTCA Method A Industria**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-TP-BR03-6**	**PAAOC-TP-BR04-0.5**	**PAAOC-TP-BR04-2**	**PAAOC-TP-BR04-4**	**PAAOC-TP-BR04-6**	**PAAOC-TP-CS01-0.5**	**PAAOC-TP-CS01-2**	**PAAOC-TP-CS01-4**	**PAAOC-TP-CS01-6**	**PAAOC-TP-CS01-6D**
Aluminum Smelting																
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	78	**1,200**	**530**	5 U	16	5.1 U	5.9 U	5 U	42 J	25
Polynuclear Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/kg	NA	NE	2,300	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/kg	NA	NL	NL	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/kg	NL	140,000	100	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/kg	5	70	4.5	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/kg	NA	110000	650	NE	NL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals																
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	6,600	9,200	11,000	7,800	11,000	5,100	8,400	9,800	10,000	1,100
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	11 U	12 U	12 U	11 U	12 U	12 U	12 U	**12.4**
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.54 U	0.54 U	0.57 U	0.58 U	0.59 U	0.54 U	0.58 U	0.62 U	0.61 U	0.61 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	4	4.9	6.6	3.6	6.4	3	4.9	7.4	8.6	9.3
Copper	mg/kg	NA	140,000	280	28.4	217	13	13	12	11	16	10	13	21	14	14
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.4 U	5.4 U	5.7 U	5.8 U	7.7	5.6	7.6	7.2	6.4	7.1
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.27 U	0.27 U	0.29 U	0.29 U	0.29 U	0.27 U	0.29 U	0.31 U	0.31 U	0.31 U
Nickel	mg/kg	NA	70,000	130	24.54	980	4.3	6.6	7.7	4.6	7	3.2	4.8	8	7.9	8.3
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	29	45	39	40	41	32	42	41	35	38
Total Petroleum Hydrocarbons (TPHs)																
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.

TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in bold exceed one or more site soil screening levels.

for the site have also been used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendix H-2, and data validation reports are included in Volume 5, Appendix I-2. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). For the Bath Recycle Building investigation, the reporting limits for arsenic exceed the protection of groundwater screening level, and the reporting limits for selenium exceed the protection of groundwater and ecological wildlife screening levels, in all samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels are compiled and presented on Figure 2.4.8-1. Results of the initial RI investigation indicate that total cyanide, PAHs as TTEC, calculated total LMW PAH, metals, and TPH-Dx do not exceed site soil screening levels. Fluoride was detected at concentrations that exceed the protection of groundwater screening level in shallow soil in test pits TP-BR01, TP-BR02, TP-BR03, and TP-BR04 but do not exceed the protection of groundwater screening level in deeper samples in those test pits, except for in TP-BR01 where fluoride was detected at a concentration of 260 mg/kg in the deepest sample at 6 ft bgs. Calculated concentrations of total HMW PAH exceeded the ecological wildlife soil screening level at all depths in test pit TP-BR01.

2.4.8.3 Conclusions and Recommendations

Results of the initial RI investigation indicated that only fluoride and calculated total HMW PAH exceed screening levels for protection of groundwater and ecological wildlife, respectively. Except at TP-BR01, concentrations of fluoride decrease to below the protection of groundwater screening level at deepest depths sampled. Total HMW PAH exceeds the ecological wildlife screening level in all soil samples from TP-BR01.

Based on results of the initial RI investigation the Bath Recycle Building is recommended for further evaluation in the FS.

2.4.9 Production Building Foundations

Production Buildings A through D have been demolished and the concrete crushed and placed in stockpiles onsite (Figure 2.1.2-1; Section 2.4.11 Crushed Concrete) and the building foundations are expected to remain in place. The production building foundations contain rows of raised pads along the north and south sides of the foundations for individual smelting pots.

2.4.9.1 Investigation Scope

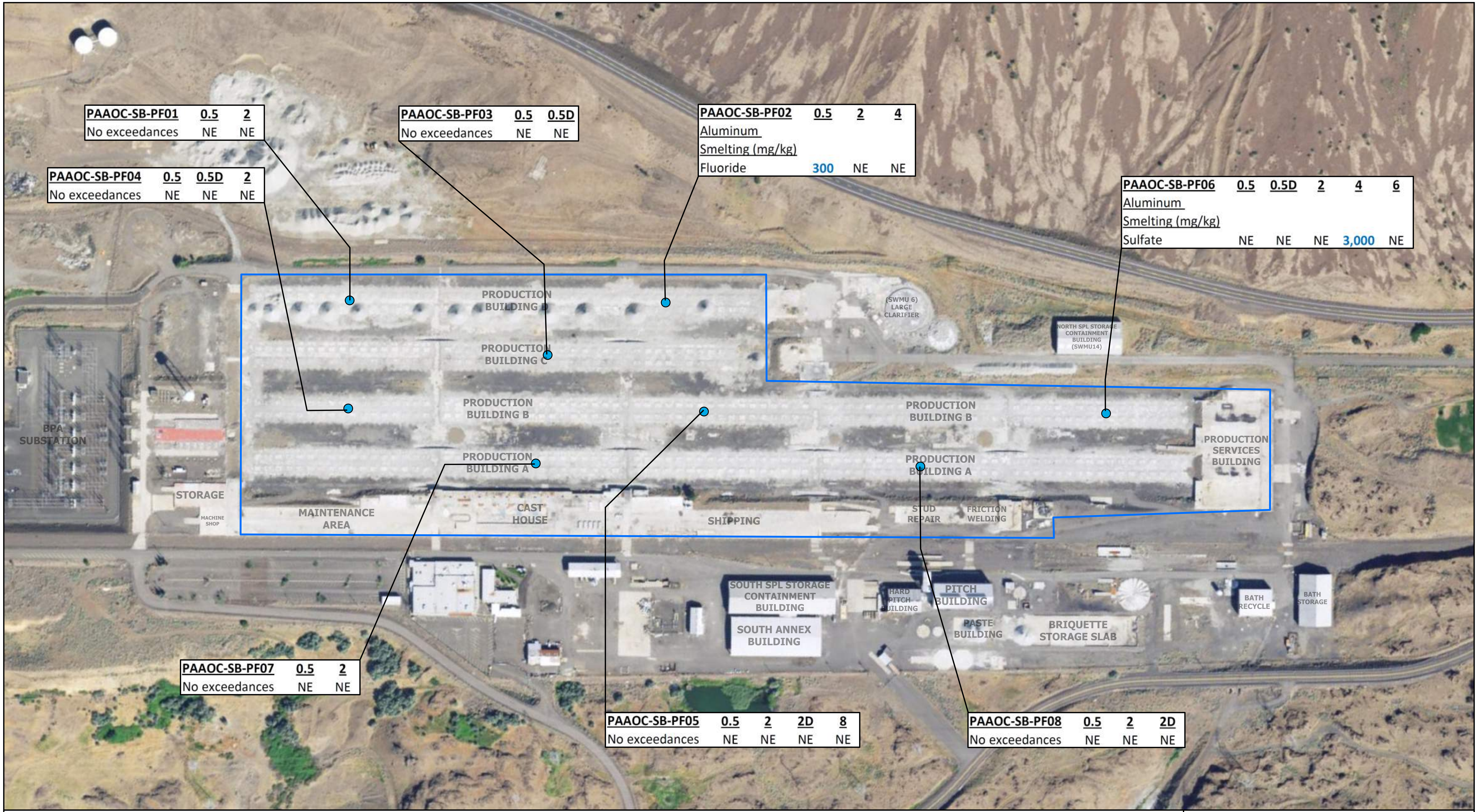
Per the approved work plan (Tetra Tech et al. 2015b), the production building foundations were investigated with eight soil borings, SB-PF01 through SB-PF08 (Figure 2.4.9-1). Concrete coring was performed through the thick reinforced concrete slabs to gain access to underlying soil. The eight soil borings were distributed among the four building foundations. The soil borings were planned to be completed to depths of up to 8 ft bgs or refusal, and soil samples collected at 0.5 and 2 ft bgs, and/or the base of the boring. Soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx.

Investigation of the Bath Recycle Building was conducted during the initial RI phase of investigation. No further investigation was proposed in the WPA.

2.4.9.2 Investigation Results

Production building foundations were investigated with eight soil borings. The soil was described and characterized, and logs of borings are included in Volume 5, Appendix G-1. Soil analytical results are summarized in Table 2.4.9-1. Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. Natural background concentrations for the site have also been used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendix H-2, and data validation reports are included in Volume 5, Appendix I-2. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). For the production building foundation investigation, reporting limits for arsenic exceed the protection of groundwater screening level, and for selenium exceed protection of groundwater and ecological wildlife screening levels, in all samples analyzed.

All sample analytical results for COPCs that exceed Plant Area AOC soil screening levels are compiled and presented on Figure 2.4.9-1. Results of the initial RI phase of investigation indicate that total cyanide, PAHs as TTEC, calculated total LMW PAH and total HMW PAH, PCBs, metals, and TPH-Dx do not exceed site soil screening levels. Only fluoride and sulfate were detected at concentrations that exceed protection of groundwater soil screening levels in shallow soil, but not in deeper samples collected from the same borings. Fluoride was detected at a concentration of 300 mg/kg in one sample SB-PF02-0.5 at 0.5 ft bgs. However, fluoride concentrations did not



PAAOC-SB-PF01	0.5	2
No exceedances	NE	NE

PAAOC-SB-PF03	0.5	0.5D
No exceedances	NE	NE

PAAOC-SB-PF02	0.5	2	4
Aluminum Smelting (mg/kg)			
Fluoride	300	NE	NE

PAAOC-SB-PF04	0.5	0.5D	2
No exceedances	NE	NE	NE

PAAOC-SB-PF06	0.5	0.5D	2	4	6
Aluminum Smelting (mg/kg)					
Sulfate	NE	NE	NE	3,000	NE

PAAOC-SB-PF07	0.5	2
No exceedances	NE	NE

PAAOC-SB-PF05	0.5	2	2D	8
No exceedances	NE	NE	NE	NE

PAAOC-SB-PF08	0.5	2	2D
No exceedances	NE	NE	NE

● RI Boring

☐ Plant Production Building Outline

Soil Screening Levels
blue: exceeds Protection of Groundwater

NE: No exceedance
D: Duplicate sample
2: Sample depth in feet bgs

0 120 240 480
Feet

Figure 2.4.9-1

Plant Area AOC

Production Building Foundations Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Table 2.4.9-1
PAAOC Production Building Foundations RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 1 of 2

	Screening Levels					Ecological Screening Levels	RI Analytical Results											
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-PF01-0.5	PAAOC-SB-PF01-2	PAAOC-SB-PF02-0.5	PAAOC-SB-PF02-2	PAAOC-SB-PF02-4	PAAOC-SB-PF03-0.5	PAAOC-SB-PF03-0.5D	PAAOC-SB-PF04-0.5	PAAOC-SB-PF04-0.5D	PAAOC-SB-PF04-2	PAAOC-SB-PF05-0.5	PAAOC-SB-PF05-2
Aluminm Smelting																		
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.052	0.05 U	0.05 U	0.05 UJ	0.05 U	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	13	6.5	**300**	18 U	35 U	23	15	5.6	54	5.5	20	12
Sulfate	mg/kg	NA	NE	2,150	NE	NE	25 J	10 UJ	36 U	32 U	100	12	13	12	15	10 U	220	10 U
Polynuclear Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0073 U	0.0076 U	0.0073 U	0.0085 U	0.009 U	0.0078 U	0.0076 U	0.0077 U	0.0076 U	0.0077 U	0.0079 U	0.0076 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0073 U	0.0076 U	0.0073 U	0.0085 U	0.009 U	0.0078 U	0.0076 U	0.0077 U	0.0076 U	0.0077 U	0.0079 U	0.0076 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0073 U	0.0076 U	0.0073 U	0.0085 U	0.009 U	0.0078 U	0.0076 U	0.0077 U	0.0076 U	0.0077 U	0.0079 U	0.0076 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0073 U	0.0076 U	0.0073 U	0.0085 U	0.009 U	0.0078 U	0.0076 U	0.0077 U	0.0076 U	0.0077 U	0.0079 U	0.0076 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0073 U	0.0076 U	0.0073 U	0.0085 U	0.009 U	0.0078 U	0.0076 U	0.0077 U	0.0076 U	0.0077 U	0.0079 U	0.0076 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0073 U	0.0076 U	0.0073 U	0.0085 U	0.009 U	0.0078 U	0.0076 U	0.0077 U	0.0076 U	0.0077 U	0.0079 U	0.0076 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.0073 U	0.0076 U	0.0073 U	0.0085 U	0.009 U	0.0078 U	0.0076 U	0.0077 U	0.0076 U	0.0077 U	0.0079 U	0.0076 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0073 U	0.0081	0.0073 U	0.0089	0.009 U	0.0078 U	0.0076 U	0.0077 U	0.0076 U	0.0077 U	0.015	0.0076 U
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.0073 U	0.0076 U	0.0073 U	0.0085 U	0.009 U	0.0078 U	0.0076 U	0.0077 U	0.0076 U	0.0077 U	0.0079 U	0.0076 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0073 U	0.0076 U	0.0073 U	0.0085 U	0.009 U	0.0078 U	0.0076 U	0.0077 U	0.0076 U	0.0077 U	0.0079 U	0.0076 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.0073 U	0.0076 U	0.0073 U	0.0085 U	0.009 U	0.0078 U	0.0076 U	0.0077 U	0.0076 U	0.0077 U	0.0079 U	0.0076 U
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0073 U	0.0076 U	0.0073 U	0.0085 U	0.009 U	0.0078 U	0.0076 U	0.0077 U	0.0076 U	0.0077 U	0.0079 U	0.0076 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.0081	0.0077	0.0073 U	0.0085 U	0.009 U	0.0078 U	0.014	0.0077 U	0.0076 U	0.0077 U	0.0082	0.0076 U
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0073 U	0.0076 U	0.0073 U	0.0085 U	0.009 U	0.0078 U	0.0076 U	0.0077 U	0.0076 U	0.0077 U	0.0079 U	0.0076 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.0073 U	0.0076 U	0.0073 U	0.0085 U	0.009 U	0.0078 U	0.0076 U	0.0077 U	0.0076 U	0.0077 U	0.0079 U	0.0076 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0073 U	0.0076 U	0.0073 U	0.0085 U	0.009 U	0.0078 U	0.0076 U	0.0077 U	0.0076 U	0.0077 U	0.0079 U	0.0076 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.0073 U	0.0076 U	0.0073 U	0.0085 U	0.009 U	0.0078 U	0.019	0.0077 U	0.0076 U	0.0077 U	0.0079 U	0.0076 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.0073 U	0.0076 U	0.0073 U	0.0085 U	0.009 U	0.0078 U	0.011	0.0077 U	0.0076 U	0.0077 U	0.0083	0.0076 U
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.0073	0.0008	0.0073	0.0009	0.009	0.0078	0.0076	0.0077	0.0076	0.0077	0.0015	0.0076
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.008	0.008	0.0073	0.009	0.009	0.0078	0.03	0.0077	0.0076	0.0077	0.008	0.0076
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.007	0.008	0.0073	0.009	0.009	0.0078	0.01	0.0077	0.0076	0.0077	0.02	0.0076
Polychlorinated Biphenyls (PCBs)																		
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.055 U	0.057 U	0.055 U	0.064 U	0.067 U	0.058 U	0.057 U	0.058 U	0.057 U	0.058 U	0.059 U	0.057 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.057 U	0.055 U	0.064 U	0.067 U	0.058 U	0.057 U	0.058 U	0.057 U	0.058 U	0.059 U	0.057 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.057 U	0.055 U	0.064 U	0.067 U	0.058 U	0.057 U	0.058 U	0.057 U	0.058 U	0.059 U	0.057 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.057 U	0.055 U	0.064 U	0.067 U	0.058 U	0.057 U	0.058 U	0.057 U	0.058 U	0.059 U	0.057 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.057 U	0.055 U	0.064 U	0.067 U	0.058 U	0.057 U	0.058 U	0.057 U	0.058 U	0.059 U	0.057 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.055 U	0.057 U	0.055 U	0.064 U	0.067 U	0.058 U	0.057 U	0.058 U	0.057 U	0.058 U	0.059 U	0.057 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.055 U	0.057 U	0.055 U	0.064 U	0.067 U	0.058 U	0.057 U	0.058 U	0.057 U	0.058 U	0.059 U	0.057 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.055	0.057	0.055	0.064	0.067	0.058	0.057	0.058	0.057	0.058	0.059	0.057
Metals																		
Aluminum	mg/kg	NA	3,500,000	NE480,000	28,299	NE	6,900	6,700	6,700	13,000	14,000	7,300	6,300	8,300	9,000	6,200	7,000	5,600
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	11 U	13 U	13 U	13 U	11 U	12 U	11 U	12 U	12 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.55 U	0.57 U	0.55 U	0.64 U	0.67 U	0.67 U	0.57 U	0.58 U	0.57 U	0.58 U	0.59 U	0.57 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	13	9.7	7.2	4.5	9.8	1.5	26	5.7	4.8	4.4	3.6	3.4
Copper	mg/kg	NA	140,000	280	28.4	217	18	13	13	17	14	19	17	14	16	8.9	25	10
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.5 U	5.7 U	5.5 U	6.4 U	6.7 U	6.7 U	5.7 U	5.8 U	5.7 U	5.8 U	5.9 U	5.7 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.27 U	0.28 U	0.27 U	0.32 U	0.34 U	0.34 U	0.29 U	0.29 U	0.28 U	0.29 U	0.3 U	0.28
Nickel	mg/kg	NA	70,000	130	24.54	980	13	8.3	8.7	6.9	6.3	3.9	12	5	6.4	3.3	4.5	3.4
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	13 U	13 U	13 U	11 U	12 U	11 U	12 U	12 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	40	40	40	41	60	29	40	48	53	42	43	40
Total Petroleum Hydrocarbons (TPHs)																		
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	27 U	28 U	27 U	32 U	34 U	29 U	29 U	29 U	28 U	29 U	30 U	29 U
Lube Oil Range Organics	mg/kg	2,000	NE	NA	NA	2,000	55 U	57 U	55 U	64 U	67 U	58 U	57 U	94	62	160	59 U	57 U

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemcial but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.

TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.4.9-1
PAAOC Production Building Foundations RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 2 of 2

	Screening Levels					Ecological Screening Levels	RI Analytical Results											
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-PF05-2D**	**PAAOC-SB-PF05-8**	**PAAOC-SB-PF06-0.5**	**PAAOC-SB-PF06-0.5D**	**PAAOC-SB-PF06-2**	**PAAOC-SB-PF06-4**	**PAAOC-SB-PF06-6**	**PAAOC-SB-PF07-0.5**	**PAAOC-SB-PF07-2**	**PAAOC-SB-PF08-0.5**	**PAAOC-SB-PF08-2**	**PAAOC-SB-PF08-2D**
Aluminm Smelting																		
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	21	22	7.1	5.7	28	8.4	19	11 J	16 J	12 J	5 U	10
Sulfate	mg/kg	NA	NE	2,150	NE	NE	100	110	16	13	130	**3,000**	840	41	10 U	21 U	10 U	10 U
Polynuclear Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0077 U	0.009 U	0.0077 U	0.0077 U	0.0078 U	0.0078 U	0.0074 U	0.0076 U	0.0073 U	0.0076 U	0.0076 U	0.0075 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0077 U	0.009 U	0.0077 U	0.0077 U	0.0078 U	0.0078 U	0.0074 U	0.0076 U	0.0073 U	0.0076 U	0.0076 U	0.0075 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0077 U	0.009 U	0.0077 U	0.0077 U	0.0078 U	0.0078 U	0.0074 U	0.0076 U	0.0073 U	0.0076 U	0.0076 U	0.0075 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0077 U	0.009 U	0.0077 U	0.0077 U	0.0078 U	0.0078 U	0.0074 U	0.0076 U	0.0073 U	0.0076 U	0.0076 U	0.0075 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0077 U	0.009 U	0.0077 U	0.0077 U	0.0078 U	0.0078 U	0.0074 U	0.0076 U	0.0073 U	0.0076 U	0.0076 U	0.0075 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0085	0.009 U	0.0077 U	0.0077 U	0.0078 U	0.0078 U	0.0074 U	0.009	0.0073 U	0.012	0.0076 U	0.0075 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.0078	0.009 U	0.0077 U	0.0077 U	0.0078 U	0.0078 U	0.0074 U	0.0085	0.0073 U	0.019	0.0076 U	0.0075 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.021	0.009 U	0.0077 U	0.0077 U	0.0078 U	0.0078 U	0.0074 U	0.027	0.0073 U	0.035	0.0076 U	0.0075 U
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.01	0.009 U	0.0077 U	0.0077 U	0.0078 U	0.0078 U	0.0074 U	0.0094	0.0073 U	0.021	0.0076 U	0.0075 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0077 U	0.009 U	0.0077 U	0.0077 U	0.0078 U	0.0078 U	0.0074 U	0.0076 U	0.0073 U	0.012	0.0076 U	0.0075 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.011	0.009 U	0.0077 U	0.0077 U	0.0078 U	0.0078 U	0.0074 U	0.026	0.0073 U	0.022	0.0076 U	0.0075 U
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0077 U	0.009 U	0.0077 U	0.0077 U	0.0078 U	0.0078 U	0.0074 U	0.0076 U	0.0073 U	0.0076 U	0.0076 U	0.0075 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.0077 U	0.009 U	0.0077 U	0.0077 U	0.0078 U	0.0078 U	0.0074 U	0.016	0.0073 U	0.012	0.0076 U	0.0075 U
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.011	0.009 U	0.0077 U	0.0077 U	0.0078 U	0.0078 U	0.0074 U	0.0076 U	0.0073 U	0.0076 U	0.0076 U	0.0075 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.0088	0.009 U	0.0077 U	0.0077 U	0.0078 U	0.0078 U	0.0074 U	0.0077	0.0073 U	0.018	0.0076 U	0.0075 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0077 U	0.009 U	0.0077 U	0.0077 U	0.0078 U	0.0078 U	0.0074 U	0.0076 U	0.0073 U	0.0076 U	0.0076 U	0.0075 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.0077 U	0.009 U	0.0077 U	0.0077 U	0.0078 U	0.0078 U	0.0074 U	0.0076 U	0.0073 U	0.0076 U	0.0076 U	0.0075 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.011	0.009 U	0.0077 U	0.0077 U	0.0078 U	0.0078 U	0.0074 U	0.015	0.0073 U	0.011	0.0076 U	0.0075 U
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.011	0.009	0.0077	0.0077	0.0078	0.0078	0.0074	0.013	0.0073	0.03	0.0076	0.0075
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.01	0.009	0.0077	0.0077	0.0078	0.0078	0.0074	0.02	0.0073	0.01	0.0076	0.0075
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.08	0.009	0.0077	0.0077	0.0078	0.0078	0.0074	0.1	0.0073	0.2	0.0076	0.0075
Polychlorinated Biphenyls (PCBs)																		
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.058 U	0.067 U	0.058 U	0.058 U	0.058 U	0.059 U	0.055 U	0.057 U	0.055 U	0.057 U	0.057 U	0.057 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.058 U	0.067 U	0.058 U	0.058 U	0.058 U	0.059 U	0.055 U	0.057 U	0.055 U	0.057 U	0.057 U	0.057 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.058 U	0.067 U	0.058 U	0.058 U	0.058 U	0.059 U	0.055 U	0.057 U	0.055 U	0.057 U	0.057 U	0.057 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.058 U	0.067 U	0.058 U	0.058 U	0.058 U	0.059 U	0.055 U	0.057 U	0.055 U	0.057 U	0.057 U	0.057 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.058 U	0.067 U	0.058 U	0.058 U	0.058 U	0.059 U	0.055 U	0.057 U	0.055 U	0.057 U	0.057 U	0.057 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.058 U	0.067 U	0.058 U	0.058 U	0.058 U	0.059 U	0.055 U	0.057 U	0.055 U	0.057 U	0.057 U	0.057 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.058 U	0.067 U	0.058 U	0.058 U	0.058 U	0.059 U	0.055 U	0.057 U	0.055 U	0.057 U	0.057 U	0.057 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.058	0.067	0.058	0.058	0.058	0.059	0.055	0.057	0.057	0.057	0.057	0.057
Metals																		
Aluminum	mg/kg	NA	3,500,000	NE480,000	28,299	NE	7,400	7,300	7,800	8,600	8,700	4,600	4,000	7,200	6,100	5,200	6,300	7,400
Arsenic	mg/kg	20	88	2.9	7.61	132	12 U	12 U	12 U	12 U	12 U	12 U	11 U	11 U	11 U	11 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.58 U	0.67 U	0.58 U	0.58 U	0.58 U	0.59 U	0.55 U	0.57 U	0.55 U	0.57 U	0.57 U	0.57 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	4.4	1.5	5.1	5.4	6.3	2.1	3.1	5.1	9.5	3.2	3.2	3.7
Copper	mg/kg	NA	140,000	280	28.4	217	13	19	14	16	15	14	11	12	13	13	9.4	10
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.8 U	6.7 U	5.8	5.8 U	5.8 U	5.6 U	5.5 U	5.7 U	5.5 U	5.7 U	5.7 U	5.7 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.29 U	0.34 U	0.29	0.29 U	0.29 U	0.29 U	0.28 U	0.29 U	0.27 U	0.28 U	0.29 U	0.28 U
Nickel	mg/kg	NA	70,000	130	24.54	980	4.2	3.9	5.3	5.5	6.1	3.5	3.5	5	4.8	3.5	3.5	4
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	12 U	13 U	12 U	12 U	12 U	12 U	11 U	11 U	11 U	11 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	50	29	46	50	48	28	49	42	45	33	43	51
Total Petroleum Hydrocarbons (TPHs)																		
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	30 U	34 U	29 U	29 U	29 U	29 U	28 U	29 U	27 U	28 U	29 U	28 U
Lube Oil Range Organics	mg/kg	2,000	NE	NA	NA	2,000	58 U	67 U	58 U	58 U	59 U	59 U	55 U	57 U	55 U	57 U	57 U	57 U

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemcial but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

exceed screening levels in the samples collected at 2 and 4 ft bgs samples. Sulfate was detected at a concentration of 3,000 mg/kg in one sample SB-PF06-4, at 4.0 ft bgs, however sulfate concentrations did not exceed screening levels in the sample collected at 6 ft bgs.

2.4.9.3 Conclusions and Recommendations

Based on the results of the initial RI phase of investigation only fluoride and sulfate were detected in shallow soil at concentrations that exceed the protection of groundwater screening levels but do not exceed in deeper samples collected from those borings. No other COPC exceeded site soil screening levels.

Fluoride exceedance may likely be related to the Crucible Cleaning Room IA. Sulfate exceedance may likely be related to the previous dry/wet scrubbers and associated piping in passage no. 4.

Because the thick production building foundations are expected to remain in place and only two COPCs exceeded screening levels in soils samples collected at shallow depths, but concentrations were not exceeded in deeper soil, the production building foundations are not recommended for further evaluation in the FS.

2.4.10 Machine Shop and Cast House Foundation

The southernmost building in the plant production area footprint (Figure 2.1.2-1) houses several ancillary production functions. The west end of this building consisted of the Machine Shop and maintenance area where various equipment and vehicles were repaired and maintained. The east end of the building contains the Cast House where the molten aluminum DC Casting Pits and shipping area were located. The building structure has been demolished and the thick foundation remains. The Machine Shop and Cast House portions of the building foundation is the focus of the initial RI investigation discussed in this section.

2.4.10.1 Investigation Scope

The Machine Shop and maintenance area in the western portion of the building included several features: three diesel ASTs, a wash station, an oil change pit, an oil-water separator, and an oil storage room. The I&M System connects to the Machine Shop foundation at the location of the oil-water separator and one sample of sediment was collected in the I&M oil trap at that connection (see Section 2.5.3, Table 2.5.3-2). Because of the thickness of the building foundation (approximately 8 ft thick) these features could not be directly investigated. Additionally, prior to the initial RI phase of investigation, these features had been cleaned by a vacuum truck, the oil-water separator specifically filled with rocks, and approximately 3,600 gallons of liquid and solid waste was appropriately disposed through contract with the vacuum truck service. The cleanup of these features was completed in 2011 and there were no observed remaining wastes noted prior to the initial RI.

The Machine Shop was investigated with a series of eight soil borings, SB-MM01 through SB-MM08, completed adjacent to the south, west, and north sides of the foundation (Figure 2.4.10-1). Soil boring SB-MM03 was completed as upper basalt groundwater monitoring well RI-MW12-BAU and results of groundwater sampling are discussed in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC. The borings were completed to depths of up to 10 ft or refusal. Discrete soil samples were planned to be collected at depths of 0.5 ft, 2 ft, 4 ft, and 6 ft or the base of the boring. Soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Gx and TPH-Dx.

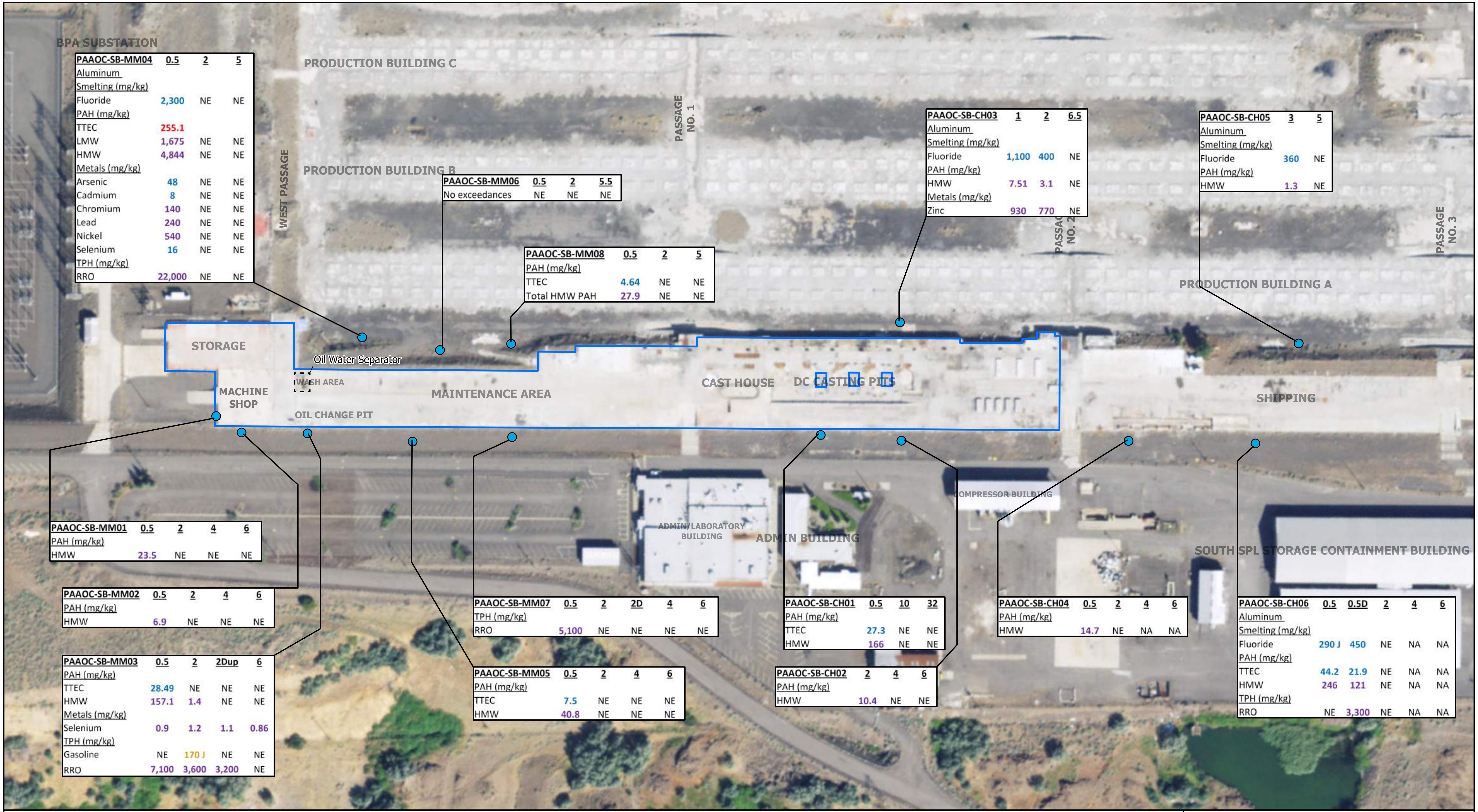
The Cast House was the main casting area for the plant and included casting pits and an oil storage room. The casting pits are constructed to a depth of about 40 ft below the base of the foundation. The oil storage room was a walled room at the north side of the foundation, north of the casting pits. Because of the thickness of the building foundation these features could not be directly investigated. The Cast House was investigated with a series of six soil borings, SB-CH01 through SB-CH06, completed adjacent to the north and south sides of the foundation (Figure 2.4.10-1). Soil samples were planned to be collected at 0.5 ft bgs, 2 ft bgs, 4 ft bgs, and 6 ft bgs with analysis of the 4-ft and 6-ft samples based on whether COPCs exceeded SLs in the 0.5-ft and 2-ft samples per the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b).

The following summarizes the Cast House boring and sample depths.

- **SB-CH01**: on the south side of the foundation was completed to 31 ft bgs and is the boring for monitoring well RI-GW4A (sampling are results discussed in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC). Soil samples were collected at 2 ft bgs, 10 ft bgs, and 31 ft bgs.

- **SB-CH02**: on the south side of the foundation was completed to 6 ft bgs, and soil samples were collected at 2 ft bgs, 4 ft bgs, and 6 ft bgs.

- **SB-CH03**: on the north side of the foundation was completed to 6.5 ft bgs, and soil samples were collected at 1 ft bgs, 2 ft bgs, and 6.5 ft bgs.



PAAOC-SB-MM04	0.5	2	5
Aluminum Smelting (mg/kg)			
Fluoride	2,300	NE	NE
PAH (mg/kg)			
TTEC	255.1		
LMW	1,675	NE	NE
HMW	4,844	NE	NE
Metals (mg/kg)			
Arsenic	48	NE	NE
Cadmium	8	NE	NE
Chromium	140	NE	NE
Lead	240	NE	NE
Nickel	540	NE	NE
Selenium	16	NE	NE
TPH (mg/kg)			
RRO	22,000	NE	NE

PAAOC-SB-MM06	0.5	2	5.5
No exceedances	NE	NE	NE

PAAOC-SB-MM08	0.5	2	5
PAH (mg/kg)			
TTEC	4.64	NE	NE
Total HMW PAH	27.9	NE	NE

PAAOC-SB-CH03	1	2	6.5
Aluminum Smelting (mg/kg)			
Fluoride	1,100	400	NE
PAH (mg/kg)			
HMW	7.51	3.1	NE
Metals (mg/kg)			
Zinc	930	770	NE

PAAOC-SB-CH05	3	5
Aluminum Smelting (mg/kg)		
Fluoride	360	NE
PAH (mg/kg)		
HMW	1.3	NE

PAAOC-SB-MM01	0.5	2	4	6
PAH (mg/kg)				
HMW	23.5	NE	NE	NE

PAAOC-SB-MM02	0.5	2	4	6
PAH (mg/kg)				
HMW	6.9	NE	NE	NE

PAAOC-SB-MM03	0.5	2	2Dup	6
PAH (mg/kg)				
TTEC	28.49	NE	NE	NE
HMW	157.1	1.4	NE	NE
Metals (mg/kg)				
Selenium	0.9	1.2	1.1	0.86
TPH (mg/kg)				
Gasoline	NE	170 J	NE	NE
RRO	7,100	3,600	3,200	NE

PAAOC-SB-MM07	0.5	2	2D	4	6
TPH (mg/kg)					
RRO	5,100	NE	NE	NE	NE

PAAOC-SB-MM05	0.5	2	4	6
PAH (mg/kg)				
TTEC	7.5	NE	NE	NE
HMW	40.8	NE	NE	NE

PAAOC-SB-CH01	0.5	10	32
PAH (mg/kg)			
TTEC	27.3	NE	NE
HMW	166	NE	NE

PAAOC-SB-CH02	2	4	6
PAH (mg/kg)			
HMW	10.4	NE	NE

PAAOC-SB-CH04	0.5	2	4	6
PAH (mg/kg)				
HMW	14.7	NE	NA	NA

PAAOC-SB-CH06	0.5	0.5D	2	4	6
Aluminum Smelting (mg/kg)					
Fluoride	290 J	450	NE	NA	NA
PAH (mg/kg)					
TTEC	44.2	21.9	NE	NA	NA
HMW	246	121	NE	NA	NA
TPH (mg/kg)					
RRO	NE	3,300	NE	NA	NA

● RI Boring

▭ Machine Shop and Cast House Foundation Outline

Soil Screening Levels
blue: exceeds Protection of Groundwater
purple: exceeds Ecological Wildlife and for TPH diesel and residual range organics exceeds MTCA Method A
red: Exceeds MTCA Method C
orange: exceeds MTCA Method A

NE: No exceedance
NA: Not analyzed
D/Dup: Duplicate sample
RRO: Residual Range Organics
2: Sample depth in feet bgs

W N E S

0 60 120 240
Feet

Figure 2.4.10-1

Plant Area AOC

Machine Shop and Cast House Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

- **SB-CH04**: on the south side of the foundation was completed to 6 ft bgs, and soil samples were collected at 0.5 ft bgs, 2 ft bgs, 4 ft bgs, and 6 ft bgs. Samples collected at 4 ft bgs and 6 ft bgs were not analyzed.

- **SB-CH05**: on the north side of the foundation was completed to 5 ft bgs, and soil samples collected were collected at 3 ft bgs and 5 ft bgs.

- **SB-CH06**: on the south side of the foundation was completed to 6 ft bgs and soil samples were collected at 0.5 ft bgs, 2 ft bgs, 4 ft bgs, and 6 ft bgs. Samples collected at 4 ft bgs and 6 ft bgs were not analyzed.

Soil samples from borings SB-CH03 and SB-CH05 on the north side of the foundation were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH, and VOCs. Soil samples from borings SB-CH01, SB-CH02, SB-CH04, and SB-CH06 on the south side of the foundation were analyzed tor free cyanide, fluoride, sulfate, PAHs, PCBs, metals and TPH-Dx.

Investigation of the Machine Shop and maintenance area and Cast House was conducted during the initial RI phase of investigation. No further investigation was proposed in the WPA.

2.4.10.2 Investigation Results

The Machine Shop was investigated with a total of eight soil borings and the analytical results are summarized on Table 2.4.10-1. The soil was described and characterized, and logs of borings are included in Volume 5, Appendix G-1. The Cast House was investigated with a total of six soil borings and the analytical results are summarized on Table 2.4.10-2. Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC soil screening levels. Natural background concentrations for the site have also been used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendices H-2 and H-1, and data validation reports are included in Volume 5, Appendices I-2 and I-1. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). For the initial RI investigation phase of the Machine Shop and Cast House, reporting limits for arsenic exceed the protection of groundwater screening level in most samples, and the reporting limits for selenium exceeds the protection of groundwater and ecological wildlife screening levels in most samples.

All sample analytical results for COPCs in Machine Shop and Cast House soil borings that exceed Plant Area AOC soil screening levels are compiled and presented on Figure 2.4.10-1. The initial RI results for the Machine Shop indicate that detected concentrations of total cyanide, sulfate, PCBs

Table 2.4.10-1
PAAOC Machine Shop RI Soil Results Summary
Columbmia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 1 of 2

	Screening Levels					Ecological Screening Levels	RI Analytical Results														
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-MM01-0.5	PAAOC-SB-MM01-2	PAAOC-SB-MM01-4	PAAOC-SB-MM01-6	PAAOC-SB-MM02-0.5	PAAOC-SB-MM02-2	PAAOC-SB-MM02-4	PAAOC-SB-MM02-6	PAAOC-SB-MM03-0.5	PAAOC-SB-MM03-2	PAAOC-SB-MM42-2 (MM03-2 dup)	PAAOC-SB-MM03-6	PAAOC-SB-MM04-0.5	PAAOC-SB-MM04-2	PAAOC-SB-MM04-5
Aluminum Smelting																					
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.072	0.05 U	0.05 U	1.8 U	2 U	2.1 U	2 U	0.069	0.05 U	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	12	14	5 U	5 U	13	8.4	5 U	5 U	30	11 J	14 J	0.68 J	**2,300**	77	23
Sulfate	mg/kg	NA	NE	2,150	NE	NE	14	10 U	10 U	12	20	10 U	10 U	24	14	48	44	13	200	21	30
Polynuclear Aromatic Hydrocarbons (PAHs)																					
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.074 U	0.0075 U	0.0071 U	0.0075 U	0.015 U	0.0075 U	0.0078 U	0.0071 U	0.088 J	0.0035 J	0.0016 U	0.0016 U	15 U	0.0074 U	0.0072 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.074 U	0.0075 U	0.0071 U	0.0075 U	0.015 U	0.0075 U	0.0078 U	0.0071 U	0.15	0.0046 J	0.0022 U	0.0021 U	15 U	0.0074 U	0.0072 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	1.1	0.0075 U	0.011	0.0075 U	0.075	0.0075 U	0.0078 U	0.0071 U	1.4	0.00065 U	0.00065 U	0.00063 U	15 U	0.0074 U	0.0072 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.074 U	0.0075 U	0.0071 U	0.0075 U	0.015 U	0.0075 U	0.0078 U	0.0071 U	0.0053 U	0.00054 U	0.0022 U	0.00053 U	15 U	0.0074 U	0.0072 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	1.8	0.0075 U	0.0071 U	0.0075 U	0.16	0.0075 U	0.0078 U	0.0071 U	3.1	0.00065 U	0.0029 J	0.00063 U	15 U	0.0083	0.0072 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	2.9	0.0075 U	0.023	0.0075 U	0.78	0.0075 U	0.0078 U	0.0071 U	17	0.061 J	0.066 J	0.0016 UJ	400	0.091	0.0072 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	2.5	0.0075 U	0.03	0.0075 U	1.1	0.0075 U	0.0078 U	0.0071 U	21	0.12 J	0.033 J	0.00042 U	60	0.11	0.0072 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	3	0.0075 U	0.035	0.0075 U	1.3	0.0075 U	0.0078 U	0.0071 U	28	0.23 J	0.072 J	0.0016 U	1,100	0.15	0.018
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	1.5	0.0075 U	0.021	0.0075 U	0.73	0.0075 U	0.0078 U	0.0071 U	18	0.31 J	0.15 J	0.00053 U	150	0.1	0.0072 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	1.2	0.0075 U	0.013	0.0075 U	0.37	0.0075 U	0.0078 U	0.0071 U	8.5	0.062 J	0.022 J	0.00063 U	210	0.054	0.0072 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	3.1	0.0075 U	0.021	0.0075 U	0.7	0.0075 U	0.0078 U	0.0071 U	18	0.078 J	0.021 J	0.0016 U	1,700	0.13	0.021
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.39	0.0075 U	0.0071 U	0.0075 U	0.14	0.0075 U	0.0078 U	0.0071 U	3.6	0.04 J	0.015 J	0.00021 U	54	0.02	0.0072 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	7.7	0.0075 U	0.035	0.0075 U	1.2	0.0075 U	0.0078 U	0.0071 U	31 J	0.12 J	0.11 J	0.0051 UJ	1,600	0.094	0.013
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.48	0.0075 U	0.0071 U	0.0075 U	0.051	0.0075 U	0.0078 U	0.0071 U	1	0.00054 U	0.00054 U	0.00053 U	15 U	0.0074 U	0.0072 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	1.7	0.0075 U	0.019	0.0075 U	0.66	0.0075 U	0.0078 U	0.0071 U	16	0.26 J	0.11 J	0.00063 U	170	0.077	0.0072 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.14	0.0075 U	0.0071 U	0.0075 U	0.015 U	0.0075 U	0.0078 U	0.0071 U	0.0016	0.0017 U	0.0031 J	0.0014 U	15 U	0.0074 U	0.0072 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	6.9	0.0075 U	0.021	0.0075 U	0.63	0.0075 U	0.0078 U	0.0071 U	11	0.035 J	0.011 J	0.0016 U	75	0.02	0.0072 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	7.2	0.0075 U	0.031	0.0075 U	1.1	0.0075 U	0.0078 U	0.0071 U	27 J	0.19 J	0.15 J	0.0046 UJ	1,000	0.1	0.011
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**3.45**	0.0075	0.04	0.0075	1.46	0.0075	0.0078	0.0071	**28.49**	0.186	0.062	0.5315	**255.1**	0.15	0.0021
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	18.12	0.0075	0.07	0.0075	2.12	0.0075	0.0078	0.0071	47.5	0.16	0.12	0.00053	**1,675**	0.12	0.01
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**23.5**	0.0075	0.2	0.0075	**6.9**	0.0075	0.0078	0.0071	**157.1**	**1.4**	0.64	0.00021	**4,844**	0.83	0.05
Polychlorinated Biphenyls (PCBs)																					
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.055 U	0.056 U	0.053 U	0.056 U	0.055 U	0.056 U	0.059 U	0.053 U	0.0079 UJ	0.008 U	0.008 U	0.0078 U	0.056 U	0.055 U	0.054 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.056 U	0.053 U	0.056 U	0.055 U	0.056 U	0.059 U	0.053 U	0.0045 UJ	0.0045 U	0.0045 U	0.0044 U	0.056 U	0.055 U	0.054 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.056 U	0.053 U	0.056 U	0.055 U	0.056 U	0.059 U	0.053 U	0.0052 UJ	0.0053 U	0.0053 U	0.0052 U	0.056 U	0.055 U	0.054 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.056 U	0.053 U	0.056 U	0.055 U	0.056 U	0.059 U	0.053 U	0.0017 UJ	0.0017 U	0.0017 U	0.0017 U	0.056 U	0.055 U	0.054 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.056 U	0.053 U	0.056 U	0.055 U	0.056 U	0.059 U	0.053 U	0.0031 UJ	0.0031 U	0.0031 U	0.0031 U	0.056 U	0.055 U	0.054 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.055 U	0.056 U	0.053 U	0.056 U	0.055 U	0.056 U	0.059 U	0.053 U	0.0016 UJ	0.0016 U	0.0016 U	0.0016 U	0.056 U	0.055 U	0.054 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.055 U	0.056 U	0.053 U	0.056 U	0.055 U	0.056 U	0.059 U	0.053 U	0.071 J	0.0042 J	0.0042 J	0.002 U	0.056 U	0.055 U	0.054 U
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	0.055	0.056	0.053	0.056	0.055	0.056	0.059	0.053	0.071	0.0042	0.0042	0.0016	0.056	0.055	0.054
Metals																					
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	6,400	6,200	4,800	6,600	5,100	9,600	7,300	4,700	7,200	6,400	5,900	3,900	20,000	4,900	5,600
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	11 U	11 U	11 U	11 U	12 U	11 U	1.3	1.2	1.3	0.83	48	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.55 U	0.56 U	0.53 U	0.56 U	0.55 U	0.56 U	0.59 U	0.53 U	0.9	0.23	0.2	0.12	8	0.56 U	0.54 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	5.9	4.3	4.7	3.6	4.9	7.7	6	4	20	4.4	3.8	2.5	**140**	3.9	4.1
Copper	mg/kg	NA	140,000	280	28.4	217	7.2	6.9	6.7	6.3	13	7.4	4.4	10	37	17	18	9.3	110	11	17
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.5 U	5.6 U	5.3 U	5.6 U	5.5 U	5.6 U	5.9 U	5.3 U	40	5.7	5.2	1.9	**240**	5.5 U	5.4 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.28 U	0.27 U	0.28 U	0.27 U	0.28 U	0.29 U	0.27 U	0.076	0.018 J	0.024	0.0065 U	0.83	0.28 U	0.27 U
Nickel	mg/kg	NA	70,000	130	24.54	980	5.6	4.7	3.3	3.3	5.6	6.6	5.8	3.1	10	3.9	3.8	2.6	**540**	18	4.7
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	11 U	11 U	11 U	12 U	11 U	**0.9**	**1.2**	**1.1**	**0.86**	**16**	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	44	37	38	47	36	54	57	32	130	67	77	28	280	31	40
Total Petroleum Hydrocarbons (TPHs)																					
Gasoline	mg/kg	100	NE	NA	NE	1,000	NA	NA	NA	NA	NA	NA	NA	NA	6.2 B	**170 J**	96 J	6.4 B	NA	NA	NA
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	56 U	28 U	27 U	28 U	27 U	28 U	29 U	27 U	950	580	520	3.8 U	4,800 U	28 U	27 U
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	460	56 U	54 U	56 U	78	56 U	59 U	53 U	**7,100**	**3,600**	**3,200**	16 J	**22,000**	55 U	54 U

Notes:

J	Estimated concentration.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
NA	Not applicable or not analyzed.	LMW PAH	Low molecular weight PAH.
NE	Not established.	HMW PAH	High molecular weight PAH.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.	Detected concentrations shown in **bold** exceed one or more site soil screening levels.	
U	Chemical was not detected. The associated value represents the method detection limit.		
UJ	Chemical was not detected. The associated limit is estimated.		

Table 2.4.10-1
PAAOC Machine Shop RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
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	Screening Levels					Ecological Screening Levels	RI Analytical Results														
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-MM05-0.5**	**PAAOC-SB-MM05-2**	**PAAOC-SB-MM05-4**	**PAAOC-SB-MM05-6**	**PAAOC-SB-MM06-0.5**	**PAAOC-SB-MM06-2**	**PAAOC-SB-MM06-5.5**	**PAAOC-SB-MM07-0.5**	**PAAOC-SB-MM07-2**	**PAAOC-SB-MM07-2D**	**PAAOC-SB-MM07-4**	**PAAOC-SB-MM07-6**	**PAAOC-SB-MM08-0.5**	**PAAOC-SB-MM08-2**	**PAAOC-SB-MM08-5**
Aluminum Smelting																					
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	33	16	17	25	27	29	6.1	28	5.9	5 U	9.9	12	34	59	5 U
Sulfate	mg/kg	NA	NE	2,150	NE	NE	13	10 U	10 U	10 U	10 U	10 U	10 U	10 U	11	10 U	16	14	10 U	19	10 U
Polynuclear Aromatic Hydrocarbons (PAHs)																					
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.13	0.015 U	0.0074 U	0.071	0.0076 U	0.0071 U	0.007 U	0.015 U	0.0074 U	0.0074 U	0.014	0.0074 U	0.15 U	0.0071 U	0.0071 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.19	0.015 U	0.0074 U	0.11	0.0076 U	0.0071 U	0.007 U	0.015 U	0.0074 U	0.0074 U	0.02	0.0074 U	0.15 U	0.0071 U	0.0071 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.96	0.017	0.0074 U	0.24	0.0076 U	0.0071 U	0.007 U	0.015 U	0.0074 U	0.0074 U	0.07	0.0074 U	0.45	0.0071 U	0.0071 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.079 U	0.015 U	0.0074 U	0.015 U	0.0076 U	0.0071 U	0.007 U	0.015 U	0.0074 U	0.0074 U	0.0076 U	0.0074 U	0.15 U	0.0071 U	0.0071 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	1.5	0.029	0.0074 U	0.11	0.013	0.0071 U	0.007 U	0.015 U	0.0074 U	0.0074 U	0.0076 U	0.0074 U	1.1	0.0071 U	0.0071 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	4.6	0.11	0.0074 U	0.023	0.1	0.0071 U	0.007 U	0.023	0.0081	0.0074 U	0.0076 U	0.0074 U	3.1	0.0071 U	0.0071 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	5.6	0.13	0.0074 U	0.015 U	0.11	0.0071 U	0.007 U	0.034	0.0077	0.0074 U	0.0076 U	0.0074 U	3.4	0.0071 U	0.0071 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	7	0.18	0.0074 U	0.015 U	0.27	0.0071 U	0.007 U	0.051	0.013	0.0074 U	0.0076 U	0.0074 U	4.3	0.0071 U	0.0099
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	3.7	0.11	0.0074 U	0.015 U	0.13	0.0071 U	0.007 U	0.04	0.0077	0.0074 U	0.0076 U	0.0074 U	2.5	0.0071 U	0.0071 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	2.4	0.058	0.0074 U	0.015 U	0.085	0.0071 U	0.007 U	0.016	0.0074 U	0.0074 U	0.0076 U	0.0074 U	1.6	0.0071 U	0.0071 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	4.8	0.12	0.0074 U	0.021	0.16	0.0071 U	0.007 U	0.03	0.0074 U	0.0074 U	0.0076 U	0.0074 U	3.2	0.0071 U	0.0077
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.8	0.025	0.0074 U	0.015 U	0.029	0.0071 U	0.007 U	0.015 U	0.0074 U	0.0074 U	0.0076 U	0.0074 U	0.5	0.0071 U	0.0071 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	9.3	0.21	0.0074 U	0.14	0.21	0.0071 U	0.007 U	0.038	0.01	0.0074 U	0.0076 U	0.0074 U	8.3	0.0071 U	0.0095
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.71	0.015 U	0.0074 U	0.091	0.0076 U	0.0071 U	0.007 U	0.015 U	0.0074 U	0.0074 U	0.015	0.0074 U	0.39	0.0071 U	0.0071 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	4.1	0.11	0.0074 U	0.015 U	0.13	0.0071 U	0.007 U	0.037	0.0074 U	0.0074 U	0.0076 U	0.0074 U	2.6	0.0071 U	0.0071 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.46	0.015 U	0.0074 U	0.24	0.0076 U	0.0071 U	0.007 U	0.015 U	0.0074 U	0.0074 U	0.016	0.0074 U	0.15 U	0.0071 U	0.0071 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	5.7	0.11	0.0074 U	0.47	0.068	0.0071 U	0.007 U	0.017	0.0074 U	0.0074 U	0.017	0.0074 U	4.7	0.0071 U	0.0071 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	7.8	0.18	0.0074 U	0.11	0.19	0.0071 U	0.007 U	0.037	0.0096	0.0074 U	0.0076 U	0.0074 U	6.7	0.0071 U	0.0071 U
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**7.5**	0.18	0.0074	0.0006	0.18	0.0071	0.007	0.05	0.02	0.0074	0.0076	0.0074	**4.64**	0.0071	0.001
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.37	0.37	0.0074	1.3	0.3	0.0071	0.007	0.06	0.01	0.0074	0.0076	0.0074	14.9	0.0071	0.01
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**40.8**	1.02	0.0074	0.15	1.2	0.0071	0.007	0.27	0.12	0.0074	0.0076	0.0074	**27.9**	0.0071	0.02
Polychlorinated Biphenyls (PCBs)																					
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.059 U	0.057 U	0.055 U	0.055 U	0.057 U	0.053 U	0.052 U	0.056 U	0.055 U	0.055 U	0.05 U	0.056 U	0.055 U	0.053 U	0.053 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.059 U	0.057 U	0.055 U	0.055 U	0.057 U	0.053 U	0.052 U	0.056 U	0.055 U	0.055 U	0.05 U	0.056 U	0.055 U	0.053 U	0.053 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.059 U	0.057 U	0.055 U	0.055 U	0.057 U	0.053 U	0.052 U	0.056 U	0.055 U	0.055 U	0.05 U	0.056 U	0.055 U	0.053 U	0.053 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.059 U	0.057 U	0.055 U	0.055 U	0.057 U	0.053 U	0.052 U	0.056 U	0.055 U	0.055 U	0.05 U	0.056 U	0.055 U	0.053 U	0.053 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.059 U	0.057 U	0.055 U	0.055 U	0.057 U	0.053 U	0.052 U	0.056 U	0.055 U	0.055 U	0.05 U	0.056 U	0.055 U	0.053 U	0.053 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.059 U	0.057 U	0.055 U	0.055 U	0.057 U	0.053 U	0.052 U	0.056 U	0.055 U	0.055 U	0.05 U	0.056 U	0.055 U	0.053 U	0.053 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.059 U	0.057 U	0.055 U	0.055 U	0.057 U	0.053 U	0.052 U	0.056 U	0.055 U	0.055 U	0.05 U	0.056 U	0.055 U	0.053 U	0.053 U
Total PCB Aroclor (calc)	mg/kg	10	66	NE	NE	0.65	0.059	0.057	0.055	0.055	0.057	0.053	0.052	0.056	0.055	0.055	0.05	0.056	0.055	0.053	0.053
Metals																					
Aluminum	mg/kg	NA	3,500,000	480000	28,299	NE	5,300	5,400	5,500	4,800	12,000	5,900	4,600	7,200	6,300	5,000	4,400	3,900	7,800	4,100	5,900
Arsenic	mg/kg	20	88	2.9	7.61	132	12 U	11 U	11 U	11 U	11 U	11 U	10 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.59 U	0.57 U	0.55 U	0.55 U	0.57 U	0.53 U	0.52 U	0.56 U	0.55 U	0.55 U	0.57 U	0.56 U	0.55 U	0.53 U	0.53 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	2.6	2.3	2.1	3.3	11	6.8	2.4	3.7	4	3.1	2.4	2.6	6.8	1.8	4.7
Copper	mg/kg	NA	140,000	280	28.4	217	12	12	8.7	8.4	16	15	14	15	11	9.5	7.2	9.7	13	11	11
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.9 U	5.7 U	5.5 U	5.5	5.9	5.3 U	5.2 U	5.6 U	5.5 U	5.5 U	5.7 U	5.6 U	5.7	5.3 U	5.3 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.3 U	0.28 U	0.28 U	0.28 U	0.29	0.26 U	0.26	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U	0.27 U	0.26 U	0.27 U
Nickel	mg/kg	NA	70,000	130	24.54	980	3	3.1	2.8 U	2.8 U	9.6	5.1	4.2	5.3	3.9	3	2.8 U	2.8 U	6.8	12.6 U	3.6
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	12 U	11 U	11 U	11 U	11 U	11 U	10 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	34	32	42	39	51	42	32	63	41	35	29	27	100	29	42
Total Petroleum Hydrocarbons (TPHs)																					
Gasoline	mg/kg	100	NE	NA	NE	1,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	30 U	29 U	28 U	28 U	29 U	27 U	26 U	430 U	28 U	28 U	28 U	28 U	46 U	27 U	27 U
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	71	57 U	55 U	55 U	57 U	53 U	52 U	**5,100**	55 U	55 U	57 U	56 U	180	53 U	53 U

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.

TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.4.10-2
PAAOC Cast House and Foundry Building RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	RI Analytical Results															
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-CH01-2	PAAOC-SB-CH01-10	PAAOC-SB-CH01-31	PAAOC-SB-CH02-2	PAAOC-SB-CH02-4	PAAOC-SB-CH02-6	PAAOC-SB-CH03-1	PAAOC-SB-CH03-2	PAAOC-SB-CH03-6.5	PAAOC-SB-CH04-0.5	PAAOC-SB-CH04-2	PAAOC-SB-CH05-3	PAAOC-SB-CH05-5	PAAOC-SB-CH06-0.5	PAAOC-SB-CH06-0.5D	PAAOC-SB-CH06-2
Aluminum Smelting																						
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	2 UJ	1.9 UJ	2.3 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 U	0.16	0.07	0.05 UJ	0.05 UJ	0.05 U	0.12	0.05 UJ	0.05 UJ	0.05 UJ
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	12 J	0.47 J	5.1 J	23 J	8.6 J	5 U	**1,100**	**400**	5 U	99 J	46 J	**360**	43	**290 J**	**450**	48 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	16	9.2 J	7.2 J	10 U	11 U	13 U	220 J	130 J	290 J	21 U	10 U	97 J	14 J	36	50	12 U
Polynuclear Aromatic Hydrocarbons (PAHs)																						
1-Methylnaphthalene	mg/kg	NL	NL	NE	NE	NL	1.6 U	1.6 U	1.9 U	0.074 U	0.0075 U	0.0074 U	0.038 U	0.038 U	0.0072 U	0.07 U	0.0074 U	0.0071 U	0.0079 U	0.72 U	0.72 U	0.0075 U
2-Methylnaphthalene	mg/kg	NA	NL	NE	NE	NL	2.2 U	2.1 U	2.5 U	0.074 U	0.0075 U	0.0074 U	0.038 U	NA	0.0072 U	0.07 U	0.0074 U	0.0071 U	0.0079 U	0.72 U	0.72 U	0.0075 U
Acenaphthene	mg/kg	NA	NL	NL	NE	NL	2 J	0.64 U	0.75 U	0.096	0.0075 U	0.0074 U	0.038 U	0.038 U	0.0072 U	0.12	0.0074 U	0.018	0.0079 U	2.1	1.1	0.0075 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.54 U	0.53 U	0.62 U	0.074 U	0.0075 U	0.0074 U	0.038 U	NA	0.0072 U	0.07 U	0.0074 U	0.0071 U	0.0079 U	0.72 U	0.72 U	0.0075 U
Anthracene	mg/kg	NL	NE	NL	NE	NL	1.5 J	0.64 U	0.75 U	0.11	0.0075 U	0.0074 U	0.07	0.038 U	0.0072 U	0.15	0.0074 U	0.03	0.0079 U	3.3 J	1.7	0.0075 U
Benzo(a)anthracene	mg/kg	2	NL	NL	NE	NL	14 J	1.6 UJ	1.9 UJ	1	0.0075 U	0.016	0.59	0.29	0.0072 U	1.4	0.019	0.14	0.0079 U	25 J	12	0.013
Benzo(a)pyrene	mg/kg	NL	NL	NL	NE	NL	19	0.43 U	0.5 U	1.4	0.0075 U	0.023	0.78	0.38	0.0072 U	2	0.027	0.099	0.0079 U	32 J	16	0.013
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	32	1.6 U	1.9 U	2.1	0.0083	0.032	1.6	0.83	0.0088	2.9	0.034	0.22	0.0079 U	47 J	23	0.02
Benzo(g,h,i)perylene	mg/kg	NL	NE	NE	NE	NL	19	0.53 U	0.62 U	1.2	0.0075 U	0.02	1	NA	0.0072 U	1.7	0.021	0.076	0.0079 U	25	13	0.01
Benzo(k)fluoranthene	mg/kg	NL	NL	NL	NE	NL	13	0.64 U	0.75 U	0.63	0.0075 U	0.014	0.24	NA	0.0072 U	0.89	0.012	0.066	0.0079 U	15	7.4	0.0075 U
Chrysene	mg/kg	NL	NL	NL	NE	NL	22	1.6 U	1.9 U	1.2	0.0075 U	0.019	0.91	0.5	0.0072 U	1.7	0.021	0.28	0.0079 U	31 J	15	0.012
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	4.6 J	0.21 U	0.25 U	0.28	0.0075 U	0.0074 U	0.19	0.1	0.0072 U	0.37	0.0074 U	0.02	0.0079 U	5.7 J	2.6	0.0075 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	28 J	5.2 UJ	6.1 UJ	1.5	0.0075 U	0.025	1.1	0.55	0.0072 U	2.2	0.03	0.32	0.0079 U	42 J	20	0.024
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.54 U	0.53 U	0.62 U	0.074 U	0.0075 U	0.0074 U	0.038 U	0.038 U	0.0072 U	0.07 U	0.0074 U	0.0083	0.0079 U	0.88	0.72 U	0.0075 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	17	0.64 U	0.75 U	1.2	0.0075 U	0.02	0.92	0.48	0.0072 U	1.7	0.018	0.08	0.0079 U	26 J	13	0.0093
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.87 U	0.85 U	0.99 U	0.074 U	0.0075 U	0.0074 U	0.00081 U	0.0012 U	0.00097 U	0.07 U	0.0074 U	0.0011 U	0.001 U	0.72 U	0.72 U	0.0075 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	13	1.6 U	1.9 U	0.59	0.0075 U	0.01	0.34	NA	0.0072 U	0.78	0.014	0.12	0.0079 U	14	7.3	0.019
Pyrene	mg/kg	NA	110,000	650	NE	NL	25 J	4.7 UJ	5.5 UJ	1.4	0.0075 U	0.025	0.97	0.48	0.0072 U	2	0.028	0.3	0.0079 U	39 J	19	0.021
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**27.28**	0.43	0.21	1.93	0.00083	0.03	1.17	0.58	0.0009	**2.74**	0.06	0.15	0.0079	**44.2**	**21.9**	0.02
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	46.45	0.52	0.62	2.3	0.0075	0.04	1.51	0.55	0.0072	3.25	0.04	0.5	0.001	62.3	30.1	0.04
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**165.6**	0.21	0.25	**10.41**	0.00083	0.17	**7.51**	**3.1**	0.0009	**14.7**	0.18	**1.3**	0.0079	**245.7**	**121**	0.1
Polychlorinated Biphenyls (PCBs)																						
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	0.056 U	0.056 U	0.056 U	0.057 U	0.058 U	0.054 U	0.053 U	0.056 U	0.053 U	0.059 U	0.054 U	0.058 U	0.056 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.0044 U	0.0045 U	0.0054 U	0.056 U	0.056 U	0.056 U	0.057 U	0.058 U	0.054 U	0.053 U	0.056 U	0.053 U	0.059 U	0.054 U	0.058 U	0.056 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.0051 U	0.0052 U	0.0062 U	0.056 U	0.056 U	0.056 U	0.057 U	0.058 U	0.054 U	0.053 U	0.056 U	0.053 U	0.059 U	0.054 U	0.058 U	0.056 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.0017 U	0.0017 U	0.002 U	0.056 U	0.056 U	0.056 U	0.057 U	0.058 U	0.054 U	0.053 U	0.056 U	0.053 U	0.059 U	0.054 U	0.058 U	0.056 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.003 U	0.0031 U	0.0037 U	0.056 U	0.056 U	0.056 U	0.057 U	0.058 U	0.054 U	0.053 U	0.056 U	0.053 U	0.059 U	0.054 U	0.058 U	0.056 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.0016 U	0.0016 U	0.0019 U	0.056 U	0.056 U	0.056 U	0.057 U	0.058 U	0.054 U	0.053 U	0.056 U	0.053 U	0.059 U	0.054 U	0.058 U	0.056 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.002 U	0.002 U	0.0024 U	0.056 U	0.056 U	0.056 U	0.057 U	0.058 U	0.054 U	0.053 U	0.056 U	0.053 U	0.059 U	0.054 U	0.058 U	0.056 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.0016	0.0016	0.0019	0.056	0.056	0.056	0.057	0.058	0.054	0.053	0.056	0.053	0.059	0.054	0.058	0.056
Metals																						
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	9,300	7,800	15,000	9,600	6,700	5,000	11,000	11,000	9,800	6,000	6,200	7,700	7,900	12,000	41,000	8,600
Arsenic	mg/kg	20	88	2.9	7.61	132	1.9	1.9	2.6	11 U	11 U	11 U	11 U	12 U	11 U	11 U	11 U	11 U	12 U	11 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.19	0.22	0.25	0.56 U	0.56 U	0.56 U	2.5	0.97	0.54 U	0.53 U	0.56 U	0.53 U	0.59 U	0.54 U	0.71	0.56 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	7.3	7.6	4.1	5.1	5.3	2.4	10	7.8	27	4.1	5.3	5.3	6.3	13	23	6.9
Copper	mg/kg	NA	140,000	280	28.4	217	16	17	22	12	8.6	11	24	19	28	16	11	15	14	23	30	13
Lead	mg/kg	1,000	NE	3,000	13.1	118	4.2	3.6	3.5	5.6 U	5.6 U	5.6 U	5.9	5.8 U	5.4 U	5.3 U	5.6 U	5.3 U	5.9 U	11	21	6.2
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.0064 U	0.0064 U	0.0077 U	0.28 U	0.28 U	0.28 U	0.29 U	0.29 U	0.27 U	0.26 U	0.28 U	0.27 U	0.29 U	0.27 U	0.27 U	0.28 U
Nickel	mg/kg	NA	70,000	130	24.54	980	7.1	6.9	6.1	5	4	2.8 U	35	23	18	5.7	4.8	5.1	7.9	12	21	5.6
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	1.4	1.4	1	11 U	11 U	11 U	11 U	12 U	11 U	11 U	11 U	11 U	12 U	11 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	51	49	57	68	46	44	**930**	**770**	33	41	43	49	41	75	140	47
Total Petroleum Hydrocarbons (TPHs)																						
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	3.9 U	3.8 U	4.5 U	28 U	28 U	28 U	60	29 U	27 U	26 U	28 U	27 U	29 U	270 U	420	28 U
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	NA	NA	NA	61	56 U	56 U	360	120	54 U	130	56 U	53 U	59 U	1,400 J	**3,300**	56 U
Volatile Organic Compounds (VOCs)																						
Benzene	mg/kg	0.03	33,000	0.027	NA	0.255	NA	NA	NA	NA	NA	NA	0.00081 U	0.0012 U	0.00097 U	NA	NA	0.0011 U	0.001 U	NA	NA	NA
Toluene	mg/kg	7	280,000	4.5	NA	5.45	NA	NA	NA	NA	NA	NA	0.004 U	0.0061 U	0.0048 U	NA	NA	0.0053 U	0.0052 U	NA	NA	NA
Ethylbenzene	mg/kg	6	350,000	5.9	NA	5.16	NA	NA	NA	NA	NA	NA	0.00081 U	0.0012 U	0.00097 U	NA	NA	0.0011 U	0.001 U	NA	NA	NA
m,p-Xylene	mg/kg	9	700,000	14	NA	10	NA	NA	NA	NA	NA	NA	0.0016 U	0.0024 U	0.0019 U	NA	NA	0.0021 U	0.0021 U	NA	NA	NA
o-Xylene	mg/kg	9	700,000	14	NA	10	NA	NA	NA	NA	NA	NA	0.00081 U	0.0012 U	0.00097 U	NA	NA	0.0011 U	0.001 U	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NA	29.8	NA	NA	NA	NA	NA	NA	0.00081 U	0.0012 U	0.00097 U	NA	NA	0.0011 U	0.001 U	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NA	30.2	NA	NA	NA	NA	NA	NA	0.00081 U	0.0012 U	0.00097 U	NA	NA	0.0011 U	0.001 U	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NA	9.92	NA	NA	NA	NA	NA	NA	0.00081 U	0.0012 U	0.00097 U	NA	NA	0.0011 U	0.001 U	NA	NA	NA
Trichloroethene	mg/kg	0.03	800	0.025	NA	12.4	NA	NA	NA	NA	NA	NA	0.00081 U	0.0012 U	0.00097 U	NA	NA	0.0011 U	0.001 U	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	0.0017	NA	6.46	NA	NA	NA	NA	NA	NA	0.00081 U	0.0012 U	0.00097 U	NA	NA	0.0011 U	0.001 U	NA	NA	NA

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Total Toxicity Equivalent Concentration
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

and TPH-Gx do not exceed Plant Area AOC soil screening levels. Fluoride was detected in one sample SB-MM04-0.5 at 2,300 mg/kg that exceeds the protection of groundwater screening level but did not exceed at deeper samples at 2 and 5 ft bgs. PAHs as TTEC were detected at calculated concentrations ranging from 4.64 to 255.1 at the 0.5 ft bgs sample locations in soil borings SB-MM03 through SB-MM05 and SB-MM08 that exceed the protection of groundwater screening level, but do not exceed at deeper depth samples in those borings. The highest calculated concentration of PAHs as TTEC was detected in sample SB-MM04-0.5 at 255.1 mg/kg, which exceeds the MTCA Method C soil screening level but not in deeper sample depths.

The calculated total LMW PAH concentration of 1,675 mg/kg exceeded the ecological wildlife screening level in one sample SB-MM04-0.5 but did not exceed at deeper sample depths. The calculated total HMW PAH concentrations of 6.9 to 4,844 mg/kg exceeded the ecological wildlife screening level at the 0.5 ft depth samples in borings SB-MM01 through SB-MM05 and SB-MM08 but did not exceed the screening level at deeper depth samples in those borings. The highest calculated concentrations of PAHs as TTEC, calculated total LMW PAH and total HMW PAH were all detected in sample SB-MM04-0.5. Selenium was detected at concentration of 0.86 mg/kg in boring SB-MM03-6 that exceeds the ecological wildlife screening level. Metals including chromium, lead, nickel, and selenium were detected in sample SB-MM04-0.5 that exceeded either the protection of groundwater and/or ecological wildlife screening levels but did not exceed the screening level at the deeper depth sampled. Residual range organics were detected at concentrations ranging from 3,600 to 22,000 in the 0.5 ft depth samples in borings SB-MM03, SB-MM04, and SB-MM07, and at 2 ft depth in boring SB-MM03 but did not exceed in deeper depth samples from those borings. One sample, SB-MM03 at 2 ft bgs, TPH-Gx was detected at 170 J mg/kg that exceeds MTCA Method A Industrial soil screening level of 100 mg/kg.

The initial RI results for the Cast House indicate that total cyanide, sulfate, PAH as total LMW, PCBs, and VOCs do not exceed Plant Area AOC soil screening levels. Fluoride was detected at concentrations that exceed the protection of groundwater screening level in shallow soil in borings SB-CH01, SB-CH03, SB-CH05, and SB-CH06 but did not exceed in deeper depth samples from those borings. PAH as TTEC was detected at calculated concentrations that exceed the protection of groundwater screening level in shallow soil from 0.5 to 3 ft bgs in borings SB-CH03, SB-CH04, SB-CH05, and SB-CH06 but did not exceed in deeper depth samples from those borings. Calculated total HMW PAH was detected at concentrations that exceed the ecological wildlife screening level in the shallowest sample in all six borings but did not exceed in deeper samples from the borings.

Zinc was detected at concentrations of 930 and 770 mg/kg at depths of 1 ft and 2 ft, respectively, in boring SB-CH03 that exceeds the ecological wildlife screening level but did not exceed at the deeper 6.5-ft sample. TPH as residual range organics was detected in one sample SB-CH06-0.5D at 3,300 mg/kg that exceeds MTCA Method A Industrial and the ecological wildlife soil screening level but did not exceed in the deeper sample from the boring.

2.4.10.3 Conclusions and Recommendations

Results for the Machine Shop initial RI investigation indicate that fluoride was detected in only one boring at 0.5 ft bgs at a concentration that exceeds the protection of groundwater screening level, but not in deeper samples. PAHs as TTEC exceeded protection of groundwater screening levels and calculated total LMW PAH and total HMW PAH exceeded ecological wildlife soil screening levels in one or more borings at 0.5 ft depth samples, but not in deeper samples. Selected metals exceeded either the protection of groundwater and/or the ecological wildlife screening levels in one boring at 0.5 ft depth sample, but not in deeper samples. Selenium was detected in sample SB-MM03-6 that exceeded the ecological wildlife screening level. TPH-Dx was detected in shallow soil at concentrations that exceed MTCA Method A Industrial and the ecological wildlife screening levels but did not exceed in samples from deeper depths.

Results for the Cast House initial RI investigation indicate that fluoride and PAHs as TTEC were detected in shallow soil at concentrations that exceed the protection of groundwater screening level, and total HMW PAH, zinc, and TPH-Dx were detected in shallow soil at concentrations that exceed the ecological wildlife screening level. TPH-Dx was detected in shallow soil at concentrations that exceed MTCA Method A Industrial and the ecological wildlife soil screening levels. In all cases, these chemicals did not exceed site soil screening levels at deeper samples from the soil borings.

Based on the results of the initial RI investigation, the Machine Shop and Cast House building foundation is recommended for further evaluation in the FS.

2.4.11 Crushed Concrete Stockpiles

Agreed Order DE 10483 Exhibit C includes in SWMU 21 Construction Rubble Storage Area “any disposal site for demolition debris generated during plant demolition”. During demolition in 2010 through 2012, concrete plant building walls and foundations were crushed and stockpiled onsite (Figure 2.4.11-1). Four main stockpiles were created including 1) the North Access Road stockpile located south of SWMU 14 building, on the south side of the north access road, 2) Northwest

Northwest Stockpile

	Minimum	Maximum
Aluminum Smelting (mg/kg)		
Fluoride	NE	290
PAH (mg/kg)		
TTEC	NE	19.2
HMW	2.5	168.4
PCB (mg/kg)		
Total PCBs	NE	0.87

North Plant Stockpile

	Minimum	Maximum
Aluminum Smelting (mg/kg)		
Fluoride	NE	250
Metals (mg/kg)		
Zinc	NE	500
PAH (mg/kg)		
TTEC	NE	13.7
HMW	5.9	87.1
PCB (mg/kg)		
Total PCBs	NE	0.9

PAAOC-WPA-SE18-WPCOMP	Surface
PAH (mg/kg)	
TTEC	6.5
HMW	37.7

PAAOC-WPA-SE18-EPCOMP	Surface
PAH (mg/kg)	
TTEC	12.4
HMW	67.3

PAAOC-WPA-SE18-SB09	1	2.5	5.5	8.8	11.3
No exceedances	NE	NE	NE	NE	NE

PAAOC-WPA-SE18-SB08	1	3.4	6.1	8.8	10.5	13.7	16.3
No exceedances	NE	NE	NE	NE	NE	NE	NE

North Access Road Stockpile

	Minimum	Maximum
Aluminum Smelting (mg/kg)		
Fluoride	NE	210
Metals (mg/kg)		
Zinc	NE	690
PAH (mg/kg)		
TTEC	NE	39.5
HMW	NE	206.3

Coke Silo Stockpile

	Minimum	Maximum
PAH (mg/kg)		
TTEC	NE	5.3
HMW	2.2	37.5

Crushed Concrete Stockpile
Other Construction Debris Stockpile
Stockpile Group Outline
Investigation Area
◊ WPA Grab Sample
● WPA Soil Boring
Plant Production Area Footprint

Soil Screening Levels
blue: Exceeds Protection of Groundwater
purple: Exceeds Ecological Wildlife

NE: No exceedance
D: Duplicate sample
2: Sample depth in feet bgs

Figure 2.4.11-1

Plant Area AOC

Crushed Concrete and Other Stockpiles Locations and Sample Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

stockpile located north of the west end of the plant production buildings, 3) North Plant stockpile consisting of a series of stockpiles on the foundation of Production Buildings C and D, and 4) two Coke Silo stockpiles located on the foundations of the Paste Building and Briquette Storage Slab. Other stockpiles that were created during the plant demolition, but do not consist solely of building foundation concrete, are located at the west and east sides of SWMU 14, at the east ends of production buildings C and D in the Crucible Cleaning Room Investigation Area, and in the SWMU 23 investigation area. The Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) indicated no data gaps were identified for the remedial investigation, therefore no additional investigation was made of the crushed concrete piles. Two samples were collected from other stockpiles west and east side of SWMU 14 during the WPA phase as part of the SB-SE18 Investigation Area and is discussed below in Section 2.4.11.2.

The stockpiles of crushed concrete remain onsite and are intended for potential reuse in redevelopment of the plant area, if feasible.

2.4.11.1 Investigation Scope

During demolition between 2010 and 2012, the crushed concrete was placed in stockpiles, monitored, and periodically sampled during crushing operations. Samples were collected either as discrete samples, or composite samples that consisted of three or four subsamples per composite sample. Sampling methodologies and analytical program for the crushed concrete stockpiles are discussed in the pre-RI data reports (PGG 2012c; 2014b). The Coke Silo stockpile sampling consisted of core samples collected prior to demolition, and discrete samples collected during crushing operations. No data gaps were identified for the remedial investigation (Tetra Tech et al. 2015a) and the following discussion presents the scope of the pre-RI demolition sampling, except for two samples from other stockpiles collected during the WPA phase of investigation.

The following is a summary of the status and sampling and analysis program for each of the four main crushed concrete stockpiles:

<u>North Access Road Stockpile</u>

- One continuous stockpile (Figure 2.4.11-1), approximately 30 ft wide, 15 ft tall, 250 ft long and estimated 4,200 yd^3
- 16 discrete samples including discrete and composite samples, collected in July 2010 and July 2012, collected after current stockpile configuration placement (PGG 2012c; 2014b)

- Pre-RI sampling analysis for total cyanide, fluoride, PAHs, PCBs, and metals (not all COPC metals, and metals in addition to the COPC metals)

- TCLP analyses for six samples collected in July 2010

- Initial portions of this stockpile were used in 2011 as backfill for SWMU 16 during closure

- This stockpile has remained in its current configuration since completion of demolition except for movement of portions of the stockpile to the top of the pile to allow access for SB-SE18 Investigation Area borings SE18-SB08 and SE18-SB09

Northwest Stockpile

- Several individual stockpiles (Figure 2.4.11-1), mostly overlapping, covering approximately 200,000-square-foot area, estimated between 80,000 and 100,000 yd^3

- 77 samples, both composite and discrete, collected during concrete crushing operations

- Pre-RI sampling analysis for total cyanide, fluoride, PAHs, PCBs, and metals (not all COPC metals, and metals in addition to the COPC metals)

- TCLP analyses for initial six samples collected July 19, 2011 (PGG 2012c)

- This stockpile has remained in its current configuration since completion of demolition and concrete crushing operations

North Plant Stockpile

- 14 individual stockpiles (Figure 2.4.11-1), with 13 located on the building D foundation and one located at the east end of the building C foundation, each pile approximately 25 ft high and 75 ft diameter at their base, estimated between 30,000 and 40,000 yd^3 per pile

- 14 composite samples collected during crushing operations (PGG 2012c)

- Pre-RI sampling analysis for total cyanide, fluoride, PAHs, PCBs, and metals (not all COPC metals, and metals in addition to the COPC metals)

- TCLP analyses for 15 samples collected in February and March 2012

- These piles remain in their current configurations since completion of demolition and concrete crushing operations, with some piles overlapping onto soil in Courtyard D segments

Coke Silo Stockpiles

- Two stockpiles located on the Paste Building and Briquette Storage Slab foundations (Figure 2.4.11-1), approximately 15 ft tall, 70 ft diameter at their base, estimated between 19,000 and 20,000 yd^3 per pile
- Eight core samples (crushed for analysis) collected prior to demolition, and eight samples of crushed concrete collected during crushing operations (PGG 2014b)
- Pre-RI sampling analysis for PAHs, PCBs, metals (not all COPC metals, and metals in addition to the COPC metals), and TPH-Gx and TPH-Dx
- TCLP analyses for the 16 coke silo-core and crushed-concrete samples collected in June and August 2012
- These piles remain in their current configurations since completion of demolition

Other Stockpiles

- Five other stockpiles are identified separately from the crushed concrete (Figure 2.4.11-1) because their contents are not wholly crushed concrete, but also include soil, bricks, metal, and other debris, in addition to minor amounts of crushed concrete
- The other stockpiles are located at the west and east sides of SWMU 14, at the east sides of Production Buildings C and D in the Crucible Cleaning Room Investigation Area, and in the SWMU 23 investigation area
- No sampling was conducted during pre-RI, or initial RI or WPA phases of investigation of the other stockpiles, except for one sample from each stockpile at the west and east sides of the SWMU 14 building as part of the SB-SE18 Investigation Area field effort (Section 2.2.7)
- WPA phase samples SE18-WCOMP and SE18-ECOMP analyses include total cyanide, fluoride, sulfate, and PAH
- No TCLP or Synthetic Precipitation Leaching Procedure (SPLP) analyses

The other stockpiles remain in their current configurations since completion of demolition.

2.4.11.2 Investigation Results

The crushed concrete piles were investigated with 123 discrete and composite samples during pre-RI demolition activities. The other stockpiles located to the west and east sides of SWMU 14 were investigated during the WPA as part of the SB-SE18 Investigation Area with collection of two grab composite samples. Pre-RI crushed concrete and other stockpile analytical results are summarized in Table 2.4.11-1 in terms of maximum and minimum detected concentrations for each of the four main crushed concrete stockpiles, and analytical results for the two samples from other stockpiles. For the crushed concrete data, calculations for TTEC, total LMW and HMW, and total PCBs have been made for the case of minimum detected concentrations and maximum detected concentrations. All minimum and maximum detected concentrations/calculated concentrations provide a range of concentrations for analyzed COPCs that may be present in the stockpiles. The crushed concrete minimum and maximum detected concentrations, and results for samples from other stockpiles, are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC soil screening levels. Reporting limits for arsenic exceed screening levels, and reporting limits for selenium exceed screening levels in most samples analyzed. Note the Pre-RI data is not data validated.

Results for TCLP and SPLP analyses are not presented here because not all COPCs were analyzed for all samples, including the critical COPCs fluoride and sulfate. The pre-RI TCLP and SPLP results are presented in the pre-RI data reports (PGG 2012c; 2014b; and located in Appendix G-3).

Crushed concrete minimum and maximum analytical results and other stockpile analytical results that exceed Plant Area AOC screening levels are compiled and presented on Figure 2.4.11-1.

The following summarizes the results of analyses for crushed concrete:

- Cyanide: Maximum detected concentrations of total cyanide did not exceed soil screening levels.
- Fluoride: Maximum detected concentrations of fluoride exceeded the protection of groundwater screening levels and included 210 mg/kg for the North Access Road stockpile, 290 mg/kg for the Northwest stockpile, and 250 mg/kg for the North Plant stockpile. Minimum detected concentrations did not exceed screening levels. Maximum detected concentrations of fluoride in the Coke Silo stockpiles did not exceed screening levels.
- Sulfate: This COPC was not an analyte for any of the crushed concrete samples.
- PAHs: Maximum calculated detections of PAHs as TTEC and HMW exceed screening levels in all four crushed concrete stockpiles. Calculated concentrations of TTEC range from 5.3 to 39.5 mg/kg and exceed the protection of groundwater screening level. Calculated concentrations of HMW PAHs exceed the ecological wildlife screening level. LMW PAHs do not exceed screening levels.

Table 2.4.11-1
Plant Area AOC Crushed Concrete Results Summary
Columbia Gorge Aluminum Smelter, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	Pre-RI Crushed Concrete Analytical Results								WPA Analytical Results	
							North Access Road Stockpile		Northwest Stockpile		North Plant Stockpile		Coke Silo Stockpile		Other Stockpiles	
CHEMICALS	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	PAAOC-WPA-SE18-WCOMP	PAAOC-WPA-SE18-ECOMP
Aluminum Smelting																
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.1 U	0.2 U	0.061	0.25	0.05	0.2	0.05 U	0.05 U	0.22 U	0.21 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	7.8	**210**	5.3	**290**	19	**250**	0.92	6.2	1.5 J	26.1
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	4.5	1.4 J
Metals																
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	12,000	18,000	12,000	20,000	12,000	22,000	6,300	13,000	NA	NA
Arsenic	mg/kg	20	88	2.9	7.61	132	3.6	6.5	2	4.6	3.6	3.8	2	3	NA	NA
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.5 U	0.5 U	0.51	**1.7**	0.61	**1.9**	0.5 U	0.5 U	NA	NA
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	9.9	14	16	44	15	49	18	30	NA	NA
Lead	mg/kg	1,000	NE	3,000	13.1	118	0.5 U	0.5 U	5.1	44	5.5	15	5 U	5 U	NA	NA
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.25 U	0.25 U	0.25 U	0.28 U	0.25 U	0.32 U	0.25 U	0.25 U	NA	NA
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	10 U	10 U	10 U	11 U	10 U	13 U	10 U	10 U	NA	NA
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	77	**690**	63	220	68	**500**	21	44	NA	NA
Polynuclear Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.003	0.16	0.003	0.1	0.01	0.09	0.0067 U	0.0067 U	NA	NA
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.003	0.25	0.003	0.1	0.01	0.11	0.01	0.16	0.41	0.023 J
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0034	1.7	0.0072	0.4	0.037	0.44	0.039	1.1	1.6000	0.2600
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0034	0.074	0.003	0.065	0.0035	0.0385	0.014	0.014	0.024 J	0.0055 J
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0034	2.8	0.026	1.1	0.076	0.91	0.11	3.5	1.7000	0.3800
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.2	21	0.22	6.2	0.54	8.9	0.28	5.5	4.1	6.4
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.1	29	0.1	5.8	0.32	9.4	0.26	3.7	4.8	9.1
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.9	40	0.46	12	1.2	17	0.45	5	5.8	13
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.3	21	0.14	4.6	0.43	8.6	0.15	2.4	3	6.7
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.2	12	0.17	5.1	0.25	4.6	0.092	1.6	2.1	4.5
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.6	24	0.65	15	1.3	14	0.29	5.1	4.7	8.4
Dibenz(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.1	5.3	0.04	1.7	0.11	2	0.04	0.65	0.63	1.3
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.5	33	0.8	15	2	19	0.62	14	8.7	8.5
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.003	1.1	0.003	0.3	0.04	0.32	0.03	1.6	0.85	0.13
Ideno(1,2,3-c,d)pyrene	mg/kg	NL	NL	NL	NE	NL	0.3	24	0.13	107	0.45	8.6	0.18	2.5	3.4	6.9
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.003	0.47	0.003	0.1	0.00345	0.19	0.026	0.26	1.1	0.022 J
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.1	13	0.16	6.9	0.6	5.2	0.49	12	8.8	2.8
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.4	30	0.56	11	1.3	14	0.48	11	9.2	11
Total TTEC	mg/kg	2	130	3.9	NE	NE	0.3	**39.5**	0.2	**19.2**	0.6	**13.7**	0.4	**5.3**	**6.5**	**12.4**
Total LMW	mg/kg	NA	NE	NE	NE	100	3.1	52.1	1	23.9	2.8	26.1	1.3	32.5	22.8	12.1
Total HMW	mg/kg	NA	NE	NE	NE	1.1	0.6	**206.3**	**2.5**	**168.4**	**5.9**	**87.1**	**2.2**	**37.5**	**37.7**	**67.3**
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.05 U	0.05 U	0.05 U	0.2 U	0.05 U	0.2 U	0.05 U	0.05 U	NA	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.05 U	0.05 U	0.05 U	0.2 U	0.05 U	0.2 U	0.05 U	0.05 U	NA	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.05 U	0.05 U	0.05 U	0.2 U	0.05 U	0.2 U	0.05 U	0.05 U	NA	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.05	0.11	0.062	0.87	0.1	0.9	0.05 U	0.05 U	NA	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.05 U	0.05 U	0.05 U	0.2 U	0.05 U	0.2 U	0.05 U	0.05 U	NA	NA
Aroclor 1254	mg/kg	NA	NL	NL	NE	NE	0.05 U	0.05 U	0.05 U	0.2 U	0.05 U	0.2 U	0.05 U	0.05 U	NA	NA
Aroclor 1260	mg/kg	NA	NL	NE	NE	NE	0.05 U	0.05 U	0.05 U	0.2 U	0.05 U	0.2 U	0.05 U	0.05 U	NA	NA
Total PCBs	mg/kg	10	66	NE	NE	0.65	0.05	0.11	0.062	**0.87**	0.1	**0.9**	0.05	0.05	NA	NA

Notes:

U	Chemical was not detected. The associated value represents the practical quantitation limit.
NA	Not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.

Pre-RI data has not been data validated.

TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more screening levels.

- Metals: Copper and nickel, two site COPC metals, were not analytes for any of the crushed concreted samples. Antimony, barium, beryllium, and silver were analytes for the crushed concrete samples but are not included here because they are not site COPCs. Only maximum detected concentrations for cadmium and zinc exceed soil screening levels. Maximum concentrations of cadmium at 1.7 and 1.9 mg/kg were detected in the Northwest stockpile and North Plant stockpile, respectively, which exceeds the protection of groundwater screening level. Maximum concentrations of zinc at 690 and 500 mg/kg were detected in the North Access Road stockpile and North Plant stockpile, respectively, which exceeds the ecological wildlife screening level.

- PCBs: Only Aroclor 1242 was detected in the Northwest and North Plant crushed concrete samples at concentrations above the practical quantitation limits. Maximum calculated concentrations of total PCBs, consisting of Aroclor 1242, of 0.87 and 0.9 mg/kg were detected in the Northwest stockpile and North Plant stockpile, respectively, which exceeds the ecological wildlife screening level.

- TPH-Gx and TPH-Dx: TPH-Gx and TPH-Dx were analytes only for the Coke Silo stockpiles. Analytical results reported in the 2014 data report (PGG 2014b) indicate TPH-Gx was not detected above the practical quantitation limit of 20 mg/kg, TPH-Dx as diesel was not detected above concentrations of 100 mg/kg, which is also the practical quantitation limit, and TPH-Dx as residual range organics was not detected above the practical quantitation limit of 50 mg/kg.

The two WPA phase samples collected from the other stockpiles located to the west and east sides of the SWMU 14 building were analyzed for total cyanide, fluoride, sulfate, and PAHs (Figure 2.4.11-1). Detected concentrations of total cyanide, fluoride, and sulfate did not exceed screening levels. Only PAHs as TTEC and total HMW exceed screening levels in both stockpiles sampled. Calculated total concentrations of PAHs as TTEC were 6.5 and 12.4 mg/kg for the west and east of SWMU 14 stockpiles, respectively, which exceeds the protection of groundwater screening level. Calculated total concentrations of HMW PAH were 37.7 and 67.3 mg/kg for the west and east stockpiles, respectively, which exceeds the ecological wildlife screening levels. Samples were not collected from any of the other stockpiles.

2.4.11.3 Conclusions and Recommendations

Pre-RI analytical results for crushed concrete indicate that total cyanide, PAH as LMW, most metals analyzed, and TPH-Gx and TPH-Dx do not exceed soil screening levels. The maximum concentrations of fluoride, calculated total PAHs as TTEC and HMW, calculated total PCBs, cadmium, and zinc exceed Plant Area AOC screening levels. Some COPCs, including sulfate, copper, nickel, and TPH were not analytes or were not analytes for all crushed concrete samples.

The other stockpiles were not sampled except for limited sampling of the piles located to the west and east sides of SWMU 14.

Plant area redevelopment includes the intent to reuse the crushed concrete onsite if feasible. There is no intent to reuse the other stockpiles based on mixed environmental and construction debris content. The four crushed concrete stockpiles are recommended for evaluation of remedial options. The other stockpiles are also recommended for evaluation in the FS.

2.4.12 Industrial Sump, Alumina Unloading Sump, Pitch Building Sump, Leaking River Water Line Vault, and Cast House DC Casting Pits

Several building or conveyance line structural features that were constructed below ground surface at depths that are near or below the level of shallow groundwater were investigated and include the Industrial sump, Alumina Unloading sump, Pitch Building sump, leaking river water line vault, and the Cast House DC Casting Pits (Figure 2.1.2-1). Water from the Industrial sump and the Cast House DC Casting Pits was sampled prior to the RI in 2011. These structures all contain water and have the potential to interact with underlying shallow groundwater either by hydraulic connection with shallow groundwater, or leakage of water from the structure into the subsurface. With the exception of the Industrial sump (sediment sample discussed in Section 2.5.3), none of the structures contained sediment and only water samples were collected. The leaking river water line vault, which is still in use, is actively leaking water from the line into the vault at an estimated rate of 4 gallons per minute (gpm), and water may potentially leak from the vault into the subsurface (see Groundwater in the Uppermost Aquifer AOC, Volume 4, Section 2 for further discussion).

The Coke and Pitch Unloading Structure also contains a sump that is constructed to a depth below the shallow groundwater but was subsequently identified as an Investigation Area under the WPA (Tetra Tech et al. 2020b). The Coke and Pitch Unloading Sump is discussed separately in Section 2.2.4.

2.4.12.1 Investigation Scope

Investigation of these structural features consisted of collection of water samples and analysis for specific COPCs. During the WPA phase of investigation, one water sample was collected from each of the Alumina Unloading sump and Pitch Building sump and the samples were analyzed for free cyanide, fluoride, sulfate, PAHs, PCBs, metals, VOCs and TPH-Dx. Also, during the WPA phase, one water sample and a duplicate sample was collected from the leaking river water line vault and the samples were analyzed for free cyanide, fluoride, sulfate, PAHs, PCBs, metals, and TPH-Dx. Prior to issuance of the Agreed Order for the site (Ecology 2014), during plant demolition in 2011, one water sample was collected from the Industrial sump and two water samples were collected from the east and west DC Casting Pits. The Industrial sump sample was analyzed for free cyanide, fluoride, PAHs, PCBs, metals, VOCs and TPH-Dx. The DC Casting Pit was sampled to determine whether fluids from the hydraulic equipment seated in the pits had leaked hydraulic fluids and may pose a threat to underlying shallow groundwater. The DC Casting Pit samples were analyzed for only PCBs and TPH-Dx.

With the exception of the Industrial sump (sediment sample discussed in Section 2.5.3), no sediment was present in any of these structural features and therefore only water samples were collected.

2.4.12.2 Investigation Results

These structural features were investigated through collection of five water samples and one duplicate sample. Water analytical results are summarized in Table 2.4.12-1. Water data is compared to MTCA Method A, MTCA Method B, MTCA Method C, and Washington MCL screening levels. Natural background concentrations for the site have also been used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendix H-4, and data validation reports are included in Volume 5, Appendix I-4. The DC Casting Pits samples were collected prior to work under the Agreed Order and the data were not validated. All samples were collected as specified in the Final RI Phase 2 Work Plan QAPP (Tetra Tech et al. 2015b), with DC Casting Pit samples collected consistent with the QAPP. The reporting limit objectives have been met.

All sample analytical results for COPCs that exceed Plant Area AOC water screening levels for these structures are compiled and presented on Figure 2.4.12-1. Results of the investigation of these structures indicate that fluoride was detected at concentrations that exceed water screening levels in the Industrial, Alumina Unloading, and Pitch Building sumps. Fluoride was detected at concentrations of 7.7, 50.7, and 37.9 µg/L in the Industrial, Alumina Unloading, and Pitch Building sumps, respectively, that exceed MTCA Method B, MTCA Method C, and WA MCL screening levels. PAHs as TTEC was detected at 2 and 29 µg/L in the Alumina Unloading and Pitch Building sumps, respectively, that exceeds the MTCA Method A, MTCA Method B, and MTCA Method C screening levels.

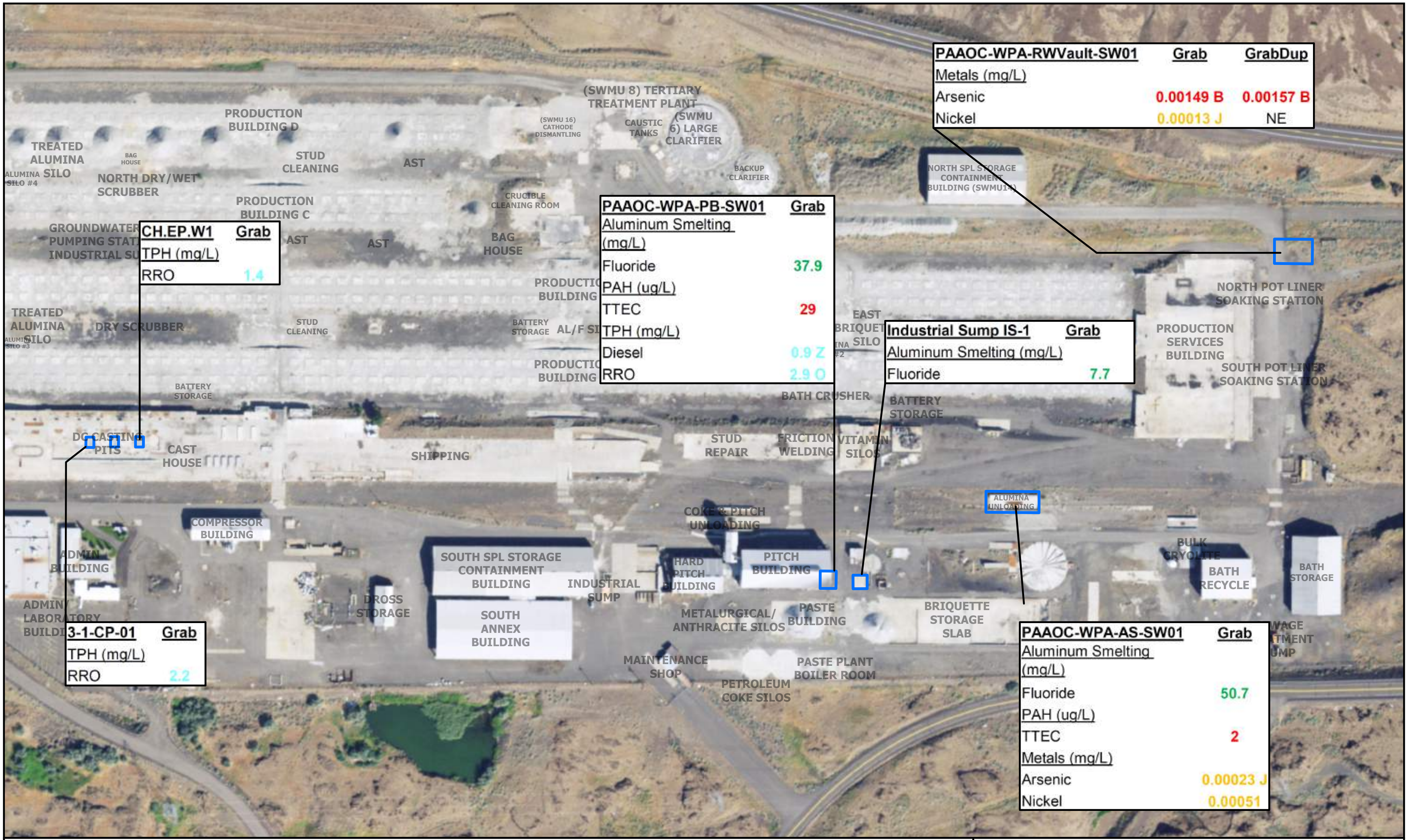
Table 2.4.12-1
PAAOC Industrial, Alumina Unloading, and Pitch Building Sumps, Leaking River Water Line Vault, and Cast House DC Casting Pit WPA and Pre-RI Water Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels						Pre-RI Analytical Results	Initial RI and WPA Analytical Results				Pre-RI Analytical Results	
Parameter Name	Units	MTCA Method A	MTCA Method B	MTCA Method C	WA MCL	Natural Background	IS-1	PAAOC-WPA-AS-SW01	PAAOC-WPA-PB-SW01	PAAOC-WPA-RWVault-SW01	PAAOC-WPA-RWVault-SW01D	3-1-CP-01 (west pit)	CH.EP.W1 (east pit)
Aluminum Smelting													
Cyanide, Free	mg/L	NE	0.01	0.022	0.2	ND	0.005 U	0.001 U	0.001 U	0.001 U	0.001 U	NA	NA
Fluoride	mg/L	NE	0.96	2.1	4	0.72	**7.7**	**50.7**	**37.9**	0.75 J	0.64 J	NA	NA
Sulfate	mg/L	NE	NE	NE	250	32	NA	34	64	17	17	NA	NA
Polynuclear Aromatic Hydrocarbons (PAHs)													
2-Methylnaphthalene	ug/L	NL	32	70	NE	NE	0.1 U	0.011 JB	0.066	0.021 U	0.021 U	NA	NA
Acenaphthene	ug/L	NA	960	2,100	NE	NE	0.1 U	0.064	0.76	0.004	0.0015 J	NA	NA
Acenaphthylene	ug/L	NA	NE	NE	NE	NE	0.1 U	0.0015 J	0.0055 J	0.021 U	0.021 U	NA	NA
Anthracene	ug/L	NA	4,800	11,000	NE	NE	0.1 U	0.11	1.3 J	0.0042 J	0.0047 J	NA	NA
Benzo(a)anthracene	ug/L	NL	NL	NL	NE	NE	0.01 U	1.1	16 J	0.032 J	0.045 J	NA	NA
Benzo(a)pyrene	ug/L	0.1	0.023	0.88	0.2	NE	0.01 U	**1.5**	**22 J**	0.038 J	0.056 J	NA	NA
Benzo(b)fluoranthene	ug/L	NL	NL	NL	NE	NE	0.01 U	1.8	26 J	0.087	0.11	NA	NA
Benzo(g,h,i)perylene	ug/L	NA	NE	NE	NE	NE	0.01 U	0.83	8.6 J	0.044 J	0.063 J	NA	NA
Benzo(k)fluoranthene	ug/L	NL	NL	NL	NE	NE	0.01 U	0.63	6.3 J	0.028	0.036	NA	NA
Chrysene	ug/L	NL	NL	NL	NE	NE	0.01 U	1.1	16 J	0.054 J	0.11 J	NA	NA
Dibenzo(a,h)anthracene	ug/L	NL	NL	NL	NE	NE	0.01 U	0.24	2.8 J	0.0099 J	0.014 J	NA	NA
Dibenzofuran	ug/L	NL	NL	NE	NE	NE	0.01 U	0.027	0.27	0.004 J	0.0032 J	NA	NA
Fluoranthene	ug/L	NL	640	1,400	NE	NE	0.1 U	1.6	25 J	0.062	0.068	NA	NA
Fluorene	ug/L	NL	640	1,400	NE	NE	0.1 U	0.041	0.47	0.0044 J	0.0028 J	NA	NA
Indeno(1,2,3-cd)pyrene	ug/L	NL	NL	NL	NE	NE	0.01 U	1.1	16 J	0.047 J	0.066 J	NA	NA
Naphthalene	ug/L	160	160	350	NE	NE	0.1 U	0.015 JB	0.09	0.042 J	0.028 J	NA	NA
Phenanthrene	ug/L	NL	NL	NE	NE	NE	0.1 U	0.62	6.6 J	0.026	0.026	NA	NA
Pyrene	ug/L	NL	480	1,100	NE	NE	0.1 U	1.3	19 J	0.049	0.058	NA	NA
TTEC cPAH (calc)	ug/L	0.1	0.2	0.2	NE	NE	0.01	**2**	**29**	0.06	0.08	NA	NA
Polychlorinated Biphenyls (PCBs)													
Aroclor 1016	ug/L	NA	1.1	2.5	NE	ND	0048 U	0.005 U	0.005 U	0.005 U	0.005 U	0.05 U	NA
Aroclor 1221	ug/L	NA	NE	NE	NE	ND	0048 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	NA
Aroclor 1232	ug/L	NA	NE	NE	NE	ND	0048 U	0.005 U	0.005 U	0.005 U	0.005 U	0.05 U	NA
Aroclor 1242	ug/L	NA	NE	NE	NE	ND	0048 U	0.005 U	0.005 U	0.005 U	0.005 U	0.05 U	NA
Aroclor 1248	ug/L	NA	NE	NE	NE	ND	0048 U	0.005 U	0.005 U	0.005 U	0.005 U	0.05 U	NA
Aroclor 1254	ug/L	NA	0.044	0.44	NE	ND	0048 U	0.005 U	0.005 U	0.01	0.01	0.05 U	NA
Aroclor 1260	ug/L	NA	0.044	0.44	NE	ND	0048 U	0.005 U	0.005 U	0.005 U	0.005 U	0.05 U	NA
Total PCBs (calc)	ug/L	0.1	0.044	0.44	0.5	ND	0.05	0.01	0.01	0.01	0.01	0.05	NA
Metals													
Aluminum	mg/L	NE	16	35	NE	1.14	0.66	1.03	1.3	0.0289 J	0.0092 J	NA	NA
Arsenic	mg/L	0.005	0.000058	0.00058	0.01	0.0069	0.0033 U	**0.00023 J**	**0.00022 J**	**0.00149 B**	**0.00157 B**	NA	NA
Cadmium	mg/L	0.005	0.008	0.018	0.05	NE	0.0044 U	0.000578	0.000246	0.000012 J	0.00002 U	NA	NA
Chromium	mg/L	0.05	24	53	0.1	0.03	0.011 U	0.0288	0.0196	0.00095	0.0008	NA	NA
Copper	mg/L	NE	0.64	1.4	13	NE	NA	0.0019	0.00085	0.0012	0.0011	NA	NA
Lead	mg/L	0.015	NE	NE	0.015	0.0004632	0.0011 U	0.000595	0.00125	0.000104	0.000056	NA	NA
Mercury	mg/L	0.002	NE	NE	0.002	NE	0.0005 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	NA	NA
Nickel	mg/L	NA	0.000096	0.00096	0.1	0.0651	NA	**0.00051**	**0.00132**	**0.00013 J**	0.00006 J	NA	NA
Selenium	mg/L	NA	0.08	0.18	0.05	NE	0.0056 U	0.001 U	0.001 U	0.0003 J	0.0003 J	NA	NA
Zinc	mg/L	NA	4.8	11	NE	NE	0.087	0.0815	0.0227	0.0024 J	0.0015 J	NA	NA
Volatile Organic Compounds (VOCs)													
Benzene	ug/L	5	0.8	8	5	NE	0.2 U	0.5 U	0.5 U	NA	NA	NA	NA
Toluene	ug/L	1,000	640	1,400	1,000	NE	1 U	0.5 U	0.5 U	NA	NA	NA	NA
Ethylbenzene	ug/L	700	800	1,800	700	NE	0.2 U	0.5 U	0.5 U	NA	NA	NA	NA
m,p-Xylene	ug/L	1,000	1,600	3,500	10,000	NE	0.4 U	0.5 U	0.5 U	NA	NA	NA	NA
o-Xylene	ug/L	5	21	3,500	10,000	NE	0.2 U	0.5 U	0.5 U	NA	NA	NA	NA
1,1,1-Trichloroethane	ug/L	5	0.54	35,000	200	NE	0.2 U	0.5 U	0.5 U	NA	NA	NA	NA
Cis-1,2-Dichloroethene	ug/L	200	16,000	35	70	NE	0.2 U	0.5 U	0.5 U	NA	NA	NA	NA
Tetrachloroethene	ug/L	5	21	110	5	NE	0.2 U	0.5 U	0.5 U	NA	NA	NA	NA
Trichloroethene	ug/L	5	0.54	8.8	5	NE	0.2 U	0.5 U	0.5 U	NA	NA	NA	NA
Vinyl Chloride	ug/L	0.2	0.029	0.29	2	NE	0.2 U	0.5 U	0.5 U	NA	NA	NA	NA
Total Petroleum Hydrocarbons (TPHs)													
Gasoline Range Organics	mg/L	1	NE	NE	NE	NE	0.1 U	NA	NA	NA	NA	NA	NA
Diesel Range Organics	mg/L	0.5	NE	NE	NE	NE	0.26 U	0.064 J	**0.9 Z**	0.023 JB	0.017 JB	0.28 U	0.26 U
Residual Range Organics	mg/L	0.5	NE	NE	2	NE	0.41 U	0.093 JB	**2.9 O**	0.037 JB	0.025 JB	**2.2**	**1.4**

Notes:

B	The sample result is less than five times the blank contamination and cross-contamination is suspected.
J	Estimated concentration.
MCL	Maximum Contaminant Level.
NA	Not applicable or not analyzed
ND	Not detected.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
O	Chromatograph fingerprint of sample resembles an oil but does not match the calibration standard.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
U	Chemical was not detected. The associated value represents the method reporting limit.
Z	Chromatograph fingerprint does not resemble a petroleum product.

Detected concentrations shown in **bold** exceed one or more site groundwater screening levels.



PAAOC-WPA-RWVault-SW01	Grab	GrabDup
Metals (mg/L)		
Arsenic	0.00149 B	0.00157 B
Nickel	0.00013 J	NE

CH.EP.W1	Grab
TPH (mg/L)	
RRO	1.4

PAAOC-WPA-PB-SW01	Grab
Aluminum Smelting (mg/L)	
Fluoride	37.9
PAH (ug/L)	
TTEC	29
TPH (mg/L)	
Diesel	0.9 Z
RRO	2.9 O

Industrial Sump IS-1	Grab
Aluminum Smelting (mg/L)	
Fluoride	7.7

3-1-CP-01	Grab
TPH (mg/L)	
RRO	2.2

PAAOC-WPA-AS-SW01	Grab
Aluminum Smelting (mg/L)	
Fluoride	50.7
PAH (ug/L)	
TTEC	2
Metals (mg/L)	
Arsenic	0.00023 J
Nickel	0.00051

▭ Sump, Pit, and Vault Outline

Water Screening Levels
red: exceeds MTCA Method C
green: exceeds WA MCL
yellow: exceeds MTCA Method B
cyan: exceeds MTCA Method A

NE: No exceedance
RRO: Residual Range Organics
B: The sample result is less than five times the blank contamination and cross-contamination is suspected
J: Estimated concentration
O: Chromatograph fingerprint of sample resembles an oil but does not match the calibration standard
Z: Chromatograph fingerprint does not resemble a petroleum product

Figure 2.4.12-1

Plant Area AOC

Industrial, Alumina Unloading, and Pitch Building Sumps, Leaking River Water Line Vault, and DC Casting Pits Water Results Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Arsenic and nickel were detected in the Alumina Unloading sump, Pitch Building sump, and leaking river water line vault at concentrations that exceed MTCA Method B and MTCA Method C. Arsenic was detected at concentrations ranging from 0.00023 J to 0.00157 B mg/L. Nickel was detected at concentrations ranging from 0.00013 J to 0.00132 mg/L.

TPH-Dx as diesel was detected in the Pitch Building sump at concentrations that exceed MTCA Method A water screening level of 0.5 mg/L. Diesel range organics were detected in the pitch building sump sample PB-SW01 at a concentration of 0.9 Z mg/L. TPH-Dx as residual range organics were detected in the Pitch Building sump and in the west and east DC Casting pits at concentrations that exceed MTCA Method A water screening level of 0.5 mg/L and/or the WA MCL of 2 mg/L. Residual range organics were detected in the pitch building sump sample PB-SW01 at a concentration of 2.90 mg/L and in the DC casting pit samples at 2.2 and 1.4 mg/L, respectively.

2.4.12.3 Conclusions and Recommendations

Results of the investigation of the Industrial sump, Alumina Unloading sump, Pitch Building sump, leaking river water line vault, and DC casting pits structures indicate that site COPCs, including fluoride, PAH as TTEC, arsenic, nickel, and TPH-Dx were detected at concentrations that exceed water screening levels. With the exception of the Industrial sump (sediment sample discussed in Section 2.5.3), no sediment was present in these structural features. The River Water Vault leakage flow rate will be evaluated in the Groundwater in the Uppermost Aquifer AOC, Volume 4, Section 2.

Based on the results of the investigation of the structural features the Industrial sump, Alumina Unloading sump, Pitch Building sump, leaking river water line vault, and the DC casting pits are recommended for further evaluation in the FS.

2.5 PAAOC WATER AND WASTE CONVEYANCE LINE SYSTEMS

The underground piping for site waters, including stormwater, collected groundwater, and process wastewater, is contained in separate conveyance systems. These include the site Stormwater Collection System, Groundwater Collection System, Industrial & Monitoring System for process waste, Scrubber Effluent System part of the original air pollution control, and Sanitary Waste System. The five conveyance line systems were previously grouped for the initial RI phase of investigation between SWMU 32 Stormwater Pond and Appurtenant Facilities (Stormwater and

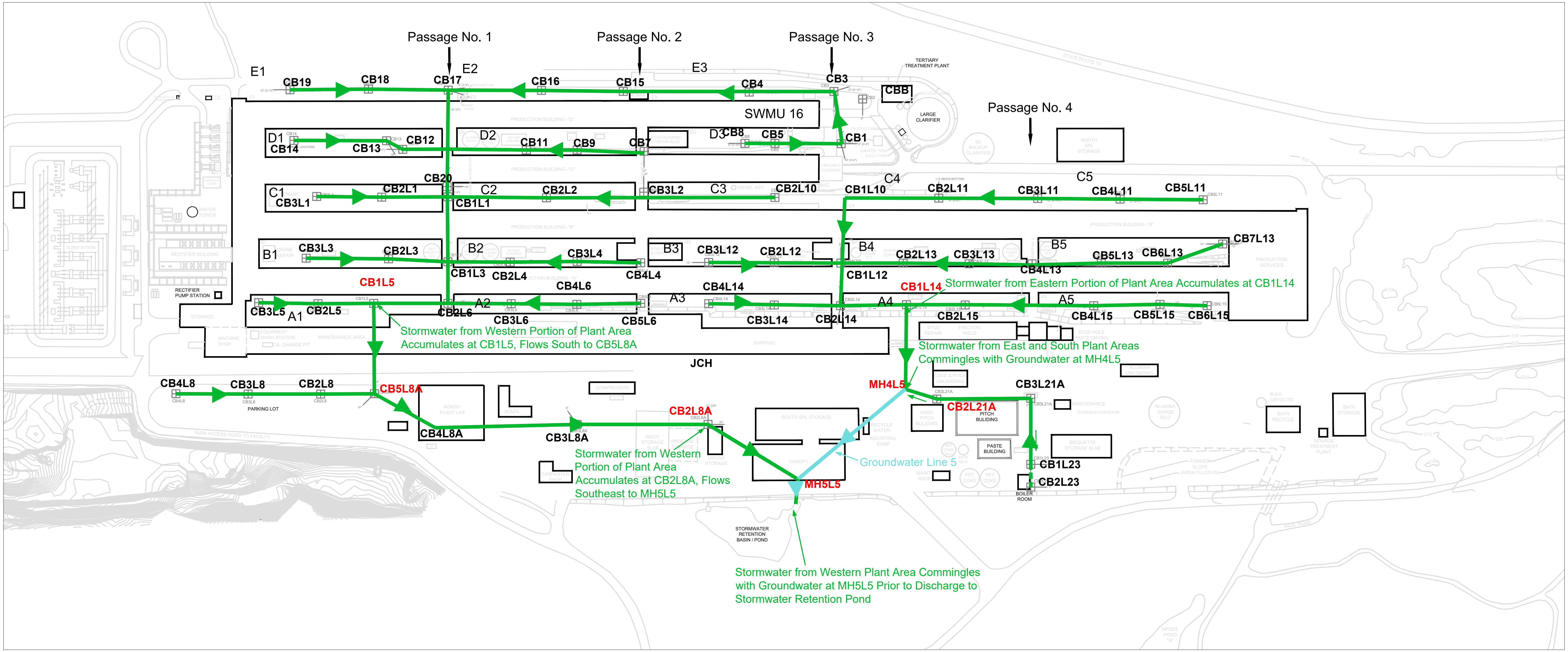
Groundwater Collection Systems) and the Plant Area AOC [Industrial & Monitoring, Scrubber Effluent, and Sanitary Sewer Systems (sump)]. To clarify and assist in understanding, the complex nature of the water and waste systems, and any interconnections between systems and shallow groundwater, they were combined into one group in the Plant Area AOC for the WPA phase of investigation and presentation in the Final RI Report.

The following sections discuss each of the five systems in terms of system configuration, scope of investigation in the initial RI and WPA phases of investigation, video surveys completed, and conclusions and recommendations.

2.5.1 Stormwater Collection System

The stormwater collection system consists of catch basins with horizontal lines between catch basins. The catch basins are located throughout all courtyard segments (i.e., Courtyard A1), around the Administrative parking lot, and in the southeast portion of the plant. The catch basins were used to collect rainwater during storm events and the associated lines eventually connect to the stormwater pond. The horizontal lines are constructed of reinforced concrete pipe of various diameters, increasing in size with proximity to the stormwater pond where all stormwater is discharged. Figure 2.5.1-1 shows the layout of the Stormwater Collection System, catch basin locations and labels, and direction of water flow in line segments. The stormwater system is present in the Crucible Cleaning Room Investigation Area (near the former Tertiary Treatment Plant), in courtyards A through E, and in the south plant area, from the parking area west of the administration building to the alumina unloading facility to the east (Figure 2.1.2-1). All stormwater drains to MH5L5 then is discharged to the Stormwater Retention Pond.

In general, stormwater in the western portion of the plant production area flows westward and eastward toward Passage No. 1 and accumulates at catch basin (CB) 1L5, located in courtyard A1. Accumulated stormwater then flows south to CB5L8A, located west of the administrative building, and then east to CB2L8A before it joins the groundwater system at groundwater manhole MH5L5 and comingles with groundwater. Stormwater in the eastern portion of the plant production area flows south and westward and accumulates at CB1L14, located in courtyard A4. Stormwater then flows south and joins the groundwater system at groundwater manhole MH4L5, commingles with groundwater and then flows to groundwater manhole MH5L5.



Source: Goldendale Aluminum Company, Plant Drawing A1/1752, "Underground Storm & Sanitary Sewer Piping W/Chem'l & Oil Str'g Areas"

Legend

Naming Convention:

CBB	Catch Basin Not Labeled on Drawing A1/1752
CB19	Catch Basin #19 (No Line #)
CB3L1	Catch Basin #3 Along Line #1
A1	Courtyard Segment A1
CB2L6	Key Catch Basin in Red

Lines Are Color-Coded by Piping System As Follows:

Green = Stormwater Collection System
Blue-Gray = Groundwater Line with Commingled Stormwater

◀	Direction of Water Flow Within Pipe Segment
—	Stormwater Line Segment
—	Groundwater Line 5 (Commingled Groundwater & Stormwater)

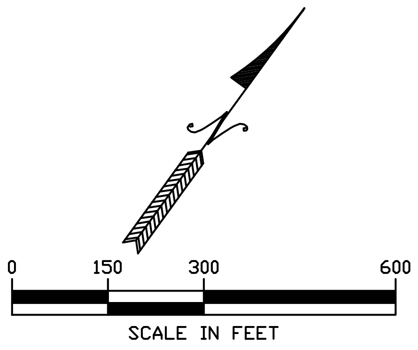


Figure 2.5.1-1

Plant Area AOC

Stormwater Collection System
System Layout

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

The Groundwater Collection System Line 5 connects with the Stormwater Collection System at MH4L5 and MH5L5 where groundwater and stormwater commingle, before the commingled water is discharged to the Stormwater Retention Pond. The stormwater catch basin and line layout is described in further detail in the following paragraphs.

Based on plant drawings, topography, size of piping, and observed configurations of the stormwater system, stormwater in the north-central portion of the Plant Area footprint collects in CB-3 to the north of the former SPL Handling Containment Building (SWMU 16) and west of the tertiary treatment plant (Figure 2.5.1-1). Catch basin CB-3 then connects west to CB-4 and eventually accumulates at CB-17, north of passage no. 1 between courtyard segments E1 and E2. The accumulated stormwater in CB-17 then flows south to connect to CB2L6 located in the south end of passage no. 1, between courtyard segments A1 and A2, and flows west to CB1L5, located immediately to the west of CB2L6 in courtyard A1. Accumulated stormwater flows south from CB1L5 into CB5L8A, located in the parking area west of the administration/laboratory building. Stormwater in this portion of the stormwater system then flows southeast from CB5L8A to CB4L8A, east to CB3L8A, and continues east to CB2L8A. The accumulated stormwater in CB2L8A comingles with groundwater in manhole MH5L5 prior to discharging to the Stormwater Retention Pond.

All catch basins located east of passage no. 3 in the courtyards A4, A5, B4, B5, C4, and C5 accumulates at CB1L14, located in Courtyard A4. The accumulated stormwater in CB1L14 flows south to commingle with Groundwater Collection Line 5 at manhole MH4L5 (Figure 2.5.1-1). Stormwater from the Paste Plant building, pitch building, and associated boiler room flows north then west and comingles with the groundwater collection line at manhole MH4L5. Flow from manhole MH4L5 continues to manhole MH5L5, where stormwater from the western portion of the plant area comingles with comingled water from eastern portion before discharging to the Stormwater Retention Pond.

2.5.1.1 Previous Investigation Scope

During demolition of the plant in 2011, and prior to issuance of the current Agreed Order in 2014, accessible stormwater catch basins were sampled. Forty-seven sediment samples were collected, managed, and shipped to Onsite Environmental Inc. laboratory in Redmond, Washington, in a manner consistent with the QAPP (Tetra Tech et al. 2015b). The sediment samples were analyzed for total cyanide, fluoride, PAHs, PCBs, metals (Al, As, Ba, Cd, Cr, Pb, Hg, Se, and Ag), and TPH-Dx. Sediment analytical results from 2011 are summarized in Table 2.5.1-1 (PAAOC Stormwater System Pre-RI Sediment Results Summary). Catch basins that were sampled in 2011 can be found on Figure 2.5.1-2 (PAAOC Stormwater Collection System Pre-RI Sediment Sampling Locations).

For the final RI Report, pre-RI sediment data are compared to the Plant Area AOC screening levels including MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. Natural background concentrations for the site have been used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendix H-2. The pre-RI sediment analytical data was not validated. Reporting limits for arsenic exceeds the protection of groundwater soil screening level in 18 out of 47 samples, and for selenium exceeds the protection of groundwater and ecological wildlife soil screening level in all samples analyzed. Metals that are COPCs for the site that were not analyzed in the pre-RI sediment samples include copper, nickel, and zinc.

Results of the pre-RI sediment analyses indicate that all analytes are detected in one or more catch basins at concentrations that exceed Plant Area AOC soil screening levels. Total cyanide was detected in one sample, CB-4, at a concentration of 2 mg/kg that exceeds the protection of groundwater screening level of 1.9 mg/kg. Fluoride was detected in 40 out of 47 samples at concentrations ranging from 150 to 3,900 mg/kg that exceed the site-specific protection of groundwater screening level of 146.7 mg/kg. PAH as TTEC was detected in 39 of 47 samples at calculated concentrations ranging from 4.7 to 2,961.7 mg/kg that exceed the MTCA Method C or protection of groundwater screening levels of 130 and 3.9 mg/kg, respectively. Total LMW PAHs were detected in 30 out of 47 samples at calculated concentrations ranging from 103.2 to 5,440 mg/kg that exceed the ecological wildlife soil screening level of 100 mg/kg. Total HMW PAHs were detected in all samples analyzed at calculated concentrations up to 14,080 mg/kg that exceed the ecological wildlife soil screening level of 1.1 mg/kg.

Metals that were detected at concentrations exceeding soil screening levels include arsenic, cadmium, chromium, lead, and mercury. Arsenic was detected in 37 out of 47 samples at concentrations up to 89 mg/kg (CB-11) that exceed the protection of groundwater screening level

Table 2.5.1-1
PAAOC Stormwater System Pre-RI Sediment Results Summary
Columbia Gorge Aluminum Smelter, Goldendale, Washington
Page 1 of 3

	Screening Levels					Ecological Screening Levels	Pre-RI Analytical Results															
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	CB-1	CB-4	CB-5	CB-7	CB-8	CB-9	CB-11	CB-12	CB14	CB-15	CB-16	CB-18	CB-19	CB2L1	CB3L1	CB2L2
Aluminum Smelter																						
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	**2**	0.05 U	0.05 U	0.05 U	0.05 U	0.25 U	0.05 U	0.05 U	0.29	0.1	0.05 U	0.066	0.05 U	0.05 U	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**530**	**1,300**	**470**	**310**	**200**	**200**	68	**160**	**150**	**2,000**	**1,600**	**540**	**1,600**	**2,000**	**2,900**	**1,100**
Polynuclear Aromatic Hydrocarbons (PAH)																						
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.44 U	34	1.7 U	0.44 U	1.5 U	0.83 U	20 U	1.6 U	0.89 U	21 U	7.6 U	1.6 U	1.8	1.9 U	2.0 U	1.6 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.44 U	47	1.7 U	0.44 U	1.5 U	0.83 U	20 U	1.6 U	0.89 U	21 U	7.6 U	1.6 U	3	1.9 U	2.0 U	1.6 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.44 U	79	3.6	0.44 U	1.5 U	0.83 U	20 U	1.6 U	0.89 U	21 U	11	2.2	9.6	3.6	2.0 U	1.6 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.44 U	22 U	1.7 U	0.44 U	1.5 U	0.83 U	20 U	1.6 U	0.89 U	21 U	7.6 U	1.6 U	1.5 U	1.9 U	2.0 U	1.6 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.49	250	3.8	1.1	1.5 U	0.83 U	20 U	1.6 U	2.8	21	32	6.7	35	8.8	4.2	1.7
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	7.5	550	35	13	15	4.6	49	22	4.3	93	92	25	58	55	31	15
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	9.2	480	38	6.6	4.4	1.9	40	5.7	5.3	74	80	24	53	49	27	12
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	15	490	64	44	44	14	230	52	10	140	110	45	51	120	78	41
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	7.5	290	32	9.4	7.2	3.2	74	10	4.3	60	58	21	30	53	36	13
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	8.1	430	38	14	16	4.2	66	18	4.3	80	81	30	46	55	39	15
Chrysene	mg/kg	NA	NL	NL	NE	NL	15	750	80	78	85	22	200	94	8.9	190	160	63	68	160	78	50
Dibenz(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	2	99	9.1	2.7	2.5	0.91	20	3.1	1.4	21 U	17	6.1	11	14	8.8	3.7
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	19	1,500	96	42	49	23	160	74	8.4	260	270	65	180	120	75	39
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.44 U	77	2.4	0.44 U	1.5 U	0.83 U	20 U	1.6 U	0.89 U	21 U	11	2.1	9.5	2.5	2.0 U	1.6 U
Ideno(1,2,3-c,d)pyrene	mg/kg	NL	NL	NL	NE	NL	6.5	250	28	8.3	6.6	2.5	55	8.7	3.7	50	52	19	28	43	31	11
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.44 U	120	1.7 U	0.44 U	1.5 U	0.83 U	20 U	1.6 U	0.89 U	21 U	12	1.6 U	7.8	1.9 U	2.0 U	1.6 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	3.3	800	25	6.3	3.5	2.9	58	5.3	3.8	98	120	34	120	34	24	9.6
Pyrene	mg/kg	NA	110,000	650	NE	NL	14	1,300	73	30	38	14	100	66	6.8	210	220	49	130	110	66	31
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**13.3**	**664.4**	**56.2**	**15.6**	**13.7**	**4.7**	**84**	**17**	**7.8**	**224.4**	**116.8**	**37.1**	**110.2**	**79.3**	**46.6**	**21.1**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	22.8	**2,826**	**130.8**	49.4	52.5	25.9	**218**	79.3	15	**379**	**456**	**110**	**361.9**	**168.9**	**103.2**	50.3
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	84.8	**4,639**	**268.7**	**206**	**218.7**	**67.31**	**834**	**279.5**	**49**	**897**	**870**	**282.1**	**475**	**659**	**394.8**	**191.7**
Polychlorinated Biphynels (PCBs)																						
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.066 U	0.28 U	0.065 U	0.22 U	0.056 U	0.21 U	0.25 U	0.058 U	0.22 U	0.26 U	0.057 U	0.061 U	0.056 U	0.071 U	0.076 U	0.062 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.066 U	0.28 U	0.065 U	0.22 U	0.056 U	0.21 U	0.25 U	0.058 U	0.22 U	0.26 U	0.057 U	0.061 U	0.056 U	0.071 U	0.076 U	0.062 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.066 U	0.28 U	0.065 U	0.22 U	0.056 U	0.21 U	0.25 U	0.058 U	0.22 U	0.26 U	0.057 U	0.061 U	0.056 U	0.071 U	0.076 U	0.062 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.066 U	0.28 U	0.065 U	0.22 U	0.056 U	0.21 U	0.25 U	0.058 U	0.22 U	0.26 U	0.057 U	0.061 U	0.056 U	0.071 U	0.076 U	0.062 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.066 U	0.28 U	0.065 U	0.22 U	0.056 U	0.21 U	0.25 U	0.058 U	0.22 U	0.26 U	0.057 U	0.061 U	0.056 U	0.071 U	0.076 U	0.062 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.066 U	0.28 U	0.065 U	0.22 U	0.056 U	0.21 U	0.25 U	0.058 U	0.22 U	0.26 U	0.057 U	0.061 U	0.056 U	1.7	0.2	0.062 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.066 U	0.28 U	0.065 U	0.22 U	0.056 U	0.21 U	0.25 U	0.058 U	0.22 U	0.26 U	0.057 U	0.061 U	0.056 U	0.071 U	0.076 U	0.062 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.066	0.28	0.065	0.22	0.056	0.21	0.25	0.058	0.22	0.26	0.057	0.061	0.056	**1.7**	0.2	0.062
Metals																						
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	27,000	22,000	51,000	27,000	11,000	23,000	16,000	26,000	7,300	17,000	9,100	14,000	13,000	29,000	35,000	35,000
Arsenic	mg/kg	20	88	2.9	7.61	132	13 U	**30**	**32**	**14**	11 U	10 U	**89**	**15**	11 U	**24**	**32**	**18**	11 U	**53**	**35**	**27**
Barium	mg/kg	NA	NA	NA	NA	NA	71	120	170	73	58	51	31	60	38	110	130	160	54	160	280	340
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.67	**4.3**	**6.7**	**8.2**	**4**	**4**	**8.1**	**4.5**	**2.6**	**7.6**	**3.7**	**4.3**	**1.1**	**2.9**	**2.7**	**3.3**
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	51	**190**	41	35	17	44	**270**	44	15	**300**	**250**	**180**	72	**85**	**100**	**120**
Lead	mg/kg	1,000	NE	3,000	13.1	118	8	33	63	30	9.1	78	**820**	**140**	12	29	55	20	12	62	46	24
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.33 U	0.35 U	0.33 U	0.28 U	0.28 U	0.26 U	0.31 U	0.29 U	0.28 U	0.32 U	0.28 U	0.30 U	0.28 U	0.36 U	0.38 U	0.31 U
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	13 U	14 U	13 U	11 U	11 U	10 U	12 U	12 U	11 U	13 U	11 U	12 U	11 U	14 U	15 U	12 U
Silver	mg/kg	NA	18,000	14	0.14	4	0.66 U	0.69 U	0.65 U	0.55 U	0.56 U	0.52 U	< 0.62	0.58 U	0.56 U	0.65 U	0.57 U	0.61 U	0.56 U	0.71 U	0.9	0.62 U
Petroleum Hydrocarbons (TPH)																						
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	370	**15,000**	970	550 U	700	100 U	780	950	110 U	**3,100**	**3,400**	280	930	1,300	1,700	220
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	**4,300**	**55,000**	**4,100**	1,300	**2,100**	530	**5,400**	**3,900**	1,100	**9,500**	**9,800**	1,300	**2,100**	**5,000**	**3,700**	1,100

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concetration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LM PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.5.1-1
PAAOC Stormwater System Pre-RI Sediment Results Summary
Columbia Gorge Aluminum Smelter, Goldendale, Washington
Page 2 of 3

	creening Levels					Ecological Screening Levels	Pre-RI Analytical Results															
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	CB3L2	CB2L4	CB3L4	CB3L5	CB2L6	CB3L6	CB4L6	CB5L6	CB4L8	CB1L10	CB2L10	CB2L11	CB3L11	CB4L11	CB5L11	CB1L12
Aluminum Smelter																						
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.42	0.05 U	0.063	0.056	0.067	0.11	0.05 U	0.36	0.05 U	0.05 U	0.1	0.05 U	0.071	0.05 U	0.13
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**750**	**170**	52	**490**	**280**	**320**	**720**	**180**	**3,500**	**840**	**1,600**	**3,900**	**2,700**	**3,500**	**3,700**	**150**
Polynuclear Aromatic Hydrocarbons (PAH)																						
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	8.5 U	20 U	20 U	18 U	21 U	20 U	24 U	0.95 U	0.1 U	0.48 U	17 U	27 U	20 U	23 U	19 U	230 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	8.5 U	20 U	20 U	18 U	21 U	20 U	24 U	0.95 U	0.1 U	0.5	17 U	27 U	20 U	23 U	19 U	230 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	8.5 U	20 U	20 U	18 U	21 U	20 U	24 U	0.95 U	0.38	1.4	26	27 U	20 U	23 U	19 U	230 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	8.5 U	20 U	20 U	18 U	21 U	20 U	24 U	0.95 U	0.1 U	0.48 U	17 U	27 U	20 U	23 U	19 U	230 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	8.5 U	27	20 U	18 U	21 U	20 U	24 U	0.95 U	0.47	3.9	90	27 U	20 U	23 U	24	230 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	47	290	120	36	180	100	130	9.8	4	25	250	96	86	130	60	860
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	42	420	190	18 U	220	120	110	11	6.2	17	180	91	82	220	76	1,100
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	130	490	210	140	600	230	380	22	7.7	63	360	260	230	630	120	1,500
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	46	300	150	28	390	120	120	10	4.6	16	120	79	87	210	62	830
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	62	350	130	50	250	130	140	11	5	29	170	110	100	270	99	880
Chrysene	mg/kg	NA	NL	NL	NE	NL	160	490	170	150	400	250	420	22	6	95	520	290	250	500	94	1,300
Dibenz(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	13	83	460	18 U	100	31	35	2.6	1.2	5	38	27 U	26	57	19 U	270
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	86	510	190	93	400	220	320	22	7.2	59	720	310	180	130	180	1,400
Fluorene	mg/kg	NL	140,000	100	NE	NL	8.5 U	20 U	20 U	18 U	21 U	20 U	24 U	0.95 U	0.17	1.2	28	27 U	20 U	23 U	19 U	230 U
Ideno(1,2,3-c,d)pyrene	mg/kg	NL	NL	NL	NE	NL	38	260	120	26	310	92	100	8.4	3.9	14	110	64	73	170	51	710
Naphthalene	mg/kg	5	70	4.5	NE	NL	8.5 U	20 U	20 U	18 U	21 U	20 U	24 U	0.95 U	0.61	1.2	25	27 U	20 U	23 U	19 U	230 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	17	160	72	18	110	68	90	5.5	2.6	16	330	66	54	33	100	460
Pyrene	mg/kg	NA	110,000	650	NE	NL	88	430	160	56	320	180	240	17	6.4	45	550	220	150	99	140	1,200
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**22.6**	**572.2**	**295.7**	**26.7**	**394.7**	**575.5**	**192.7**	**209.3**	**8.44**	**31.6**	**278**	**146.9**	**282.9**	**350.7**	**109.9**	**1,644.9**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	**103**	**697**	**262**	**111**	**510**	**288**	**410**	27.5	11.43	82.7	**1,219**	**376**	**234**	**163**	**280**	**1,860**
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**626**	**3,113**	**1,710**	**486**	**2,770**	**1,253**	**1,675**	**113.8**	**45**	**309**	**2,298**	**1,210**	**1,184**	**2,286**	**702**	**8,650**
Polychlorinated Biphynels (PCBs)																						
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.064 U	0.25 U	0.25 U	0.22 U	0.27 U	0.25 U	0.30 U	0.24 U	0.26 U	0.24 U	0.22 U	0.10 U	0.077 U	0.087 U	0.070 U	0.29 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.064 U	0.25 U	0.25 U	0.22 U	0.27 U	0.25 U	0.30 U	0.24 U	0.26 U	0.24 U	0.22 U	0.10 U	0.077 U	0.087 U	0.070 U	0.29 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.064 U	0.25 U	0.25 U	0.22 U	0.27 U	0.25 U	0.30 U	0.24 U	0.26 U	0.24 U	0.22 U	0.10 U	0.077 U	0.087 U	0.070 U	0.29 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.064 U	0.25 U	0.25 U	0.22 U	0.27 U	0.25 U	0.30 U	0.24 U	0.26 U	0.24 U	0.22 U	0.10 U	0.077 U	0.087 U	0.070 U	0.29 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.064 U	0.25 U	0.25 U	0.22 U	0.27 U	0.25 U	0.30 U	0.24 U	0.26 U	0.24 U	0.22 U	0.10 U	0.077 U	0.087 U	0.070 U	0.29 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.38	0.25 U	0.25 U	0.22 U	0.27 U	0.25 U	0.30 U	0.24 U	0.26 U	0.24 U	0.64	0.10 U	0.21	0.17	0.070 U	0.29 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.064 U	0.25 U	0.25 U	0.22 U	0.27 U	0.25 U	0.30 U	0.24 U	0.26 U	0.24 U	0.22 U	0.10 U	0.077 U	0.087 U	0.070 U	0.29 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.38	0.25	0.25	0.22	0.27	0.25	0.3	0.24	0.26	0.24	0.64	0.1	0.21	0.17	0.07	0.29
Metals																						
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	31,000	150,000	29,000	39,000	37,000	73,000	74,000	27,000	14,000	18,000	16,000	33,000	36,000	45,000	35,000	26,000
Arsenic	mg/kg	20	88	2.9	7.61	132	**33**	**14**	13 U	**22**	**20**	**26**	**48**	**14**	13 U	**12**	**25**	**45**	**68**	**50**	**40**	15U
Barium	mg/kg	NA	NA	NA	NA	NA	330	70	71	63	150	89	100	92	62	140	120	240	120	120	82	140
Cadmium	mg/kg	2	3,500	0.69	0.81	14	**2.4**	**3**	**2.4**	**10**	**3.4**	**4.3**	**7.6**	**3.6**	0.64 U	**1.6**	**4**	**16**	**11**	**6.7**	**9.3**	**2.2**
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	**95**	66	58	**68**	**110**	**170**	**200**	61	13	31	**330**	65	**170**	**95**	**85**	22
Lead	mg/kg	1,000	NE	3,000	13.1	118	54	39	22	42	**130**	**240**	100	18	31	15	50	**140**	110	**230**	44	45
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.32 U	**29**	0.32 U	0.28 U	0.33 U	0.31 U	0.66	0.31	0.32 U	0.3 U	0.27 U	0.50 U	0.38 U	0.44 U	0.35 U	0.36 U
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	13 U	12 U	13 U	11 U	13 U	13 U	15 U	12 U	13 U	12 U	11 U	20 U	15 U	17 U	14 U	15 U
Silver	mg/kg	NA	18,000	14	0.14	4	0.64 U	0.62 U	0.63 U	0.56 U	0.66 U	0.63 U	0.75 U	0.59 U	0.64 U	0.6 U	0.54 U	1.0 U	0.77 U	0.87 U	0.70 U	0.73 U
Petroleum Hydrocarbons (TPH)																						
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	**3,800**	**25,000**	**8,700**	**3,800**	**20,000**	**13,000**	**18,000**	1,900	1,000	**2,900**	**5,600**	**7,900**	**17,000**	**13,000**	**6,200**	**65,000**
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	720	**4,100**	1,200	840	**3,900**	**2,200**	**3,800**	590 U	170	**2,000**	**3,700**	2,000	**3,700**	1,400	670	540

Notes:

J	Estimated concentration.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
NA	Not applicable or not analyzed.	LM PAH	Low molecular weight PAH.
NE	Not established.	HMW PAH	High molecular weight PAH.
NL	Not listed or not shown for this chemical but detected concetration is accounted for by the summation process.	Detected concentrations shown in **bold** exceed one or more site soil screening levels.	
U	Chemical was not detected. The associated value represents the method detection limit.		
UJ	Chemical was not detected. The associated limit is estimated.		

Table 2.5.1-1
PAAOC Stormwater System Pre-RI Sediment Results Summary
Columbia Gorge Aluminum Smelter, Goldendale, Washington
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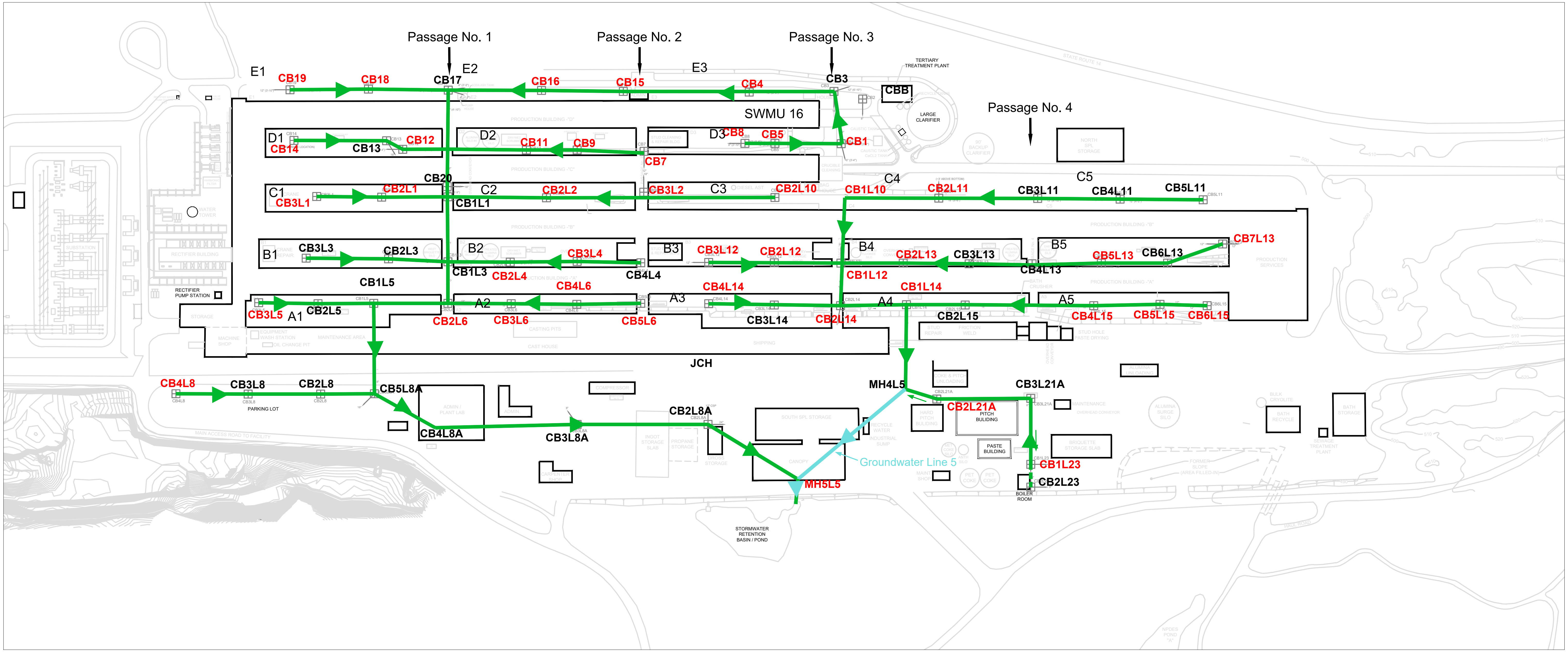
	reening Levels					Ecological Screening Levels	Pre-RI Analytical Results														
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**CB2L12**	**CB3L12**	**CB2L13**	**CB3L13**	**CB5L13**	**CB7L13**	**CB1L14**	**CB2L14**	**CB4L14**	**CB4L15**	**CB5L15**	**CB6L15**	**CB1L23 (CB1L20)**	**CB2L21A**	**MH5L5**
Aluminum Smelter																					
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.061	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.065	0.091	0.05 U	0.72
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	130	65	**260**	120	130	**160**	**290**	**300**	**340**	**510**	**1,000**	**940**	**760**	66	130
Polynuclear Aromatic Hydrocarbons (PAH)																					
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	18 U	17 U	48 U	20 U	19 U	48 U	17 U	22 U	17 U	22 U	22 U	200 U	27 U	0.92 U	1 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	18 U	17 U	48 U	20 U	19 U	48 U	17 U	22 U	17 U	22 U	22 U	200 U	27 U	0.92 U	1 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	18 U	17 U	110	20 U	19 U	0.57	49	22 U	17 U	22 U	22 U	200 U	230	0.92 U	1 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	18 U	17 U	48 U	20 U	19 U	48 U	17 U	22 U	17 U	22 U	22 U	200 U	27 U	0.92 U	1 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	18 U	17 U	130	20 U	27	0.65	73	22 U	17 U	33	22 U	200 U	280	0.92 U	1.2
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	47	33	1,300	230	190	6.9	810	44	24	390	170	670	730	8.1	12
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	71	50	2,200	340	300	13	1,200	57	20	540	200	900	640	12	14
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	83	63	2,100	390	300	14	1,200	89	60	670	390	1,300	890	15	26
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	57	42	1,400	230	190	8.6	810	50	23	410	180	760	410	9.2	13
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	53	41	1,700	250	220	11	870	55	26	450	180	680	510	11	13
Chrysene	mg/kg	NA	NL	NL	NE	NL	73	49	1,600	320	230	9	1,100	87	79	590	380	1,200	880	13	24
Dibenz(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	18 U	17 U	480	62	64	2.8	270	22 U	17 U	110	50	210	120	2.5	3.9
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	72	54	2,400	380	350	12	1,400	93	58	640	280	1,100	2,800	15	28
Fluorene	mg/kg	NL	140,000	100	NE	NL	18 U	17 U	48 U	20 U	19 U	48 U	27	22 U	17 U	22 U	22 U	200 U	230	0.92 U	1 U
Ideno(1,2,3-c,d)pyrene	mg/kg	NL	NL	NL	NE	NL	48	35	1,200	200	170	7.4	700	41	18	350	150	640	360	7.8	11
Naphthalene	mg/kg	5	70	4.5	NE	NL	18 U	17 U	48 U	20 U	19 U	48 U	17 U	22 U	17 U	22 U	22 U	200 U	27 U	0.92 U	1 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	26	19	740	110	110	4.1	420	31	17 U	200	81	400	1,900	5	8.5
Pyrene	mg/kg	NA	110,000	650	NE	NL	66	48	2,100	340	290	10	1,200	83	44	560	240	980	2,100	12	22
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**94.8**	**67.7**	**2,961.7**	**456.4**	**853.1**	**17.3**	**1,596**	**80.8**	**114.4**	**742.9**	**297.8**	**1,262**	**909.8**	**110.6**	**20.8**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	98	73	**3,380**	**490**	**487**	17.32	**1,847**	**124**	58	**840**	**361**	**1,500**	**5,440**	20	37.7
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**498**	**361**	**14,080**	**2,362**	**1,954**	**82.7**	**8,160**	**506**	**294**	**4,070**	**1,940**	**7,340**	**6,640**	**90.6**	**138.9**
Polychlorinated Biphynels (PCBs)																					
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.22 U	0.22 U	0.072 U	0.26 U	0.070 U	0.072 U	0.21 U	0.27 U	0.21 U	0.28 U	0.27 U	0.25 U	0.34 U	0.23 U	0.26 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.22 U	0.22 U	0.072 U	0.26 U	0.070 U	0.072 U	0.21 U	0.27 U	0.21 U	0.28 U	0.27 U	0.25 U	0.34 U	0.23 U	0.26 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.22 U	0.22 U	0.072 U	0.26 U	0.070 U	0.072 U	0.21 U	0.27 U	0.21 U	0.28 U	0.27 U	0.25 U	0.34 U	0.23 U	0.26 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.22 U	0.22 U	0.072 U	0.26 U	0.070 U	0.072 U	0.21 U	0.27 U	0.21 U	0.28 U	0.27 U	0.25 U	0.34 U	0.23 U	0.26 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.22 U	0.22 U	0.072 U	0.26 U	0.070 U	0.072 U	0.21 U	0.27 U	0.21 U	0.28 U	0.27 U	0.25 U	0.34 U	0.23 U	0.26 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.22 U	0.22 U	0.072 U	0.26 U	0.070 U	0.072 U	0.21 U	0.27 U	0.21 U	0.39	0.27 U	0.25 U	0.36	0.23 U	0.26 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.22 U	0.22 U	0.072 U	0.26 U	0.070 U	0.072 U	0.21 U	0.27 U	0.21 U	0.28 U	0.27 U	0.25 U	0.34 U	0.23 U	0.26 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.22	0.22	0.072	0.26	0.07	0.072	0.21	0.27	0.21	0.39	0.27	0.25	0.36	0.23	0.26
Metals																					
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	16,000	14,000	34,000	55,000	120,000	15,000	15,000	45,000	42,000	15,000	32,000	53,000	32,000	4,600	35,000
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	14 U	13 U	14 U	**24**	11 U	**41**	**35**	14 U	14 U	**14**	17 U	11 U	**58**
Barium	mg/kg	NA	NA	NA	NA	NA	51	52	45	97	42	47	66	310	84	47	82	93	76	52	210
Cadmium	mg/kg	2	3,500	0.69	0.81	14	**2.2**	**2.1**	**2.6**	**2.5**	**3.5**	**1.2**	**4**	**5.2**	**4.4**	**3.1**	**3.3**	**3.9**	**4.4**	0.57 U	**3.1**
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	51	**260**	20	**110**	27	**210**	46	**110**	**100**	40	41	45	48	3.7	55
Lead	mg/kg	1,000	NE	3,000	13.1	118	25	34	34	41	85	25	40	62	21	67	39	32	33	5.7 U	46
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.27 U	0.36 U	0.32 U	0.35 U	0.97	0.27 U	0.34 U	0.27 U	0.35 U	0.34 U	0.31 U	0.42 U	0.29 U	0.32 U
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	14 U	13 U	14 U	14 U	11 U	14 U	11 U	14 U	14 U	12 U	17 U	11 U	13 U
Silver	mg/kg	NA	18,000	14	0.14	4	0.56 U	0.54 U	0.72 U	0.64 U	0.70 U	0.72 U	0.54 U	0.68 U	0.54 U	0.69 U	0.69 U	0.62 U	0.84 U	0.57 U	0.64 U
Petroleum Hydrocarbons (TPH)																					
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	**6,600**	**4,700**	**76,000**	**25,000**	**14,000**	**1,600**	**36,000**	**4,400**	**2,800**	**17,000**	**11,000**	4,400	**37,000**	650	**6,600**
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	**13,000**	**4,200**	**2,500**	310	2,500	310	**5,800**	680 U	540 U	**2,400**	**2,800**	680	**83,000**	120 U	860

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concetration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.

TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LM PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.



Source: Goldendale Aluminum Company, Plant Drawing A1/1752, "Underground Storm & Sanitary Sewer Piping W/Chem'l & Oil Str'g Areas"

Legend

Naming Convention:

CBB	Catch Basin Not Labeled on Drawing A1/1752
CB19	Catch Basin #19 (No Line #)
CB3L1	Catch Basin #3 Along Line #1
A1	Courtyard Segment A1

Sample Locations:

CB2L6	Pre-RI Sediment Sample Location in Red

Lines Inspected Are Color-Coded by Piping System As Follows:

Green = Stormwater Collection System

Blue-Gray = Groundwater Line with Commingled Stormwater

◀	Direction of Water Flow Within Pipe Segment
—	Stormwater Line Segment
—	Groundwater Line 5 (Commingled Groundwater & Stormwater)

G

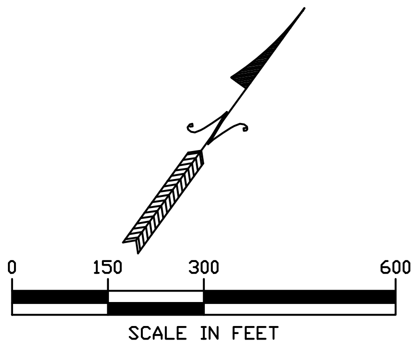


Figure 2.5.1-2

Plant Area AOC

Stormwater Collection System
Pre-RI Sediment Sample Locations

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

of 2.9 mg/kg, considering the natural background concentration of 7.61 mg/kg. Cadmium was detected in 46 of 47 samples at concentrations up to 9.3 mg/kg that exceed the protection of groundwater screening level of 0.69 mg/kg, considering the natural background concentration of 0.81 mg/kg. Chromium was detected in 21 of 47 samples at concentrations up to 330 mg/kg that exceed the ecological wildlife screening level of 67 mg/kg, considering the natural background concentration of 31.88 mg/kg. Lead was detected in 6 of 47 samples at concentrations up to 820 mg/kg that exceed the ecological wildlife screening level of 118 mg/kg, considering the natural background concentration of 13.1 mg/kg. Mercury was detected in one sample, CB2L4, at a concentration of 29 mg/kg that exceeds both the protection of groundwater screening level of 2.1 mg/kg and the ecological wildlife screening level of 5.5 mg/kg.

Diesel range organics were detected at concentrations up to 83,000 mg/kg in 17 of 47 samples that exceed MTCA Method A Industrial and the ecological wildlife screening level of 2,000 mg/kg. Residual range organics were detected at concentrations up to 76,000 mg/kg in 37 of 47 samples that exceed MTCA Method A Industrial and the ecological wildlife screening level of 2,000 mg/kg.

COPCs that were detected in the 47 catch basins sampled in 2011 represent contaminants that were likely introduced into the stormwater system from ground surface. This may have included air deposition at ground surface in courtyards from plant emissions, spills of product during transport overhead or along courtyards, spills that may have occurred from containers or mobile equipment, and leaks from fixed facilities such as transformer substations. Demolition of the plant production buildings had begun prior to catch basin sampling 2011, so that activity may also have introduced contaminants into the stormwater system. Presence of contaminated sediments in catch basins and into horizontal piping could have migrated as particulates or dissolved components in the stormwater and eventually been discharged to the Stormwater Pond.

After sampling the catch basins and prior to issuance of the current Agreed Order (Ecology 2014), the Stormwater System was cleaned, including the 47 catch basins listed on Table 2.5.1-1. Note that catch basins are only associated with the Stormwater System, and all the remaining line group discussions discuss manholes. The cleaning process included vacuuming sediment from a catch basin when feasible, flushing potable water through the horizontal lines to the next downstream catch basin, and then covering the catch basin with filters and waddles. The following is a description of the catch basins cleaned by courtyard segment:

- **Courtyard A**: All catch basins in Courtyard Segments A were cleaned.
- **Courtyard B**: Most catch basins in Courtyard Segments B1 and B2, except for CB3L4, were inaccessible and not cleaned. All catch basins in Courtyard Segments B3, B4, and B5 were cleaned.
- **Courtyard C**: All catch basins in Courtyard Segments C were cleaned except for CB1L1 and CB1L10.
- **Courtyard D**: All catch basins in Courtyard Segment D were cleaned except for CB-10 because its cover is welded shut.
- **Courtyard E**: All catch basins in Courtyard Segment E were cleaned.
- **Tertiary Treatment Plant**: Catch basins CB-1, CB-2, and CB-3 were cleaned.
- **Parking Lot**: All catch basins were cleaned.
- **Administration Building to MH5L5**: All accessible catch basins were cleaned.
- **Paste Plant to MH4L5**: All five catch basins were cleaned.

Resultant catch basin and line cleaning water was pumped to the former large clarifier located near the Tertiary Treatment Plant for evaporation. Solids were temporarily stored in the Bath House located southeast of the east end of Production Building A. About 21 tons of catch basin solids were disposed at Columbia Ridge Landfill. A more detailed description of the sediment sampling and line cleaning is presented in the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a). After catch basins were sampled and cleaned in 2011, surface protections were placed at catch basins located in areas where demolition activities were occurring. Demolition activities continued into 2012, after sampling and cleaning the Stormwater Collection System, and recontamination of parts of the system may have occurred. In April of 2021, all of the waddles and stormwater protection were replaced around the catch basins throughout the Plant Area.

2.5.1.2 Initial RI Phase Investigation Scope

The Stormwater Collection System was investigated during the initial RI phase of investigation in 2016 and 2017. Investigation objectives as follows were described in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b):

- **System identification** to locate, inspect, and document status of all catch basins. Inspection results were used to identify locations for water and sediment sample locations, horizontal pipe segments for video survey, and confirm stormwater system cleanup.
- **Collection of sediment and water samples** from selected catch basins to further characterize COPCs in sediment and water in the system.
- **Conduct a video survey** of selected system horizontal pipe segments to determine presence of sediment in the horizontal pipes and evaluate connections between the stormwater and other systems.

2.5.1.3 Initial RI Phase Investigation Results

The following sections describe the work performed to meet the objectives stated above.

2.5.1.3.1 System Identification

A system identification inventory of the Stormwater Collection System was conducted during the initial RI phase to determine the location and status of all catch basins. Catch basins were located using historic site engineering plans obtained from the onsite plant construction files repository. All catch basins were located by assessing its relative location on maps and drawings to field-locate, comparing measured invert depths to surveyed depths on engineering plans, and comparing orientations of the features against the plans. Some catch basins shown on maps could not be located or were buried and then excavated for inspection. Other catch basins were found but not shown on, or identified from, any map or plan.

When each catch basin was located, its position was recorded using a hand-held global positioning system (GPS) unit, photos were taken of the catch basin (exterior and interior), and the catch basin was inspected by a Professional Engineer. The inspection included noting size and orientation of horizontal pipes entering the catch basin, integrity of the cover, ring and frame, barrel, shelf, and rungs, and presence of water and sediment. Other medium to small diameter horizontal pipes with unknown origins intersecting many of the catch basins were also mapped. The source of the medium to small diameter horizontal pipes appears to have been from previous roof drains but was difficult to discern as the structures have been demolished. System observations and measurements are summarized in Table 2.5.1-2. The table also indicates which stormwater catch basins were cleaned in 2011.

2.5.1.3.2 Collection of Sediment and Water Samples

During the initial RI phase, six sediment samples and one duplicate sediment sample were collected from catch basins that had not been sampled in 2011 during plant demolition. The sediment samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Gx, and TPH-Dx. Sediment analytical results are summarized on Table 2.5.1-3 (PAAOC Stormwater Collection System RI Sediment Results Summary). Sediment data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife screening levels. Natural background concentrations for the site were used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendix H-2, and data validation reports are included in Volume 5, Appendix I-2. All samples were collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The reporting limit for selenium in one sample exceeded the ecological wildlife soil screening level.

All sediment sample analytical results that exceed Plant Area AOC soil screening levels are compiled and presented on Figure 2.5.1-3. Only total cyanide does not exceed screening levels. Fluoride was detected in four out of seven samples at concentrations up to 1,330 mg/kg that exceed the protection of groundwater screening level of 147.6 mg/kg. Detected concentrations of PAH as TTEC exceed the protection of groundwater screening level of 3.9 mg/kg in six out of seven samples and exceeds the MTCA Method C screening level of 130 mg/kg in one sample. Total LMW PAH was detected at calculated concentrations up to 910.19 mg/kg in five out of seven samples that exceeds the ecological wildlife screening level. Total HMW PAH was detected at calculated concentrations up to 5,872.6 mg/kg that exceeds the ecological wildlife screening level in all samples analyzed.

Calculated concentrations of total PCBs exceed the ecological wildlife screening level in two out of seven samples at 0.83 and 3.98 mg/kg. Five metals including arsenic, cadmium, nickel, selenium, and zinc were detected at concentrations that exceed the protection of groundwater or ecological wildlife screening levels in one or more samples. Arsenic exceeds the protection of groundwater screening level in four out of seven samples. Cadmium exceeds the protection of groundwater

Table 2.5.1-2
PAAOC Stormwater Collection System Inspection Summary
Columbia Gorge Aluminum Smelter, Goldendale Washington
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CB No.	Line No.	Location Name	Invert Depth from Plans (Ft)	Invert Depth Measured (Ft)	Cleaned in 2012 (Y/N)	Invert Protection Intact (Y/N)	Sediment Present (Y/N)	Water Present (Y/N)	Sampled	Photo Numbers	Comments
1	1	CB1L1	5.2	7'1"	Y	Y	Y	N	11-11-16, S	518-520(S)	PW1. Grate damage. Standing water in inlet pipes, wet sediment.
2	1	CB2L1	5.2	3'10"	Y	Y	Y	N	(2012, pre-RI)	516-517(N)	Surface debris in CB.
3	1	CB3L1	3.2	2'4"	Y	Y	Y	N	(2012, pre-RI)	513-515(N)	Liner. Grate damage. Surface debris in CB covers inlets.
2	2	CB2L2	4.2	3'7"	Y	Y	Y	N	(2012, pre-RI)	524-526(S)	Surface debris in CB covers inlets.
3	2	CB3L2	3.3	7'10"	Y	N	Y	N	(2012, pre-RI)	595-597(S)	PW2. Different invert elevations differs from plans. Surface debris covers inlets. May not be CB3L2.
1	3	CB1L3	4.2	3'7"	N	N	Y	N	NS	506-508(N)	PW1. Surface debris in CB. Standing water in inlets, wet sediment.
2	3	CB2L3	6.1	5'1"	N	N	Y	N	11-11-16, S	509-510(S)	Liner. Severe rusting, encrustation.
3	3	CB3L3	3.2	3'0"	N	N	Y	N	NS	511-512(S)	Liner. Some sediment with large fragments.
2	4	CB2L4	6.6	6'7"	Y	Y	Y	N	(2012, pre-RI)	502-505(S)	Liner. Small diameter lines deviate from plans. Standing water.
3	4	CB3L4	7	6'2"	Y	Y	Y	N	(2012, pre-RI)	500-501(S)	Liner. Large fragments on sediment. Standing water.
4	4	CB4L4	2.5	1'10"	N	N	Y	N	NS	497-499(N)	PW2. Surface debris covers inlets.
1	5	CB1L5	10.5	10'8"	Y	Y	Y	N	(2012, pre-RI)	434-436(N)	Liner. Trace sediment. Some standing water. Main collector of stormwater from west portion of PAAOC (west of Passage No. 3).
2	5	CB2L5	6.9	7'0"	Y	Y	Y	N	NS	430-433(N)	Liner? Trace sediment.
3	5	CB3L5	3.2	3'3"	Y	Y	Y	N	(2012, pre-RI)	426-427(N)	Liner. Surface debris in CB.
5	5	MH5L5	23.5	4'10"	Y	Y	Y	Y	(2012, pre-RI)	373-374(S)	Standing water, sump. Inflow from east, outflow to south.
2	6	CB2L6	5.5	5'6"	Y	Y	Y	Y	(2012, pre-RI)	437-439(S)	PW1. Liner. Some standing water. Surface debris in CB.
3	6	CB3L6	8.6	8'3"	Y	N	Y	N	(2012, pre-RI)	440-441(N)	Grate, surface debris in CB. Sediment appears wet.
4	6	CB4L6	7.6	7'4"	Y	Y	Y	N	(2012, pre-RI)	442-443(N)	Trace sediment. Standing water.
5	6	CB5L6	2.7	2'7"	Y	N	Y	N	(2012, pre-RI)	444-445(N)	PW2. Grate damage. Surface debris and large fragments in CB.
2	8	CB2L8	7	7'1"	Y	Y	Y	N	NS	315-316(S)	Liner. No sediment.
3	8	CB3L8	5.5	5'5"	Y	Y	N	N	NS	317-319(S)	Liner. No sediment.
4	8	CB4L8	4	3'11"	Y	Y	Y	N	(2012, pre-RI)	320-322(S)	Liner. No sediment.
1	10	CB1L10	4.4		N			N	(2012, pre-RI)		Could not locate.
2	10	CB2L10	4.1	3'3"	Y	Y	Y	N	(2012, pre-RI)	562-563(S)	Buried. Metal, plastic, surface debris in CB.
2	11	CB2L11	5.6	5'1"	Y	Y	Y	N	(2012, pre-RI)	566-569(N)	Liner? Surface debris in CB. Standing water.

Notes:

CB	Catch basin.
FT	Feet
NS	Not sampled.
(N)(S)	Photograph view to north (N) or south (S).
PW	Plant passage way running north-south between cast house and production buildings, beginning from west with Passage No. 1.
(2012), pre RI	Samples collected during 2012 during demolition and prior to issuance of Agreed Order and initiation of Remedial Investigation.
S, W	Sediment or water sample.
Surface Debris	Includes large rocks, bricks, metal, lumber, plastic, and other debris dislodged at some time from ground surface into catch basin.
Invert	Lowest point inside catch basin.

Table 2.5.1-2
PAAOC Stormwater Collection System Inspection Summary
Columbia Gorge Aluminum Smelter, Goldendale Washington
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CB No.	Line No.	Location Name	Invert Depth from Plans (Ft)	Invert Depth Measured (Ft)	Cleaned in 2012 (Y/N)	Invert Protection Intact (Y/N)	Sediment Present (Y/N)	Water Present (Y/N)	Sampled	Photo Numbers	Comments
3	11	CB3L11	4.8	4'10"	Y	Y	Y	N	(2012, pre-RI)	570-571(N)	Liner. Surface debris in CB. Wet sediment.
4	11	CB4L11	4	4'2"	Y	Y	Y	N	(2012, pre-RI)	572-573(N)	Liner. Surface debris, large fragments in CB. Standing water.
5	11	CB5L11	4.3	3'2"	Y	Y	Y	Y	(2012, pre-RI)	574-575(N)	Liner. Surface debris in CB. Standing water covers inlets.
1	12	CB1L12	4.3	4'0"	Y	N	Y	N	(2012, pre-RI)	484-486(N)	PW3. Buried. Surface debris in CB. Standing water at inlets.
2	12	CB2L12	5.9	5'4"	Y	N	Y	N	(2012, pre-RI)	492-493(S)	Buried. Trace surface debris in CB.
3	12	CB3L12	3.3	3'1"	Y	Y	Y	N	(2012, pre-RI)	494-496(S)	Buried. Liner. Surface debris, large fragments in CB.
2	13	CB2L13	7.8	8'2"	Y	Y	Y	Y	(2012, pre-RI)	482-483(S)	Liner. Standing water. No sediment.
3	13	CB3L13	5.2	6'0"	Y	Y	Y	Y	(2012, pre-RI)	487-490(S),	Buried. Grate damage. Liner. Sheen. Lines in CB deviate from plan.
4	13	CB4L13	2.5	1'10"	Y	N	Y	N	11-11-16, S	603-604	PW4. Wet sediment.
7	13	CB7L13	3.3	7'0"	Y	N	Y	N	(2012, pre-RI)	473-474(N)	Liner. Invert elevations differ from plans. May not be CB7L13. Surface debris in
1	14	CB1L14	9.3	7'8"	Y	N	N	Y	-11-16, W 3-14-17,	459-460(S)	Standing water. Surface debris present 3/14/17. Connects to Groundwater System MH4L5 to the south. Main stormwater collector for eastern portion of PAAOC (east of Passage No. 3).
2	14	CB2L14	10.7	10'1"	Y	N	Y	Y	(2012, pre-RI)	453-455(N),	Trace sediment. Standing water.
3	14	CB3L14	6.1	5'0"	Y	N	Y	N	11-11-16, S	448-449(N)	Surface debris, plastic in CB.
4	14	CB4L14	3.3	3'1'"	Y	Y	Y	N	NS	446-447(N)	Surface debris, sediment in CB.
2	15	CB2L15	5.2	5'9"	Y	Y	N	N	NS	461-463(N)	Liner. No sediment. Trace standing water.
3	15	CB3L15	4.7						NS		Could not locate. May be previously unknown CBY (Table 5).
4	15	CB4L15	4.2	4' 3"	Y	Y	Y	Y	NS	467-468(N)	Liner. Grate damage. Standing water.
5	15	CB5L15	3.7	4' 4"	Y	Y	Y	Y	NS	469-470(N)	Liner. Surface debris in CB. Standing water.
6	15	CB6L15	3.3	3'8"	Y	Y	N	Y	NS	471-472(N)	Liner. Standing water.
1	23	CB1L23	4.3	6'2"	Y	Y	N	Y	NS	388-389(N)	Standing water, with sheen.
2	23	CB2L23	3	2'9"	Y	N	Y	N	11-11-16, S	1-2(N)	Surface debris, sediment fills CB.
1	21A	MH1L21A	7.1		Y	N	N	Y			See MH4L5 GW Line (Table 2). Connects to Groundwater System and stormwater commingles with groundwater.
2	21A	CB2L21A	6.6	6'2"	Y	Y	N	Y		384-385(N)	Some standing water.
3	21A	CB3L21A	5.8	4'8"	Y	N	Y	Y		386-387(N)	Could not get cover off. Standing water and sediment visible through grate.

Notes:

CB	Catch basin.
FT	Feet
NS	Not sampled.
(N)(S)	Photograph view to north (N) or south (S).
PW	Plant passage way running north-south between cast house and production buildings, beginning from west with Passage No. 1.
(2012), pre RI	Samples collected during 2012 during demolition and prior to issuance of Agreed Order and initiation of Remedial Investigation.
S, W	Sediment or water sample.
Surface Debris	Includes large rocks, bricks, metal, lumber, plastic, and other debris dislodged at some time from ground surface into catch basin.
Invert	Lowest point inside catch basin.

Table 2.5.1-2
PAAOC Stormwater Collection System Inspection Summary
Columbia Gorge Aluminum Smelter, Goldendale Washington
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CB No.	Line No.	Location Name	Invert Depth from Plans (Ft)	Invert Depth Measured (Ft)	Cleaned (Y/N)	Invert Protection Intact (Y/N)	Sediment Present (Y/N)	Water Present (Y/N)	Sampled	Photo Numbers	Comments
2	8A	CB2L8A	21.8	21'6"	Y	N	N	Y	11-11-16, W 3-14-17, W	358-360(N)	Has a MH cover, standing water. Surface debris present 3/14/17. Connects to Groundwater System MH5L5 and stormwater commingles with groundwater.
3	8A	CB3L8A	20.9	19'9"	Y	N	N	Y	NS	355-357(N)	Standing water.
4	8A	CB4L8A	20		Y	N	N	N	NS	331-332 (N)	Located at sink in Men's Restroom
5	8A	CB5L8A	19.5	19'4"	Y	Y	Y	Y	NS	312-314(N)	Liner. Too deep to retrieve samples. Standing water.
1		CB-1		15'5"	Y	Y	Y	Y	NS	585-589(N)	Standing water.
2		CB-2		4'1"	Y	Y	Y	Y	NS	581-582(S)	Mostly surface debris in CB. Standing water, sump.
3		CB-3		16'9"	Y	Y	Y	Y	NS	576-580(S)	Too much standing water and not enough sediment.
4		CB-4		4'1" (TD)	Y	Y	Y	Y	NS	555-556(N)	Standing water.
5		CB-5		5'0" (TD)	Y	Y	Y	Y	NS	557-559(N)	Liner. Grate damage. Some surface debris in CB. Standing water.
6		CB-6			Y	N	N	N	NS		See CB3L2
7		CB-7		2'7"	Y	Y	Y		NS	527-529(N)	PW2. Surface debris covers inlets.
8		CB-8		4'3" (TD)	Y	Y	Y	Y	NS	560-561(S)	Liner. Standing water.
9		CB-9		4'4"	Y	N	Y	Y	NS	530-531(S)	Liner. Standing water.
10		CB-10			Y	N	N	N	NS		Cover welded shut. Could not access.
11		CB-11		3'9"	Y	N	Y	Y	NS	532-533(S)	Liner. Standing water.
12		CB-12		6'3"(TD)	Y	Y	N	Y	NS	534-536(S)	Liner. Standing water.
13		CB-13		4'7" (TD)	Y	Y	Y	Y	NS	537-538(S)	Liner. Not enough sediment to sample. Standing water.
14		CB-14		4'6"(TD)	Y	Y	N	Y	NS	539-540(S)	Liner. Standing water, sump.
15		CB-15		3'2" (TD)	Y	Y	N	Y	NS	551-552(N)	Liner. Standing water.
16		CB-16		5'1" (TD)	Y	Y	Y	Y	NS	549-550(S)	Liner. Standing water, sump.
17		CB-17		4'10" (TD)	Y	Y	Y	N	11-11-16, S	546-548(S)	Liner. Surface debris in CB.
18		CB-18		4'9" (TD)	Y	Y	Y	Y	NS	543-545(S)	Liner. Standing water.
19		CB-19		4'3" (TD)	Y	Y	N	Y	NS	541-542(S)	Liner. Standing water.
20		CB-20		8'8"	N	N	Y	N	NS	521-523(S)	Liner. Surface debris in CB. Pipes in CB deviate from plans.

Notes:

CB	Catch basin.
FT	Feet
NS	Not sampled.
(N)(S)	Photograph view to north (N) or south (S).
PW	Plant passage way running north-south between cast house and production buildings, beginning from west with Passage No. 1.
(2012), pre RI	Samples collected during 2012 during demolition and prior to issuance of Agreed Order and initiation of Remedial Investigation.
S, W	Sediment or water sample.
Surface Debris	Includes large rocks, bricks, metal, lumber, plastic, and other debris dislodged at some time from ground surface into catch basin.
Invert	Lowest point inside catch basin.

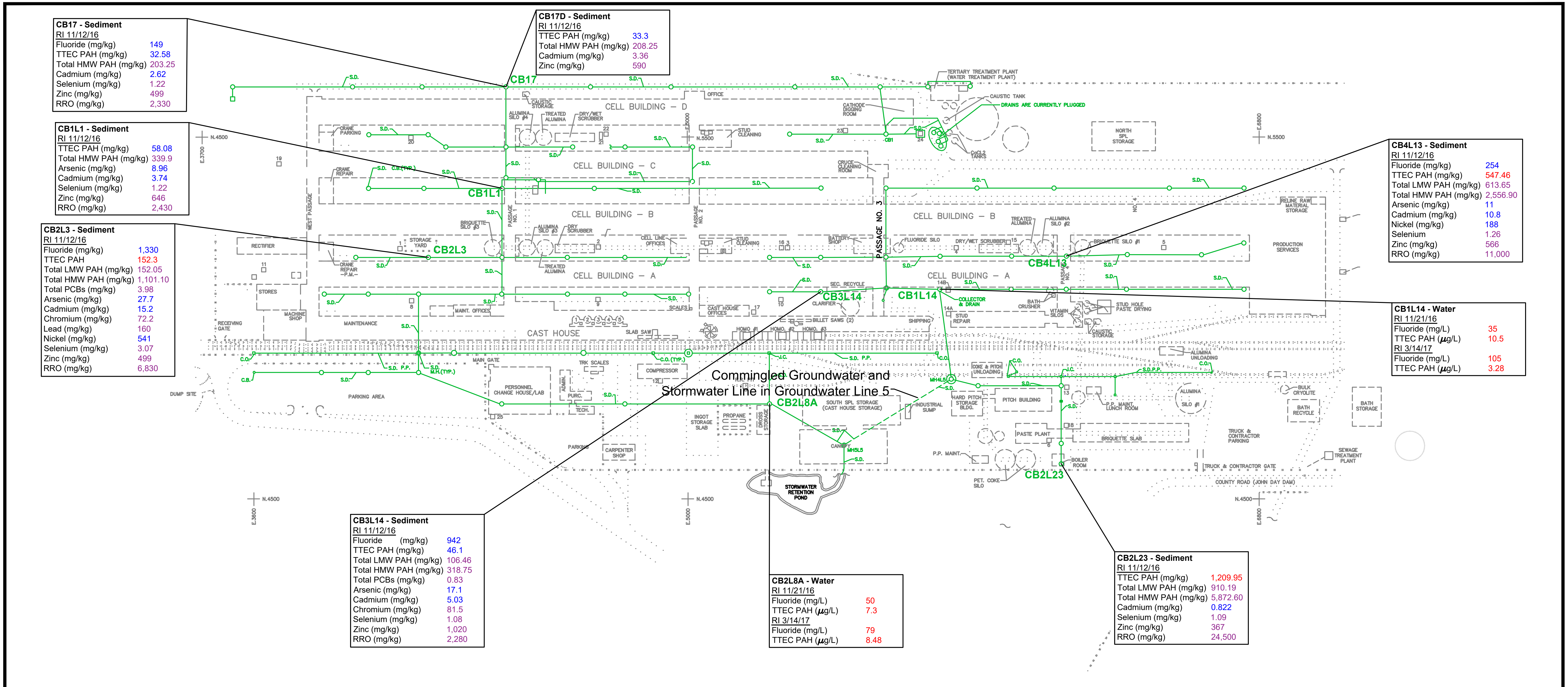
Table 2.5.1-3
PAAOC Stormwater Collection System RI Sediment Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	RI Analytical Results						
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**SWMU32-SD-STW-17**	**SWMU32-SD-STW-17D**	**SWMU32-SD-STW-1L1**	**SWMU32-SD-STW-2L23**	**SWMU32-SD-STW-2L3**	**SWMU23-SD-STW-3L14**	**SWMU32-SD-STW-4L13**
Aluminum Smelting													
Cyanide	mg/kg	NA	2,200	1.9	NE	5	0.0976 U	0.0980 U	0.0976 U	0.0984 U	0.097 U	0.0967 U	0.099 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**149**	129	133	13.1	**1,330**	**942**	**254**
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	NA	NA	NA	NA	NA	NA
Polynuclear Aromatic Hydrocarbons (PAHs)													
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NA	NL	0.481 U	0.471 U	0.468 U	2.39	0.536 U	0.427 U	0.792
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.481 U	0.471 U	0.468 U	3.4	0.536 U	0.427 U	1.09
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	1.13	1.04	1.87	39.3	2.49	2.41	12.8
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.481 U	0.471 U	0.468 U	0.443 U	0.536 U	0.427 U	0.510 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	2.53	2.69	4.55	53.1	7.34	6.61	18.7
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	17.7	18.3	30.3	501	63.9	29.3	173
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	22.3	22.6	40.7	910	82.9	30.8	430
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	45.4	45.3	68.6	1,200	429	64.9	619
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	18.2	18.7	30.6	633	87.4	25.4	161
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	11.3	14	26	440	61.4	19.3	117
Chrysene	mg/kg	NA	NL	NL	NE	NL	32.5	31.6	47.8	679	152	52.5	387
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	4.75	5.02	8.39	91.6	25.6	6.25	42.9
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	0.481 U	0.471 U	0.57	11.8	0.835	1.03	3.94
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	33.8	35.5	54	781	116	71.7	475
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.924	0.84	1.48	26.8	1.62	1.91	9.15
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	20.4	21.1	35.7	699	98.9	28	184
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.481 U	0.471 U	0.468 U	6.69	0.536 U	0.527	2
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	10.1	10.9	16.9	303	24.6	23.3	96
Pyrene	mg/kg	NA	110,000	650	NE	NL	30.7	31.5	51.8	719	100	62.3	443
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**32.58**	**33.3**	**58.08**	**1,209.95**	**152.3**	**46.1**	**547.46**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	48.48	51	76.8	**910.19**	**152.05**	**106.46**	**613.65**
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**203.25**	**208.12**	**339.9**	**5,872.6**	**1,101.10**	**318.75**	**2,556.90**
Polychlorinated Biphenyls (PCBs)													
Aroclor 1016	mg/kg	NA	250	NE	NE	NL	0.0537 U	0.0116 U	0.0584 U	0.0096 U	0.0618 U	0.0103 U	0.0253 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NL	0.0537 U	0.0116 U	0.0584 U	0.0096 U	0.0618 U	0.0103 U	0.0253 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NL	0.0537 U	0.0116 U	0.0584 U	0.0096 U	0.0618 U	0.0103 U	0.0253 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NL	0.0569	0.0345	0.084	0.0096 U	0.0618 U	0.0103 U	0.0253 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NL	0.0537 U	0.0116 U	0.0584 U	0.0096 U	0.403	0.0103 U	0.0253 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NL	0.158	0.135	0.06	0.0262	0.0618 U	0.255	0.0426
Aroclor 1260	mg/kg	NA	66	NE	NE	NL	0.147	0.131	0.0584 U	0.0177	0.584	0.253	0.0931
Aroclor 1262	mg/kg	NA	NL	NE	NE	NL	0.0537 U	0.0116 U	0.0584 U	0.0096 U	0.0618 U	0.0103 U	0.0253 U
Aroclor 1268	mg/kg	NA	NL	NE	NE	NL	0.222	0.0116 U	0.0837	0.0244	2.99	0.32	0.291
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.58	0.3	0.23	0.07	**3.98**	**0.83**	0.43
Metals													
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	16,600	18,600	21,300	6,810	90,500	24,000	59,000
Arsenic	mg/kg	20	88	2.9	7.61	132	5.2	6.89	**8.96**	1.76	**27.7**	**17.1**	**11**
Cadmium	mg/kg	2	3,500	0.69	0.81	14	**2.62**	**3.36**	**3.74**	**0.822**	**15.2**	**5.03**	**10.8**
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	39.4	45.6	52.4	15	**72.2**	**81.5**	39.2
Copper	mg/kg	NA	140,000	280	28.4	217	63.3	56.7	104	78.1	53.3	143	58.5
Lead	mg/kg	1,000	NE	3,000	13.1	118	16.1	33.2	25.7	33.1	**160**	83.3	41.2
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.0487	0.947 U	0.973	0.226	1.07	0.867	1.01
Nickel	mg/kg	NA	70,000	130	24.54	980	44.4	58.9	107	12.7	**541**	128	**188**
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	**1.22**	1.18 U	**1.22**	**1.09**	**3.07**	**1.08**	**1.26**
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	**499**	**590**	**646**	**367**	**499**	**1,020**	**566**
Total Petroleum Hydrocarbons (TPHs)													
Gasoline Range Organics	mg/kg	100	NE	NA	NA	1,000	6.27 U	7.73 U	5.51 U	7.73 U	10.8 U	4.8 U	6.73 U
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	486 U	438 U	482 U	438 U	529 U	439 U	506 U
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	**2,330**	1,820	**2,430**	**24,500**	**6,830**	**2,280**	**11,000**

Notes:

NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for in the summation process.
U	Chemical was not detected. The associated value represents the method reporting limit.
TTEC cPAH (calc)	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.



CB17 - Sediment

RI 11/12/16

Fluoride (mg/kg)	149
TTEC PAH (mg/kg)	32.58
Total HMW PAH (mg/kg)	203.25
Cadmium (mg/kg)	2.62
Selenium (mg/kg)	1.22
Zinc (mg/kg)	499
RRO (mg/kg)	2,330

CB17D - Sediment

RI 11/12/16

TTEC PAH (mg/kg)	33.3
Total HMW PAH (mg/kg)	208.25
Cadmium (mg/kg)	3.36
Zinc (mg/kg)	590

CB1L1 - Sediment

RI 11/12/16

TTEC PAH (mg/kg)	58.08
Total HMW PAH (mg/kg)	339.9
Arsenic (mg/kg)	8.96
Cadmium (mg/kg)	3.74
Selenium (mg/kg)	1.22
Zinc (mg/kg)	646
RRO (mg/kg)	2,430

CB2L3 - Sediment

RI 11/12/16

Fluoride (mg/kg)	1,330
TTEC PAH	152.3
Total LMW PAH (mg/kg)	152.05
Total HMW PAH (mg/kg)	1,101.10
Total PCBs (mg/kg)	3.98
Arsenic (mg/kg)	27.7
Cadmium (mg/kg)	15.2
Chromium (mg/kg)	72.2
Lead (mg/kg)	160
Nickel (mg/kg)	541
Selenium (mg/kg)	3.07
Zinc (mg/kg)	499
RRO (mg/kg)	6,830

CB4L13 - Sediment

RI 11/12/16

Fluoride (mg/kg)	254
TTEC PAH (mg/kg)	547.46
Total LMW PAH (mg/kg)	613.65
Total HMW PAH (mg/kg)	2,556.90
Arsenic (mg/kg)	11
Cadmium (mg/kg)	10.8
Nickel (mg/kg)	188
Selenium	1.26
Zinc (mg/kg)	566
RRO (mg/kg)	11,000

CB1L14 - Water

RI 11/21/16	
Fluoride (mg/L)	35
TTEC PAH (μg/L)	10.5
RI 3/14/17	
Fluoride (mg/L)	105
TTEC PAH (μg/L)	3.28

CB3L14 - Sediment

RI 11/12/16

Fluoride (mg/kg)	942
TTEC PAH (mg/kg)	46.1
Total LMW PAH (mg/kg)	106.46
Total HMW PAH (mg/kg)	318.75
Total PCBs (mg/kg)	0.83
Arsenic (mg/kg)	17.1
Cadmium (mg/kg)	5.03
Chromium (mg/kg)	81.5
Selenium (mg/kg)	1.08
Zinc (mg/kg)	1,020
RRO (mg/kg)	2,280

CB2L8A - Water

RI 11/21/16	
Fluoride (mg/L)	50
TTEC PAH (μg/L)	7.3
RI 3/14/17	
Fluoride (mg/L)	79
TTEC PAH (μg/L)	8.48

CB2L23 - Sediment

RI 11/12/16

TTEC PAH (mg/kg)	1,209.95
Total LMW PAH (mg/kg)	910.19
Total HMW PAH (mg/kg)	5,872.60
Cadmium (mg/kg)	0.822
Selenium (mg/kg)	1.09
Zinc (mg/kg)	367
RRO (mg/kg)	24,500

Source: Goldendale Aluminum Company, Plant Drawing A1/1752, "Underground Storm & Sanitary Sewer Piping W/Chem'l & Oil Str'g Areas"

Legend

○	Storm Drain Catch Basin
●	Storm Drain Manhole
▫	Storm Drain Clean Out

RRO	TPH-Dx as Residual Range Organics
RI	Initial RI Phase
WPA	WPA Phase

Soil Screening Levels

red	Exceeds MTCA Method C
blue	Exceeds Protection of Groundwater
purple	Exceeds Ecological-Wildlife

Water Screening Levels

red	Exceeds MTCA Method C
green	Exceeds WA MCL

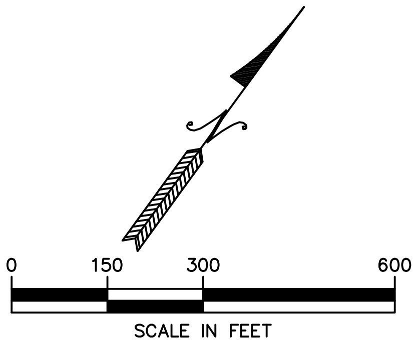


Figure 2.5.1-3

Plant Area AOC

Stormwater Collection System
Sediment and Water Sample Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

screening level in six out of seven samples and exceeds the ecological wildlife screening level in one sample. Nickel exceeds the protection of groundwater screening level in one out of seven samples. Selenium exceeds the ecological wildlife screening level in six out of seven samples. Zinc exceeds the ecological wildlife screening level in all samples analyzed.

Only TPH-Dx as residual range organics exceeded MTCA Method A Industrial and the ecological wildlife screening level of 2,000 mg/kg. Residual range organics was detected at concentrations up to 11,000 mg/kg in six out of seven samples.

Water samples were collected from the stormwater system at locations that would characterize stormwater collected from the western portion of the plant production area, at CB2L8A, and from the eastern portion of the plant production area, at CB1L14. These two catch basins were sampled during spring and fall seasons during 2016 and 2017 (Figure 2.5.1-3). The water samples were analyzed for free cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Gx, and TPH-Dx. Water analytical results are summarized on Table 2.5.1-4 (PAAOC Stormwater Collection System RI Water Results Summary). Water data are compared to MTCA Method A, MTCA Method B, MTCA Method C, and Washington State MCL screening levels. Natural background concentrations for the site were used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendix H-2, and data validation reports are included in Volume 5, Appendix I-2. All samples were collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The reporting limit objectives have been met.

All water sample analytical results that exceed Plant Area AOC screening levels are shown on Figure 2.5.1-3. Results indicate that free cyanide, PCBs, metals, TPH-Gx, and TPH-Dx were detected at concentrations that do not exceed water screening levels. Fluoride was detected in both water samples (CB2L8A and CB1L14) that ranged in concentrations from 35 to 105 mg/L that exceed MTCA Method C and WA MCL screening levels. Even though protections were put into place around catch basins after they were cleaned in 2011, demolition continued, and additional contamination may have been introduced into the system from the surface. Concentrations of fluoride detected in shallow soil in Courtyard Segment A5, along stormwater line 15 which drains to stormwater CB1L14, ranged from 340 to 2,300 mg/kg (Figure 2.3.5-1 in Section 2.3.5) and could be the source of elevated concentrations of fluoride detected in water at CB1L14. Water sample locations in catch basins CB2L8A and CB1L14 are located prior to the comingling of stormwater and groundwater in Line 5 at MH4L5 and MH5L5, respectively. Comingled groundwater and

Table 2.5.1-4
PAAOC Stormwater Collection System Water Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels						RI Analytical Results			
Parameter Name	**Units**	**MTCA Method A**	**MTCA Method B**	**MTCA Method C**	**WA MCL**	**Natural Background**	**SWMU32-SW-STW-1L14 (11/11/2016)**	**SWMU32-SW-STW-1L14 (3/14/2017)**	**SWMU32-SW-STW-2L8A (11/11/2016)**	**SWMU32-SW-STW-2L8A (3/14/2017)**
Aluminum Smelting										
Cyanide, Free	mg/L	NE	0.01	0.022	0.02	ND	0.005 U	0.0059	0.006	0.0056
Fluoride	mg/L	NE	0.96	2.1	4	0.72	**35**	**105**	**50**	**79**
Sulfate	mg/L	NE	NE	NE	250	32	43	4	36	3
Polynuclear Aromatic Hydrocarbons (PAHs)										
1-Methylnaphthalene	ug/L	NA	1.5	15	NE	NE	0.0381 U	0.105 U	0.0381 U	0.0755 U
2-Methylnaphthalene	ug/L	NL	32	70	NE	NE	0.0381 U	0.105 U	0.0381 U	0.0755 U
Acenaphthene	ug/L	NA	960	2100	NE	NE	0.187	0.0319	0.0508	0.0227
Acenaphthylene	ug/L	NA	NE	NE	NE	NE	0.0539	0.0526 U	0.019 U	0.053
Anthracene	ug/L	NA	4,800	11000	NE	NE	0.689	0.203	0.406	0.956
Benzo(a)anthracene	ug/L	NL	NL	NL	NE	NE	4.96	1.89	5.89	7.67
Benzo(a)pyrene	ug/L	0.1	0.023	0.88	0.2	NE	6.84	1.61	3.15	2.1
Benzo(b)fluoranthene	ug/L	NL	NL	NL	NE	NE	16.6	8.31	20.8	35.1
Benzo(g,h,i)perylene	ug/L	NA	NE	NE	NE	NE	6.95	3.07	4.52	6.97
Benzo(k)fluoranthene	ug/L	NL	NL	NL	NE	NE	4.52	1.99	5.18	7.26
Chrysene	ug/L	NL	NL	NL	NE	NE	10.6	5.67	23.4	33.1
Dibenzo(a,h)anthracene	ug/L	NL	NL	NL	NE	NE	1.82	0.753	1.66	2.37
Dibenzofuran	ug/L	NL	NL	NE	NE	NE	0.0579	0.0526 U	0.03	0.0262
Fluoranthene	ug/L	NA	640	1,400	NE	NE	9.83	3.34	12	14.8
Fluorene	ug/L	NA	640	1,400	NE	NE	0.101	0.0526 U	0.0354	0.0295
Indeno(1,2,3-cd)pyrene	ug/L	NL	NL	NL	NE	NE	7.6	3.19	5.65	8.08
Naphthalene	ug/L	160	160	350	NE	NE	0.0381 U	0.105 U	0.0381 U	0.0755 U
Phenanthrene	ug/L	NA	NE	NE	NE	NE	1.8	0.535	1.49	1.69
Pyrene	ug/L	NA	480	1,100	NE	NE	9.24	3.02	9.57	12.3
TTEC cPAH (calc)	ug/L	0.1	0.2	0.2	NE	NE	**10.5**	**3.28**	**7.3**	**8.48**
Polychlorinated Biphenyls (PCBs)										
Aroclor 1016	ug/L	NA	1.1	2.5	NE	ND	0.0381 U	0.0472 U	0.0381 U	0.0971 U
Aroclor 1221	ug/L	NA	NE	NE	NE	ND	0.0381 U	0.0472 U	0.0381 U	0.0971 U
Aroclor 1232	ug/L	NA	NE	NE	NE	ND	0.0476 U	0.0472 U	0.0381 U	0.0971 U
Aroclor 1242	ug/L	NA	NE	NE	NE	ND	0.0381 U	0.0472 U	0.0381 U	0.163
Aroclor 1248	ug/L	NA	NE	NE	NE	ND	0.0381 U	0.0472 U	0.0381 U	0.0971 U
Aroclor 1254	ug/L	NA	0.044	0.44	NE	ND	0.0381 U	0.0472 U	0.0381 U	0.0971 U
Aroclor 1260	ug/L	NA	0.044	0.44	NE	ND	0.0381 U	0.0472 U	0.0381 U	0.0971 U
Total PCBs (calc)	ug/L	0.1	0.044	0.44	0.5	ND	0.0381 U	0.0472 U	0.0381 U	**0.163**
Metals										
Aluminum	mg/L	NE	16	35	NE	1.14	4.8	0.874	1.27	1.9
Arsenic	mg/L	0.005	0.000058	0.000583	0.01	0.0069	0.00239	0.00123	0.00201	0.00274
Cadmium	mg/L	0.005	0.008	0.0175	0.05	NE	0.00102	0.000311	0.000689	0.000844
Chromium	mg/L	0.05	24	53	0.1	0.03	0.00771	0.00178	0.00266	0.00388
Copper	mg/L	NE	0.64	1.4	13	NE	0.0111	0.00272	0.0104	0.0112
Lead	mg/L	0.015	NE	NE	0.015	0.00046	0.00394	0.00104	0.00804	0.0066
Mercury	mg/L	0.002	NE	NE	0.002	NE	0.00008 U	0.00008 U	0.00008 U	0.0000773
Nickel	mg/L	NA	0.000096	0.00096	0.1	0.065	0.0219	0.00858	0.0133	0.0348
Selenium	mg/L	NA	0.08	0.18	0.05	NE	0.001 U	0.00213	0.001 U	0.00233
Zinc	mg/L	NA	4.8	11	NE	NE	0.118	0.0318	0.0975	0.106
Total Petroleum Hydrocarbons (TPHs)										
Gasoline Range Organics	mg/L	1	NE	NE	NE	NE	0.1 U	0.1 U	0.1 U	0.1 U
Diesel Range Organics	mg/L	0.5	NE	NE	NE	NE	0.19 U	0.189 U	0.19 U	0.204
Residual Range Organics	mg/L	0.5	NE	NE	NE	NE	0.381 U	0.285	0.381 U	**0.71**

Notes:

J	Estimated concentration.
MCL	Maximum Contaminant Level.
NA	Not Analyzed
ND	Not detected.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
U	Chemical was not detected. The associated value represents the method reporting limit.

Detected concentrations shown in **bold** exceed one or more site groundwater screening levels.

stormwater in Line 5 eventually connects with the stormwater pond from the north via manhole MH5L5. PAH as TTEC was detected in all water samples at calculated concentrations up to 10.5 mg/L that exceeds all of the considered water screening levels.

2.5.1.3.3 Video Survey

As part of the initial RI, a video survey of selected segments of stormwater lines was completed from March 13 through 15, 2017. The video survey was performed to evaluate the sources of water in the lines and discharging to Pond A, construction materials, integrity of pipes, and the presence of sediment. The survey was completed using a Rausch steerable four-wheel drive L 135 Tractor with an electric lift and camera to allow for continuous monitoring and recording. The video survey was limited by pipe diameter, presence of water, and thickness of accumulated sediment. Video clips of selected sections of stormwater lines are listed in Table 2.5.1-5 under column headings Survey Start Point and Survey End Point. The sections of stormwater lines videoed are shown on Figure 2.5.1-4. Video clips of selected line segments are included in Volume 5, Appendix G-2. In the following section, discussions of specific video clips are noted with a parenthetical citation: (2017 video CB-3 to CBBB). All tables, figures, and video survey clips of the selected line segments described below should be referenced while reviewing this section.

Stormwater catch basin CB-3, located north of the SPL Handling Containment Building (SWMU 16), and east of the former scrubber recycling system, was video surveyed in an 8-inch polyvinyl chloride (PVC) line segment to the east towards CBBB (not on plant drawings) (Figure 2.5.1-4). Numerous other PVC line segments were observed connected with the 8-inch PVC horizontal line prior to meeting with CB-3. The video survey confirmed that stormwater, and possibly wastewater associated with the scrubber recycling system, flowed west from CBBB through an 8-inch PVC horizontal line segment into CB-3 (2017 video CB-3 to CBBB). CB-3 was then video surveyed to the west via an 18-inch concrete line segment to confirm the connection to CB-4 via (2017 video CB-3 to CB-4).

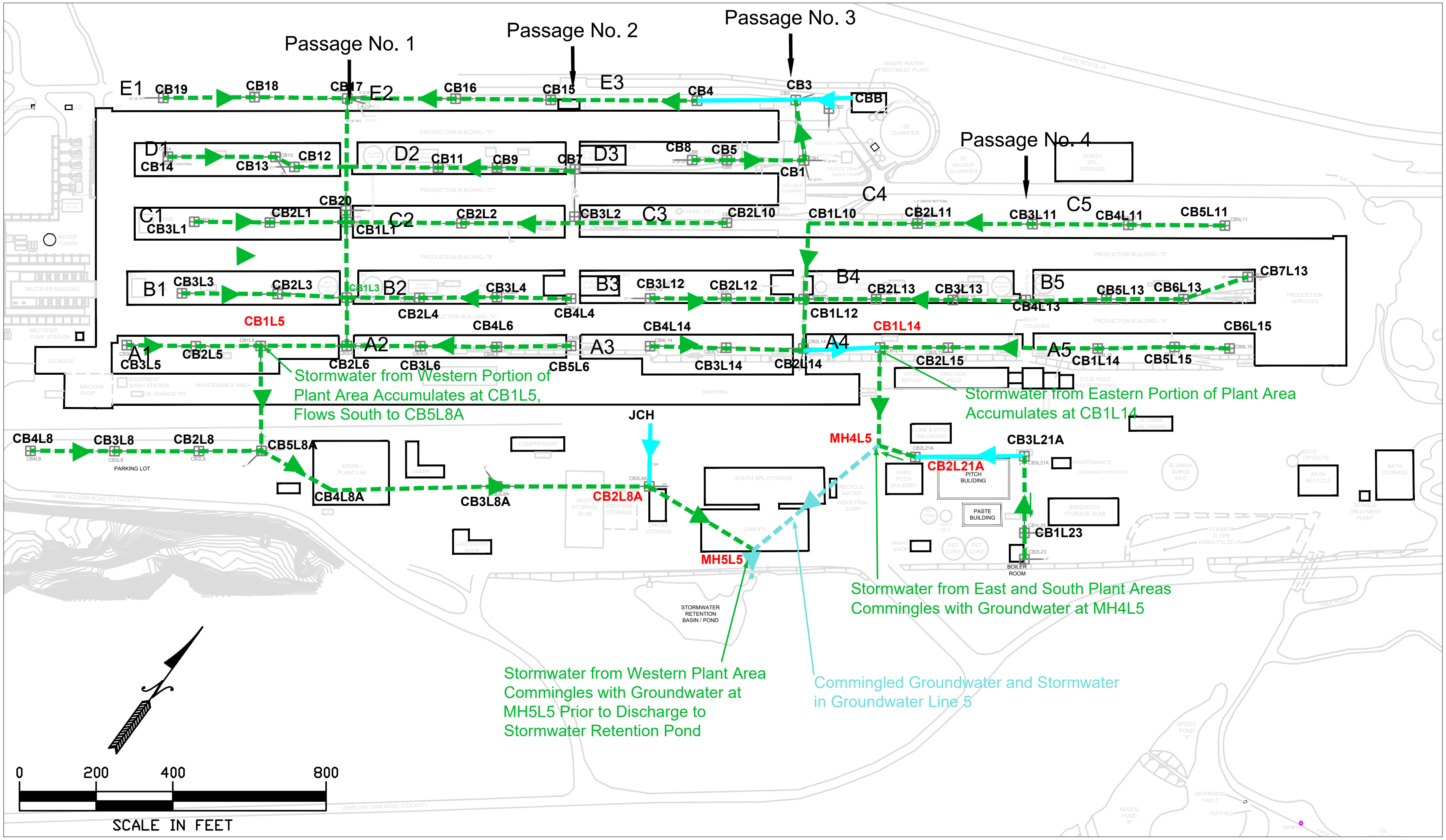
Stormwater catch basin CB2L14, located atop passage no. 3 at the southern end between courtyard segments A3 and A4, was video surveyed to the east to confirm connection to CB1L14 in courtyard A4 (Figure 2.5.1-4). The video survey confirmed connection from CB2L14 to CB1L14 via a 36-inch horizontal concrete pipe segment (2017 video CB2L14 to CB1L14). Debris and water were observed in the horizontal pipe segment for approximately 115 ft and standing water was observed in the vault at the end of the video clip in CB1L14.

Table 2.5.1-5
PAA0C Stormwater Collection System 2017 Video Survey Results
Columbia Gorge Aluminum Smelter, Goldendale Wasghington

Survey Start Point	Survey End Point	Survey Distance (Ft)	Horizontal Pipe Size and type	Water Present (Y/N)	Sediment Present (Y/N)	Survey Description and Comments
CB-3	CBBB	148.6	8-inch PVC pipe	N	N	Survey completed to the east to confirm connection with CBBB near the scrubber recycling building.
CB-3	CB-4	252.1	18-inch concrete pipe	N	N	Survey completed to the west to confirm connection with CB4 north of the SPL Handling Containment Building (SWMU 16) in the Crucilble Cleaning Room Investigation Area.
CB2L14	CB1L14	194.3	36-inch concrete pipe	Y	N/A	Survey completed to the east to confirm connection with CB1L14. Stormwater from the eastern portion of the site accumulates at CB1L14.
CB2L8A	JCH	161	10-inch CMP	N	N	Survey completed to the north to confirm connection with JCH north of the Dross Storage Building.
CB2L23	CB1L23	0	8-inch concrete pipe	Y	Y	Survey could not be completed but lines were verified to connect near Paste Plant Building.
CB2L21A	CB3L21A	194.6	10-inch concrete pipe	Y	Y	Survey completed 194.6 feet to the east but was terminated because of blockage in line.

Notes:

Y	Yes
N	No
NA	Not Applicable



Legend

Naming Convention:

CBB	Catch Basin Not Labeled on Drawing A1/1752
CB19	Catch Basin #19 (No Line #)
CB3L1	Catch Basin #3 Along Line #1
A1	Courtyard Segment A1
CB2L6	Key Catch Basin in Red

Lines Inspected Are Color-Coded by Piping System As Follows:

Green = Stormwater Collection System

Blue-Gray = Groundwater Line with Commingled Stormwater

◀	Direction of Water Flow Within Pipe Segment
━━	Line Segment Video Inspected
- - -	Line Segment Not Video Inspected; Assumed Connection Based on Drawings and Visual Evidence
- - -	Commingled Groundwater and Stormwater Line Not Video Inspected

Figure 2.5.1-4

Plant Area AOC

Stormwater Collection System
Video Survey Locations and Observations

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Stormwater catch basin CB2L8A, located to the west of the South SPL Storage Building (SWMU 15) and north of the Dross Storage Building, was video surveyed to determine additional connections to the horizontal line segment and to see if this horizontal line connected to the existing horizontal groundwater line at MH5L5 (Figure 2.5.1-4). The stormwater line segment was surveyed to the north from CB2L8A towards JCH (not on plant drawings) and confirmed the connection via a 10-inch corrugated metal pipe as a storm drain cleanout located along the paved access road (2017 video CB2L8A to JCH). A video survey to the southeast to determine connection to MH5L5 could not be completed due to standing water downstream from CB2L8A.

Stormwater catch basins were video surveyed in the southeast portion of the site, around the previous paste plant, pitch building, and associated boiler room. The investigation of these horizontal pipe segments was to determine if the catch basins are connected to Groundwater Collection System line 5 at manhole MH4L5. CB2L23, located by the former paste plant building in the southeast portion of the plant area, could not be videoed due to presence of debris but was visually confirmed to connect north towards CB1L23 and further north to CB3L21A (Figure 2.5.1-4). It should be noted that a PVC pipe with two 90-degree bends was observed that appears to have previously drained from the paste plant boiler room to CB2L23 to the east. The only portion of horizontal line segments video surveyed in the southeast portion of the site was from CB2L21A to CB3L21A (2017 video CB2L21A to CB3L21A). Standing water was observed in the line segment for approximately 40 ft and then debris and hardened sediment was observed in the line until the video ended at 194 ft. Additionally, CB2L21A was visually observed connecting to groundwater manhole MH4L5 via an approximately 10-inch concrete pipe approximately 3 ft bgs.

2.5.1.4 Initial RI Phase Conclusions

Seven sediment and four water samples were collected during the initial RI phase of investigation. Sediment analytical results indicate that fluoride, PAHs as TTEC, LMW, HMW, total PCBs, several metals, and residual range organics exceed site screening levels in all samples analyzed. The catch basins sampled during the initial RI phase were not cleaned in 2011 and the sediment data indicate high concentrations of COPCs remain in some portions of the Stormwater Collection System. This presents the potential for recontamination in other parts of the system as well as potential discharge of particulate and dissolved COPCs to the Stormwater Retention Pond. COPCs have likely been introduced into the Stormwater System primarily from surface soil surrounding individual catch basins. As discussed in the previous section, various sources of contamination from plant operations have impacted surface soil in courtyard segments (Section 2.3.5). COPCs may have been introduced into catch basins through use of courtyards for movement of mobile equipment during plant operations, or through heavy demolition equipment movement along courtyards as production building demolition proceeded. The courtyards were closed areas, exposed soil surrounded by tall production buildings, so the most likely source of contaminants that occur in the stormwater catch basins and lines would be surface soil surrounding the catch basins.

Water analytical results indicate that fluoride and PAH as TTEC are present in stormwater catch basins CB1L14A and CB2L8A at concentrations that exceed MTCA Method C and WA MCL for fluoride and MTCA Method C for PAH as TTEC. The stormwater is discharged to the Stormwater Retention Pond. This is discussed further in the Groundwater in the Uppermost Aquifer AOC (Volume 4, Section 2).

Stormwater Collection System conditions and connections with other systems based on site drawings, visual inspections, topography, the size of the pipes, and video survey are summarized in bullets below:

- Stormwater, and possibly wastewater, may have flowed from the scrubber recycling system into the stormwater system at CB-3 near the former SPL Handling Containment Building (SWMU 16).
- Manhole MHA was originally thought to connect to the Stormwater System, but no such connection was found. (During additional 2020 video surveying for the I&M System, manhole MHA was found to be a manhole connected to the I&M System).
- A PVC pipe with two 90-degree bends was observed that appears to have previously drained potential wastewater from the paste plant boiler room east to CB2L23.
- Accumulated stormwater in CB1L14 flows south from courtyard A4 to comingle with groundwater at manhole MH4L5.
- Accumulated stormwater in CB2L21A flows west from the paste plant area to connect with the groundwater manhole MH4L5.
- Accumulated stormwater in CB2L8A flows southeast and connects to groundwater manhole MH5L5.
- The comingled water in the Stormwater Retention Pond backs up into the Groundwater Collection System line 5 manholes MH5L5, MH4L5, and MH3L5 and into stormwater catch basins CB2L8A and CB1L14 when the pond reaches a full capacity.

2.5.1.5 WPA Phase Investigation Scope

No data gaps were identified for the Stormwater Collection System, based on Ecology and Yakama Nation Draft RI Report review comments (Ecology and Yakama Nation 2019). Accordingly, no investigation was conducted during the WPA phase of investigation.

2.5.1.6 RI Conclusions and Recommendations of the Stormwater Collection System

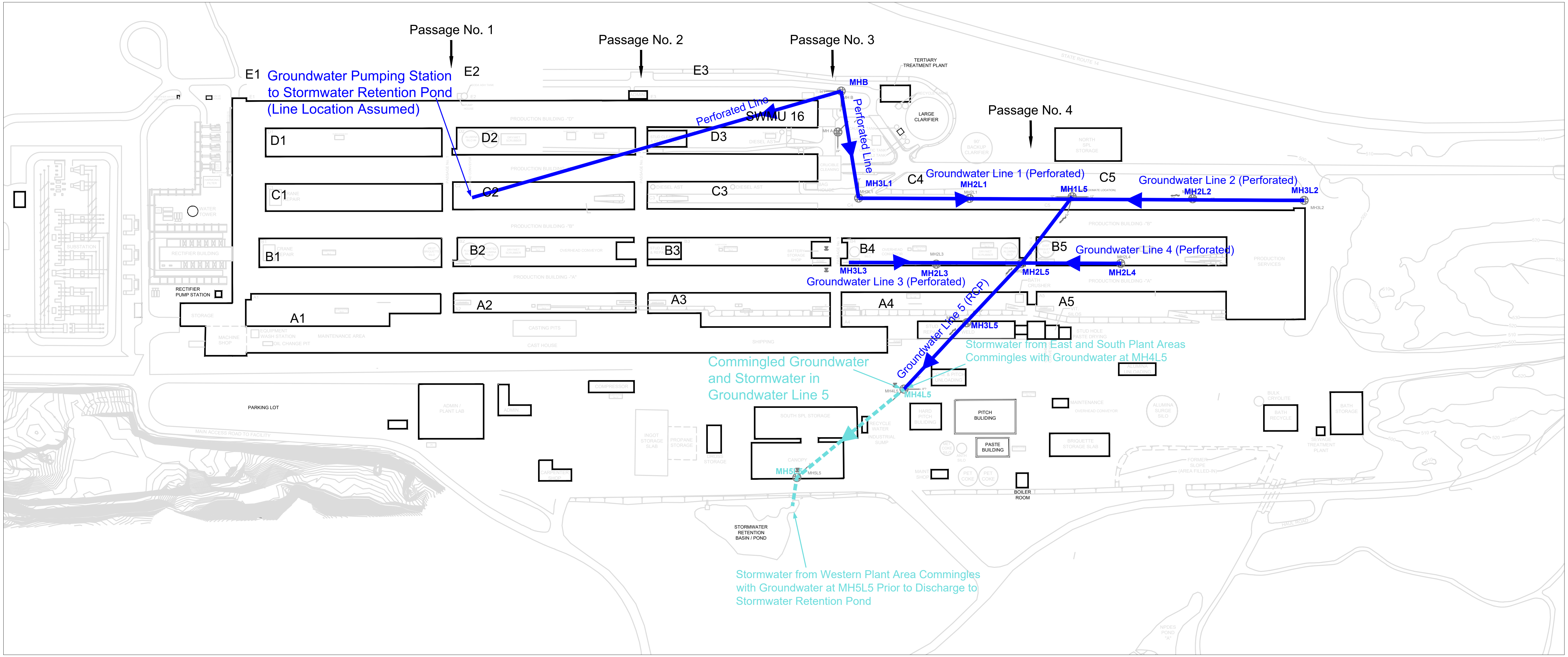
Sediment and water present in the Stormwater Collection System contain site COPCs at concentrations that exceed soil and water screening levels. The source of COPCs in Stormwater System sediment and water samples is likely the impacted surface soil that surrounds each catch basin in the enclosed courtyard areas. These detected compounds have the potential to migrate through the Stormwater Collection System and into the Stormwater Retention Pond where there is further potential for impact to shallow groundwater beneath the Stormwater Retention Pond. Video survey results indicate that the Stormwater Collection System connects to the Groundwater Collection System at groundwater manholes MH4L5 and MH5L5, where stormwater commingles with collected groundwater before discharging to the Stormwater Retention Pond.

The Stormwater Collection System is recommended for further evaluation in the FS to address sediment contamination in catch basins and horizontal lines. The Stormwater Collection System may also act as a preferential pathway for contaminate transport.

2.5.2 Groundwater Collection System

The Groundwater Collection System consists of a series of manholes with horizontal lines between manholes (Figure 2.5.2-1). The Groundwater Collection System is present in the Tertiary Treatment Plant area beginning at manhole MHB, in Courtyard Segments C4 and C5, then as a diagonal line from Courtyard Segment C5 that extends southwest to MH5L5, and to the discharge point at the Stormwater Retention Pond. A southwest diagonal line extends between manhole MHB and a pump station at the west end of Courtyard Segment C2.

Horizontal pipes in the Groundwater Collection System consist of reinforced concrete pipe that become larger in diameter with proximity to the Stormwater Retention Pond. Portions of the line segments connecting from manhole MHB to the west towards the stormwater pumping station and south to MH1L3 in western portion of Courtyard Segment C4 are perforated. All groundwater line



Source: Goldendale Aluminum Company, Plant Drawing A1/1752, "Underground Storm & Sanitary Sewer Piping W/Chem'l & Oil Str'g Areas"

Legend

Naming Convention:

MHB	Manhole #B Not Labeled on Drawing A1/1752
MH1L5	Manhole #1 Along Line #5
A1	Courtyard Segment A1

Lines Are Color-Coded by Piping System As Follows:

Blue = Groundwater Collection System
Blue-Gray = Commingled Groundwater and Stormwater Line 5 Segment

◀	Direction of Water Flow Within Pipe Segment
—	Line Segment
- - -	Commingled Groundwater and Stormwater Line 5 Segment

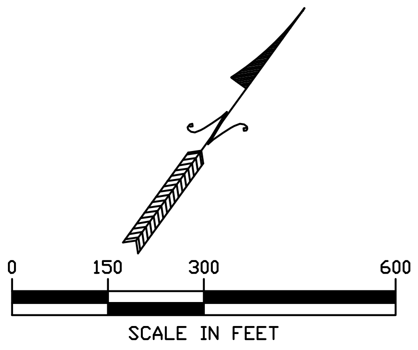


Figure 2.5.2-1

Plant Area AOC

Groundwater Collection System
System Layout

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

segments located in Courtyard Segments C4, C5, B4, and B5 are also perforated. Groundwater Line 5 connecting from MH1L5 in Courtyard Segment C5 to MH5L5 north of the stormwater retention pond is reinforced concrete piping.

Historically, groundwater collected at manhole MHB, located north of the SPL Handling Containment Building (SWMU 16), flowed west through a 36-inch perforated corrugated metal pipe to a groundwater pumping station located in courtyard C2. The pumping station previously pumped water from a holding tank, located beneath the pumping station that was dismantled in approximately 2010, to the stormwater retention pond. The pump and line are no longer operable; however, water was observed in the holding tank beneath the pumping station. Water was not present in the perforated corrugated metal pipe between manhole MHB and the former pump station, but sediment was observed in the line segment. Manhole MHB also connected to an 18-inch corrugated metal pipe extending southeast to MH3L1, located in the western portion of courtyard C4. This line segment sits approximately 2 feet above the perforated corrugated metal pipe connecting to the groundwater pumping station and is currently dry and contains no water.

Groundwater line 2, located in Courtyard Segments C4 and C5, is a 24-inch perforated corrugated metal pipe that collects groundwater originating from spring activity along the northern boundary of the plant footprint (Figure 2.5.2-1). Groundwater in line 2 flows to the west from MH2L2 to MH1L5 where line 2 connects to groundwater collection line 5. No water is present at the head of line 2 in MH3L2 to the west and no water was observe flowing east into MH1L5. Flow from MH1L5 is through a 30-inch non-reinforced concrete line segment that extends diagonally to the southwest through MH2L5, where perforated east-west lines 3 and 4 connect. No water was observed flowing into groundwater line 5 from groundwater lines 3 and 4 as they are both above the groundwater table. The 30-inch non-reinforced concrete line segment extends through MH3L5, to MH4L5, through MH5L5, and then groundwater discharges to the Stormwater Retention Pond. The line from MH1L5 to MH4L5 is a non-reinforce concrete line and is not perforated. At MH4L5, the Stormwater Collection System joins groundwater line 5 and commingled stormwater flows from MH5L5, where commingled stormwater joins before discharge to the Stormwater Retention Pond.

2.5.2.1 Previous Investigations of Groundwater Collection System

No previous investigation was conducted for the Groundwater Collection System prior to issuance of the Agreed Order (Ecology 2014).

2.5.2.2 Initial RI Phase Investigation Scope

The Groundwater Collection System was investigated during the initial RI phase of investigation in 2016 and 2017. Investigation objectives described in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) are as follows:

- **System identification** to locate, inspect, and document status of all manholes. Inspection results were used to identify locations for sample collection and horizontal pipe segments for video survey.
- **Collection of Water Samples** in selected manholes to further characterize presence of COPCs in groundwater flowing in the Groundwater Collection System. Flow measurements were also conducted at the time water samples were collected. Flow measurements of water depth were made at groundwater manhole MH1L5 for use with the Manning Equation for calculation of flow in a partway filled pipe. Additional information regarding slope of line and diameter of pipe were obtained from site drawings. The resulting flow calculations are summarized in the Manning Equation memo dated July 7, 2021 (Volume 5, Appendix G-3). The calculated flow rate at MH1L5 is estimated at up to 30 gpm.
- **Conduct a video survey** of selected system horizontal line segments to determine connections between systems and to the Stormwater Retention Pond.

2.5.2.3 Initial RI Phase Investigation Results

The following sections describe the work performed to meet the objectives stated above. For clarity, the video survey conducted during the initial RI phase in 2017 is discussed together with the video survey conducted during the WPA phase in 2020 in Section 2.5.2.6.3.

2.5.2.3.1 System Identification

System identification was completed in 2016 consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). Results of the system identification were used to identify locations for water sampling, and system horizontal line segments for video surveying.

The Groundwater Collection System was located using historic site plans and engineering plans obtained from onsite plant construction files. All groundwater manholes were located by assessing its relative location on maps and drawings, comparing measured invert depths to surveyed depths on engineering plans, and comparing orientations of the manholes against the plans. Some manholes shown on plant maps could not be located or were buried and then excavated for inspection. Other manholes were found but were not previously identified onsite plans.

When each manhole was located, its position was recorded using a hand-held GPS unit, photos were taken of the manhole (exterior and interior), and the manhole was inspected by an engineer. Manhole inspection included size and orientation of horizontal pipes entering the manhole, integrity of the cover, ring and frame, barrel, shelf, and rungs, the presence of water and sediment, and if the groundwater manhole was sampled. System observations and measurements are summarized in Table 2.5.2-1.

Inspection of the Groundwater Collection System indicated standing water in the horizontal line segment from Manhole MHB, located to the north of the SPL Handling Containment Building (SWMU 16), to MH3L1 in courtyard C4. The perforated line segment from manhole MHB to the west contained some sediment in the manhole but not enough to sample, and no video survey was performed in 2017. No sediment or water samples were taken from the western portion of the groundwater collection system.

Inspection of the eastern portion of the Groundwater Collection System indicated flowing water is present in Line 2 in Courtyard Segment C5 in the perforated 24-inch line between MH2L2 and MH1L5. Even though standing water was observed in horizontal line segment from manhole MHB to MH3L1 in Courtyard C4 during the 2017 video survey, no water was observed flowing from the west to enter manhole MH1L5. Groundwater flows southwest from MH1L5 through a diagonal 30-inch non-reinforced concrete line connecting to MH5L5, where it is then discharged to the Stormwater Retention Pond. However, no sediment was present in this concrete horizontal line. Six water sampling locations were identified in the eastern portion of the groundwater collection system.

2.5.2.3.2 Collection of Samples in the Groundwater Collection System

During the initial RI phase, six water samples were collected from the Groundwater Collection System where water was present as determined by system identification. The water samples collected were analyzed for free cyanide, fluoride, sulfate, PAHs, PCBs, metals, VOCs, and TPH-Gx and TPH-Dx.

Water sample analytical results from the groundwater system lines are summarized in Table 2.5.2-2 (PAAOC Groundwater Collection System RI Groundwater Results Summary). Water data are compared to MTCA Method A, MTCA Method B, MTCA Method C, and Washington State MCL screening levels. Natural background concentrations for the site were used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5,

Table 2.5.2-1
PAAOC Groundwater Collection System Inspection Summary
Columbia Gorge Aluminum Smelter, Goldendale, Washington

MH No.	Line No.	Location Name	Invert Depth from Plans (Ft)	Invert Depth Measured (Ft)	Sediment Present	Water Present	Sampled	Photo Numbers	Comments
					Y/N	Y/N			
2	1	MH2L1	9.6	9' 4"	Y	N	NS	339-340(S)	Trace sediment and surface debris in MH.
3	1	MH3L1	8.4	8' 0"	Y	N	NS	341-342(N)	Buried. Trace sediment and surface debris in MH.
2	2	MH2L2	9.3	9' 0"	N	Y	11-10-16, W 6-26-19, W 5-11-21, W	337-338(S)	Buried. Active water flow to west. Perforated pipe upstream.
3	2	MH3L2	20.8	20' 4"	N	N	NS	334-336(S)	Buried. Appears to be dry.
2	3	MH2L3	10.9	10' 9"	Y	N	NS	343-344(S), 345-346	Very Dark Grayish black silt on measuring stick. 12-inch horizontal pipe to west.
3	3	MH3L3	6.1		N	N	NS		Could not locate.
2	4	MH2L4	11	10' 7"	Y	N	NS	347-351(S)	Dk. Gray silty sand on probe. Surface debris in MH.
1	5	MH1L5	9.7	9' 5"	N	Y	11-10-16, W 10-15-19, W 5-11-21, W	307-309(N)	Active water flow from the east, and no flow observed from west.
2	5	MH2L5	7.8	7' 0"	N	Y	11-10-16, W	299-300(S), 301(E),302(W), 304-306(S)	Active water flow from the northeast. Minor water contributions from east and west.
3	5	MH3L5	12	20' 0"	N	Y	11-10-16, W	292-295(N)	Active water flow from NE. Measured invert different from plans.
4	5	MH4L5	21.7	20' 11"	N	Y	11-10-16, W	284-288(N)	Standing water; outflow not visible, submerged. Water dripping from upper stormwater pipe CG2L21A.
5	5	MH5L5	22	22' 6"	Y	Y	11-10-16, W	289-291(N)	Standing water; outflow not visible, possibly submerged.
		MHB		20' 2"	Y	N	NS		Possible groundwater manhole MH#12. Sediment and possible connection to pump station located in western portion of Courtyard Segment C2.

Notes:

MH	Manhole.
Ft	Feet.
NS	Not sampled.
(N)(S)	Photograph view to north (N) or south (S)
S,W	Sediment or water sample.
Surface Debris	Includes large rocks, bricks, metal, lumber, plastic, and other debris dislodged at some time from ground surface into manhole.
Invert	Lowest point inside manhole.

Table 2.5.2-2
PAAOC Groundwater Collection System RI Groundwater Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels						RI Analytical Results					
Parameter Name	**Units**	**MTCA Method A**	**MTCA Method B**	**MTCA Method C**	**WA MCL**	**Natural Background**	**SWMU32-GW-GWC-1L5**	**SWMU32-GW-GWC-2L2**	**SWMU32-GW-GWC-2L5**	**SWMU32-GW-GWC-3L5**	**SWMU32-GW-GWC-4L5**	**SWMU32-GW-GWC-5L5**
Aluminum Smelting												
Cyanide, Free	mg/L	NE	0.01	0.022	0.2	ND	0.0093	0.009	0.0085	0.007	0.0063	0.0067
Fluoride	mg/L	NE	0.96	2.1	4	0.72	0.1 U	0.669	0.793	0.72	1.9	**4.98**
Sulfate	mg/L	NE	NE	NE	250	32	36.9	36	37.3	37	63	45.5
Polynuclear Aromatic Hydrocarbons (PAHs)												
1-Methylnaphthalene	ug/L	NL	1.5	15	NE	NE	0.0762 U	0.0762 U	0.125	1.19	0.18	0.0762 U
2-Methylnaphthalene	ug/L	NL	32	70	NE	NE	0.0762 U	0.0762 U	0.157	1.51	0.225	0.0762 U
Acenaphthene	ug/L	NA	960	2,100	NE	NE	0.654	0.0381 U	1.84	16.4	2.21	0.49
Acenaphthylene	ug/L	NA	NE	NE	NE	NE	0.0381 U	0.0381 U	0.0381 U	0.19 U	0.0381 U	0.0381 U
Anthracene	ug/L	NA	4,800	11,000	NE	NE	0.767	0.0381 U	1.64	14.3	2.52	0.437
Benzo(a)anthracene	ug/L	NL	NL	NL	NE	NE	5.8	0.327	13.4	107	25.6	3.83
Benzo(a)pyrene	ug/L	0.1	0.023	0.88	0.2	NE	8.83	0.516	22.5	161	37.4	6.29
Benzo(b)fluoranthene	ug/L	NL	NL	NL	NE	NE	14.4	0.873	32.6	234	55.4	10.4
Benzo(g,h,i)perylene	ug/L	NA	NE	NE	NE	NE	5.64	0.397	13.6	112	25.5	4.42
Benzo(k)fluoranthene	ug/L	NL	NL	NL	NE	NE	4.72	0.318	10.3	76.8	14.7	2.98
Chrysene	ug/L	NL	NL	NL	NE	NE	8.75	0.498	18.3	138	35.7	5.62
Dibenzo(a,h)anthracene	ug/L	NL	NL	NL	NE	NE	1.71	0.1	4.02	30.2	5.14	1.21
Dibenzofuran	ug/L	NL	NL	NE	NE	NE	0.156	0.0381 U	0.368	3.74	0.583	0.0842
Fluoranthene	ug/L	NA	640	1,400	NE	NE	9.36	0.493	22	176	47.3	5.77
Fluorene	ug/L	NA	640	1,400	NE	NE	0.303	0.0381 U	0.677	7.07	1.2	0.154
Indeno(1,2,3-cd)pyrene	ug/L	NL	NL	NL	NE	NE	6.47	0.436	17.4	120	27.2	4.88
Naphthalene	ug/L	160	160	350	NE	NE	0.113	0.0762 U	0.271	2.43	0.357	0.0762 U
Phenanthrene	ug/L	NA	NE	NE	NE	NE	3.27	0.157	7.52	67.5	11.1	1.94
Pyrene	ug/L	NA	480	1,100	NE	NE	8.49	0.463	20.5	158	42.1	5.39
TTEC cPAH (calc)	ug/L	0.1	0.2	0.2	NE	NE	**12.23**	**0.73**	**30.5**	**219.2**	**50.56**	**8.6**
Polychlorinated Biphenyls (PCBs)												
Aroclor 1016	ug/L	NA	1.1	3	NE	ND	0.0377 U	0.0377 U	0.0377 U	0.0377 U	0.0377 U	0.0377 U
Aroclor 1221	ug/L	NA	NE	NE	NE	ND	0.0377 U	0.0377 U	0.0377 U	0.0377 U	0.0377 U	0.0377 U
Aroclor 1232	ug/L	NA	NE	NE	NE	ND	0.0377 U	0.0377 U	0.0377 U	0.0377 U	0.0377 U	0.0377 U
Aroclor 1242	ug/L	NA	NE	NE	NE	ND	0.0377 U	0.0377 U	0.0377 U	0.0377 U	0.0377 U	0.0377 U
Aroclor 1248	ug/L	NA	NE	NE	NE	ND	0.0377 U	0.0377 U	0.0377 U	0.0377 U	0.0377 U	0.0377 U
Aroclor 1254	ug/L	NA	0.044	0.44	NE	ND	0.0377 U	0.0377 U	0.0377 U	0.0377 U	0.0377 U	0.0377 U
Aroclor 1260	ug/L	NA	0.044	0.44	NE	ND	0.0377 U	0.0377 U	0.0377 U	0.0377 U	0.0377 U	0.0377 U
Total PCBs (calc)	ug/L	0.1	0.044	0.44	0.5	ND	0.0377	0.0377	0.0377	0.0377	0.0377	0.0377
Metals												
Aluminum	mg/L	NE	16	35	NE	1.14	1.52	0.393	1.35	2.49	1.92	2.8
Arsenic	mg/L	0.005	0.000058	0.00058	0.01	0.0069	**0.00185**	**0.00109**	**0.00187**	**0.00374**	**0.0033**	**0.00223**
Cadmium	mg/L	0.005	0.008	0.018	0.05	NE	0.0000002 U	0.0000002 U	0.000443	0.000635	0.000624	0.00163
Chromium	mg/L	0.05	24	53	0.1	0.03	0.00206	0.00103	0.00471	0.00577	0.00486	0.0131
Copper	mg/L	NE	0.64	1.4	13	NE	0.00573	0.0028	0.00489	0.0115	0.00739	0.751
Lead	mg/L	0.015	NE	NE	0.015	0.0004632	0.00349	0.0021	0.00223	0.00542	0.00364	0.0198
Mercury	mg/L	0.002	NE	NE	0.002	NE	0.00008 U	0.00008 U	0.00008 U	0.00008 U	0.00008 U	0.00008 U
Nickel	mg/L	NA	0.000096	0.001	0.1	0.0651	0.00391	0.00149	0.0102	0.0185	0.0112	0.0156
Selenium	mg/L	NA	0.08	0.18	0.05	NE	0.001 U	0.001 U	0.001 U	0.001 U	0.0013	0.001 U
Zinc	mg/L	NA	4.8	11	NE	NE	0.428	0.041	0.0363	0.151	0.0713	0.67
Volatile Organic Compounds (VOCs)												
Benzene	ug/L	5	0.8	8	5	NE	NA	NA	NA	NA	NA	NA
Toluene	ug/L	1,000	640	1,400	1,000	NE	NA	NA	NA	NA	NA	NA
Ethylbenzene	ug/L	700	800	1,800	700	NE	NA	NA	NA	NA	NA	NA
m,p-Xylene	ug/L	1,000	1,600	3,500	10,000	NE	NA	NA	NA	NA	NA	NA
o-Xylene	ug/L	1,000	1,600	3,500	10,000	NE	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	ug/L	200	16,000	35,000	200	NE	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	ug/L	NE	16	35	70	NE	NA	NA	NA	NA	NA	NA
Tetrachloroethene	ug/L	5	21	110	5	NE	NA	NA	NA	NA	NA	NA
Trichloroethene	ug/L	5	0.54	8.8	5	NE	NA	NA	NA	NA	NA	NA
Vinyl Chloride	ug/L	0.2	0.029	0.29	2	NE	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (TPHs)												
Gasoline Range Organics	mg/L	1	NE	NE	NE	NE	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Diesel Range Organics	mg/L	0.5	NE	NE	NE	NE	0.19 U	0.19 U	0.189 U	0.189 U	0.189 U	0.19 U
Residual Range Organics	mg/L	0.5	NE	NE	NE	NE	0.381 U	0.381 U	**0.681**	**0.858**	**0.832**	0.381 U

Notes:

J	Estimated concentration.
MCL	Maximum Contaminant Level.
NA	Not Analyzed
ND	Not detected.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
U	Chemical was not detected. The associated value represents the method reporting limit.

Detected concentrations shown in **bold** exceed one or more site groundwater screening levels.

Appendix H-2, and data validation reports are included in Volume 5, Appendix I-2. All samples were collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). All reporting limit objectives were met for the six collected samples.

All sample analytical results for COPCs that exceed Plant Area AOC water screening levels are compiled and presented on Figure 2.5.2-2. Water analytical results indicate free cyanide, sulfate, PCBs, all metals except arsenic, VOCs, and TPH-Gx and TPH-Dx do not exceed Plant Area AOC water screening levels.

Fluoride was detected in one of the six collected samples at 4.98 mg/L which exceeds the Method C and WA MCL screening levels of 2.1 mg/L and 4.0 mg/L, respectively. PAHs as TTEC were detected in all six samples at concentrations that range from 0.73 to 219.2 µg/L which exceeds the MTCA Method C screening level of 0.2 µg/L. Benzo(a)pyrene was detected in all six samples at concentrations that range from 0.516 to 161 µg/L, which exceeds the WA MCL of 0.2 µg/L. Arsenic was detected in all six samples at concentrations that range from 0.00109 to 0.00374 mg/L that exceeds the MTCA Method C screening level of 0.00058 mg/L.

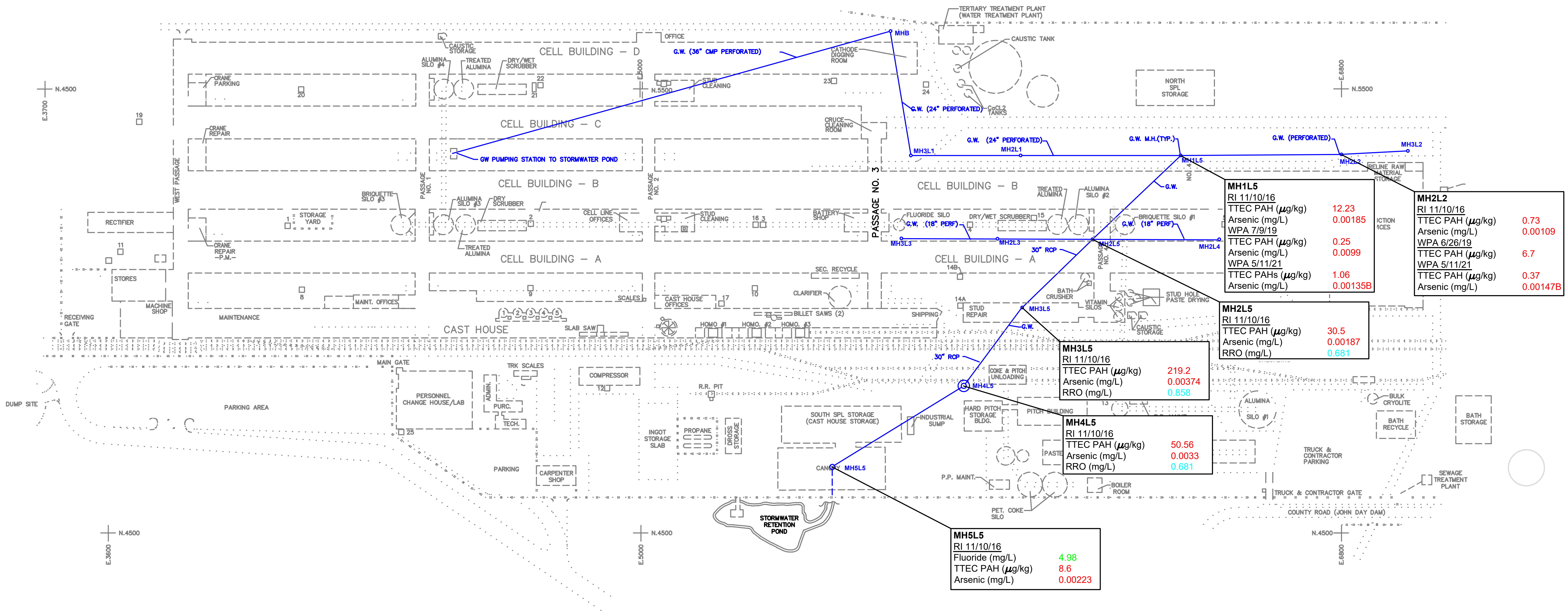
2.5.2.4 Initial RI Phase Investigation Conclusions

Results of the initial RI phase of investigation indicated that fluoride, PAHs as TTEC, and arsenic are present in groundwater flowing in the Groundwater Collection System in Courtyard Segment C5 and line 5 at concentrations that exceed both the MTCA Method C and WA MCL Plant Area AOC water screening levels.

Investigation of the Stormwater Collection System during the initial RI phase of investigation could not confirm whether the system was connected to another system at any other point than groundwater manholes MH4L5 and MH5L5. A data gap assessment, based on Ecology review of the Draft RI Report, resulted in identification of data gaps for the Groundwater Collection System to be addressed during the WPA phase of investigation.

2.5.2.5 WPA Phase Investigation Scope

The Groundwater Collection System was investigated during the WPA phase in 2020 and 2021. The objectives for the WPA phase of investigation were as follows.



MH1L5

RI 11/10/16	
TTEC PAH (µg/kg)	12.23
Arsenic (mg/L)	0.00185
WPA 7/9/19	
TTEC PAH (µg/kg)	0.25
Arsenic (mg/L)	0.0099
WPA 5/11/21	
TTEC PAHs (µg/kg)	1.06
Arsenic (mg/L)	0.00135B

MH2L2

RI 11/10/16	
TTEC PAH (µg/kg)	0.73
Arsenic (mg/L)	0.00109
WPA 6/26/19	
TTEC PAH (µg/kg)	6.7
WPA 5/11/21	
TTEC PAH (µg/kg)	0.37
Arsenic (mg/L)	0.00147B

MH2L5

RI 11/10/16	
TTEC PAH (µg/kg)	30.5
Arsenic (mg/L)	0.00187
RRO (mg/L)	0.681

MH3L5

RI 11/10/16	
TTEC PAH (µg/kg)	219.2
Arsenic (mg/L)	0.00374
RRO (mg/L)	0.858

MH4L5

RI 11/10/16	
TTEC PAH (µg/kg)	50.56
Arsenic (mg/L)	0.0033
RRO (mg/L)	0.681

MH5L5

RI 11/10/16	
Fluoride (mg/L)	4.98
TTEC PAH (µg/kg)	8.6
Arsenic (mg/L)	0.00223

Source: Goldendale Aluminum Company, Plant Drawing A1/1752, "Underground Storm & Sanitary Sewer Piping W/Chem'l & Oil Str'g Areas"

Legend

—	Ground Water Manhole
CMP	Corrugated Metal Pipe
PERF	Perforated Pipe
RCP	Reinforced Concrete Pipe
RRO	TPH-Dx as Residual Range Organics
RI	Initial RI Phase
WPA	WPA Phase

Water Screening Levels

cyan	Exceeds MTCA Method A
red	Exceeds MTCA Method C
green	Exceeds WA MCL

0 150 300 600

SCALE IN FEET

Figure 2.5.2-2

Plant Area AOC

Groundwater Collection System
Water Sample Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

- **Collection of water samples** from selected manholes in lines 2 and 5, and collection of flow measurements for calculation of flow volume in line 2 in Courtyard Segment C5 between MH2L2 and MH1L5.
- **Conduct a video survey** to identify connections between the Groundwater Collection System and other conveyance lines, and determine the source of the water discharge at the head of NPDES Pond A.

2.5.2.6 WPA Phase Investigation Results

The discussion in the following sections address the results of collection of water samples and video surveys. The video survey conducted during the initial RI phase in 2017 is discussed together with the video survey conducted during the WPA phase in Section 2.5.2.6.3 below.

2.5.2.6.1 Collection of Water Samples

During the WPA phase of investigation, four water samples were collected from Groundwater Collection System manholes MH2L2 and MH1L5 where water was present as determined by system identification. The water samples collected were analyzed for free cyanide, fluoride, sulfate, PAHs, PCBs, metals, VOCs, TPH-Gx and TPH-Dx.

Water sample analytical results from the groundwater system lines are summarized in Table 2.5.2-3 (PAAOC Groundwater Collection System WPA Groundwater Results Summary). Water data are compared to MTCA Method A, MTCA Method B, MTCA Method C, and Washington MCL water screening levels. Natural background concentrations for the site have been used to adjust water screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendix H-4, and data validation reports are included in Volume 5, Appendix I-4. All samples were collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The reporting limit objectives have been met.

All water analytical results for COPCs that exceed Plant Area AOC water screening levels are compiled and presented on Figure 2.5.2-2. Analytical results indicate that free cyanide, fluoride, sulfate, PCBs, all metals except arsenic, VOCs, TPH-Gx and TPH-Dx do not exceed Plant Area AOC water screening levels.

Only PAHs as TTEC and arsenic are detected at concentrations that exceed water screening levels. PAHs as TTEC was detected in all four samples at concentrations that range from 0.25 to 6.7 µg/L that exceed the MTCA Method C screening level of 0.2 µg/L. Arsenic was detected in three of four

Table 2.5.2-3
PAAOC Groundwater Collection System WPA Groundwater Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

		Screening Levels					WPA Analytical Results			
Parameter Name	**Units**	**MTCA Method A**	**MTCA Method B**	**MTCA Method C**	**WA MCL**	**Natural Background**	**PAAOC-WPA-GWC-MH2L2-GW02**	**PAAOC-WPA-GWC-MH2L2-GW03**	**PAAOC-WPA-GWC-MH1L5-GW02**	**PAAOC-WPA-GWC-MG1L5-GW03**
Aluminum Smelting										
Cyanide, Free	mg/L	NE	0.01	0.022	0.2	ND	0.005 U	0.002 U	0.005 U	0.002 U
Fluoride	mg/L	NE	0.96	2.1	4	0.72	0.84	1.07 J	1.3	1.08 J
Sulfate	mg/L	NE	NE	NE	250	32	33	31.6	25	31.9
Polynuclear Aromatic Hydrocarbons (PAHs)										
1-Methylnaphthalene	ug/L	NA	1.5	15	NE	NE	0.1 U	NA	0.1 U	NA
2-Methylnaphthalene	ug/L	NL	32	70	NE	NE	0.1 U	0.021 U	0.1 U	0.0019 J
Acenaphthene	ug/L	NA	960	2,100	NE	NE	0.1 U	0.0089 J	0.1 U	0.024
Acenaphthylene	ug/L	NA	NE	NE	NE	NE	0.1 U	0.0077 U	0.1 U	0.015 J
Anthracene	ug/L	NA	4,800	11,000	NE	NE	0.1 U	0.021 J	0.1 U	0.065
Benzo(a)anthracene	ug/L	NL	NL	NL	NE	NE	0.83	0.2	0.1	0.65
Benzo(a)pyrene	ug/L	0.1	0.023	0.88	0.2	NE	0.92	0.24	0.16	0.7
Benzo(b)fluoranthene	ug/L	NL	NL	NL	NE	NE	1.8	0.52	0.38	1.5
Benzo(g,h,i)perylene	ug/L	NA	NE	NE	NE	NE	0.87	0.28	0.27	0.73
Benzo(k)fluoranthene	ug/L	NL	NL	NL	NE	NE	0.47	0.16	0.11	0.45
Chrysene	ug/L	NL	NL	NL	NE	NE	1.4	0.35	0.2	1
Dibenzo(a,h)anthracene	ug/L	NL	NL	NL	NE	NE	0.15	0.06	0.038	0.16
Dibenzofuran	ug/L	NL	NL	NE	NE	NE	NA	0.0031 J	NA	0.0076 J
Fluoranthene	ug/L	NA	640	1,400	NE	NE	1.1	0.37	0.16	1.1
Fluorene	ug/L	NA	640	1,400	NE	NE	0.1 U	0.006 J	0.1 U	0.015 J
Indeno(1,2,3-cd)pyrene	ug/L	NL	NL	NL	NE	NE	0.88	0.29	0.25	0.78
Naphthalene	ug/L	160	160	350	NE	NE	0.1 U	0.037	0.1 U	0.054
Phenanthrene	ug/L	NA	NE	NE	NE	NE	0.4	0.088	0.1 U	0.25
Pyrene	ug/L	NA	480	1,100	NE	NE	1	0.36	0.15	1.2
TTEC cPAH (calc)	ug/L	0.1	0.2	0.2	NE	NE	**6.7**	**0.37**	**0.25**	**1.06**
Polychlorinated Biphenyls (PCBs)										
Aroclor 1016	ug/L	NA	1.1	2.5	NE	ND	0.05 U	0.005 U	0.019 U	0.005 U
Aroclor 1221	ug/L	NA	NE	NE	NE	ND	0.05 U	0.01 U	0.019 U	0.01 U
Aroclor 1232	ug/L	NA	NE	NE	NE	ND	0.05 U	0.005 U	0.019 U	0.005 U
Aroclor 1242	ug/L	NA	NE	NE	NE	ND	0.05 U	0.005 U	0.019 U	0.005 U
Aroclor 1248	ug/L	NA	NE	NE	NE	ND	0.05 U	0.005 U	0.019 U	0.005 U
Aroclor 1254	ug/L	NA	0.044	0.44	NE	ND	0.05 U	0.005 U	0.019 U	0.005 U
Aroclor 1260	ug/L	NA	0.044	0.44	NE	ND	0.05 U	0.005 U	0.019 U	0.005 U
Total PCBs (calc)	ug/L	0.1	0.044	0.44	0.5	ND	0.05	0.005	0.019	0.005
Metals										
Aluminum	mg/L	NE	16	35	NE	1.14	0.1 U	0.0895 J	5.3	0.0173 J
Arsenic	mg/L	0.005	0.000058	0.00058	0.01	0.0069	0.0033 U	**0.00147 B**	**0.0099**	**0.00135 B**
Cadmium	mg/L	0.005	0.008	0.018	0.05	NE	0.0044 U	0.000028	0.0044 U	0.00002
Chromium	mg/L	0.05	24	53	0.1	0.03	0.011 U	0.0008	0.011 U	0.00053
Copper	mg/L	NE	0.64	1.4	13	NE	0.011 U	0.0014	0.011 U	0.00022
Lead	mg/L	0.015	NE	NE	0.015	0.0004632	0.0011 U	0.00023	0.0073	0.000061
Mercury	mg/L	0.002	NE	NE	0.002	NE	0.0005 U	0.0002 U	0.0005 U	0.0002 U
Nickel	mg/L	NA	0.000096	0.001	0.1	0.0651	0.022 U	0.0003	0.022 U	0.00008 J
Selenium	mg/L	NA	0.08	0.18	0.05	NE	0.0056 U	0.0007 J	0.0056 U	0.0006 J
Zinc	mg/L	NA	4.8	10.5	NE	NE	0.028 U	0.0042	0.15	0.0031 J
Volatile Organic Compounds (VOCs)										
Benzene	ug/L	5	0.8	8	5	NE	0.2 U	NA	0.2 U	NA
Toluene	ug/L	1,000	640	1,400	1,000	NE	1 U	NA	1 U	NA
Ethylbenzene	ug/L	700	800	1,800	700	NE	0.2 U	NA	0.2 U	NA
m,p-Xylene	ug/L	1,000	1,600	3,500	10,000	NE	0.4 U	NA	0.4 U	NA
o-Xylene	ug/L	1,000	1,600	3,500	10,000	NE	0.2 U	NA	0.2 U	NA
1,1,1-Trichloroethane	ug/L	200	16,000	35,000	200	NE	0.2 U	NA	0.2 U	NA
Cis-1,2-Dichloroethene	ug/L	NE	16	35	70	NE	0.2 U	NA	0.2 U	NA
Tetrachloroethene	ug/L	5	21	110	5	NE	0.2 U	NA	0.2 U	NA
Trichloroethene	ug/L	5	0.54	8.8	5	NE	0.2 U	NA	0.2 U	NA
Vinyl Chloride	ug/L	0.2	0.029	0.29	2	NE	0.2 U	NA	0.2 U	NA
Total Petroleum Hydrocarbons (TPHs)										
Gasoline Range Organics	mg/L	1	NE	NE	NE	NE	0.1 U	NA	0.11 U	NA
Diesel Range Organics	mg/L	0.5	NE	NE	NE	NE	0.25 U	0.015 JB	0.27 U	0.016 JB
Residual Range Organics	mg/L	0.5	NE	NE	NE	NE	0.4 U	0.036 JB	0.43 U	0.045 JB

Notes:

B	The sample result is less than five times the blank contamination and cross-contamination is suspected.
J	Estimated concentration.
MCL	Maximum Contaminant Level.
NA	Not Analyzed
ND	Not detected.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
U	Chemical was not detected. The associated value represents the method reporting limit.

Detected concentrations shown in **bold** exceed one or more site groundwater screening levels.

samples at concentrations that range from 0.00135 to 0.0099 mg/L and exceeds the MTCA Method C screening level of 0.00058 mg/L.

2.5.2.6.2 Video Survey Scope

Video surveys of selected segments of groundwater horizontal lines was completed during March 13 through 15, 2017 and September 28 through October 1, 2020. The video surveys were performed to evaluate the sources of water, construction materials, integrity of pipes, and the presence of water and sediment. The survey was completed using a Rausch steerable four-wheel drive L 135 Tractor with an electric lift and camera to allow for continuous monitoring and recording. The video survey was limited by pipe diameter, presence of water, and thickness of accumulated sediment. Selected sections of groundwater lines that were video surveyed are further documented in Table 2.5.2-4 (2017 Video Survey Results) and Table 2.5.2-5 (2020 Video Survey Results), and the sections videoed are shown on Figure 2.5.2-3. Video clips and extracted photos of key features are included in Volume 5, Appendix G-2. In the following section, discussion of specific video clips is noted with a parenthetical citation (2017 video MHB_SE) and extracted photos is noted with the parenthetical citation (Photo A – Appendix G-2). All tables, figures, video survey clips, and extracted photos of the selected line segments described below should be referenced while reviewing this section.

2.5.2.6.3 Video Survey Results

A video survey in March 2017 of horizontal groundwater line segments began at manhole MHB, an unnamed manhole located to the west of the former Wastewater Treatment Plant and north of the SPL Handling Containment Building (SWMU 16). The horizontal groundwater line from manhole MHB is an 18-inch perforated corrugated metal pipe that runs south-southeast and contained groundwater at the time of the survey. The horizontal line inspection showed standing water in the line segment but ended at approximately 200 ft because a wheel fell off the vehicle. The distance of the video indicates that groundwater accumulates in this horizontal line in the northern portion of the site (2017 video MHB_SE).

Video surveying in October 2020 began at manhole MH3L1 located in the western portion of Courtyard Segment C4. When manhole MH3L1 was opened in 2020, the wheel lost in 2017 was sitting in the manhole. MH3L1 was dry at this time, contained only rocks and confirmed an 18-inch

Table 2.5.2-4
PAA0C Groundwater Collection System 2017 Video Survey Results
Columbia Gorge Aluminum Smelter, Goldendale Wasghington

Survey Start Point	Survey End Point	Survey Distance (Ft)	Horizontal Pipe Size and type	Water Present (Y/N)	Sediment Present (Y/N)	Survey Description and Comments
MHB	Southwest	208.4	24-inch perforated Corrugated Metal Pipe (CMP)	Y	N	Unable to survey further due to the vehicle lossing a wheel at 200 feet. Groundwater line located east of the SPL Handling Containment Building (SWMU 16).

Notes:

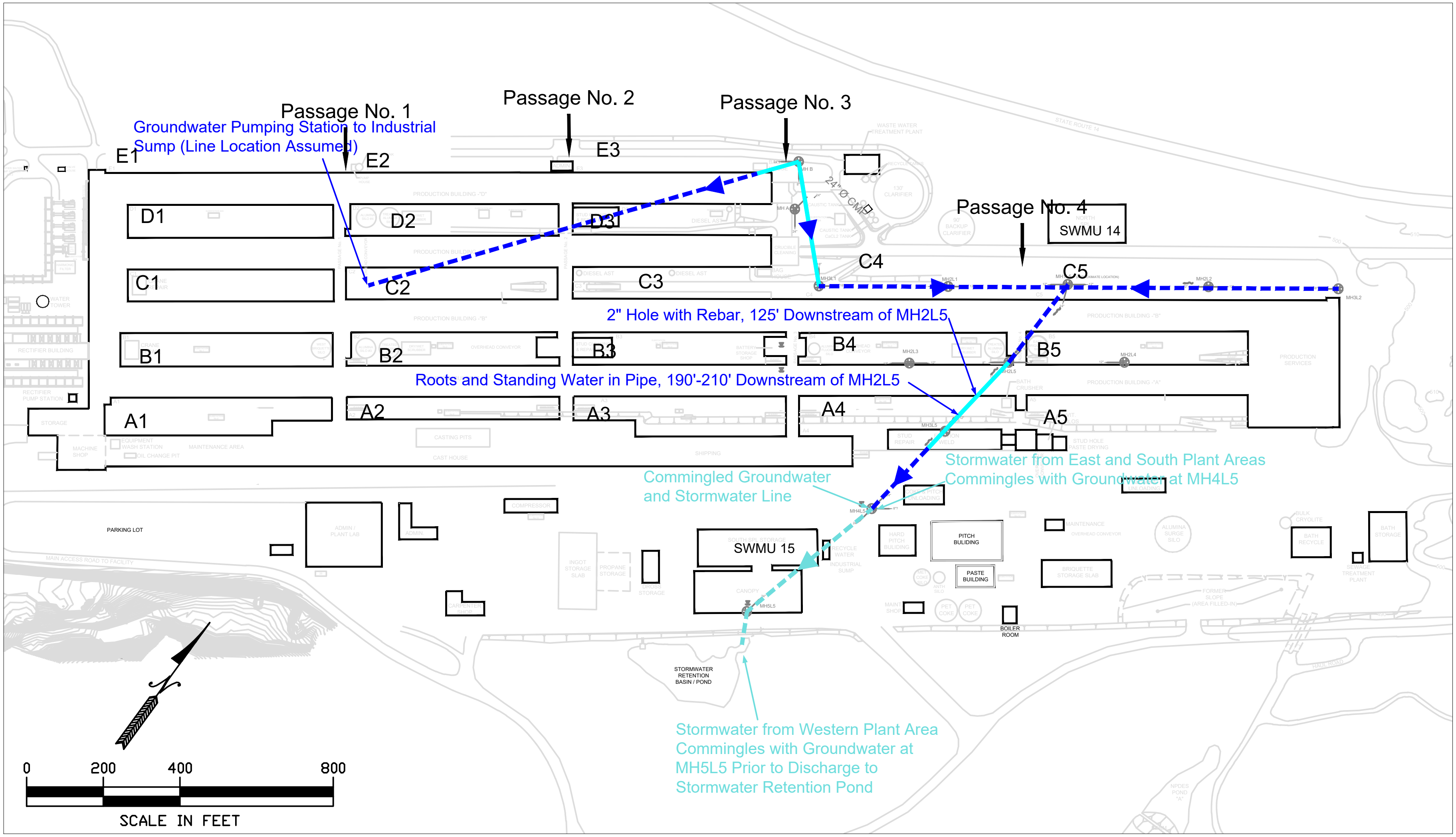
Y	Yes
N	No
NA	Not Applicable

Table 2.5.2-5
PAAOC Groundwater Collection System 2020 Video Survey Results
Columbia Gorge Aluminum Smelter, Goldendale, Washington

SurveyStart Point	Survey End Point	Survey Distance (Ft)	Horizontal Pipe Size and Type	Water Present (Y/N)	Sediment Present (Y/N)	Survey Description and Comments
MH3L1	MHB	85.9 feet	18-inch perforated Corrugated Metal Pipe (CMP)	N	Y	Survey to the north showed rocks in line, water markings along the sides of the horizontal pipe, seam breaches at 31, 50, 71, and 80 feet. Survey ended at 80 feet because of breach.
MHB	Previous pumping station	112.9 feet	36-inch perforated Corrugated Metal Pipe (CMP)	N	Y	Survey to the west showed a lot of sediment in horizontal pipe, seam damanged at 36 feet. Camera became stuck in the sediment at 113 feet. The outlet of the line segment connecting MHB to former pumping station to the west is located at the base of the manhole, approximately 2 ft lower than the 18-inch CMP outlet connecting MHB to MH3L1 to the southeast.
MH2L5	MH3L5	318.4 feet	30-inch Nonreinforced Concrete Pipe	Y	N	Survey to the southwest showed groundwater in line, rebar through concrete at 129 feet, roots and exposed soil from 190 to 203 feet, MH3L5 at 232 feet.

Notes:

Y	Yes
N	No
NA	Not Applicable



Source: Goldendale Aluminum Company, Plant Drawing A1/1752, "Underground Storm & Sanitary Sewer Piping W/Chem'l & Oil Str'g Areas"

Legend

Naming Convention:

MHB	Manhole #B Not Labeled on Drawing A1/1752
MH1L5	Manhole #1 Along Line #5
A1	Courtyard Segment A1

Lines Inspected Are Color-Coded by Piping System As Follows:

Blue = Groundwater System

Blue-Gray = Commingled Groundwater & Stormwater

◀	Direction of Water Flow Within Pipe Segment
━	Line Segment Video Inspected
╍	Line Segment Not Video Inspected; Assumed Connection Based on Drawings and Visual Evidence
╍	Commingled Stormwater & Groundwater Line Segment Not Video Inspected

Figure 2.5.2-3

Plant Area AOC

Groundwater Collection System
Video Survey Locations and Observations

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

perforated corrugated metal pipe leading to manhole MHB (Photo A, Appendix G-2). No line segment connection was observed to the west from Courtyard C4. From this, it was determined that the horizontal perforated groundwater line connects between manhole MH3L1 and manhole MHB and that sufficient water flow occurs during some portion of the year to have moved the video tractor wheel to the base of MH3L1.

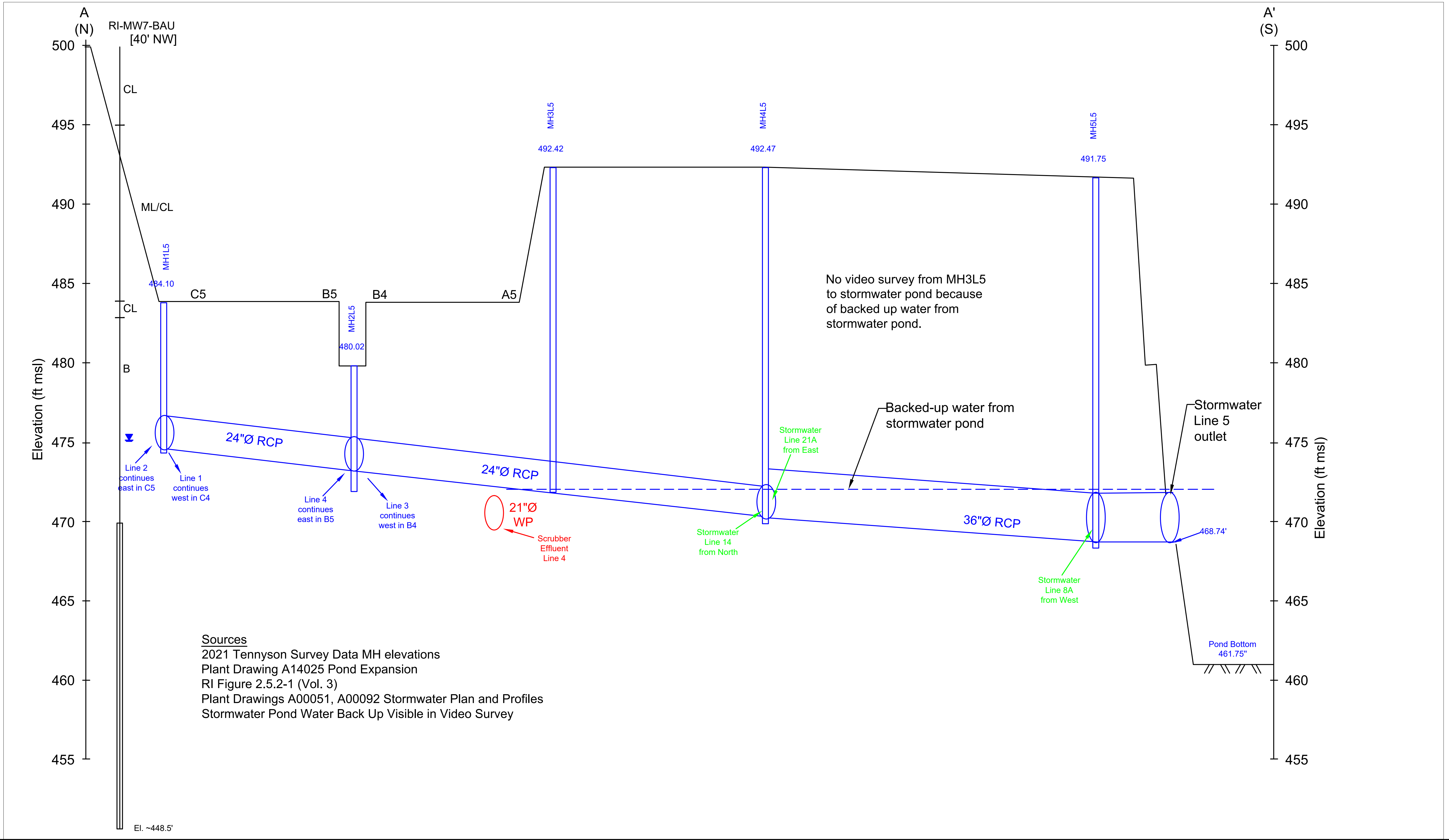
The video survey from manhole MH3L1 to manhole MHB showed evidence of previous water level lines and some accumulation of sediment in up to approximately 50% of the 18-inch perforated corrugated metal pipeline segment (2020 video MH3L1 to MHB). This was most evident from the beginning of the video survey and especially obvious from 11.5 ft to approximately 60 ft into the horizontal line segment. There were also numerous seams of the perforated corrugated metal pipe that had separated, and exposed soil could be seen through the seams (Photo B, Appendix G-2). At approximately 79.7 ft, the base of the perforate corrugated line segment at the seam is pushed up, causing a breach in the line and the video tractor was unable to continue (Photo C, Appendix G-2). This also appears to be the area where the vehicle from the previous video survey in 2017 lost the wheel due to the breach in the line.

Per a conversation with Columbia Gorge Aluminum site manager Dave Rooney during the WPA field work on September 30, 2020, he mentioned there was a former groundwater pumping station (demolished and inaccessible) located in the western portion of C2 (Figure 2.5.2-3). The Columbia Gorge Aluminum representative stated this was the low point for the western portion of the site (everything west of passage no. 3), especially prior to the construction of Production Buildings D and E, circa 1981. The pumps would automatically turn on when the water reached a certain level in the holding tank beneath the pumping station and the water would then be pumped from the western portion of C2 to the Stormwater Retention Pond. The pipe segment connecting the groundwater pumping station with the Stormwater Retention Pond is not accessible because of demolition and is also not visible at the stormwater pond, as it is above the high-water level and surrounded by dense vegetation.

The video tractor was then placed in manhole MHB to determine a potential connection to the west with a former groundwater pumping station located in Courtyard Segment C2 (Figure 2.5.2-3). Note that the 36-inch perforated corrugated metal pipeline segment connecting from manhole MHB to the west is located at the base of the manhole, approximately 2 ft lower than the 18-inch perforated corrugated metal pipeline segment connecting southeast to MH3L1. The horizontal line segment southwest from manhole MHB is a perforated 36-inch corrugated metal pipe that contained sediment and sludge from groundwater accumulation (2020 video MHB_SW). A break in the corrugated metal was observed at approximately 36.9 ft on the seam that exposed soil (Photo D, Appendix G-2). A second breach in the metal was observed at approximately 45 ft, although not to the extent as the first breach at 36.9 ft. No other breaks or breaches were observed in this horizontal line segment. The horizontal line segment contained sediment and sludge that began to accumulate on the wheels and at approximately 104 ft, the vehicle began to bog down, and the survey was abandoned (Photo E, Appendix G-2).

The diagonal 30-inch non-reinforced concrete groundwater collection line located between manhole MH2L5 and manhole MH3L5 was videoed surveyed (2020 video MH2L5 to MH3L5). This video survey was completed to assess potential standing water in this line segment from the back-up of water from the stormwater pond. The horizontal non-reinforced concrete groundwater line segment between manhole MH2L5 and manhole MH3L5 is also approximately 5 ft above the Scrubber Effluent wooden line segment between Scrubber Effluent Manholes MH15L4 and MH16L4 located in Courtyard A4. A breach in the wooden line segment between Scrubber Effluent Manhole MH15L4 and MH16L4 was observed (Photo F, Appendix G-2), is discussed detail in Section 5.4.5.5.5, and shown on cross-section Figure 2.5.2-4.

The horizontal 30-inch non-reinforced concrete line from MH2L5 had flowing water and appeared in good condition until approximately 125 ft, where a 2-inch borehole was observed to have been drilled vertically through the top of the concrete pipe (Photo G, Appendix G-2). A piece of rebar, approximately 1.5-inches in diameter, was then placed through the borehole, but it is unclear if the borehole was drilled through the base of the concrete pipe as the camera was not able to see through the flowing water (Photo H, Appendix G-2). The water became more stagnant after approximately 130 ft and remained that way until roots were observed growing from a crack on the southeast wall near a seam at approximately 190 ft. Roots and approximately 2 inches of standing water appeared between approximately 191 and 203 ft (Photo I, Appendix G-2). After approximately 203 ft, the water began flowing but rocks and roots were still observed until approximately 210 ft (Photo E, Appendix G-2). The remaining portion of this line segment was in good condition with flowing water and visual evidence indicated a connection with manhole MH3L5 at approximately 229 ft.



Sources
2021 Tennyson Survey Data MH elevations
Plant Drawing A14025 Pond Expansion
RI Figure 2.5.2-1 (Vol. 3)
Plant Drawings A00051, A00092 Stormwater Plan and Profiles
Stormwater Pond Water Back Up Visible in Video Survey

Legend

WP	Wooden Pipe
RCP	Reinforced ConcretePipe
C5	Courtyard Segment
CL	Clay
ML	Silt
B	Basalt

Screened Interval

Water level

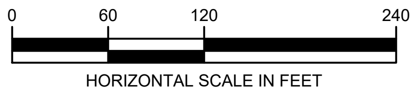


Figure 2.5.2-4

Plant Area AOC
Groundwater Collection System
Line 5 Section A-A'

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

When the video tractor reached approximately 277 ft, the flowing water became more stagnant, indicating the upstream end of water backed up from the stormwater pond in this segment of groundwater line 5.

2.5.2.6.4 Video Survey Conclusions

Groundwater Collection System connections based on site drawings, visual inspections, topography, the size of the pipes, and video surveys are summarized below:

- Numerous seam breaches and visible accumulated soil was observed in the 18-inch perforated corrugated metal pipeline between manholes MHB and MH3L1 that could potentially be a conduit allowing shallow groundwater to enter and exit the line through perforations across the width of the corrugated metal pipe.

- During the 2017 video survey of between manholes MH3L1 and MHB standing water was observed in the line. The line was dry in the 2020 video survey and contained rocks and the video tractor wheel lost in 2017 suggesting that potentially substantial flow occurs in this line during portions of the year that would be discharged to the Stormwater Retention Pond.

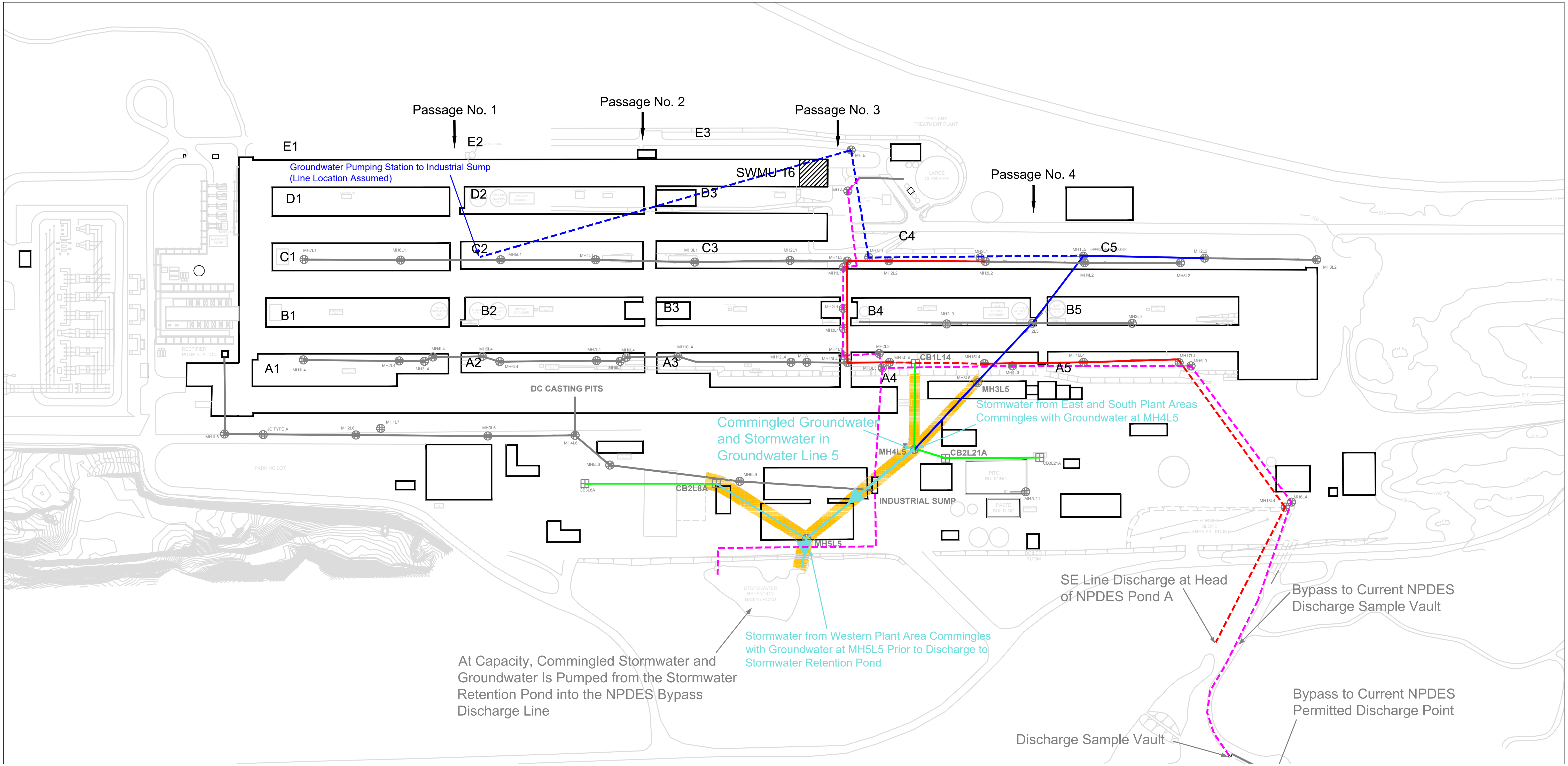
- A horizontal 36-inch perforated corrugated metal pipe connects manhole MHB with an out of service holding tank in Courtyard Segment C2 previously used as a groundwater pumping station that connected to the Stormwater Retention Pond. Based on site observations, the holding tank contains an unknown volume of water.

- Accumulated water in the line between manholes MH2L5 and MH3L5 may potentially leak into the subsurface as a result of observed breaches in the concrete seams, growing roots, rocks, and standing water from approximately 190 to 210 ft. Water that leaks from the groundwater line would potentially infiltrate to the shallow groundwater, which has also been observed flowing into the Scrubber Effluent System at a breach in the wooden line segment at approximately 150 ft to the east between Scrubber Effluent Manholes MH15L4 and MH16L4 (Figure 2.5.2-4).

- The comingled water in the Stormwater Retention Pond backs up into the Groundwater Collection System in line 5 through to manholes MH5L5, MH4L5, and MH3L5 and also into stormwater catch basins CB2L8A and CB1L14 when the pond reaches a full capacity (Figure 2.5.2-5).

2.5.2.7 RI Conclusions and Recommendations

Water analytical results indicate that fluoride, PAHs as TTEC, and arsenic are present in groundwater line 2 at concentrations that exceed water screening levels. The groundwater is discharged to the Stormwater Retention Pond where it has the potential to impact shallow



Source: Goldendale Aluminum Company, Plant Drawing A1/1752, "Underground Storm & Sanitary Sewer Piping W/Chem'l & Oil Str'g Areas"

Legend

Naming Convention:

MHW	Manhole #W Not Labeled on Drawing A1/1752
MH13L4	Manhole #13 Along Line #4
A1	Courtyard Segment A1

🟪	Industrial & Monitoring Collection System
🟥	Scrubber Effluent System
🟦	Groundwater Collection System
🟩	Stormwater Collection System - Only Stormwater Lines that Interact with Groundwater Collection System Are Shown on This Figure
🟧	Stormwater backs up into groundwater and stormwater lines when stormwater pond nears capacity

Solid Lines Indicate Year-Round Flow
Dashed Lines Indicate Seasonal Flow
Gray Lines Indicate Dry at Time of Observation

0 150 300 600
SCALE IN FEET

Figure 2.5.2-5

Plant Area AOC

Water Observed in PAAOC Lines

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

groundwater beneath the pond and is discussed further in Groundwater in the Uppermost Aquifer AOC (Volume 4, Section 2).

Video survey observations indicate that a substantial flow of groundwater enters the groundwater line between manholes MHB and MH3L1 seasonally. The numerous seam breaches and visible accumulated soil observed in the 18-inch perforated corrugated metal pipeline between manholes MHB and MH3L1 could potentially be a source to shallow groundwater.

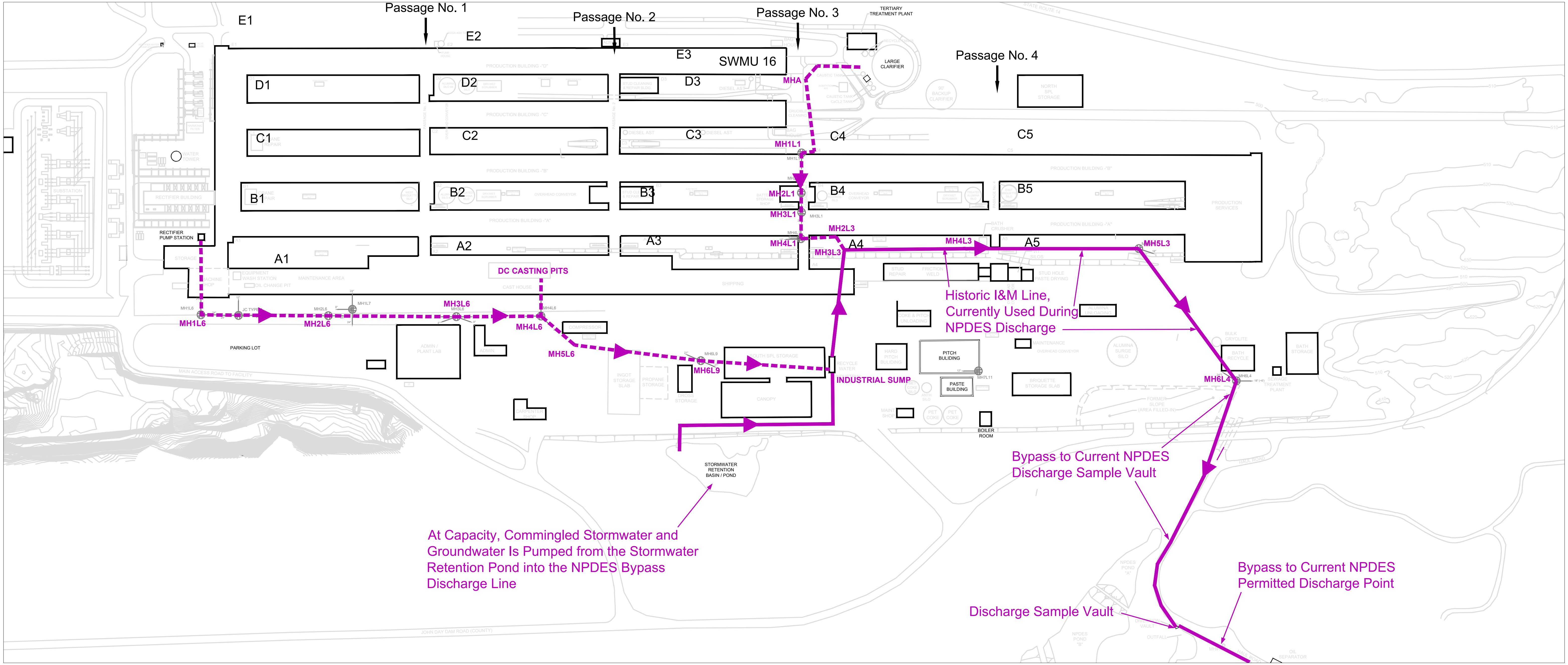
The out of service holding tank located beneath the groundwater pumping station in Courtyard Segment C2 appears to have been used during major storm events. Note that the 36-inch perforated corrugated metal pipe connected to manhole MHB at the base of the manhole is approximately 2 ft lower the 18-inch perforated corrugated metal pipe connecting to MH3L1.

Accumulated and potentially contaminated water in the groundwater line segment 5 may be leaking into the subsurface to impact shallow groundwater between manholes MH2L5, MH3L5 and MH4L5. This leakage from groundwater line 5 is located approximately 5 ft above a breach in the Scrubber Effluent System located between manholes MH15L4 and MH16L4, in Courtyard A4, where groundwater was observed flowing from the breach into the Scrubber Effluent System.

The Groundwater Collection System is recommended for further evaluation in the FS to investigate contaminated groundwater in the horizontal lines, and potential failed line integrity and leakage into the subsurface. The former groundwater pumping station in Courtyard Segment C2 should be evaluated to determine the volume of water remaining in the tank and possibly sampled for site COPCs. The Groundwater Collection System may also act as a preferential pathway for contaminate transport.

2.5.3 Industrial and Monitoring Lines and Associated Industrial Sump

The I&M System consists of a series of manholes connected by horizontal concrete lines. The I&M System is present in the vicinity of the Tertiary Treatment Plant, along the Passage No. 3 corridor, in Courtyard Segment A4 and A5, south of the Cast House Building to the Administration Building and southeast to the Industrial Sump, and in the vicinity of the Pitch Building Group (Figure 2.5.3-1). The I&M System conveyed process wastewater from the plant production area to the Industrial Sump located east of SWMU 15 (North SPL Building) and historically from the Tertiary Treatment Plant to the head of NPDES Pond A. The I&M System is no longer in use from



Source: Goldendale Aluminum Company, Plant Drawing A1/1752, "Underground Storm & Sanitary Sewer Piping W/Chem'l & Oil Str'g Areas"

Legend

Naming Convention:

MHA	Manhole #A Not Labeled on Drawing A1/1752
MH1L1	Manhole #1 Along Line #1
A1	Courtyard Segment A1

Lines Are Color-Coded by Piping System As Follows:

Purple = Industrial & Monitoring System

◀	Direction of Water Flow Within Pipe Segment
━━	Industrial & Monitoring System Current NPDES Bypass Discharge Line
- - -	Industrial & Monitoring Historic Wastewater Conveyance (Not in Use)

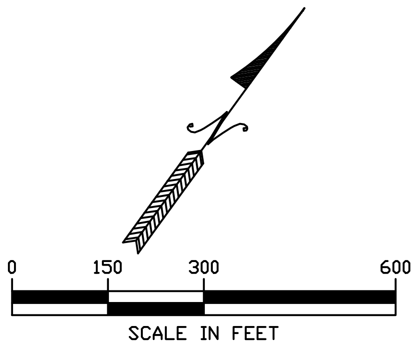


Figure 2.5.3-1

Plant Area AOC

Industrial & Monitoring System
System Layout

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

the Rectifier Station Pump to the Industrial Sump, and no longer discharges wastewater to the Industrial Sump. The only portion of the I&M line currently in use is the bypass line for discharging water from the Stormwater Retention Pond through the Industrial Sump to MH3L3, to MH4L3, to MH5L3, to MH6L4, then to the NPDES discharge point at the Columbia River. However, the I&M line portion north of manhole MHA and near the Tertiary Treatment Plant is demolished and seasonally flowing water was observed on the video survey entering north of manhole MHA (2017 video MHA_NE). Seasonal water entering the I&M line system north of manhole MHA will commingle at MH3L3 at approximately 1-2 gpm when water is pumped from the Stormwater Retention Pond via the Industrial Sump during a time of NPDES discharge.

The northern head of the I&M System connects to the former Tertiary Treatment Plant the northeast of manhole MHA located to the south of the SPL Handling Containment Building (SWMU 16). From manhole MHA flow is to the south to MH3L1 and then continues south through Passage No 3 to MH4L1 located between Courtyard Segments A3 and A4. The I&M line then connects via a 36-inch concrete line east through I&M manholes MH2L3 through MH5L3 in Courtyard Segments A4 and A5. The Industrial Sump connects to the manhole MH3L3 via a 36-inch concrete reinforced line.

The western head of the I&M System, south of the Cast House, begins at the Rectifier Station Pump sump. The I&M lines from the Rectifier Station Pump sump extends south through the Machine Shop to south of the Cast House foundation and then turn east at manhole MH1L6. The line 6 segment continues east from MH1L6 through to MH4L6, where a separate I&M line segment connects from the DC casting pits, located north in the Cast House Foundation. At MH4L6 the I&M line turns southeast, meets with MH5L9, extends through MH6L9, and ends at the Industrial Sump through a 36-inch concrete horizontal line.

When the plant was in operation, process wastewater was discharged to NPDES Pond A through a line extending from MH5L3 in Courtyard Segment C5, to MH6L4 west of the Sewage Treatment Plant, then southwest to Pond A. In 2010 a new bypass line was constructed for discharge of commingled stormwater and groundwater stored in the Stormwater Retention Pond to the NPDES discharge point at the Columbia River near NPDES Pond D. Currently, when the Stormwater Retention Pond nears capacity, water is pumped from the Stormwater Retention Pond to the Industrial Sump, then north to MH3L3, east to MH4L3, to MH5L3, and then southwards through MH6L4 via a 36-inch reinforced concrete pipe to the new 2010 bypass line. The I&M line that previously allowed discharge to NPDES Pond A was abandoned in place in approximately 2008. This was accomplished by filling with concrete material and removing from service by severing the previous connection with the I&M line.

2.5.3.1 Previous Investigations

No previous investigation occurred for the I&M System and/or the associated Industrial Sump prior to issuance of the Agreed Order (Ecology 2014). However, the DC casting pits that are in the Cast House foundation and that were connected to the I&M System were investigated with collection of two water samples from the pits in March 2012. The water samples were analyzed for PCBs and TPH-Dx Analytical results indicate no exceedance of Plant Area AOC water screening levels for PCBs or TPH-Dx. The analytical results are shown on Figure 2.5.3-2.

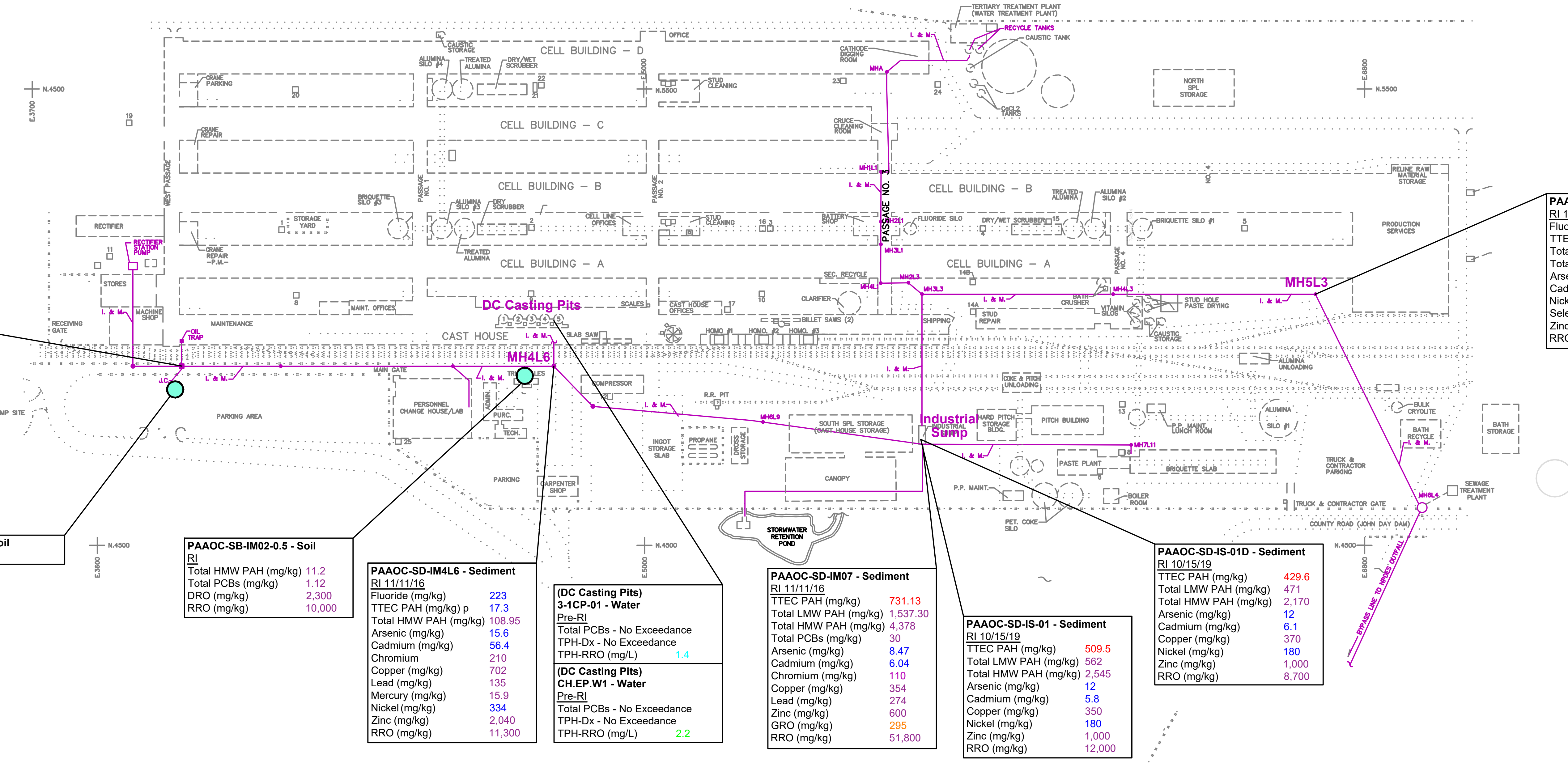
2.5.3.2 RI Phase Investigation Scope

The I&M System was investigated during the initial RI phase of investigation in 2016 and 2017. Investigation objectives as follows were described in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b):

- **System identification** to locate, inspect, and document status of all manholes. Inspection results were used to identify locations for sediment and/or water samples and horizontal pipe segments for video survey.
- **Collection of soil and sediment samples** near and in selected manholes to further characterize presence of COPCs in the I&M Collection System and to determine whether the I&M System lines have leaked wastewater to the subsurface.
- **Conduct a video survey** of selected system horizontal line segments to determine.
- connections between systems, the Tertiary Treatment Plant, the Industrial Sump, and the bypass line.
- **Confirm System cleanup** by evaluating presence of contamination in lines and whether cleanup is warranted.

2.5.3.3 Initial RI Phase Investigation Results

The following sections describe the work performed to meet the objectives stated above. For clarity, the initial RI phase 2017 video survey is discussed together with the WPA phase 2020 video survey in the following Section 2.5.3.6.3.



PAAOC-SD-IM03 - Sediment
RI 11/11/16

Fluoride (mg/kg)	295
TTEC PAH (mg/kg)	161.41
Total HMW PAH (mg/kg)	819.8
Total PCBs (mg/kg)	1.02
Arsenic (mg/kg)	13.2
Cadmium (mg/kg)	29.1
Copper (mg/kg)	450
Selenium (mg/kg)	1.54
Zinc	989
RRO (mg/kg)	126,000

PAAOC-SB-IM03 - Soil
No Exceedances

PAAOC-SB-IM02-0.5 - Soil
RI

Total HMW PAH (mg/kg)	11.2
Total PCBs (mg/kg)	1.12
DRO (mg/kg)	2,300
RRO (mg/kg)	10,000

PAAOC-SD-IM4L6 - Sediment
RI 11/11/16

Fluoride (mg/kg)	223
TTEC PAH (mg/kg) p	17.3
Total HMW PAH (mg/kg)	108.95
Arsenic (mg/kg)	15.6
Cadmium (mg/kg)	56.4
Chromium	210
Copper (mg/kg)	702
Lead (mg/kg)	135
Mercury (mg/kg)	15.9
Nickel (mg/kg)	334
Zinc (mg/kg)	2,040
RRO (mg/kg)	11,300

(DC Casting Pits)
3-1CP-01 - Water
Pre-RI
Total PCBs - No Exceedance
TPH-Dx - No Exceedance
TPH-RRO (mg/L) 1.4

(DC Casting Pits)
CH.EP.W1 - Water
Pre-RI
Total PCBs - No Exceedance
TPH-Dx - No Exceedance
TPH-RRO (mg/L) 2.2

PAAOC-SD-IM07 - Sediment
RI 11/11/16

TTEC PAH (mg/kg)	731.13
Total LMW PAH (mg/kg)	1,537.30
Total HMW PAH (mg/kg)	4,378
Total PCBs (mg/kg)	30
Arsenic (mg/kg)	8.47
Cadmium (mg/kg)	6.04
Chromium (mg/kg)	110
Copper (mg/kg)	354
Lead (mg/kg)	274
Zinc (mg/kg)	600
GRO (mg/kg)	295
RRO (mg/kg)	51,800

PAAOC-SD-IS-01 - Sediment
RI 10/15/19

TTEC PAH (mg/kg)	509.5
Total LMW PAH (mg/kg)	562
Total HMW PAH (mg/kg)	2,545
Arsenic (mg/kg)	12
Cadmium (mg/kg)	5.8
Copper (mg/kg)	350
Nickel (mg/kg)	180
Zinc (mg/kg)	1,000
RRO (mg/kg)	12,000

PAAOC-SD-IS-01D - Sediment
RI 10/15/19

TTEC PAH (mg/kg)	429.6
Total LMW PAH (mg/kg)	471
Total HMW PAH (mg/kg)	2,170
Arsenic (mg/kg)	12
Cadmium (mg/kg)	6.1
Copper (mg/kg)	370
Nickel (mg/kg)	180
Zinc (mg/kg)	1,000
RRO (mg/kg)	8,700

PAAOC-SD-IM5L3 - Sediment
RI 11/11/16

Fluoride (mg/kg)	1,230
TTEC PAH (mg/kg)	235.4
Total LMW PAH (mg/kg)	233.28
Total HMW PAH (mg/kg)	1,445
Arsenic	11.8
Cadmium (mg/kg)	4.92
Nickel	143
Selenium	2.72
Zinc	810
RRO (mg/kg)	8,030

Source: Goldendale Aluminum Company, Plant Drawing A1/1752, "Underground Storm & Sanitary Sewer Piping W/Chem'l & Oil Str'g Areas"

Legend

INDUSTRIAL & MONITORING MANHOLE
OIL TRAP
● RI SOIL BORING

RRO	TPH-Dx as Residual Range Organics
RI	Initial RI Phase
WPA	WPA Phase

Soil Screening Levels

orange	Exceeds MTCA Method A
red	Exceeds MTCA Method C
blue	Exceeds Protection of Groundwater
purple	Exceeds Ecological Screening Level-Wildlife

Water Screening Levels

cyan	Exceeds MTCA Method A
red	Exceeds MTCA Method C
green	Exceeds WA MCL

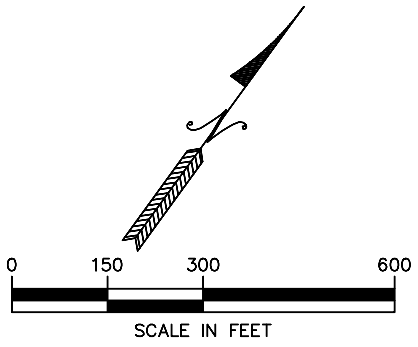


Figure 2.5.3-2

Plant Area AOC

Industrial & Monitoring System
Soil and Sediment Sample Locations and
Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

2.5.3.3.1 System Identification

System identification was completed in 2016 consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). Results of the system identification were used to identify locations for sediment sampling, and system horizontal line segments for video surveying.

The I&M System was located using historic site plans and engineering plans obtained from onsite plant construction files. All I&M manholes were located by assessing the relative location on maps and drawings, comparing measured invert depths to surveyed depths on engineering plans, and comparing orientations of the manholes against the plans. Some manholes shown on plant maps could not be located or were buried and then excavated for inspection. Other manholes were found but not shown on, or identified from, any map or plan. System layout is summarized on Figure 2.5.3-1.

When each manhole was located, its position was recorded using a hand-held GPS unit, photos were taken of the manhole (exterior and interior), and the manhole was inspected by an engineer. Manhole inspection included size and orientation of horizontal pipes entering the manhole, integrity of the cover, ring and frame, barrel, shelf, and rungs, the presence of water and sediment, and if the groundwater manhole was sampled. System observations and measurements are summarized in Table 2.5.3-1.

Inspection of the I&M System in the Tertiary Treatment Plant area indicated that water, but no sediment, was present in the 36-inch concrete horizontal line from manhole MHA, located to the south of the SPL Handling Containment Building (SWMU 16), to MH1L1.

Inspection of the southern portion of the I&M System indicated sediment is present in manholes located in Courtyard Segments A4 and A5. Standing or flowing water was also observed in the horizontal line in Courtyard A4 and A5. Sediment sampling was recommended for this portion of the I&M System.

Inspection of the western portion of the I&M System indicated sediment was present in this 36-inch concrete horizontal line that connects to the western edge of the Cast House Foundation. Sediment and soil were recommended for the western portion of the I&M Collection System.

Table 2.5.3-1
PAAOC Industrial Monitoring System Inspection Summary
Columbia Gorge Aluminum Smelter
Goldendale, Washington

MH No.	Line No.	Location Name	Invert Depth from Plans (Ft)	Invert Depth Measured (Ft)	Sediment Present Y/N	Water Present Y/N	Sampled	Photo Numbers	Comments
1	1	MH1L1	5.6	6' 2"	N	N	NS	174-175 (N)	2 ft x 2 ft opening in north Passage No. 3 with no cover. Surface debris, large fragments in MH.
2	1	MH2L1	6.8, 14.7	6' 9", 12' 5"	N	Y	NS	176-178 (E)	PW3. No cover. Standing water.
3	1	MH3L1	7, 14.9, 17.2		Y	Y	NS	179(E), 180-181(W), 182(N), 183(S)	PW3. No cover. Sediment is likely surface debris.
4	1	MH4L1	7.5	6' 4"	Y	N	NS	184-185(N), 186(S)	PW3. No cover. Surface debris in MH. Standing water in inlet from N, trace water at E/W inlets.
2	3	MH2L3	6.1		N	N	NS		Located 60 ft east of MH4L1, standing water.
3	3	MH3L3	6.5		N	N	NS		Located 20 ft southeast of MH2L3.Connection to Industrial Sump to the south.
4	3	MH4L3	7.8		N	N	NS		Located 400 ft east of MH3L3. Trace of water.
5	3	MH5L3	9.1	8' 9"	Y	N	11-11-16, S	352-354 (S)	Buried. Plastic tube inside MH. Trace water in inlets at W, SE.
6	4	MH6L4	18.7	18' 3"	Y	Y	NS	188 (E), 399-400(N)	Small pipes in MH deviate from plans. Standing water. Severe encrustation inside MH.
1	6	MH1L6	4.9	5' 3"	N	N	NS		
2	6	MH2L6	5.9	5' 9"	Y	Y	NS	156-157(N)	Trace of sediment. Standing water.
3	6	MH3L6	7	7' 2"	Y	N	NS	160-162 (N)	Trace of sediment and water. Small pipes in MH deviate from plans.
4	6	MH4L6	7.8	9' 3"	Y	Y	11-11-16, S	163-164(N)	Invert depth from plans. Low water flow from W, standing water. Connection to Cast House DC Casting Pits.
5	9	MH5L9	8		N	N	NS		Located south of Compressor Building. Broken lid in MH.
6	9	MH6L9	9	9' 7"	N	N	NS	165-166 (N)	Located east of SWMU 15 buildling. Connects to Industrial Sump to west.
7	11	MH7L11	4.2	> 3' 3"	N	N	NS	171-173(N)	No cover. Trace water, metal cover, and surface debris in MH.
1	7	MH1L7		19' 8"	N	Y	NS	158-159	MH marked MH1L7 but not shown/labeled on plans. Some standing water.
MHA		MHA		13'4"	Y	Y	NS		Cover missing, 24" diameter outlet lines to northeast and to south

Notes:

MH	Manhole.
Ft	Feet.
NS	Not sampled.
(N)(S)	Photograph view to north (N), south (S), east (E), or west (W)
S	Sediment sample.
PW	Plant passage way running north-south between cast house and production buildings, beginning from west with passage way no. 1.
Surface Debris	Includes large rocks, bricks, metal, lumber, plastic, and other debris dislodged at some time from ground surface into manhole.
Invert	Lowest point inside manhole.

2.5.3.3.2 Collection of Soil and Sediment Samples

I&M lines that previously conveyed process wastewater were investigated during the initial RI phase with two soil borings (SB-IM02 and SB-IM03), and four sediment samples collected from I&M manholes (SD-IM01, SD-IM07, SD-IM4L6, and SD-IM5L3) (Figure 2.5.3-2). Soil borings were drilled to depths below the anticipated I&M line invert depth, with samples collected in SB-IM02 at 0.5 ft bgs, 6 ft bgs, and 10 ft bgs, and in SB-IM03 at 0.5 ft bgs, 4 ft bgs, and 8 ft bgs. Soil and sediment samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, VOC, TPH-Gx, and TPH-Dx.

Soil and sediment analytical results are summarized in Table 2.5.3-2 (PAAOC Industrial & Monitoring System RI and WPA Soil and Sediment Results Summary). Soil and sediment data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC screening levels. Natural background concentrations for the site were used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendix H-2, and data validation reports are included in Volume 5, Appendix I-2. All samples were collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The reporting limits for arsenic exceed the protection of groundwater screening level, and for selenium exceed the protection of groundwater and ecological wildlife soil screening levels, for all soil samples analyzed. Reporting limits for selenium exceed the ecological wildlife screening level in four out of six sediment samples analyzed.

All soil and sediment sample analytical results that exceed Plant Area AOC soil screening levels are compiled and presented on Figure 2.5.3-2.

The initial RI results for soil samples indicate that total cyanide, fluoride, sulfate, metals, VOCS, and TPH-Gx do not exceed Plant Area AOC soil screening levels. Only total HMW PAH, PCBs and TPH-Dx exceed soil screening levels. Calculated concentrations of total HMW PAH, PCBs, and TPH-Dx as diesel and residual range organics exceeded MTCA Method A and the ecological wildlife screening level in one sample SB-IM02-0.5, but do not exceed in deeper samples from the boring.

The initial RI results for sediment samples indicate that total cyanide, sulfate, VOCs, TPH-Gx, and TPH-Dx as diesel do not exceed Plant Area AOC soil screening levels. Initial RI results for sediment samples exceed for fluoride, PAHs as TTEC, total LMW PAH, and total HMW PAH, PCBs, all metals except aluminum and TPH-Dx as residual range organics.

Table 2.5.3-2
PAAOC Industrial & Monitoring System Soil and Sediment Results Summary
Columbia Gorge Aluminum Smelter, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	RI Soil Analytical Results							RI Sediment Analytical Results				WPA Analytical Results	
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-IM02-0.5	PAAOC-SB-IM02-6	PAAOC-SB-IM02-10	PAAOC-SB-IM03-0.5	PAAOC-SB-IM03-4	PAAOC-SB-IM03-4D	PAAOC-SB-IM03-8	PAAOC-SD-IM03	PAAOC-SD-IM07	PAAOC-SD-IM4L6	PAAOC-SD-IM5L3	PAAOC-SD-IS-01	PAAOC-SD-IS01D
Aluminum Smelting																			
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.0963 U	0.0968 U	0.145	0.0964 U	0.000062	0.00005 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	81 J	5 UJ	5 UJ	5 UJ	10 J	10 J	5.9 J	**295**	44.5	**223**	**1,230**	0.022	0.018
Sulfate	mg/kg	NA	NE	2,150	NE	NE	44 J	57 J	24 J	10 UJ	10 UJ	18 J	61 J	123	22.1 U	140	42.9	0.01 U	0.01 U
Polynuclear Aromatic Hydrocarbons (PAHs)																			
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	3.4	0.0073 U	0.0072 U	0.014 U	0.015	0.0076 U	0.007 U	1.19 U	4.39	0.764 U	0.477	3.9 U	4.1 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	3.6	0.0073 U	0.0072 U	0.014 U	0.02	0.0076 U	0.007 U	1.19 U	5.54	0.764 U	0.58	3.9 U	4.1 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.27 U	0.0073 U	0.0072 U	0.014 U	0.054	0.0076 U	0.007 U	1.19 U	77.5	0.764 U	5.79	24	19.00
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.27 U	0.0073 U	0.0072 U	0.014 U	0.0077 U	0.0076 U	0.007 U	1.19 U	0.677 U	0.764 U	0.436 U	3.9 U	4.1 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.27 U	0.0073 U	0.0072 U	0.014 U	0.029	0.0076 U	0.007 U	1.41	125	0.925	9.58	25	21
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.89	0.0073 U	0.0072 U	0.018	0.047 J	0.017	0.007 U	38.9	488	7.13	129	260	220
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	1	0.0073 U	0.0072 U	0.017	0.05 J	0.024	0.007 U	113	574	10.7	156	380	320
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	2.2	0.0073 U	0.0072 U	0.021	0.055 J	0.028	0.007 U	232	767	33.2	364	550	450
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	1.1	0.0073 U	0.0072 U	0.02	0.03	0.018	0.007 U	111	331	11.6	115	270	230
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.7	0.0073 U	0.0072 U	0.014 U	0.022	0.012	0.007 U	57.9	235	8.02	105	130	120
Chrysene	mg/kg	NA	NL	NL	NE	NL	2	0.0073 U	0.0072 U	0.044	0.044 J	0.018	0.007 U	76.6	645	13	236	300	260
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.27 U	0.0073 U	0.0072 U	0.014 U	0.0077 U	0.0076 U	0.007 U	26.6	88	3.1	37	45	40
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	3.1	0.0073 U	0.0072 U	0.014 U	0.1 J	0.028	0.007 U	42.2	958	10.5	164	380	320
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.6	0.0073 U	0.0072 U	0.014 U	0.024	0.0076 U	0.007 U	1.19 U	52.5	0.764 U	3.6	13	11
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	1.1	0.0073 U	0.0072 U	0.014 U	0.028	0.019	0.007 U	121	368	13	135	280	240
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.054	0.001 U	0.0011 U	0.014 U	0.039	0.0076 U	0.0011 U	1.19 U	7.79	0.764 U	1	3.9 U	4.1 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	1.8	0.0073 U	0.0072 U	0.041	0.13	0.015	0.007 U	5.64	316	3.63	49.1	120	100
Pyrene	mg/kg	NA	110,000	650	NE	NL	2.2	0.0073 U	0.0072 U	0.023	0.09 J	0.025	0.007 U	42.8	882	9.2	168	330	290
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	1.51	0.0073	0.0072	0.02	0.09	0.03	0.007	**161.41**	**731.13**	**17.3**	**235.4**	**509.5**	**429.6**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	5.6	0.0073	0.0011	0.041	0.38	0.04	0.001	49.25	**1,537.30**	15.06	**233.28**	**562**	**471**
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**11.2**	0.0073	0.0072	0.14	0.37	0.16	0.007	**819.8**	**4,378**	**108.95**	**1,445**	**2,545**	**2,170**
Polychlorinated Biphenyls (PCBs)																			
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.051 UJ	0.054 U	0.054 U	0.054 U	0.058 U	0.057 U	0.052 U	0.308 U	0.845 U	0.0974 U	0.0105 U	0.12 U	0.13 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.051 UJ	0.054 U	0.054 U	0.054 U	0.058 U	0.057 U	0.052 U	0.308 U	0.845 U	0.0974 U	0.0105 U	0.12 U	0.13 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.051 UJ	0.054 U	0.054 U	0.054 U	0.058 U	0.057 U	0.052 U	0.308 U	0.845 U	0.0974 U	0.0105 U	0.12 U	0.13 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.8 J	0.054 U	0.054 U	0.054 U	0.058 U	0.057 U	0.052 U	0.308 U	30	0.0974 U	0.0141	0.12 U	0.13 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.051 UJ	0.054 U	0.054 U	0.054 U	0.058 U	0.057 U	0.052 U	1.02	0.845 U	0.0974 U	0.0105 U	0.12 U	0.13 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.32 J	0.054 U	0.054 U	0.054 U	0.058 U	0.057 U	0.052 U	0.308 U	0.845 U	0.163	0.192	0.12 U	0.13 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.51 UJ	0.054 U	0.054 U	0.054 U	0.058 U	0.057 U	0.052 U	0.308 U	3.63 U	0.234 U	0.0105 U	0.12 U	0.13 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	**1.12**	0.054	0.054	0.054	0.058	0.057	0.052	**1.02**	**30**	0.163	0.21	0.12	0.13
Metals																			
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	5,200 J	4,900 J	5,200 J	3,700	7,400	7,400	3,400	72,100	51,400	48,900	66,800	73,000	79,000
Arsenic	mg/kg	20	87.5	2.9	7.61	132	10 U	11 U	11 U	11 U	12 U	11 U	10 U	**13.2**	**8.47**	**15.6**	**11.8**	**12**	**12**
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.51 U	0.54 U	0.54 U	0.54 U	0.58 U	0.57 U	0.52 U	**29.1**	**6.04**	**56.4**	**4.92**	**5.8**	**6.1**
Chromium	mg/kg	2,000	5,300,000	490,000	32	67	16	1.4	5.4	4.4	5.8	5.8	2.6	43.1	**110**	**210**	50.2	47	54
Copper	mg/kg	NA	140,000	280	28.4	217	20	6.1	9.2	9.8	8.1	9.2	8.3	**450**	**354**	**702**	117	**350**	**370**
Lead	mg/kg	1,000	NE	3,000	13	118	7	5.4 U	5.4 U	5.4 U	6.8	7.4	5.2 U	103	**274**	**135**	65.2	67	69
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.26 U	0.27 U	0.27 U	0.27 U	0.29 U	0.28 U	0.26 U	1.23 U	0.227	**15.9**	0.886 U	0.46	0.53
Nickel	mg/kg	NA	70,000	130	24.54	980	23	2.7 U	4.2	4.1	4.9	4.6	2.6 U	111	81.5	**334**	**143**	**180**	**180**
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	10 U	11 U	11 U	11 U	12 U	11 U	10 U	**1.54**	1.69 U	1.98 U	**2.72**	5.0 U	5.0 U
Zinc	mg/kg	NA	1,100,000	6,000	81	360	45	37	50	32	41	45	23	**989**	**600**	**2,040**	**810**	**1,000**	**1,000**
Volatile Organic Compounds (VOCs)																			
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.001 U	0.001 U	0.0011 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0217 U	0.0244 U	0.0384 U	0.0116 U	0.0019 U	0.0018 U
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0051 U	0.0052 U	0.0054 U	0.0055 U	0.0058 U	0.0059 U	0.0054 U	0.108 U	0.122 U	0.154 U	0.0465 U	0.0019 U	0.0018 U
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.0053	0.001 U	0.0011 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0542 U	0.107 U	0.0768 U	0.0233 U	0.0019 U	0.0018 U
Xylenes, total	mg/kg	9	700,000	14	NE	10	0.024	0.0021 U	0.0022 U	0.0022 U	0.0023 U	0.0024 U	0.0022 U	0.162 U	0.183 U	0.230 U	0.0698 U	0.0038 U	0.0035 U
1,1,1-Trichloroethane	mg/kg	2	7,000,000	1.5	NE	29.8	0.001 U	0.001 U	0.0011 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0542 U	0.061 U	0.0768 U	0.0233 U	0.0019 U	0.0018 U
cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.001 U	0.001 U	0.0011 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0542 U	0.061 U	0.0768 U	0.0233 U	0.0019 U	0.0018 U
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9092	0.001 U	0.001 U	0.0011 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0542 U	0.061 U	0.0768 U	0.0233 U	0.0019 U	0.0018 U
Trichloroethene	mg/kg	0.03	1,800	0.025	NE	12.4	0.001 U	0.001 U	0.0011 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0542 U	0.061 U	0.0768 U	0.0233 U	0.0019 U	0.0018 U
Vinyl chloride	mg/kg	NE	88	0.0017	NE	6.46	0.001 U	0.001 U	0.0011 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0542 U	0.061 U	0.0768 U	0.0233 U	0.0024 U	0.0023 U
Total Petroleum Hydrocarbons (TPHs)																			
Gasoline Range Organics	mg/kg	100	NE	NA	NE	1,000	9.5 U	5.5 U	5.4 U	11 U	6.6 U	6.3 U	5.2 U	10.8 U	**295**	15.4 U	4.65 U	49 U	51 U
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	**2,300**	27 U	27 U	270 U	29 U	28 U	26 U	1,220 U	950	797 U	437 U	1,000	1,200
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	**10,000**	54 U	54 U	1,100	58 U	57 U	53 U	**126,000**	**51,800**	**11,300**	**8,030**	**12,000**	**8,700**

Notes:

J	Estimated Concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for in the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Fluoride was detected in three of the four sediment samples at concentrations that ranged from 223 mg/kg and 1,230 mg/kg which exceed the protection of groundwater screening level of 147.6 mg/kg. PAHs exceed one or more of the MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels at least two sediment samples analyzed. PAHs as TTEC exceeds only the protection of groundwater screening level in one of four samples and exceeds the MTCA Method C screening level in three out of four samples. Calculated concentrations of total LMW PAH exceed the ecological soil screening level in two out of four samples, and calculated concentrations of total HMW PAH exceed the ecological soil screening level in all sediment samples.

Calculated concentrations of total PCBs were detected in two sediment samples IM-SD03 and IM-SD07 at concentrations that range from 1.02 to 30 mg/kg, respectively, which exceed the ecological wildlife screening level of 0.65 mg/kg. Metals, including arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc, were detected in at least one out of four sediment samples at concentrations that exceed either the protection of groundwater and/or the ecological wildlife screening levels. Maximum concentrations are 15.6 mg/kg for arsenic, 56.4 mg/kg for cadmium, 210 mg/kg for chromium, 702 mg/kg for copper, 274 mg/kg for lead, 15.9 mg/kg for mercury, 334 mg/kg for nickel, 1.54 mg/kg for selenium, and 2,040 mg/kg for zinc.

TPH-Dx as residual range organics were detected in all six sediment samples at concentrations ranging from 8,030 to 126,000 mg/kg that exceed MTCA Method A Industrial and the ecological wildlife screening level of 2,000 mg/kg.

2.5.3.4 Initial RI Investigation Conclusions

Soil sample analytical results indicate that only calculated total HMW PAH, total PCBs, and TPH-Dx as diesel and residual range organics exceed Plant Area AOC soil screening levels in one sample SB-IM02-0.5. Analytical soil results do not appear to indicate that leakage of waste from the I&M lines to subsurface soil has occurred.

Sediment sample analytical results indicate that fluoride, PAHs as TTEC, total LMW PAH, total HMW PAH, PCBs, all metals except aluminum, and TPH-Dx as residual range organics were detected in all sediment samples at concentrations that exceed protection of groundwater, the ecological wildlife, and/or MTCA Method A screening levels.

2.5.3.5 WPA Phase Investigation Scope

The I&M System was investigated during the WPA phase in 2020 and 2021. The objectives for the WPA phase of investigation were as follows.

- Collection of a sediment sample from the Industrial Sump.
- Conduct a video survey to identify connections between the I&M line system and other conveyance lines.

2.5.3.6 WPA Phase Investigation Results

The following sections discuss analytical results for Industrial Sump sediment, and video surveys of selected I&M line segments. For clarity, video surveys conducted during the initial RI and the WPA phases of investigation are discussed together in Section 2.5.3.6.3 below.

2.5.3.6.1 Collection of Sediment Samples from Industrial Sump

During the WPA phase of investigation, one sediment sample and one duplicate sample were collected from the Industrial Sump. The sediment samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, VOCs, TPH-Gx, and TPH-Dx.

Sediment sample analytical results are presented in Table 2.5.3-2 (PAAOC Industrial & Monitoring System RI and WPA Soil and Sediment Results Summary). Sediment data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC soil screening levels. Natural background concentrations for the site have been used to adjust soil screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendix H-4, and data validation reports are included in Volume 5, Appendix I-4. All samples were collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). All reporting limit objectives were met (reference to QAPP/SAP).

All sediment sample results that exceed Plant Area AOC soil screening results are compiled and presented on Figure 2.5.3-2. The WPA results for sediment samples indicate that total cyanide, fluoride, sulfate, PCBs, VOCS, TPH-Gx, and TPH-Dx as diesel do not exceed MTCA Method A Industrial, MTCA Method C, protection of groundwater, or ecological wildlife soil screening levels.

PAHs as TTEC, calculated total LMW PAH, and calculated total HMW PAH were detected in both sediment samples at concentrations that soil screening levels. PAHs as TTEC was detected at calculated concentrations that exceed both MTCA Method C and protection of groundwater screening levels. Calculated concentrations of total LMW PAH and total HMW PAH were detected at concentrations that exceed the ecological wildlife screening level in both sediment samples.

Metals, including arsenic, cadmium, copper, nickel, and zinc, were detected at concentrations that exceed either the protection of groundwater and/or the ecological wildlife soil screening levels. Maximum concentrations are 12 mg/kg for arsenic, 6.1 mg/kg for cadmium, 370 mg/kg for copper, 180 mg/kg for nickel, and 1,000 mg/kg for zinc.

TPH-Dx as residual range organics were detected at concentrations of 8,700 and 12,000 mg/kg that exceeds MTCA Method A Industrial and the ecological wildlife screening level of 2,000 mg/kg.

2.5.3.6.2 Video Survey Investigation

Video surveys of selected I&M line horizontal pipes was completed during March 13 through 15, 2017 and September 28 through October 1, 2020. The video surveys were performed to evaluate the sources of water discharging to NPDES Pond A, construction materials, integrity of pipes, and the presence of sediment. The survey was completed using a Rausch steerable four-wheel drive L 135 Tractor with an electric lift and camera to allow for continuous monitoring and recording. The video survey was limited by pipe diameter, presence of water, and thickness of accumulated sediment. Selected sections of I&M lines that were video surveyed are further documented in Table 2.5.3-3 (PAAOC Industrial & Monitoring System 2017 Video Survey Results), and Table 2.5.3-4 (PAAOC Industrial & Monitoring System 2020 Video Survey Results). Segments of I&M horizontal pipes that were videoed are shown on Figure 2.5.3-3. Video clips and extracted photos of key features are included in Volume 5, Appendix G-2. In the following section, discussion of specific video clips is noted with a parenthetical citation (2017 video MH1L1_EAST) and extracted photos are noted with the parenthetical citation (Photo A – Appendix G-2). All tables, figures, video survey clips, and extracted photos of the selected line segments described below should be referenced while reviewing this section.

Table 2.5.3-3
PAA0C Industrial & Monitoring System 2017 Video Survey Results
Columbia Gorge Aluminum Smelter, Goldendale Wasghington

Survey Start Point	Survey End Point	Survey Distance (Ft)	Horizontal Pipe Size and type	Water Present (Y/N)	Sediment Present (Y/N)	Survey Description and Comments
MHA	North	18.9	36-inch RCP	Y	N/A	Survey halted because of blockage. Unclear where water in MHA orginates.
MH1L1	MHA	232.6	36-inch RCP	Y	N/A	Survey completed to the north to confirm connection with MHA.
MH6L4	Outfall sampling station	701.7	36-inch RCP	Y	N	This is the by-pass line that previously discharged to NPDES Pond A.
MH6L4	MH5L3	510.3	36-inch RCP	Y	Y	Part of the by-pass line.
MH5L3	West	700.6	36-inch RCP	Y	N	Survey went beyond MH4L3 and confirmed that location.
MH4L3	MH2L3	424.5	36-inch RCP	Y	N	Survey went beyond MH3L3 and to MH2L3, but was halted because of encrustation build up.
MH3L3	Industrial Sump	337.3	36-inch RCP	Y	N	Suvery went to the Industrial sump and confirmed that connection. Bypass line
MH2L3	MH4L1	47.8	36-inch RCP	Y	Y	Confirmed location of MH4L1. Blockage observed near southern portion of Passage No. 3 where many lines converge.
MH6L9	Industrial Sump	401.8	36-inch RCP	Y	N	Survey completed to confirm connection with Industrial Sump to the west.
MH6L9	MH5L9	395.1	36-inch RCP	Y	N	Survey completed to confirm connection with MH5L9.
MH5L9	MH4L5	109.8	36-inch RCP	Y	N	Survey halted because an older manhole cover was in the manhole and blocking access.
MH4L5	DC Cast House	66	18-inch RCP	Y	N	Suvery completed to the north to confirm connnection with DC Casting Pits in Cast House.

Notes:

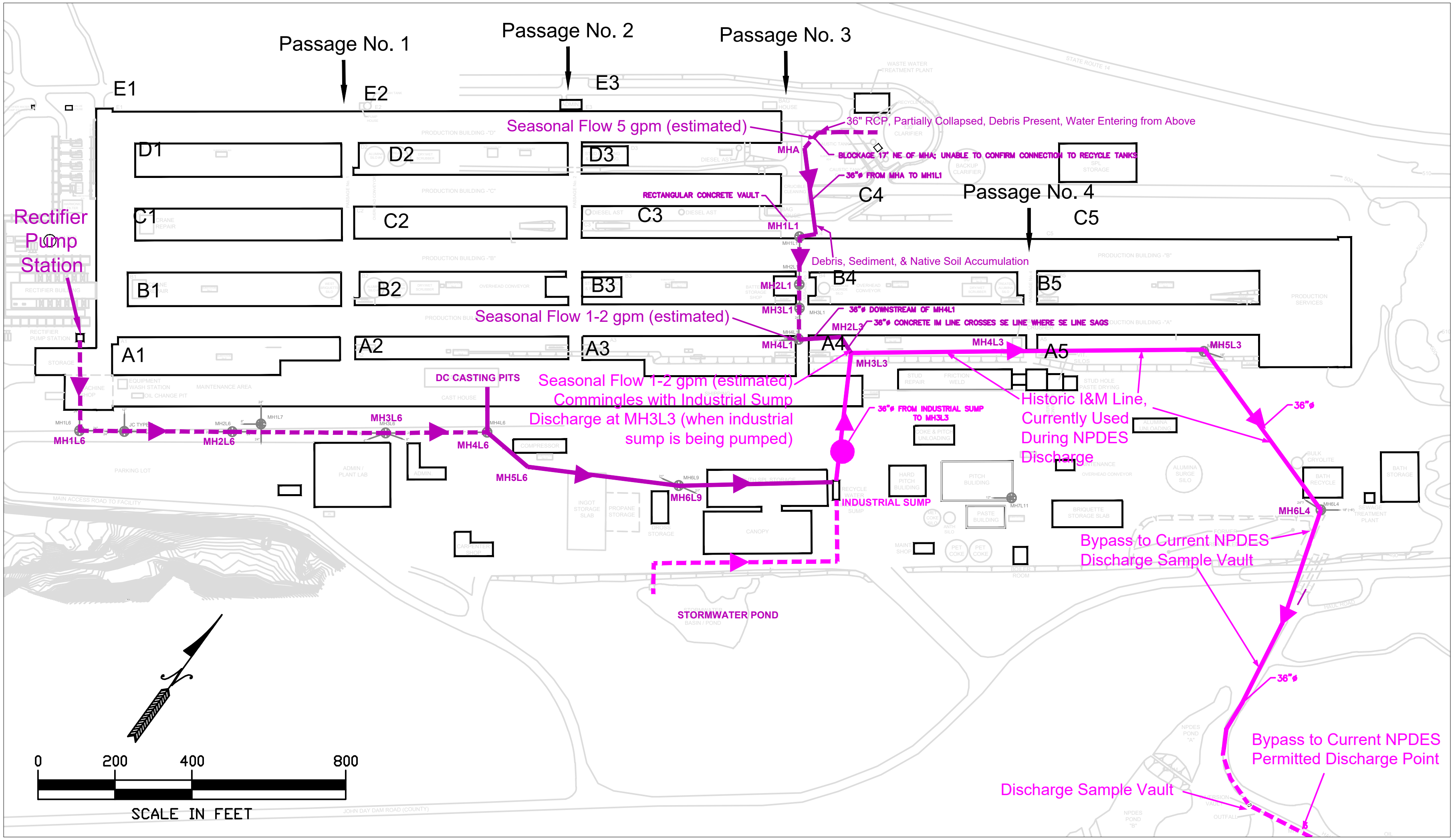
Y	Yes
N	No
NA	Not Applicable
RCP	Reinforced Concrete

Table 2.5.3-4
PAAOC Industrial & Monitoring System 2020 Video Survey Results
Columbia Gorge Aluminum Smelter, Goldendale, Washington

SurveyStart Point	Survey End Point	Survey Distance (Ft)	Horizontal Pipe Size and Type	Water Present (Y/N)	Sediment Present (Y/N)	Survey Description and Comments
MHA	MH1L3	217.7 feet	36-inch concrete pip	Y	Y	Survey showed some sediment in line, debris and soil in line from 177 to 202 feet, and damage to line at about 208 feet. Survey ended at 217 feet at MH1L3.

Notes:

Y	Yes
N	No
NA	Not Applicable



Source: Goldendale Aluminum Company, Plant Drawing A1/1752, "Underground Storm & Sanitary Sewer Piping W/Chem'l & Oil Str'g Areas"

Legend

Naming Convention:

MHA	Manhole #A Not Labeled on Drawing A1/1752
MH1L1	Manhole #1 Along Line #1
A1	Courtyard Segment A1

Lines Inspected Are Color-Coded by Piping System As Follows:
Purple = Industrial & Monitoring System
Pink = Bypass Discharge Line

◀	Direction of Water Flow Within Pipe Segment
━━	Line Segment Video Inspected
╍╍	Line Segment Not Video Inspected; Assumed Connection Based on Drawings and Visual Evidence
━━	Bypass Discharge Line, Commingled Groundwater and Stormwater from Stormwater Retention Pond and Groundwater Are Pumped into Bypass Line for Discharge, Line Segment Video Inspected
╍╍	Line from Stormwater Pond to Industrial Sump Not Video Inspected; Assumed Connection Based on Drawings and Visual Evidence

Figure 2.5.3-3

Plant Area AOC

Industrial & Monitoring System
Video Survey Locations and Observations

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

2.5.3.6.3 Video Survey Results

Manhole MH1L1 was video surveyed to the east-northeast in the direction of manhole MHA (2017 video MH1L1_EAST); however, the opening was severely damaged during the demolition of the production buildings (Photo K – Appendix G-2). The opening to manhole MH1L1 is currently an approximately 2-foot by 2-foot square hole located 20 ft southwest of Passage No. 3 between Courtyards C3 and C4. The 36-inch horizontal concrete line was videoed and contained debris, demolition materials, and standing water for approximately 11 ft into the line segment. The horizontal concrete line then abruptly turns 90 degrees to the north and standing water was observed for approximately 45 ft until the concrete line sloped upwards and water was observed flowing south from manhole MHA. The video survey of the horizontal concrete line continued to the north for approximately 230 ft where it reached the old manhole MHA cover in the base of the manhole (Photo L – Appendix G-2). Flowing water in the 36-inch concrete line was observed in video survey that appears to emanate from north of manhole MHA. The concrete line appeared in good condition, although the base of the concrete line contained water and was not visible.

Manhole MHA, located to the south of SWMU 16, contains a 36-inch horizontal concrete line segment that was videoed from manhole MHA to the north but was halted because of the observed blockage and debris (2017 video MHA_NE). At approximately 17 ft into the 36-inch horizontal concrete line, the line is crushed because of prior demolition activities; however, flowing water is observed (Photo M – Appendix G-2). During video surveying in October 2020, it was reconfirmed that the 36-inch concrete line is still blocked approximately 17 ft to the northeast of manhole MHA (Photo N – Appendix G-2). The previous video survey performed in March of 2017 showed a large volume of flowing water, approximately 5 to 10 gpm was observed flowing through manhole MHA; however, only a small amount of water was observed flowing through manhole MHA during October 2020 video survey. This is likely because if the timing of the survey in late fall versus the previous survey conducted in early spring.

A video in October 2020 of the 36-inch concrete line south from manhole MHA to manhole MH1L1 (video MHA – MH1L1 2020) indicated the concrete line was in good condition (some of the concrete seams showed signs of wear but no breaks or breaches were observed) until approximately 175 where one crack on the wall on the east side was observed. At approximately 188 ft, accumulation of sediment and other debris was observed. At approximately 202 ft, the concrete line flattens out and a piece of wood was blocking the way, but the video tractor was able to get through. At 212 ft, a break at the seam in the concrete line segment was observed along the walls and at the base of the pipe, which also contained debris, sediment, and what appears to be accumulated soil (Photo O – Appendix G-2). The line turned at a 90-degree angle at approximately 217 ft where it aligns and then meets with MH1L1.

A video survey south from manhole MH1L1 could not performed because of the damaged manhole and standing water in the line segments located in passage No. 3. Manhole MH4L1, located at the southern end of passage No 3. contained 1-2 gpm of visually observed water flowing south-southeast, but was also damaged, and the video survey could not be performed north through Passage No. 3 (2017 video MH2L3_NW). Manhole MH4L1 connects west via a 36-inch concrete line to MH2L3, to MH3L3, and through to MH4L3 (2017 video MH4L3_WEST). Water was visually observed flowing east-southeast through this portion of line segments at approximately 1-2 gpm.

When the Stormwater Retention Pond is reaching capacity, water is pumped from the pond to the Industrial Sump, then into manhole MH3L3 in courtyard A4 via a 36-inch concrete line. A video survey from manhole MH3L3 to the industrial sump confirmed this connection (2017 video MH3L3 to Industrial Sump). From manhole MH3L3, water was visually observed flowing east through manholes MH4L3 and MH5L3 in courtyards A4 and A5, respectively (2017 video MH4L3_WEST and 2017 video MH5L3_WEST). At manhole MH5L3, standing water was observed before the line angles southeast to connect with manhole MH6L4 west of the Sewage Treatment Plant (2017 video MH6L4 to MH5L3). From manhole MH6L4, located approximately 27 ft west of Scrubber Effluent System manhole MH18L4, water continued to be visually observed flowing through the horizontal 36-inch concrete line that connects to the sampling vault located along the roadway near NPDES Pond B (2017 video MH6L4 to sampling vault). Standing water was observed at the end of the video survey from approximately 650 to 700 ft and is suspected to be backing up at the sample vault. Water pumped from the stormwater pond is sampled at the sample vault prior to the outfall into the Columbia River.

I&M manhole MH6L9, located approximately 20 ft to the west of the South SPL Storage building (SWMU 15) was video surveyed to confirm connection to the Industrial Sump. Manhole MH6L9 was videoed to the east in a 36-inch concrete line and confirmed a connection with the Industrial Sump (2017 video MH6L9_SUMP). This same line segment was then video surveyed west from manhole MH6L9 towards manhole MH5L9, and through to manhole MH4L6 (2017 video MH6L9 to MH5L9 and 2017 video MH5L9 to MH4L6). Manhole MH4L6 was not video surveyed to the west but continues west from MH4L6 to MH1L6 where it connects to the north with the Rectifier Pump Station.

From Manhole MH4L6, the line was video surveyed to the north to confirm a suspected connection with the DC Casting Pits located beneath the Cast House Foundation does occur (2017 video MH4L6_NORTH). A large concrete basin containing standing rainwater was observed at the base of the DC Casting Pits and connects south to MH4L6. Apart from an old manhole lid located in the horizontal line segment at MH5L9, the horizontal line segments were clear of obstructions and breaches, contained minor areas of standing water (either backed up water from the Industrial Sump in the line or suspected rainwater), and a connection from the DC Casting Pits in the Cast House Foundation to the Industrial Sump was observed. Even though the line connecting between the DC Casting Pits and the Industrial Sump remains intact, the line has not been used for I&M water since the plant ceased operation in 2003.

2.5.3.6.4 WPA Phase Investigation Conclusions

Conclusions from the WPA phase of investigation of the I&M System based on site drawings, visual inspections, topography, the size of the pipes, sediment sampling and video surveys are summarized in bullets below:

- The 36-inch concrete pipe between manhole MHA and the former Tertiary Treatment Plant, and likely the two former clarifiers, is crushed as a result of demolition activities and debris blocks access for further video inspection.
- South flowing water (observed in 2017), and evidence of past flow (observed in 2020), was visible in the horizontal line to north of manhole MHA. The source of the water is likely groundwater based on water levels measured in nearby well WPA-GW10 and temporary screened boring WPA-CCR-SB05.

- Water flow in the vicinity of manhole MHA during the 2017 survey is visually estimated to be approximately 5 to 10 gpm. This indicates that the portion of crushed line segment approximately 17 ft northeast of manhole MHA in the I&M System acts as a groundwater collection line.

- A significant decrease in water flow at manhole MH1L1 during the 2020 survey indicates that the integrity of the line before this point allows flowing water to leak from the pipe. This apparent line damage and decrease in flow indicates potential discharge of water to the subsurface in this area.

- Water was visually estimated to be flowing through manhole MH4L1 at approximately 1-2 gpm in the southern portion of passage No. 3. Flow east through the I&M line segments manholes in Courtyards A4 and A5, and southeast to the bypass discharge sample vault was visually estimated to be 1-2 gpm.

- The Industrial Sump is currently connected to manhole MH3L3 in Courtyard A4 (approximately 337 ft north), and this portion of the line is currently in use as the new NPDES Permit discharge bypass line.

- The Industrial Sump is currently connected to manhole MH6L9 to the west of the South SPL Building (SWMU 15) and continues to the west where it connects with the DC Casting Pits north of MH4L6. The I&M line segments continue west from MH4L6 to MH1L6 where it connects to the north with the Rectifier Pump Station.

- Seasonal water entering the I&M system northeast of manhole MHA could potentially comingle at manhole MH3L3 when the stormwater retention pump is pumped through the Industrial Sump and/or at the sample vault along the roadway by NPDES Pond B.

- The I&M System wastewater discharge outfall previously daylighted at the head of the NPDES pond A prior to the construction of the bypass line in approximately 2010.

- The I&M line that previously allowed discharge to NPDES Pond A was abandoned in place in approximately 2008. This was accomplished by filling the line with concrete material and removing from service by severing the previous connection with the I&M line.

- Sediment present in manholes and the Industrial Sump contain elevated concentrations of several site COPCs that exceed Plant Area AOC soil screening levels.

2.5.3.7 RI Conclusions and Recommendations

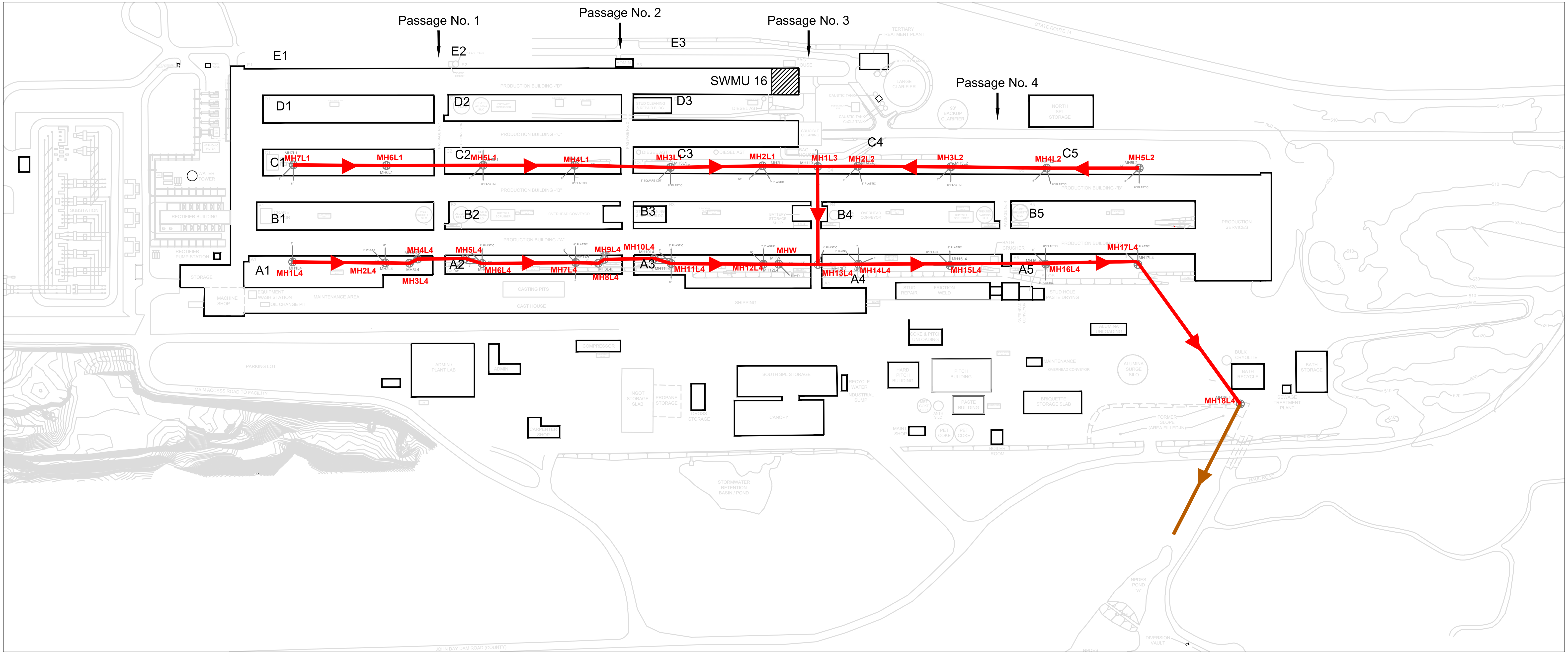
The I&M System is recommended for further evaluation in the FS to address contaminated sediment in manholes, contaminated sediment in the Industrial Sump, and seasonal water entering the I&M system north of manhole MHA. The I&M System may also act as a preferential pathway for contaminate transport.

2.5.4 Scrubber Effluent System

The Scrubber Effluent System consists of a series of manholes with connections via wooden horizontal lines. The Scrubber Effluent System is present in the Tertiary Treatment Plant area (based on plant drawings and discussed in later sections), in Courtyards A and C, south through Passage No. 3 connecting the lines in Courtyards A and C and extends into the southeast plant area from MH17L4 in Courtyard Segment A5 and daylighting near the head of NPDES Pond A (Figure 2.5.4-1). The original system manholes and horizontal lines were constructed of redwood and conveyed and discharged waste and wastewater from the original air scrubber system to NPDES Pond A (settling pond). In its original layout, the system extended to MH18L4, where it ended with a splash plate at the outfall from MH18L4.

In early 1981, when the John Day Dam Road was constructed south of the plant, the Scrubber Effluent System was extended to its current outfall point near the head of NPDES Pond A. The line extension was constructed by the addition of approximately 400 ft of 21-inch reinforced concrete pipe from MH18L4 to an outlet near the head of NPDES Pond A. The approximately 400 ft reinforced concrete pipe line-extension was completed under the John Day Dam Road in approximately 1981 and was utilized until approximately 1985. After 1985, the wet scrubbers ceased operating, and the Scrubber Effluent System no longer conveyed air scrubber waste or wastewater to NPDES Pond A. All dry air scrubber waste was sent to the West Surface Impoundment (WSI) Pond. During investigation under the Agreed Order, and likely prior to that time, water has discharged seasonally to NPDES Pond A from the Scrubber Effluent System outfall.

During development of the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b), redevelopment plans for the site preferred an option for the Scrubber Effluent System to be abandoned in place. This shaped the scope of the initial RI to evaluate the integrity of the horizontal lines and potential for past leakage of waste and wastewater to subsurface soil and shallow groundwater to have occurred along the system alignment.



Source: Goldendale Aluminum Company, Plant Drawing A1/1752, "Underground Storm & Sanitary Sewer Piping W/Chem'l & Oil Str'g Areas"

Legend

Naming Convention:

MHW	Manhole #W Not Labeled on Drawing A1/1752
MH13L4	Manhole #13 Along Line #4
A1	Courtyard Segment A1

Lines Are Color-Coded by Piping System As Follows:

Red = Scrubber Effluent System

◀	Direction of Water Flow Within Pipe Segment
—	Wooden Line Segment
—	Concrete Line Segment

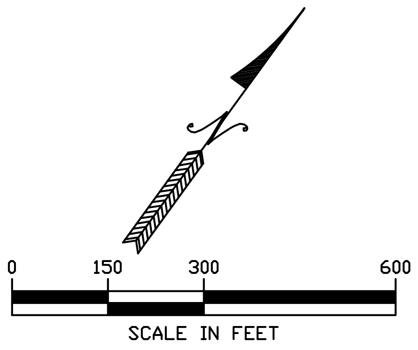


Figure 2.5.4-1

Plant Area AOC

Scrubber Effluent System
System Layout

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

2.5.4.1 Previous Investigations

Limited investigation of the Scrubber Effluent System occurred prior to issuance of the Agreed Order (Ecology 2014). Investigation included collection of sediment and wood samples, and limited removal of sediment from some of the manholes that were available during plant demolition. Previous investigations were discussed in the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a).

Sediment and wood sample analyses did not include all current site COPCs, was not data validated, and cannot be reliably geolocated or evaluated. Heavy equipment used for demolition staged in Courtyards A and C may have buried some manholes and resulted in reintroduction of surface materials and contamination into other manholes. The RI investigations conducted under the Agreed Order have re-investigated the previous investigations and, based on the unreliability of the data and potential reintroduction of surface materials and contamination into the Scrubber Effluent System, the previous investigation data and cleanup is not discussed further in the RI Report.

2.5.4.2 Initial RI Phase Investigation Scope

The Scrubber Effluent System was investigated during the initial RI phase of investigation in 2016 and 2017. Investigation objectives as follows were described in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b):

- **System identification** to locate, inspect, and document the status of all manholes. Inspection results were used to identify locations for collection of sediment and wood samples, and horizontal pipe segments for video survey.

- **Collection of sediment and wood samples** in selected manholes. Wood sample data would allow evaluation of the integrity of the wood horizontal lines and the potential for leakage to subsurface soil and shallow groundwater.

- **Collection of soil samples** from soil borings located along the alignment of the Scrubber Effluent System in Courtyards A and C, in the vicinity of the Tertiary Treatment Plant, and in the southeast plant area to characterize presence of COPCs in soil surrounding the horizontal lines to evaluate the potential that the Scrubber Effluent System may have leaked waste and/or wastewater into subsurface soil and shallow groundwater.

- **Conduct a video survey** of selected horizontal line segments to identify connections between the Scrubber Effluent System and other site systems, evaluate the integrity of the horizontal lines and any breaches that may exist, and determine the source of water discharging to NPDES Pond A.

2.5.4.3 Initial RI Phase Investigation Results

The following sections describe the work performed during the initial RI phase to meet the objectives stated above. For clarity the video survey conducted during the initial RI phase in 2017 and during the WPA phase in 2020 are discussed together in Section 2.5.3.6.3.

2.5.4.3.1 System Identification

System identification was conducted in 2016 consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). Results of the system identification were used to identify locations for sediment sampling, and system horizontal line segments for video surveying.

The Scrubber Effluent System was located using historic site plans and engineering plans obtained from onsite plant construction files. All Scrubber Effluent manholes were located by assessing its relative location on maps and drawings, comparing measured invert depths to surveyed depths on engineering plans, and comparing orientations of the manholes against the plans. Some manholes shown on plant maps could not be located or were buried and then excavated for inspection. Other manholes were found but not shown on, or identified from, any map or plan. System layout is summarized on Figure 2.5.4-1.

When each manhole was located, its position was recorded using a hand-held GPS unit, photos were taken of the manhole (exterior and interior), and the manhole was inspected by an engineer. Manhole inspection included size and orientation of horizontal pipes entering the manhole, integrity of the cover, ring and frame, barrel, shelf, and rungs, the presence of water and sediment, and if the groundwater manhole was sampled. System observations and measurements are summarized in Table 2.5.4-1.

While plant drawings indicated the presence of Scrubber Effluent System lines and manholes in the vicinity of the Tertiary Treatment Plant, Scrubber Effluent manholes were not identified in the field and therefore not inspected during the system identification process. Later investigation during the WPA phase determined that the Scrubber Effluent System appears to end north of Passage No. 3 and is discussed below in Section 2.5.4.6.2.

Table 2.5.4-1
PAAOC Scrubber Effluent System Inspection Summary
Columbia Gorge Aluminum Smelter, Goldendale, Washington
Page 1 of 2

MH No.	Line No.	Location Name	Invert Depth from Plans (Ft)	Invert Depth Measured (Ft)	Sediment Present	Water Present	Sampled	Photo Numbers	
					Y/N	Y/N			Comments
2	1	MH2L1	9	9' 6"	Y	Y	NS	258-260(S)	Buried. Wood cover intact. Surface debris in MH, HC odor, sheen on water. Small pipes in MH deviate from plans.
3	1	MH3L1	9.5	7' 5"	N	N	NS	269-271(S)	Wood cover intact, surface debris in MH. Small pipes in MH deviate from plans.
4	1	MH4L1	6.5	6' 3"	N	N	NS	255-257(S)	Wood cover intact. Surface debris in MH. Small lines in MH deviate from plans.
5	1	MH5L1	4.3	2' 11"	Y	N	NS	251-252(N), 253-254(S)	Surface debris in MH. Small pipes in MH deviate from plans.
6	1	MH6L1	2.8	3' 10"	Y	N	NS	249-250(N)	Wood, surface debris in MH. Small pipes in MH deviate from plans.
7	1	MH7L1	2.3	2' 2"	Y	N	NS	243-245(N), 246(S), 247-248(E)	Wood cover intact, exposed wood shallow horizontal pipe near MH. Surface debris in MH covers inlets. E outlet appears wood.
2	2	MH2L2	9	10' 0"	Y	Y	11-11-16, S 5-11-21, W	266-268(S)	Wood cover intact, small pipes in MH deviate from plans. Standing water above inlet inverts.
3	2	MH3L2	7.5	8' 5"	Y	Y	5-11-21, S	272-273(S)	Wood cover intact, small pipes in MH deviate from plans. Standing water above inlet inverts.
4	2	MH4L2	6.5	6' 6"	Y	Y	5-11-21, S	274-276(S)	Wood cover intact, small pipes in MH deviate from plans. Standing water above inlet inverts.
5	2	MH5L2	4.5	4' 8"	Y	N	5-11-21, S	277-278(S)	Wood debris present, small pipes in MH deviate from plans. Surface debris on sediment. Sediment appears damp.
1	3	MH1L3	10	6' 8"	N	N	NS	261-262(S), 263-264(N)	Water drips from shallow pipe. Pipes at MH base are buried in sediment. Small pipes in MH deviate from plans. Severe encrustation in MH. Surface debris over sediment.
1	4	MH1L4	3.5	2' 9"	Y	N	NS	189-192(N)	Surface debris over sediment fills MH to covers inlets. E outlet pipe appears wood.
2	4	MH2L4	5	5' 6"	Y	N	11-11-16, S	193-194(N), 195(W)	Small pipes in MH deviate from plans. Wood, pipes, surface debris in MH partially covers inlets. Some standing water. Pipes at base of MH appear wood.
3	4	MH3L4	5.5	5' 7"	Y	N	NS	196-197(N)	Surface debris over sediment. Horizontal pipes appear wood.
4	4	MH4L4	5.8	6' 1"	N	Y	NS	198-200, 241-242	MH paved over, wood cover intact, sheen on water, "growies" present.

Notes:

MH	Manhole.
Ft	Feet.
NS	Not sampled.
(N)(S)	Photograph view to north (N) or South (S) or west (W).
S, W	Sediment or water sample.
Surface Debris	Includes large rocks, bricks, metal, lumber, plastic, and other debris dislodged at some time from ground surface into manhole.
Invert	Lowest point inside manhole.

Table 2.5.4-1
PAAOC Scrubber Effluent System Inspection Summary
Columbia Gorge Aluminum Smelter, Goldendale, Washington
Page 2 of 2

MH No.	Line No.	Location Name	Invert Depth from Plans (Ft)	Invert Depth Measured (Ft)	Sediment Present	Water Present	Sampled	Photo Numbers	Comments
					Y/N	Y/N			
5	4	MH5L4	7	6' 4"	Y	N	NS	201-202(N)	Wood debris present in MH. Encrustation inside MH.
6	4	MH6L4	6	6' 2"	N	N	NS	203-204(N)	Small pipes in MH deviate from plans. Surface debris to top of inlets. Horizontal pipes appear wood.
7	4	MH7L4	7.8	7' 7"	Y	N	NS	205-206(N)	Small pipes in MH deviate from plans. Surface debris to top of inlets. Horizontal pipes appear wood.
8	4	MH8L4	8	8' 2"	Y	N	NS	230(N), 238-239(N)	MH paved over, wood cover intact, "growies" present. Horizontal pipes appear wood. 2012 report indicates this MH previously sampled, but it was found paved over.
9	4	MH9L4	8.5	9' 0"	Y	N	NS	231(N), 235-237(N)	MH paved over, wood cover intact, "growies" present.
10	4	MH10L4	9.5	10' 0"	Y	N	11-11-16, S	208(N), 232-234(N)	Wood cover intact with a few inches of dense compacted sediment over wooden cover, "growies" present.
11	4	MH11L4	9	9' 3"	Y	N	NS	207(N), 209-210(N), 211(S)	Wood cover intact, small pipes in MH deviate from plans. Upper pipe appears wood, pipes at base of MH do not appear wood.
12	4	MH12L4	10.5	10' 4"	Y	N	NS	212-215(N)	Small pipes in MH deviate from plans.
13	4	MH13L4	13	12' 5"	N	Y	NS	216-217(N)	Passage No. 3. Small pipes in MH deviate from plans. Standing water. Horizontal pipes appear to be wood with encrustation.
14	4	MH14L4	11.5	11' 4"	Y	N	NS	218-221(N)	Small pipes in MH deviate from plans. Horizontal pipes appear to be wood.
15	4	MH15L4	13.5	13' 8"	Y	N	NS	222-223(N)	Small pipes in MH deviate from plans. Horizontal pipes appear to be wood.
16	4	MH16L4	15	14' 6"	Y	Y	NS	224-226(N)	Damaged wood barrel. Small pipes in MH deviate from plans. Upper horizontal pipe appears wood, pipes at base of MH appear to be wood.
17	4	MH17L4	16.5	14' 9"	Y	Y	11-11-16, S	227-229(N)	Pipes at base of MH buried in sediment. Small pipes in MH deviate from plans. Upper horizontal pipe appears wood. Standing water.
18	4	MH18L4	17	23' 3"	Y	N	NS	394-398(N)	Severe encrustation inside MH. Tarp and nylon rope in MH obscures horizontal pipes at base of MH.

Notes:

MH	Manhole.
Ft	Feet.
NS	Not sampled.
(N)(S)	Photograph view to north (N) or South (S) or west (W).
S, W	Sediment or water sample.
Surface Debris	Includes large rocks, bricks, metal, lumber, plastic, and other debris dislodged at some time from ground surface into manhole.
Invert	Lowest point inside manhole.

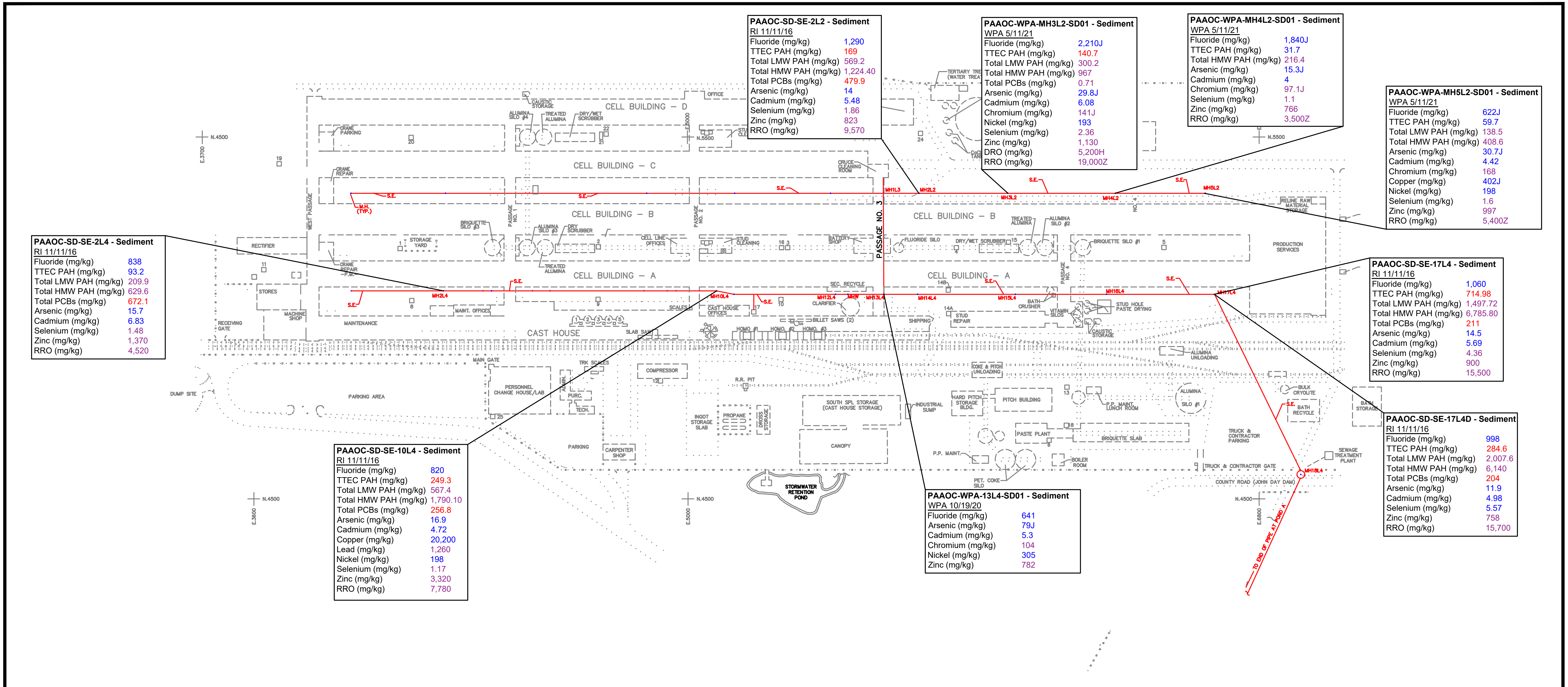
2.5.4.3.2 Collection of Sediment Samples from Scrubber Effluent System

The Scrubber Effluent System was investigated during the initial RI phase by collection of sediment samples from Scrubber Effluent Manholes SD-SE-2L2, SD-SE2L4, SD-SE10L4, and SD-SE17L4 (Figure 2.5.4-2). A fifth sediment sample was planned to be collected from Scrubber Effluent Manhole MH18L4, which is the last access point prior to the Scrubber Effluent System outfall near the head of NPDES Pond A. When the manhole was cleared of obstruction, no sediment was present and therefore, no sediment sample was collected. Scrubber Effluent line manhole sediment samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, VOCs, and TPH-Dx.

Sediment analytical results are summarized in Table 2.5.4-2 (PAAOC Scrubber Effluent System RI Sediment Results Summary). Sediment data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC soil screening levels. It should be noted that contaminated sediment in a pipe is not an exposure pathway for wildlife and this implied risk will be evaluated in the feasibility study. Natural background concentrations for the site have been used to adjust screening levels where applicable during the screening process. Laboratory analytical reports are included in Volume 5, Appendix H-2, and data validation reports are included in Volume 5, Appendix I-2. For the Scrubber Effluent System sediment samples, the reporting limit objectives have been met.

All sediment sample analytical results for COPCs that exceed Plant Area AOC soil screening levels are compiled and presented on Figure 2.5.4-2 (PAAOC Scrubber Effluent System Sediment Sample Locations and Exceedance Summary). Initial RI sediment sample results indicate that total cyanide, sulfate, VOCs, TPH-Gx, and TPH-Dx as diesel do not exceed MTCA Method C, protection of groundwater, and/or ecological wildlife screening levels. Fluoride was detected in all samples at concentrations that range from 830 mg/kg to 1,060 mg/kg which exceed the protection of groundwater screening level of 147.6 mg/kg.

Detected concentrations of PAHs as TTEC and calculated total LMW and total HMW exceed the MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC soil screening levels in all sediment samples. Calculated concentrations of Total PCBs detected in sediment range from 204 to 672.1 mg/kg and exceed MTCA Method C and ecological wildlife screening levels in all sediment samples.



PAAOC-SD-SE-2L2 - Sediment
RI 11/11/16

Fluoride (mg/kg)	1,290
TTEC PAH (mg/kg)	169
Total LMW PAH (mg/kg)	569.2
Total HMW PAH (mg/kg)	1,224.40
Total PCBs (mg/kg)	479.9
Arsenic (mg/kg)	14
Cadmium (mg/kg)	5.48
Selenium (mg/kg)	1.86
Zinc (mg/kg)	823
RRO (mg/kg)	9,570

PAAOC-WPA-MH3L2-SD01 - Sediment
WPA 5/11/21

Fluoride (mg/kg)	2,210J
TTEC PAH (mg/kg)	140.7
Total LMW PAH (mg/kg)	300.2
Total HMW PAH (mg/kg)	967
Total PCBs (mg/kg)	0.71
Arsenic (mg/kg)	29.8J
Cadmium (mg/kg)	6.08
Chromium (mg/kg)	141J
Nickel (mg/kg)	193
Selenium (mg/kg)	2.36
Zinc (mg/kg)	1,130
DRO (mg/kg)	5,200H
RRO (mg/kg)	19,000Z

PAAOC-WPA-MH4L2-SD01 - Sediment
WPA 5/11/21

Fluoride (mg/kg)	1,840J
TTEC PAH (mg/kg)	31.7
Total HMW PAH (mg/kg)	216.4
Arsenic (mg/kg)	15.3J
Cadmium (mg/kg)	4
Chromium (mg/kg)	97.1J
Selenium (mg/kg)	1.1
Zinc (mg/kg)	766
RRO (mg/kg)	3,500Z

PAAOC-WPA-MH5L2-SD01 - Sediment
WPA 5/11/21

Fluoride (mg/kg)	622J
TTEC PAH (mg/kg)	59.7
Total LMW PAH (mg/kg)	138.5
Total HMW PAH (mg/kg)	408.6
Arsenic (mg/kg)	30.7J
Cadmium (mg/kg)	4.42
Chromium (mg/kg)	168
Copper (mg/kg)	402J
Nickel (mg/kg)	198
Selenium (mg/kg)	1.6
Zinc (mg/kg)	997
RRO (mg/kg)	5,400Z

PAAOC-SD-SE-2L4 - Sediment
RI 11/11/16

Fluoride (mg/kg)	838
TTEC PAH (mg/kg)	93.2
Total LMW PAH (mg/kg)	209.9
Total HMW PAH (mg/kg)	629.6
Total PCBs (mg/kg)	672.1
Arsenic (mg/kg)	15.7
Cadmium (mg/kg)	6.83
Selenium (mg/kg)	1.48
Zinc (mg/kg)	1,370
RRO (mg/kg)	4,520

PAAOC-SD-SE-17L4 - Sediment
RI 11/11/16

Fluoride (mg/kg)	1,060
TTEC PAH (mg/kg)	714.98
Total LMW PAH (mg/kg)	1,497.72
Total HMW PAH (mg/kg)	6,785.80
Total PCBs (mg/kg)	211
Arsenic (mg/kg)	14.5
Cadmium (mg/kg)	5.69
Selenium (mg/kg)	4.36
Zinc (mg/kg)	900
RRO (mg/kg)	15,500

PAAOC-SD-SE-10L4 - Sediment
RI 11/11/16

Fluoride (mg/kg)	820
TTEC PAH (mg/kg)	249.3
Total LMW PAH (mg/kg)	567.4
Total HMW PAH (mg/kg)	1,790.10
Total PCBs (mg/kg)	256.8
Arsenic (mg/kg)	16.9
Cadmium (mg/kg)	4.72
Copper (mg/kg)	20,200
Lead (mg/kg)	1,260
Nickel (mg/kg)	198
Selenium (mg/kg)	1.17
Zinc (mg/kg)	3,320
RRO (mg/kg)	7,780

PAAOC-SD-SE-17L4D - Sediment
RI 11/11/16

Fluoride (mg/kg)	998
TTEC PAH (mg/kg)	284.6
Total LMW PAH (mg/kg)	2,007.6
Total HMW PAH (mg/kg)	6,140
Total PCBs (mg/kg)	204
Arsenic (mg/kg)	11.9
Cadmium (mg/kg)	4.98
Selenium (mg/kg)	5.57
Zinc (mg/kg)	758
RRO (mg/kg)	15,700

PAAOC-WPA-13L4-SD01 - Sediment
WPA 10/19/20

Fluoride (mg/kg)	641
Arsenic (mg/kg)	79J
Cadmium (mg/kg)	5.3
Chromium (mg/kg)	104
Nickel (mg/kg)	305
Zinc (mg/kg)	782

Source: Goldendale Aluminum Company, Plant Drawing A1/1752, "Underground Storm & Sanitary Sewer Piping W/Chem'l & Oil Str'g Areas"

Legend

—— SCRUBBER EFFLUENT LINE

RRO	TPH-Dx as Residual Range Organics
RI	Initial RI Phase
WPA	WPA Phase

Soil Screening Levels

red	Exceeds MTCA Method C
blue	Exceeds Protection of Groundwater
purple	Exceeds Ecological Wildlife and for TPH diesel and residual range organics exceeds MTCA Method A

Water Screening Levels

red	Exceeds MTCA Method C
green	Exceeds WA MCL

Notes

H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.
J	Estimated Concentration
Z	Chromatographic fingerprint does not resemble a petroleum product

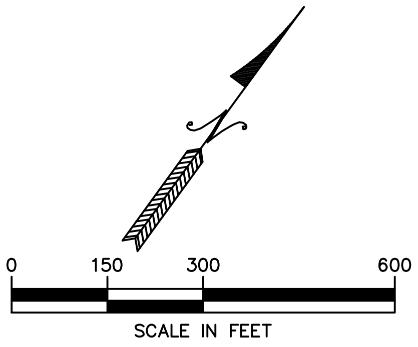


Figure 2.5.4-2

Plant Area AOC

Scrubber Effluent System Sediment Sample Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Table 2.5.4-2
PAAOC Scrubber Effluent System RI Sediment Results Summary
Columbia Gorge Aluminum Smelter, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	RI Analytical Results				
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SD-SE-2L2	PAAOC-SD-SE-2L4	PAAOC-SD-SE-10L4	PAAOC-SD-SE-17L4	PAAOC-SD-SE-17L4D
Aluminum Smelting											
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.0975 U	0.0994 U	0.1 U	0.0997 U	0.098 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**1,290**	**838**	**820**	**1,060**	**998**
Sulfate	mg/kg	NA	NE	2,150	NE	NE	41	34.5	196	87.8	84
Polynuclear Aromatic Hydrocarbons (PAHs)											
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	1.62	0.696	1.67	0.59	0.486 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	1.19	0.713	1.62	0.645	0.543
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	12.5	6.68	12.7	7.83	6.68
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.531 U	0.517	0.56	0.866	0.868
Anthracene	mg/kg	NA	NE	2,300	NE	NL	47	14	43.7	21.1	23.1
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	124	69.8	172	591	563
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	112	68	167	362	18.4
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	263	26.9	368	1,850	1,480
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	66	61.6	99.7	193	155
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	64.1	55.2	99.1	404	177
Chrysene	mg/kg	NA	NL	NL	NE	NL	205	149	357	1,790	2,050
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	20.8	17.7	33.3	69.8	54.6
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	6.27	2.64	4.96	3.34	2.94
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	355	130	362	1,330	1,850
Fluorene	mg/kg	NL	140,000	100	NE	NL	13.9	4.9	14.3	5.71	4.98
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	77.5	67.4	115	436	182
Naphthalene	mg/kg	5	70	4.5	NE	NL	1.77	0.987	2.14	1.21	0.933
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	139	52.8	132	131	121
Pyrene	mg/kg	NA	110,000	650	NE	NL	292	114	379	1,090	1,460
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**169**	**93.2**	**249.3**	**714.98**	**284.6**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	**569.2**	**209.9**	**567.4**	**1,497.72**	**2,007.60**
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**1,224.40**	**629.6**	**1,790.10**	**6,785.80**	**6,140**
Polychlorinated Biphenyls (PCBs)											
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	65.1 U	11.1 U	10.6 U	61.1 U	58.7 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	65.1 U	11.1 U	10.6 U	61.1 U	58.7 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	65.1 U	11.1 U	10.6 U	61.1 U	58.7 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	215	47.1	22.7	61.1 U	58.7 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	65.1 U	11.1 U	10.6 U	61.1 U	58.7 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	86.8	201	65	211	204
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	87	165	64.9	61.1 U	58.7 U
Aroclor 1262	mg/kg	NA	NL	NE	NE	NE	65.1 U	11.1 U	70.2	61.1 U	58.7 U
Aroclor 1268	mg/kg	NA	NL	NE	NE	NE	91.1	259	34	61.1 U	58.7 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	**479.9**	**672.1**	**256.8**	**211**	**204**
Metals											
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	30,500	30,000	43,300	61,300	51,800
Arsenic	mg/kg	20	87.5	2.9	7.61	132	**14**	**15.7**	**16.9**	**14.5**	**11.9**
Cadmium	mg/kg	2	3,500	0.69	0.81	14	**5.48**	**6.83**	**4.72**	**5.69**	**4.98**
Chromium	mg/kg	2,000	5,300,000	490,000	32	67	52.1	64.9	66.7	52.5	41.3
Copper	mg/kg	NA	140,000	280	28.4	217	74	88.1	**20,200**	119	98.2
Lead	mg/kg	1,000	NE	3,000	13	118	48.6	54.7	**1,260**	82.1	80.2
Mercury	mg/kg	2	NE	2.1	0.04	5.5	1.09	0.902	0.938	0.966	0.972 U
Nickel	mg/kg	NA	70,000	130	24.54	980	110	104	**198**	120	117
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	**1.86**	**1.48**	**1.17**	**4.36**	**5.57**
Zinc	mg/kg	NA	1,100,000	6,000	81	360	**823**	**1,370**	**3,320**	**900**	**758**
Volatile Organic Compounds (VOCs)											
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.021 U	0.0207 U	0.0152 U	0.0139 U	0.0336 U
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0841 U	0.083 U	0.0608 U	0.0695 U	0.135 U
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.042 U	0.0415 U	0.0438	0.0348 U	0.0673 U
Xylenes, total	mg/kg	9	700,000	14	NE	10	0.126 U	0.124 U	0.163	0.104 U	0.202 U
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.042 U	0.0415 U	0.0304 U	0.0348 U	0.0673 U
cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.042 U	0.0415 U	0.0304 U	0.0348 U	0.0673 U
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9092	0.042 U	0.0415 U	0.0304 U	0.0348 U	0.0673 U
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.042 U	0.0415 U	0.0304 U	0.0348 U	0.0673 U
Vinyl chloride	mg/kg	NE	88	0.0017	NE	6.46	0.042 U	0.0415 U	0.0304 U	0.0348 U	0.0673 U
Total Petroleum Hydrocarbons (TPHs)											
Gasoline Range Organics	mg/kg	100	NE	NA	NE	1,000	8.41 U	8.3 U	6.08 U	7 U	13.5 U
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	536 U	448 U	457 U	480 U	489 U
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	**9,570**	**4,520**	**7,780**	**15,500**	**15,700**

Notes:

NA	Not applicable or not analyzed.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
NE	Not established.	LMW PAH	Low molecular weight PAH.
NL	Not listed or not shown for this chemical but detected concentration accounted for in the summation process.	HMW PAH	High molecular weight PAH.
U	Chemical was not detected. The associated value represents the method detection limit.		

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Several metals, including arsenic, cadmium, chromium, copper, lead, nickel, selenium, and zinc, were detected at concentrations that exceed MTCA Method C and/or ecological wildlife soil screening levels in at least one sample. Arsenic was detected at concentrations up to 16.9 mg/kg and exceeds protection of groundwater screening level in all samples. Cadmium was detected at concentrations up to 6.83 mg/kg and exceeds the protection of groundwater screening level in all samples. Chromium was detected in one sample at a concentration of 66.7 mg/kg that exceeds the ecological wildlife screening level. Copper was detected in one sample at a concentration of 20,200 mg/kg that exceeds protection of groundwater and ecological wildlife screening levels. Lead was detected in one sample at a concentration of 1,260 mg/kg that exceeds the ecological wildlife screening level. Nickel was detected in one sample at a concentration of 198 mg/kg that exceeds the protection of groundwater screening level. Selenium was detected at concentrations ranging from 1.17 mg/kg to 5.57 mg/kg that exceeds ecological wildlife screening levels in all samples and protection of groundwater screening level in one sample. Zinc was detected at concentrations up to 3,320 mg/kg that exceeds the ecological wildlife screening level in all samples.

TPH-DX as residual range organics were detected in all samples at concentrations ranging from 4,250 mg/kg to 15,700 mg/kg that exceeds MTCA Method A Industrial and the ecological wildlife screening level of 2,000 mg/kg.

2.5.4.3.3 Collection of Soil Samples Along Scrubber Effluent System Alignment

Subsurface soil surrounding the Scrubber Effluent System horizontal lines along the system alignment was investigated with 29 soil borings completed to depths at and below the anticipated invert of the Scrubber Effluent line horizontal pipes. The location of the Scrubber Effluent line borings in Courtyards A and C, near the Tertiary Treatment Plant, and in the southeast plant area are shown on Figure 2.5.4-3. The purpose of the sampling locations and depths was to evaluate whether there is evidence that leakage of waste and wastewater from the Scrubber Effluent Lines has impacted subsurface soil. Eighteen Scrubber Effluent borings were originally identified in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The Supplemental Remedial Investigation Work Plan for the Plant Area AOC (PGG 2017) identified additional borings investigating other site features with sample collection depths specified in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). These additional borings were drilled to deeper depths to include samples above and below the Scrubber Effluent line inverts at those locations.

Maxar

Scrubber Effluent System Borings

- ● Courtyard A Boring (Table 2.5.4-3)
- ● Courtyard C Boring (Table 2.5.4-4)
- ● Southeast Boring (Table 2.5.4-5)
- ● Tertiary Treatment, SE System not present (Table 2.5.4-5)

- ▭ Plant Production Area Footprint
- — Scrubber Effluent Lines

Figure 2.5.4-3

Plant Area AOC
Locations of Soil Borings to Investigate
Soil Near The Scrubber Effluent System

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Soil samples collected from the 29 soil borings were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Dx, and VOCs. Soil analytical results are summarized in the following tables.

- Courtyard A: Table 2.5.4-3 (PAAOC Scrubber Effluent System in Courtyard A Soil Results Summary)
- Courtyard C: Table 2.5.4-4 (PAAOC Scrubber Effluent System in Courtyard C Soil Results Summary)
- Tertiary Treatment Plant and southeast plant area: Table 2.5.4-5 (PAAOC Scrubber Effluent System in Tertiary Treatment Plant and Southeast Plant Areas Soil Results Summary)

The following sections discuss analytical results for soil boring samples collected from along the Scrubber Effluent System alignment in Courtyard A, Courtyard C, and in the vicinity of the Tertiary Treatment Plant and southeast plant area.

2.5.4.3.4 Soil Samples Results for Courtyard A

Thirteen Scrubber Effluent soil borings were completed in Courtyard A, and 57 soil samples collected from the borings (Figure 2.5.4-3). Scrubber Effluent Line 4 extends for the length of Courtyard A with MH1L4 at the western end of Courtyard Segment A1, and MH17L4 at the eastern end of Courtyard Segment A5. Courtyard A has a relatively consistent elevation along its length, and Line 4 has a consistent slope for its length, with manhole invert depths of approximately 3.5 ft bgs at MH1L4 to 17.5 ft bgs at MH17L4.

Soil samples collected from soil the borings in Courtyard A were analyzed for total cyanide, fluoride, sulfate, cPAHs, PCBs, metals, TPH-Dx, and VOCs. Soil analytical results are summarized in Table 2.5.4-3 (PAAOC Scrubber Effluent System in Courtyard A Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC soil screening levels. Natural background concentrations for the site have been used to adjust screening levels during the screening process. Laboratory analytical reports are included in Volume 5 Appendix H-2, and data validation reports are included in Volume 5 Appendix I-2. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). For soil in Courtyard A, reporting limits for arsenic exceed the protection of groundwater soil screening level, and for selenium exceed the protection of groundwater and ecological wildlife soil screening level, in all samples analyzed.

Table 2.5.4-3
PAAOC Scrubber Effluent System in Courtyard A RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Page 1 of 4

	Screening Levels					Ecological Screening Levels	RI Analytical Results											
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-BC01-3	PAAOC-SB-BC01-6	PAAOC-SB-BC01-11	PAAOC-SB-BC01-15	PAAOC-SB-CH03-1	PAAOC-SB-CH03-2	PAAOC-SB-CH03-6.5	PAAOC-SB-CH05-3	PAAOC-SB-CH05-5	PAAOC-SB-COPC05-1	PAAOC-SB-COPC05-3	PAAOC-SB-COPC05-5
Aluminum Smelting																		
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.16	0.07	0.05 U	0.12	0.05 U	0.19	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**280**	76	80	32	**1,100**	**400**	5 U	**360**	43	72	14	7.7
Sulfate	mg/kg	NA	NE	2,150	NE	NE	61 J	35 J	46	140 J	220 J	130 J	290 J	97 J	14 J	180	520	2,000
Polynuclear Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	16 U	0.0084 U	0.0073 U	0.0077 U	0.038 U	0.038 U	0.0072 U	0.0071 U	0.0079 U	0.0073 U	0.0077 U	0.0075 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	16 U	0.0084 U	0.0073 U	0.0077 U	0.038 U	0.038 U	0.0072 U	0.0071 U	0.0079 U	0.0073 U	0.0077 U	0.0075 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	16 U	0.0084 U	0.0073 U	0.0077 U	0.038 U	0.038 U	0.0072 U	0.018	0.0079 U	0.0073 U	0.0077 U	0.0075 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	16 U	0.0084 U	0.0073 U	0.0077 U	0.038 U	0.038 U	0.0072 U	0.0071 U	0.0079 U	0.0073 U	0.0077 U	0.0075 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	16 U	0.0084 U	0.0073 U	0.0077 U	0.07	0.038 U	0.0072 U	0.03	0.0079 U	0.0073 U	0.0077 U	0.0075 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	21	0.0084 U	0.011	0.036	0.59	0.29	0.0072 U	0.14	0.0079 U	0.013	0.0077 U	0.0075 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	28	0.0084 U	0.016	0.053	0.78	0.38	0.0072 U	0.099	0.0079 U	0.011	0.0077 U	0.0075 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	32	0.012	0.023	0.069	1.6	0.83	0.0088	0.22	0.0079 U	0.021	0.0077 U	0.008
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	18	0.0084 U	0.014	0.039	1	0.54	0.0072 U	0.076	0.0079 U	0.0082	0.0077 U	0.0075 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	16 U	0.0084 U	0.0073 U	0.024	0.47	0.24	0.0072 U	0.066	0.0079 U	0.0075	0.0077 U	0.0075 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	25	0.0093	0.013	0.042	0.91	0.5	0.0072 U	0.28	0.0079 U	0.018	0.0077 U	0.0075 U
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	16 U	0.0084 U	0.0073 U	0.0082	0.19	0.1	0.0072 U	0.02	0.0079 U	0.0073 U	0.0077 U	0.0075 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	36	0.018	0.016	0.054	1.1	0.55	0.0072 U	0.32	0.0079 U	0.031	0.0077 U	0.0075 U
Fluorene	mg/kg	NL	140,000	100	NE	NL	16 U	0.0084 U	0.0073 U	0.0077 U	0.038 U	0.038 U	0.0072 U	0.0083	0.0079 U	0.0073 U	0.0077 U	0.0075 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	19	0.0084 U	0.011	0.04	0.92	0.48	0.0072 U	0.08	0.0079 U	0.0073 U	0.0077 U	0.0075 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0053	0.0014 U	0.0073 U	0.0077 U	0.038 U	0.038 U	0.0072 U	0.0071 U	0.0079 U	0.0073 U	0.0077 U	0.0075 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	18	0.0014 U	0.0073 U	0.021	0.34	0.16	0.0072 U	0.12	0.0079 U	0.022	0.0077 U	0.0075 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	37	0.017	0.015	0.051	0.97	0.48	0.0072 U	0.3	0.0079 U	0.028	0.0077 U	0.0075 U
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**35.5**	0.001	0.02	0.07	1.2	0.6	0.0009	0.15	0.0079	0.03	0.0077	0.0008
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	34.01	0.02	0.02	0.08	1.51	0.71	0.007	0.5	0.0079	0.05	0.0077	0.008
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**180**	0.04	0.1	0.36	**7.43**	**3.84**	0.009	**1.3**	0.0079	0.11	0.0077	0.0008
Polychlorinated Biphehnyls (PCBs)																		
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.06 U	0.063 U	0.055 U	0.058 U	0.057 U	0.058 U	0.054 U	0.053 U	0.059 U	0.055 U	0.058 U	0.057 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.06 U	0.063 U	0.055 U	0.058 U	0.057 U	0.058 U	0.054 U	0.053 U	0.059 U	0.055 U	0.058 U	0.057 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.06 U	0.063 U	0.055 U	0.058 U	0.057 U	0.058 U	0.054 U	0.053 U	0.059 U	0.055 U	0.058 U	0.057 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.06 U	0.063 U	0.055 U	0.058 U	0.057 U	0.058 U	0.054 U	0.053 U	0.059 U	0.055 U	0.058 U	0.057 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.06 U	0.063 U	0.055 U	0.058 U	0.057 U	0.058 U	0.054 U	0.053 U	0.059 U	0.055 U	0.058 U	0.057 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.06 U	0.063 U	0.055 U	0.058 U	0.057 U	0.058 U	0.054 U	0.053 U	0.059 U	0.055 U	0.058 U	0.057 U
Aroclor 1260	mg/kg	NA	66.0	NE	NE	NE	0.06 U	0.063 U	0.055 U	0.058 U	0.057 U	0.058 U	0.054 U	0.053 U	0.059 U	0.055 U	0.058 U	0.057 U
Total PCBs (calc)	mg/kg	10	66.0	NE	NE	0.65	0.06	0.063	0.055	0.058	0.057	0.058	0.054	0.053	0.059	0.055	0.058	0.057
Metals																		
Aluminum	mg/kg	NA	3,500,000	480000	28,299	NE	17,000	13,000	4,300	3,800	11,000	11,000	9,800	7,700	7,900	8,500	8,600	9,500
Arsenic	mg/kg	20	88	2.9	7.61	132	12 U	13 U	11 U	12 U	11 U	12 U	11 U	11 U	12 U	11 U	12 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.6 U	0.63 U	0.55 U	0.58 U	**2.5**	**0.97**	0.54 U	0.53 U	0.59 U	0.55 U	0.58 U	0.57 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	5.7	1.9	1.8	2.2	10	7.8	27	5.3	6.3	7.6	7.1	6.1
Copper	mg/kg	NA	140,000	280	28.4	217	17	18	12	14	24	19	28	15	14	14	12	13
Lead	mg/kg	1,000	NE	3,000	13.1	118	6 U	6.3 U	5.5 U	5.8 U	5.9	5.8 U	5.4 U	5.3 U	5.9 U	5.8	5.8 U	6.8
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.3 U	0.31 U	0.27 U	0.29 U	0.29 U	0.29 U	0.27 U	0.27 U	0.29 U	0.28 U	0.29 U	0.28 U
Nickel	mg/kg	NA	70,000	130	24.54	980	12	3.6	2.7 U	2.9	35	23	18	5.1	7.9	7	6.1	5.8
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	12 U	13 U	11 U	12 U	11 U	12 U	11 U	11 U	12 U	11 U	12 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	68	33	32	34	**930**	**770**	33	49	41	45	44	49
Total Petroleum Hydrocarbons (TPHs)																		
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	210 U	32 U	28 U	29 U	60	29 U	27 U	27 U	29 U	28 U	29 U	28 U
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	1,400	63 U	55 U	58 U	360	120	54 U	53 U	59 U	55 U	58 U	57 U
Volatile Organic Compounds (VOCs)																		
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.00081 U	0.0012 U	0.00097 U	0.0011 U	0.001 U	0.0014 U	0.0013 U	0.0013 U
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0066 U	0.007 U	0.0038 U	0.0051 U	0.004 U	0.0061 U	0.0048 U	0.0053 U	0.0052 U	0.0071 U	0.0063 U	0.0064 U
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.00081 U	0.0012 U	0.00097 U	0.0011 U	0.001 U	0.0014 U	0.0013 U	0.0013 U
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.0026 U	0.0028 U	0.0015 U	0.002 U	0.0016 U	0.0024 U	0.0019 U	0.0021 U	0.0021 U	0.0028 U	0.0025 U	0.0025 U
o-Xylene	mg/kg	9	700,000	14	NE	10	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.00081 U	0.0012 U	0.00097 U	0.0011 U	0.001 U	0.0014 U	0.0013 U	0.0013 U
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.00081 U	0.0012 U	0.00097 U	0.0011 U	0.001 U	0.0014 U	0.0013 U	0.0013 U
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.00081 U	0.0012 U	0.00097 U	0.0011 U	0.001 U	0.0014 U	0.0013 U	0.0013 U
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.00081 U	0.0012 U	0.00097 U	0.0011 U	0.001 U	0.0014 U	0.0013 U	0.0013 U
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.00081 U	0.0012 U	0.00097 U	0.0011 U	0.001 U	0.0014 U	0.0013 U	0.0013 U
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	0.0013 U	0.0014 U	0.00075 U	0.001 U	0.00081 U	0.0012 U	0.00097 U	0.0011 U	0.001 U	0.0014 U	0.0013 U	0.0013 U

Notes:

J	Estimated concentration.	TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
NA	Not applicable or not analyzed.	LMW PAH	Low molecular weight PAH.
NE	Not established in lookup tables.	HMW PAH	High molecular weight PAH.
NL	Not listed or not shown for this chemical but detected concentration is accounted for in the summation process	Detected concentrations shown in bold exceed one or more site soil screening levels.	
U	Chemical was not detected. The associated value represents the method detection limit.		

Table 2.5.4-3
PAAOC Scrubber Effluent System in Courtyard A RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

		Screening Levels				Ecological Screening Levels	RI Analytical Results											
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-SE01-3	PAAOC-SB-SE03-3	PAAOC-SB-SE03-3D	PAAOC-SB-SE03-5	PAAOC-SB-SE03-7	PAAOC-SB-SE05-3	PAAOC-SB-SE05-6	PAAOC-SB-SE05-8	PAAOC-SB-SE07-3	PAAOC-SB-SE07-6	PAAOC-SB-SE07-6D	PAAOC-SB-SE07-14
Aluminum Smelting																		
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**920**	6.5	5 U	5 U	29	20	7	20	**410**	20 J	31	31
Sulfate	mg/kg	NA	NE	2,150	NE	NE	12	**3,100**	290	800	110	840 J	2,000 J	**4,100**	50 J	21 J	38	140 J
Polynuclear Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.28 U	0.0072 U	0.0071 U	0.0072 U	0.0071 U	0.0074 U	0.0073 U	0.0085 U	0.035 U	0.15 U	0.0073 U	0.0085 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.28 U	0.0072 U	0.0071 U	0.0072 U	0.0071 U	0.0074 U	0.0073 U	0.0085 U	0.035 U	0.15 U	0.0073 U	0.0085 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.56	0.0072 U	0.0071 U	0.0072 U	0.0071 U	0.0074 U	0.0073 U	0.0085 U	0.035 U	0.18	0.0073 U	0.0085 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.28 U	0.0072 U	0.0071 U	0.0072 U	0.0071 U	0.0074 U	0.0073 U	0.0085 U	0.035 U	0.15 U	0.0073 U	0.0085 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	1.3	0.0072 U	0.0071 U	0.0072 U	0.0071 U	0.0074 U	0.0073 U	0.0085 U	0.048	0.49 J	0.0073 U	0.0085 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	7.7	0.0072 U	0.0071 U	0.0072 U	0.0071 U	0.0074 U	0.036	0.0085 U	0.35	5.7 J	0.0077	0.0085 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	8.8	0.0072 U	0.0071 U	0.0072 U	0.0071 U	0.0074 U	0.032	0.0085 U	0.4	6.6 J	0.0073 U	0.0085 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	24	0.0072 U	0.011	0.0093	0.0071 U	0.0074 U	0.059	0.0085 U	0.71	16 J	0.019	0.0085 U
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	9.2	0.0072 U	0.0071 U	0.0072 U	0.0071 U	0.0074 U	0.028	0.0085 U	0.36	6.3	0.0073 U	0.0085 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	6.9	0.0072 U	0.0071 U	0.0072 U	0.0071 U	0.0074 U	0.019	0.0085 U	0.22	3.7 J	0.0073 U	0.0085 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	13	0.011	0.0096	0.0073	0.0071 U	0.0074 U	0.048	0.0085 U	0.6	13 J	0.027	0.0085 U
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	2.1	0.0072 U	0.0071 U	0.0072 U	0.0071 U	0.0074 U	0.0073 U	0.0085 U	0.081	1.3 J	0.0073 U	0.0085 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	16	0.0072 U	0.0089	0.0072 U	0.0071 U	0.0074 U	0.065	0.0085 U	0.51	8.2 J	0.019	0.0085 U
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.4	0.0072 U	0.0071 U	0.0072 U	0.0071 U	0.0074 U	0.0073 U	0.0085 U	0.035 U	0.15 U	0.0073 U	0.0085 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	9.7	0.0072 U	0.0071 U	0.0072 U	0.0071 U	0.0074 U	0.028	0.0085 U	0.34	4.7 J	0.0073 U	0.0085 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0061	0.0072 U	0.0071 U	0.0072 U	0.0071 U	0.0074 U	0.0073 U	0.0085 U	0.035 U	0.15 U	0.0073 U	0.0085 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	5.7	0.0072 U	0.0071 U	0.0072 U	0.0071 U	0.0074 U	0.025	0.0085 U	0.16	1.9	0.0073 U	0.0085 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	14	0.0072 U	0.0085	0.0072 U	0.0071 U	0.0074 U	0.06	0.0085 U	0.49	7.6 J	0.016	0.0085 U
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**14**	0.001	0.001	0.001	0.0071	0.0074	0.06	0.0085	0.6	**10**	0.003	0.0085
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	84.96	0.007	0.009	0.007	0.0071	0.0074	0.09	0.0085	0.72	10.8	0.02	0.0085
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**95.4**	0.01	0.021	0.02	0.0071	0.0074	0.31	0.0085	**3.6**	**64.9**	0.07	0.0085
Polychlorinated Biphehnyls (PCBs)																		
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.053 U	0.054 U	0.053 U	0.054 U	0.053 U	0.055 U	0.055 U	0.064 U	0.053 U	0.056 U	0.055 U	0.064 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.053 U	0.054 U	0.053 U	0.054 U	0.053 U	0.055 U	0.055 U	0.064 U	0.053 U	0.056 U	0.055 U	0.064 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.053 U	0.054 U	0.053 U	0.054 U	0.053 U	0.055 U	0.055 U	0.064 U	0.053 U	0.056 U	0.055 U	0.064 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.053 U	0.054 U	0.053 U	0.054 U	0.053 U	0.055 U	0.055 U	0.064 U	0.053 U	0.056 U	0.055 U	0.064 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.053 U	0.054 U	0.053 U	0.054 U	0.053 U	0.055 U	0.055 U	0.064 U	0.053 U	0.056 U	0.055 U	0.064 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.053 U	0.054 U	0.053 U	0.054 U	0.053 U	0.055 U	0.055 U	0.064 U	0.053 U	0.056 U	0.055 U	0.064 U
Aroclor 1260	mg/kg	NA	66.0	NE	NE	NE	0.053 U	0.054 U	0.053 U	0.054 U	0.053 U	0.055 U	0.055 U	0.064 U	0.053 U	0.056 U	0.055 U	0.064 U
Total PCBs (calc)	mg/kg	10	66.0	NE	NE	0.65	0.053	0.054	0.053	0.054	0.053	0.055	0.055	0.064	0.053	0.056	0.055	0.064
Metals																		
Aluminum	mg/kg	NA	3,500,000	480000	28,299	NE	15,000	6,900	6,600	6,000	4,800	6,200	6,400	17,000	6,000	10,000	8,200	13,000
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	11 U	11 U	11 U	11 U	11 U	13 U	11 U	11 U	11 U	13 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	**3**	0.54 U	0.53 U	0.54 U	0.53 U	0.55 U	0.55 U	0.64 U	0.57	0.56 U	0.55 U	0.64 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	34	5.9	6	4.6	1.1 U	4.7	5.8	7.1	5.5	7.3 J	5.5	3
Copper	mg/kg	NA	140,000	280	28.4	217	130	12	14	12	12	16	18	23	20	17	14	16
Lead	mg/kg	1,000	NE	3,000	13.1	118	21	5.4 U	5.3 U	5.4 U	5.3 U	5.5 U	5.5 U	6.4 U	5.3 U	5.6 U	5.5 U	6.4 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.26 U	0.27 U	0.27 U	0.27 U	0.26 U	0.28 U	0.27 U	0.32 U	0.27 U	0.28 U	0.27 U	0.32 U
Nickel	mg/kg	NA	70,000	130	24.54	980	62	5.9	5.4	4.7	3.7	5.1	5	7.4	6.9	7.5	5.1	4.1
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	**16**	11 U	11 U	11 U	11 U	11 U	13 U	11 U	11 U	11 U	13 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	**860**	40	39	36	24	40	44	63	210	57 J	45	45
Total Petroleum Hydrocarbons (TPHs)																		
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	300 U	27 U	27 U	27 U	27 U	28 U	27 U	32 U	27 U	28 U	27 U	32 U
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	**2,500**	55 U	53 U	54 U	53 U	55 U	55 U	64 U	67	95	55 U	64 U
Volatile Organic Chemicals (VOCs)																		
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.00087 U	0.00089 U	0.0012 U	0.00097 U	0.00083 U	0.00097 U	0.0011 U	0.0014 U	0.0011 U	0.00079 U	0.001 U	0.0013 U
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0044 U	0.0044 U	0.006 U	0.0048 U	0.0042 U	0.0049 U	0.0056 U	0.007 U	0.0057 U	0.0039 U	0.005 U	0.0063 U
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.00087 U	0.00089 U	0.0012 U	0.00097 U	0.00083 U	0.00097 U	0.0011 U	0.0014 U	0.0011 U	0.00079 U	0.001 U	0.0013 U
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.0017 U	0.0018 U	0.0024 U	0.0019 U	0.0017 U	0.0019 U	0.0023 U	0.0028 U	0.0023 U	0.0016 U	0.002 U	0.0025 U
o-Xylene	mg/kg	9	700,000	14	NE	10	0.00087 U	0.00089 U	0.0012 U	0.00097 U	0.00083 U	0.00097 U	0.0011 U	0.0014 U	0.0011 U	0.00079 U	0.001 U	0.0013 U
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.00087 U	0.00089 U	0.0012 U	0.00097 U	0.00083 U	0.00097 U	0.0011 U	0.0014 U	0.0011 U	0.00079 U	0.001 U	0.0013 U
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.00087 U	0.00089 U	0.0012 U	0.00097 U	0.00083 U	0.00097 U	0.0011 U	0.0014 U	0.0011 U	0.00079 U	0.001 U	0.0013 U
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.00087 U	0.00089 U	0.0012 U	0.00097 U	0.00083 U	0.00097 U	0.0011 U	0.0014 U	0.0011 U	0.00079 U	0.001 U	0.0013 U
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.00087 U	0.00089 U	0.0012 U	0.00097 U	0.00083 U	0.00097 U	0.0011 U	0.0014 U	0.0011 U	0.00079 U	0.001 U	0.0013 U
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	0.00087 U	0.00089 U	0.0012 U	0.00097 U	0.00083 U	0.00097 U	0.0011 U	0.0014 U	0.0011 U	0.00079 U	0.001 U	0.0013 U

Notes:

J	Estimated concentration.	TTEC	Total Toxicity Equvalent Concentration for carcinogenic PAHs.
NA	Not applicable or not analyzed.	LMW PAH	Low molecular weight PAH.
NE	Not established in lookup tables.	HMW PAH	High molecular weight PAH.
NL	Not listed or not shown for this chemical but detected concentration accounted for in the summation process.	Detected concentrations shown in bold exceed one or more site soil screening levels.	
U	Chemical was not detected. The associated value represents the method detection limit.		

Table 2.5.4-3
PAAOC Scrubber Effluent System in Courtyard A RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	RI Analytical Results											
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-SE07-16.5**	**PAAOC-SB-SE08-3**	**PAAOC-SB-SE08-3D**	**PAAOC-SB-SE08-6**	**PAAOC-SB-SE08-11**	**PAAOC-SB-SE08-15**	**PAAOC-SB-SE08-19**	**PAAOC-SB-SE14-3**	**PAAOC-SB-SE14-6**	**PAAOC-SB-SE14-13**	**PAAOC-SB-SE14-17**	**PAAOC-SB-SWMU2402-1**
Aluminum Smelting																		
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	20	70 J	50	100	**270**	69	**160**	130	46	16	14	41 U
Sulfate	mg/kg	NA	NE	2,150	NE	NE	120 J	240 J	**2,300**	630 J	23 J	180 J	12 J	28 J	10 UJ	14 J	160 J	18 U
Polynuclear Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0082 U	0.037 U	0.0089	0.0075 U	0.15 U	0.0076 U	0.0079 U	0.3 U	0.0077 U	0.0073 U	0.0075 U	0.28 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0082 U	0.037 U	0.011	0.0075 U	0.15 U	0.0076 U	0.0079 U	0.3 U	0.0077 U	0.0073 U	0.0075 U	0.28 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0082 U	0.078	0.059	0.0075 U	0.16	0.0076 U	0.0079 U	0.3 U	0.0077 U	0.0073 U	0.0075 U	0.28 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0082 U	0.037 U	0.0074	0.0075 U	0.15 U	0.0076 U	0.0079 U	0.3 U	0.0077 U	0.0073 U	0.0075 U	0.28 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0082 U	0.17	0.12	0.0075 U	0.27	0.0076 U	0.0079 U	0.34	0.0077 U	0.0073 U	0.0075 U	0.28 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0082 U	0.54 J	0.3	0.0075 U	2.5	0.0076 U	0.013	2.9	0.0096	0.014	0.0075 U	0.68
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.0082 U	0.57 J	0.29	0.0075 U	3.3	0.0076 U	0.0079 U	3.9	0.012	0.02	0.0075 U	1.1
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0082 U	0.84 J	0.43	0.0075 U	6	0.0076 U	0.035	5.5	0.02	0.033	0.0095	1.5
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.0082 U	0.43	0.22	0.0075 U	3	0.0076 U	0.0079 U	3.4	0.015	0.022	0.0075 U	0.93
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0082 U	0.27	0.13	0.0075 U	1.8	0.0076 U	0.0079 U	1.7	0.0088	0.015	0.0075 U	0.49
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.0082 U	0.64 J	0.32	0.019	4.3	0.0076 U	0.056	3.1	0.014	0.027	0.0081	0.88
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0082 U	0.097	0.048	0.0075 U	0.65	0.0076 U	0.0079 U	0.78	0.0077 U	0.0073 U	0.0075 U	0.28 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.0082 U	1.2 J	0.72	0.03	4.5	0.0076 U	0.04	4.5	0.017	0.029	0.01	1
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0082 U	0.082	0.065	0.0075 U	0.15 U	0.0076 U	0.0079 U	0.3 U	0.0077 U	0.0073 U	0.0075 U	0.28 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.0082 U	0.45 J	0.23	0.0075 U	3.1	0.0076 U	0.0079 U	2.8	0.011	0.017	0.0075 U	0.92
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0015 U	0.054 J	0.028	0.0075 U	0.15 U	0.0076 U	0.0079 U	0.3 U	0.0077 U	0.0073 U	0.0075 U	0.28 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.0082 U	0.78	0.52	0.0075 U	1.4	0.0076 U	0.0079 U	1.6	0.0077 U	0.0098	0.0075 U	0.43
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.0082 U	0.99 J	0.59	0.018	4.1	0.0076 U	0.029	4.1	0.017	0.029	0.01	0.96
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.0082	0.8	0.41	0.0002	**4.8**	0.0076	0.01	**5.3**	0.02	0.03	0.001	1.6
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.0082	2.36	1.52	0.03	6.33	0.0076	0.04	6.44	0.02	0.04	0.04	1.43
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.0082	**4.83**	**2.6**	0.04	**28.8**	0.0076	0.13	**28.2**	0.11	0.2	0.03	**7.5**
Polychlorinated Biphehnyls (PCBs)																		
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.061 U	0.055 U	0.055 U	0.056 U	0.058 U	0.057 U	0.059 U	0.056 U	0.058 U	0.055 U	0.056 U	0.053 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.061 U	0.055 U	0.055 U	0.056 U	0.058 U	0.057 U	0.059 U	0.056 U	0.058 U	0.055 U	0.056 U	0.053 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.061 U	0.055 U	0.055 U	0.056 U	0.058 U	0.057 U	0.059 U	0.056 U	0.058 U	0.055 U	0.056 U	0.053 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.061 U	0.055 U	0.055 U	0.056 U	0.058 U	0.057 U	0.059 U	0.056 U	0.058 U	0.055 U	0.056 U	0.053 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.061 U	0.055 U	0.055 U	0.056 U	0.058 U	0.057 U	0.059 U	0.056 U	0.058 U	0.055 U	0.056 U	0.053 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.061 U	0.055 U	0.055 U	0.056 U	0.058 U	0.057 U	0.059 U	0.056 U	0.058 U	0.055 U	0.056 U	0.053 U
Aroclor 1260	mg/kg	NA	66.0	NE	NE	NE	0.061 U	0.055 U	0.055 U	0.056 U	0.058 U	0.057 U	0.059 U	0.056 U	0.058 U	0.055 U	0.056 U	0.053 U
Total PCBs (calc)	mg/kg	10	66.0	NE	NE	0.65	0.061	0.055	0.055	0.056	0.058	0.057	0.059	0.056	0.058	0.055	0.056	0.053
Metals																		
Aluminum	mg/kg	NA	3,500,000	480000	28,299	NE	10,000	7,000	7,700	7,200	9,300	6,000	7,200	7,900	7,700	6,700	6,000	4,100
Arsenic	mg/kg	20	88	2.9	7.61	132	12 U	11 U	11 U	11 U	12 U	11 U	12 U	11 U	12 U	11 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.61 U	0.55 U	0.55 U	0.56 U	0.58 U	0.57 U	0.59 U	0.56 U	0.58 U	0.55 U	0.56 U	0.53 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	3.4	3.8	4.6	5.8	13	5.8	5.8	7.3	4.6	6.1	3.6	2.3
Copper	mg/kg	NA	140,000	280	28.4	217	15	19 J	11	12	29	19	17	14	11	12	21	18
Lead	mg/kg	1,000	NE	3,000	13.1	118	6.1 U	5.5 U	5.6	5.6 U	5.8 U	5.7 U	5.9 U	5.6 U	5.8 U	5.5 U	5.6 U	5.3 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.31 U	0.27 U	0.27 U	0.28 U	0.29 U	0.28 U	0.3 U	0.28 U	0.29 U	0.28 U	0.28 U	0.26 U
Nickel	mg/kg	NA	70,000	130	24.54	980	3.9	4.3	4.2	4.9	20	8.1	6.4	6	4.3	6.6	4.3	15
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	12 U	11 U	11 U	11 U	12 U	11 U	12 U	11 U	12 U	11 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	39	60	55	39	150	61	62	54	40	36	41	18
Total Petroleum Hydrocarbons (TPHs)																		
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	31 U	430 J	27 U	28 U	71	29 U	30 U	28 U	29 U	28 U	28 U	29 U
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	62 U	95	55 U	56 U	440	57 U	60 U	110	58 U	55 U	56 U	210
Volatile Organic Chemicals (VOCs)																		
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0013 U	0.00097 U	0.0013 U	0.0012 U	0.00097 U	0.00093 U	0.00079 U	0.00099 U
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0073 U	0.0056 U	0.006 U	0.0055 U	0.0063 U	0.0048 U	0.0066 U	0.0061 U	0.0048 U	0.0047 U	0.004 U	0.005 U
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0013 U	0.00097 U	0.0013 U	0.0012 U	0.00097 U	0.00093 U	0.00079 U	0.00099 U
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.0029 U	0.0023 U	0.0024 U	0.0022 U	0.0025 U	0.0019 U	0.0026 U	0.0024 U	0.0019 U	0.0019 U	0.0016 U	0.002 U
o-Xylene	mg/kg	9	700,000	14	NE	10	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0013 U	0.00097 U	0.0013 U	0.0012 U	0.00097 U	0.00093 U	0.00079 U	0.00099 U
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0013 U	0.00097 U	0.0013 U	0.0012 U	0.00097 U	0.00093 U	0.00079 U	0.00099 U
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0013 U	0.00097 U	0.0013 U	0.0012 U	0.00097 U	0.00093 U	0.00079 U	0.00099 U
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0013 U	0.00097 U	0.0013 U	0.0012 U	0.00097 U	0.00093 U	0.00079 U	0.00099 U
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0013 U	0.00097 U	0.0013 U	0.0012 U	0.00097 U	0.00093 U	0.00079 U	0.00099 U
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0013 U	0.00097 U	0.0013 U	0.0012 U	0.00097 U	0.00093 U	0.00079 U	0.00099 U

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for in the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH

Detected concentrations shown in bold exceed one or more site soil screening levels.

Table 2.5.4-3
PAAOC Scrubber Effluent System in Courtyard A RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	RI Analytical Results										
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-SWMU2402-3	PAAOC-SB-SWMU2402-5	PAAOC-SB-SWMU2403-1	PAAOC-SB-SWMU2403-3	PAAOC-SB-SWMU2403-6	PAAOC-SB-SWMU2403-11	PAAOC-SB-VS01-3	PAAOC-SB-VS01-3D	PAAOC-SB-VS01-6	PAAOC-SB-VS01-11	PAAOC-SB-VS01-13
Aluminum Smelting																	
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.051	0.05 U	0.15	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**400 J**	110	**2,300**	**340**	68	47 U	45 J	59	5 U	**240**	7.4
Sulfate	mg/kg	NA	NE	2,150	NE	NE	84	17 U	20 U	23 U	16 U	50 U	25 J	26	280 J	350 J	180 J
Polynuclear Aromatic Hydrocarbons (PAHs)																	
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.015 U	0.0073 U	1.4 U	0.0074 U	0.0092 U	0.0075 U	0.015 U	0.016 U	0.0087 U	15 U	0.0078 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.015 U	0.0073 U	1.4 U	0.0074 U	0.0092 U	0.0075 U	0.015 U	0.016 U	0.0087 U	15 U	0.0078 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.015 U	0.0073 U	1.4 U	0.0074 U	0.0092 U	0.0075 U	0.015 U	0.016 U	0.0087 U	15 U	0.0078 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.015 U	0.0073 U	1.4 U	0.0074 U	0.0092 U	0.0075 U	0.015 U	0.016 U	0.0087 U	15 U	0.0078 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.015 U	0.0073 U	1.4 U	0.0074 U	0.0092 U	0.01	0.024	0.016 U	0.0087 U	15 U	0.0078 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.04	0.0085	8.3	0.0074 U	0.0092 U	0.13	0.19 J	0.096	0.0087 U	83	0.019
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.057	0.012	12	0.0074 U	0.0092 U	0.17	0.28 J	0.14	0.0087 U	130	0.027
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.082	0.019	19	0.0074 U	0.0092 U	0.32	0.36 J	0.18	0.0087 U	170	0.036
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.05	0.012	12	0.0074 U	0.0092 U	0.18	0.2	0.1	0.0087 U	98	0.021
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.026	0.0073 U	5.9	0.0074 U	0.0092 U	0.097	0.13 J	0.059	0.0087 U	60	0.012
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.047	0.01	11	0.0074 U	0.0092 U	0.19	0.22 J	0.11	0.0087 U	110	0.023
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.015 U	0.0073 U	2.4	0.0074 U	0.0092 U	0.039	0.047	0.023	0.0087 U	21	0.0078 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.057	0.012	13	0.0074 U	0.0092 U	0.22	0.31 J	0.16	0.0087 U	130	0.029
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.015 U	0.0073 U	1.4 U	0.0074 U	0.0092 U	0.0075 U	0.015 U	0.016 U	0.0087 U	15 U	0.0078 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.041	0.0088	12	0.0074 U	0.0092 U	0.18	0.21 J	0.11	0.0087 U	100	0.022
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.015 U	0.0073 U	1.4 U	0.0074 U	0.0092 U	0.0075 U	0.015 U	0.016 U	0.0087 U	0.0019	0.0078 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.027	0.0073 U	3.9	0.0074 U	0.0092 U	0.053	0.13	0.062	0.0087 U	51	0.012
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.052	0.011	13	0.0074 U	0.0092 U	0.22	0.28 J	0.14	0.0087 U	110	0.028
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.08	0.02	**16.9**	0.0074	0.0092	0.25	0.4	0.2	0.0087	**174.5**	0.04
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.08	0.01	16.9	0.0074	0.0092	0.3	0.46	0.22	0.0087	**181**	0.04
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.4	0.08	**95.6**	0.0074	0.0092	**1.53**	**1.92**	0.96	0.0087	**882**	0.19
Polychlorinated Biphehnyls (PCBs)																	
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.057 U	0.055 U	0.052 UJ	0.055 U	0.069 U	0.056 U	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.057 U	0.055 U	0.052 UJ	0.055 U	0.069 U	0.056 U	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.057 U	0.055 U	0.052 UJ	0.055 U	0.069 U	0.056 U	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.057 U	0.055 U	0.052 UJ	0.055 U	0.069 U	0.056 U	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.057 U	0.055 U	0.052 UJ	0.055 U	0.069 U	0.056 U	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.057 U	0.055 U	0.052 UJ	0.055 U	0.069 U	0.056 U	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U
Aroclor 1260	mg/kg	NA	66.0	NE	NE	NE	0.057 U	0.055 U	0.052 UJ	0.055 U	0.069 U	0.056 U	0.056 U	0.059 U	0.065 U	0.055 U	0.059 U
Total PCBs (calc)	mg/kg	10	66.0	NE	NE	0.65	0.057	0.055	0.052	0.055	0.069	0.056	0.056	0.059	0.065	0.055	0.059
Metals																	
Aluminum	mg/kg	NA	3,500,000	480000	28,299	NE	9,400	6,900	18,000	5,700	17,000	7,200	6,800 J	8,400	15,000	8,200	5,800
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	10 U	11 U	14 U	11 U	11 U	12 U	13 U	11 U	12 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.57 U	0.55 U	0.52 U	0.55 U	0.69 U	0.56 U	0.56 U	0.59 U	0.65 U	0.55 U	0.59 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	5	4	12	3.1	8.7	9.4	4 J	5.7	5.1	13	6.1
Copper	mg/kg	NA	140,000	280	28.4	217	11	12	25	8.4	17	11	11 J	14	15	15	22
Lead	mg/kg	1,000	NE	3,000	13.1	118	6.7	5.5 U	7.6	5.5 U	7.7	5.6 U	5.6 U	5.9 U	6.5 U	5.5 U	5.9 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.27 U	0.26 U	0.28 U	0.35 U	0.28 U	0.28 U	0.29 U	0.33 U	0.27 U	0.29 U
Nickel	mg/kg	NA	70,000	130	24.54	980	8.6	3.8	30	2.8 U	7.9	5.1	3.5	5.1	6.3	8.7	3.1
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	10 U	11 U	14 U	11 U	11 U	12 U	13 U	11 U	12 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	49	45	86	33	58	40	43	46	54	58	36
Total Petroleum Hydrocarbons (TPHs)																	
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	28 U	27 U	700 U	28 U	35 U	28 U	28 U	29 U	33 U	460 U	29 U
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	57 U	55 U	**7,100**	56 U	69 U	130	57 U	59 U	65 U	**4,500**	59 U
Volatile Organic Chemicals (VOCs)																	
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.0011 U	0.0011 U	0.00094 U	0.001 U	0.0014 U	0.0011 U	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0055 U	0.0054 U	0.0047 U	0.0052 U	0.0068 U	0.0053 U	0.005 U	0.006 U	0.0055 U	0.0054 U	0.0048 U
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.0011 U	0.0011 U	0.00094 U	0.001 U	0.0014 U	0.0011 U	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.0022 U	0.0022 U	0.0019 U	0.0021 U	0.0027 U	0.0021 U	0.002 U	0.0024 U	0.0022 U	0.0021 U	0.0019 U
o-Xylene	mg/kg	9	700,000	14	NE	10	0.0011 U	0.0011 U	0.00094 U	0.001 U	0.0014 U	0.0011 U	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.0011 U	0.0011 U	0.00094 U	0.001 U	0.0014 U	0.0011 U	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.0011 U	0.0011 U	0.00094 U	0.001 U	0.0014 U	0.0011 U	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.0011 U	0.0011 U	0.00094 U	0.001 U	0.0014 U	0.0011 U	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.0011 U	0.0011 U	0.00097	0.001 U	0.0014 U	0.0011 U	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U
Vinyl Chloride	mg/kg	NE	88	0.0017	NE	6.46	0.0011 U	0.0011 U	0.00094 U	0.001 U	0.0014 U	0.0011 U	0.001 U	0.0012 U	0.0011 U	0.0011 U	0.00097 U

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for in the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in bold exceed one or more site soil screening levels.

Table 2.5.4-4
PAAOC Scrubber Effluent System in Courtyard C RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
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	Screening Levels					Ecological Screening Levels	RI Analytical Results											
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-AST01-1	PAAOC-SB-AST01-3	PAAOC-SB-AST01-5.5	PAAOC-SB-AST02-1	PAAOC-SB-AST02-3	PAAOC-SB-AST02-6	PAAOC-SB-BH03-1	PAAOC-SB-BH03-3	PAAOC-SB-BH03-6	PAAOC-SB-BH03-8	PAAOC-SB-COPC02-1	PAAOC-SB-COPC02-3
Aluminum Smelting																		
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	NA	NA	NA	NA	NA	NA	0.05 U	0.062	0.05 U	0.05 U	0.05 U	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	NA	NA	NA	NA	NA	NA	30 U	14 U	7.7 U	7.6 U	**240**	66
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	NA	NA	NA	NA	NA	1,800	**7,500**	**5,200**	**7,100**	18 U	81
Polynuclear Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.14 U	0.008 U	0.007 U	3.6 U	0.0094 U	0.0077 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.0072 U	0.0074 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.14 U	0.008 U	0.007 U	3.6 U	0.0094 U	0.0077 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.0072 U	0.0074 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.14 U	0.008 U	0.007 U	3.6 U	0.0094 U	0.0077 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.0072 U	0.0074 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.14 U	0.008 U	0.007 U	3.6 U	0.0094 U	0.0077 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.0072 U	0.0074 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.18	0.008 U	0.007 U	7.4	0.0094 U	0.0077 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.019	0.0074 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	1.3	0.008 U	0.007 U	32	0.0094 U	0.01	0.25	0.01 U	0.0087 U	0.0097 U	0.11	0.0074 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	1.7	0.0085	0.007 U	32	0.015	0.012	0.33	0.01 U	0.0087 U	0.0097 U	0.15	0.0074 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	2.5	0.017	0.007 U	66	0.02	0.024	0.79	0.01 U	0.0087 U	0.0097 U	0.3	0.0074 U
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	1.5	0.012	0.007 U	28	0.021	0.011	0.6	0.01 U	0.0087 U	0.0097 U	0.26	0.0074 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.85	0.008 U	0.007 U	20	0.0094 U	0.0077 U	0.19	0.01 U	0.0087 U	0.0097 U	0.088	0.0074 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	1.7	0.011	0.007 U	46	0.012	0.019	0.4	0.01 U	0.0087 U	0.0097 U	0.21	0.0074 U
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.33	0.008 U	0.007 U	6.5	0.0094 U	0.0077 U	0.091	0.01 U	0.0087 U	0.0097 U	0.043	0.0074 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	2.5	0.0084	0.007 U	58	0.016	0.022	0.3	0.01 U	0.0087 U	0.0097 U	0.19	0.0074 U
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.14 U	0.008 U	0.007 U	3.6 U	0.0094 U	0.0077 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.0072 U	0.0074 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	1.6	0.0092	0.007 U	30	0.012	0.0083	0.36	0.01 U	0.0087 U	0.0097 U	0.2	0.0074 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.14 U	0.008 U	0.007 U	3.6 U	0.0094 U	0.0077 U	0.039 U	0.01 U	0.0087 U	0.0097 U	0.0072 U	0.0074 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.79	0.008 U	0.007 U	19	0.012	0.015	0.082	0.01 U	0.0087 U	0.0097 U	0.051	0.0074 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	2.2	0.0086	0.007 U	63	0.02	0.026	0.29	0.01 U	0.0087 U	0.0097 U	0.18	0.0074 U
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	2.4	0.11	0.007	**47.91**	0.02	0.02	0.5	0.01	0.0087	0.0097	0.23	0.0074
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	3.5	0.008	0.007	84.4	0.03	0.04	0.4	0.01	0.0087	0.0097	0.26	0.0074
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**13.7**	0.07	0.007	**323.5**	0.1	0.11	**3.3**	0.01	0.0087	0.0097	**1.54**	0.0074
Polychlorinated Biphenyls (PCBs)																		
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.059 U	0.075 U	0.065 U	0.073 U	0.054 U	0.056 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.059 U	0.075 U	0.065 U	0.073 U	0.054 U	0.056 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.059 U	0.075 U	0.065 U	0.073 U	0.054 U	0.056 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.059 U	0.075 U	0.065 U	0.073 U	0.054 U	0.056 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.059 U	0.075 U	0.065 U	0.073 U	0.054 U	0.056 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	NA	NA	NA	NA	NA	NA	0.059 U	0.075 U	0.065 U	0.073 U	0.054 U	0.056 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.059 U	0.075 U	0.065 U	0.073 U	0.054 U	0.056 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	NA	NA	NA	NA	NA	NA	0.059	0.075	0.065	0.073	0.054	0.056
Metals																		
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	NA	NA	NA	NA	NA	NA	9,500	14,000	11,000	19,000	6,900	5,100
Arsenic	mg/kg	20	87.5	2.9	7.61	132	NA	NA	NA	NA	NA	NA	12 U	15 U	13 U	15 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	NA	NA	NA	NA	NA	NA	0.59 U	0.75 U	0.65 U	0.73 U	0.54 U	0.56 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	NA	NA	NA	NA	NA	NA	1.9	7.9	5.1	3.2	12	2.1
Copper	mg/kg	NA	140,000	280	28.4	217	NA	NA	NA	NA	NA	NA	11	21	16	18	13	9.1
Lead	mg/kg	1,000	NE	3,000	13.1	118	NA	NA	NA	NA	NA	NA	5.9 U	7.5 U	6.5 U	7.3 U	5.6	5.6 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	NA	NA	NA	NA	NA	NA	0.29 U	0.37 U	0.32 U	0.36 U	0.27 U	0.28 U
Nickel	mg/kg	NA	70,000	130	24.54	980	NA	NA	NA	NA	NA	NA	2.9 U	12	5	9.7	8.6	2.8 U
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	NA	NA	NA	NA	NA	NA	12 U	15 U	13 U	15 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	NA	NA	NA	NA	NA	NA	29	72	46	56	49	27
Total Petroleum Hydrocarbons (TPHs)																		
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	43 U	30 U	26 U	**2,800**	460	120	29 U	38 U	33 U	36 U	27 U	28 U
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	250	60 U	53 U	**7,500**	70 U	58 U	95	75 U	65 U	73 U	93	56 U
Volatile Organic Compounds (VOCs)																		
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.001 U	0.0013 U	0.0011 U	0.00086 U	0.0015 U	0.0011 U	0.0011 U	0.0017 U	0.0014 U	0.0017 U	0.00097 U	0.0011 U
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0052 U	0.0066 U	0.0053 U	0.0043 U	0.0073 U	0.0054 U	0.0056 U	0.0083 U	0.0072 U	0.0084 U	0.0048 U	0.0055 U
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.001 U	0.0013 U	0.0011 U	0.00086 U	0.0015 U	0.0011 U	0.0011 U	0.0017 U	0.0014 U	0.0017 U	0.00097 U	0.0011 U
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.0021 U	0.0027 U	0.0021 U	0.0018	0.0029 U	0.0022 U	0.0022 U	0.0033 U	0.0029 U	0.0033 U	0.0019 U	0.0022 U
o-Xylene	mg/kg	9	700,000	14	NE	10	0.001 U	0.0013 U	0.0011 U	0.0015	0.0015 U	0.0011 U	0.0011 U	0.0017 U	0.0014 U	0.0017 U	0.00097 U	0.0011 U
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	NA	NA	NA	0.00086 U	0.0015 U	0.0011 U	0.0011 U	0.0017 U	0.0014 U	0.0017 U	0.00097 U	0.0011 U
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	NA	NA	NA	0.00086 U	0.0015 U	0.0011 U	0.0011 U	0.0017 U	0.0014 U	0.0017 U	0.00097 U	0.0011 U
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	NA	NA	NA	0.00086 U	0.0015 U	0.0011 U	0.0011 U	0.0017 U	0.0014 U	0.0017 U	0.00097 U	0.0011 U
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	NA	NA	NA	0.00086 U	0.0015 U	0.0011 U	0.0011 U	0.0017 U	0.0014 U	0.0017 U	0.00097 U	0.0011 U
Vinyl Chloride	mg/kg	NE	87.50	0.0017	NE	6.46	NA	NA	NA	0.00086 U	0.0015 U	0.0011 U	0.0011 U	0.0017 U	0.0014 U	0.0017 U	0.00097 U	0.0011 U

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for in the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.5.4-4
PAAOC Scrubber Effluent System in Courtyard C RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	RI Analytical Results											
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-COPC02-5	PAAOC-SB-COPC02-7	PAAOC-SB-COPC02-9	PAAOC-SB-CR02-1	PAAOC-SB-SE04-1	PAAOC-SB-SE02-1	PAAOC-SB-SE06-3	PAAOC-SB-SE06-3D	PAAOC-SB-SE06-6	PAAOC-SB-SE06-9	PAAOC-SB-SE09-3	PAAOC-SB-SE09-5
Aluminum Smelting																		
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.05 U	0.05 U	0.058 J	0.05 U	0.05 UJ	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	27 U	39 U	24 U	**180**	**170**	81	**320**	**300**	110	48 U	**1,200**	**390**
Sulfate	mg/kg	NA	NE	2,150	NE	NE	57 U	74	140	10 U	26	10 U	14 U	25	32 U	42 U	75	87
Polynuclear Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0075 U	0.0075 U	0.0073 U	0.0074 U	0.0074 U	0.0072 U	0.15 U	0.15 U	0.0076 U	0.007 U	0.018 U	0.0081 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0075 U	0.0075 U	0.0073 U	0.0074 U	0.0074 U	0.0072 U	0.15 U	0.15 U	0.0076 U	0.007 U	0.018 U	0.0081 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0075 U	0.0075 U	0.0073 U	0.0074 U	0.0074 U	0.0072 U	0.15 U	0.15 U	0.0076 U	0.007 U	0.018 U	0.0081 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0075 U	0.0075 U	0.0073 U	0.0074 U	0.0074 U	0.0072 U	0.15 U	0.15 U	0.0076 U	0.007 U	0.018 U	0.0081 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0075 U	0.0094	0.0073 U	0.0096	0.0074 U	0.0072 U	0.15 U	0.2	0.0076 U	0.007 U	0.018 U	0.0081 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0075 U	0.053	0.0073 U	0.052	0.0074 U	0.0072 U	0.53 J	1.4	0.0076 U	0.007 U	0.023	0.0081 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.0075 U	0.067	0.0073 U	0.062	0.0074 U	0.0072 U	0.47 J	1.4	0.0076 U	0.007 U	0.048	0.0081 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0075 U	0.15	0.0073 U	0.11	0.0099	0.0072 U	1.2 J	3.1	0.0076 U	0.007 U	0.082	0.0081 U
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.0075 U	0.099	0.0073 U	0.086	0.0074 U	0.0072 U	0.46	1.3	0.0076 U	0.007 U	0.018 U	0.0081 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0075 U	0.042	0.0073 U	0.031	0.0074 U	0.0072 U	0.31	1	0.0076 U	0.007 U	0.029	0.0081 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.0075 U	0.091	0.0073 U	0.07	0.0074 U	0.0072 U	0.77 J	2.1	0.0076 U	0.007 U	0.038	0.0081 U
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0075 U	0.015	0.0073 U	0.015	0.0074 U	0.0072 U	0.15 U	0.3	0.0076 U	0.007 U	0.018 U	0.0081 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.0075 U	0.084	0.0073 U	0.086	0.0074 U	0.0072 U	0.84 J	2.2	0.0076 U	0.007 U	0.037	0.0081 U
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0075 U	0.0075 U	0.0073 U	0.0074 U	0.0074 U	0.0072 U	0.15 U	0.15 U	0.0076 U	0.007 U	0.018 U	0.0081 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.0075 U	0.066	0.0073 U	0.073	0.0074 U	0.0072 U	0.41 J	1.4	0.0076 U	0.007 U	0.069	0.0081 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0075 U	0.0075 U	0.0073 U	0.0011 U	0.0074 U	0.0072 U	0.15 U	0.15 U	0.0076 U	0.007 U	0.018 U	0.0081 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.0075 U	0.0075 U	0.0073 U	0.014	0.0074 U	0.0072 U	0.26	0.66	0.0076 U	0.007 U	0.018 U	0.0081 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.0075 U	0.076	0.0073 U	0.085	0.0074 U	0.0072 U	0.87 J	2.4	0.0076 U	0.007 U	0.036	0.0081 U
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.0075	0.1	0.0073	0.09	0.00099	0.0072	0.7	2.14	0.0076	0.007	0.07	0.0081
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.0075	0.1	0.0073	0.11	0.0074	0.0072	1.1	3.1	0.0076	0.007	0.04	0.0081
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.0075	0.7	0.0073	0.6	0.0099	0.0072	**5.2**	**14.4**	0.0076	0.007	0.33	0.0081
Polychlorinated Biphenyls (PCBs)																		
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.056 U	0.056 U	0.055 U	0.056 U	0.055 U	0.054 U	0.055 U	0.056 U	0.057 U	0.053 U	0.068 U	0.06 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.056 U	0.055 U	0.056 U	0.055 U	0.054 U	0.055 U	0.056 U	0.057 U	0.053 U	0.068 U	0.06 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.056 U	0.055 U	0.056 U	0.055 U	0.054 U	0.055 U	0.056 U	0.057 U	0.053 U	0.068 U	0.06 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.056 U	0.055 U	0.056 U	0.055 U	0.054 U	0.055 U	0.056 U	0.057 U	0.053 U	0.068 U	0.06 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.056 U	0.056 U	0.055 U	0.056 U	0.055 U	0.054 U	0.055 U	0.056 U	0.057 U	0.053 U	0.068 U	0.06 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.056 U	0.056 U	0.055 U	0.056 U	0.055 U	0.054 U	0.055 U	0.056 U	0.057 U	0.053 U	0.068 U	0.06 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.056 U	0.056 U	0.055 U	0.056 U	0.055 U	0.054 U	0.055 U	0.056 U	0.057 U	0.053 U	0.068 U	0.06 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.056	0.056	0.055	0.056	0.055	0.054	0.055	0.056	0.057	0.053	0.068	0.06
Metals																		
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	6,500	7,300	5,400	3,800 J	8,300	6,300 J	12,000	13,000	12,000	3,600	12,000	6,700
Arsenic	mg/kg	20	87.5	2.9	7.61	132	11 U	11 U	11 U	11 U	11 U	0.054 U	11 U	11 U	11 U	11 U	14 U	12 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.56 U	0.56 U	0.55 U	0.56 U	0.55 U	0.54 U	0.55 U	0.56 U	0.57 U	0.53 U	0.68 U	0.6 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	5.9	6.2	7.6	5.1	5.9	3.3	12 J	7.2	11	4	6.1	3.8
Copper	mg/kg	NA	140,000	280	28.4	217	15	14	19	6.9	11	12	35 J	12	25	14	24	91
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.6 U	5.7	5.5 U	5.9	5.5 U	5.4 U	6.1	5.6 U	7.2	5.3 U	6.8 U	6 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.28 U	0.28 U	0.27 U	0.28 U	0.28 U	0.27 U	0.28 U	0.28 U	0.29 U	0.26 U	0.34 U	0.3 U
Nickel	mg/kg	NA	70,000	130	24.54	980	5	6.1	3.7	5.7	5.8	4.3	14 J	4.5	11	5.4	5.5	8.3
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	11 U	11 U	5.4 U	11 U	11 U	11 U	11 U	14 U	12 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	48	42	36	23	44	41	96 J	45	66	41	39	140
Total Petroleum Hydrocarbons (TPHs)																		
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	28 U	28 U	27 U	28 U	28 U	27 U	28 U	40 U	29 U	26 U	34 U	30 U
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	56 U	56 U	55 U	82	55 U	54 U	130 J	260	62	53 U	68 U	60 U
Volatile Organic Compounds (VOCs)																		
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.0011 U	0.0011 U	0.001 U	0.0011 U	0.001 U	0.00092 U	0.0011 U	0.001 U	0.0012 U	0.00097 U	0.0014 U	0.0013 U
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0054 U	0.0054 U	0.0051 U	0.0054 U	0.0052 U	0.0046 U	0.0055 U	0.005 U	0.0059 U	0.0049 U	0.007 U	0.0064 U
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.0011 U	0.0011 U	0.001 U	0.0011 U	0.00 U	0.00092 U	0.0011 U	0.001 U	0.0012 U	0.00097 U	0.0014 U	0.0013 U
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.0022 U	0.0022 U	0.002 U	0.0022 U	0.0021 U	0.0018 U	0.0022 U	0.002 U	0.0024 U	0.0019 U	0.0028 U	0.0026 U
o-Xylene	mg/kg	9	700,000	14	NE	10	0.0011 U	0.0011 U	0.001 U	0.0011 U	0.001 U	0.00092 U	0.0011 U	0.001 U	0.0012 U	0.00097 U	0.0014 U	0.0013 U
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.0011 U	0.0011 U	0.001 U	0.0011 U	0.001 U	0.00092 U	0.0011 U	0.001 U	0.0012 U	0.00097 U	0.0014 U	0.0013 U
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.0011 U	0.0011 U	0.001 U	0.0011 U	0.001 U	0.00092 U	0.0011 U	0.001 U	0.0012 U	0.00097 U	0.0014 U	0.0013 U
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.0011 U	0.0011 U	0.001 U	0.0011 U	0.001 U	0.00092 U	0.0011 U	0.001 U	0.0012 U	0.00097 U	0.0014 U	0.0013 U
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.0011 U	0.0011 U	0.001 U	0.0011 U	0.001 U	0.00092 U	0.0011 U	0.001 U	0.0012 U	0.00097 U	0.0014 U	0.0013 U
Vinyl Chloride	mg/kg	NE	87.50	0.0017	NE	6.46	0.0011 U	0.0011 U	0.001 U	0.0011 U	0.001 U	0.00092 U	0.0011 U	0.001 U	0.0012 U	0.00097 U	0.0014 U	0.0013 U

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for in the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.5.4-4
PAAOC Scrubber Effluent System in Courtyard C RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
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	Screening Levels					Ecological Screening Levels	RI Analytical Results										
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**PAAOC-SB-SE10-3**	**PAAOC-SB-SE10-3D**	**PAAOC-SB-SE10-6**	**PAAOC-SB-SE10-10**	**PAAOC-SB-SE10-11.5**	**PAAOC-SB-SE15-2**	**PAAOC-SB-SE15-4**	**PAAOC-SB-SE15-7**	**PAAOC-SB-SE18-2**	**PAAOC-SB-SE18-5**	**PAAOC-SB-SE18-9**
Aluminum Smelting																	
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.05 U	0.1	0.05 U	0.05 U	0.05 U	0.086	0.05 U	0.059	0.05 U	0.05 U	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	22 U	15	5.5 U	8.1 U	16 U	26 U	5 U	82	5 U	7 U	5 U
Sulfate	mg/kg	NA	NE	2,150	NE	NE	20 UJ	91	300	430	260	44 U	50 UJ	10 U	180	400	**2,200**
Polynuclear Aromatic Hydrocarbons (PAHs)																	
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	7.3 U	7.4 U	0.0074 U	0.015 U	0.007 U	0.015 U	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	7.3 U	7.4 U	0.0074 U	0.015 U	0.007 U	0.015 U	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	7.3 U	7.4 U	0.0074 U	0.023	0.007 U	0.015 U	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	7.3 U	7.4 U	0.0074 U	0.015 U	0.007 U	0.015 U	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	11	14	0.0074 U	0.055	0.007 U	0.11	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	13	17	0.0074 U	0.085	0.037	0.23	0.0074 U	0.0074 U	0.018	0.0072 U	0.0074 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	14	18	0.0074 U	0.092	0.057	0.24	0.0074 U	0.0074 U	0.021	0.0072 U	0.0074 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	15	20	0.0074 U	0.12	0.082	0.26	0.0074 U	0.0074 U	0.049	0.0072 U	0.0074 U
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	9.3	11	0.0074 U	0.087	0.056	0.13	0.0074 U	0.0074 U	0.021	0.0072 U	0.0074 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	7.3 U	8	0.0074 U	0.034	0.025	0.098	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	14	18	0.0074 U	0.097	0.05	0.23	0.0074 U	0.0074 U	0.051	0.0072 U	0.0074 U
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	7.3 U	7.4 U	0.0074 U	0.015 U	0.011	0.034	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	34	42	0.0074 U	0.18	0.061	0.54	0.0074 U	0.0074 U	0.056	0.0072 U	0.0074 U
Fluorene	mg/kg	NL	140,000	100	NE	NL	7.3 U	7.4 U	0.0074 U	0.02	0.007 U	0.015 U	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	8.7	12	0.0074 U	0.063	0.052	0.15	0.0074 U	0.0074 U	0.019	0.0072 U	0.0074 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	7.3 U	7.4 U	0.0074 U	0.0011	0.007 U	0.015 U	0.0074 U	0.0074 U	0.015 U	0.0072 U	0.0074 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	29	38	0.0074 U	0.14	0.025	0.28	0.0074 U	0.0074 U	0.015	0.0072 U	0.0074 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	32	40	0.0074 U	0.17	0.057	0.51	0.0074 U	0.0074 U	0.054	0.0072 U	0.0074 U
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**17.81**	**23.9**	0.0074	0.15	0.08	0.34	0.0074	0.0074	0.03	0.0072	0.0074
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	74	94	0.0074	0.42	0.09	0.93	0.0074	0.0074	0.07	0.0072	0.0074
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**106**	**144**	0.0074	0.75	0.43	**1.9**	0.0074	0.0074	0.23	0.0072	0.0074
Polychlorinated Biphenyls (PCBs)																	
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.054 U	0.055 U	0.056 U	0.056 U	0.052 U	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.054 U	0.055 U	0.056 U	0.056 U	0.052 U	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.054 U	0.055 U	0.056 U	0.056 U	0.052 U	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.054 U	0.055 U	0.056 U	0.056 U	0.052 U	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.054 U	0.055 U	0.056 U	0.056 U	0.052 U	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.054 U	0.055 U	0.056 U	0.056 U	0.052 U	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.054 U	0.055 U	0.056 U	0.056 U	0.052 U	0.056 U	0.056 U	0.056 U	0.055 U	0.054 U	0.056 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.054	0.055	0.056	0.056	0.052	0.056	0.056	0.056	0.055	0.054	0.056
Metals																	
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	8,100	7,800	7,200	7,600	3,000	7,000	7,600	7,000	8,300	4,200	8,800
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	11 U	11 U	10 U	11 U	11 U	11 U	11 U	11 U	11 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.54 U	0.55 U	0.56 U	0.56 U	0.52 U	0.56 U	0.56 U	0.56 U	0.55 U	0.54 U	0.56 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	13 J	7.5	5.6	5.2	7	5.3	5	6.9	7.7	4.1	6.2
Copper	mg/kg	NA	140,000	280	28.4	217	14	13	11	20	20	11	10	13	16	11	13
Lead	mg/kg	1,000	NE	3,000	13.1	118	6.7	8.9	5.6 U	5.6 U	5.2 U	5.6 U	5.6 U	5.6 U	5.5 U	5.4 U	5.6 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.27 U	0.28 U	0.28 U	0.28 U	0.26 U	0.28 U	0.28 U	0.28 U	0.27 U	0.27 U	0.28 U
Nickel	mg/kg	NA	70,000	130	24.54	980	7.4	5.8	5.1	7.5	4.3	4.9	4.2	6.8	9.1	6.7	6.3
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	11 U	11 U	10 U	11 U	11 U	11 U	11 U	11 U	11 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	54	55	35	38	42	39	42	44	45	34	40
Total Petroleum Hydrocarbons (TPHs)																	
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	620 U	280 U	28 U	28 U	26 U	28 U	28 U	28 U	110 U	27 U	28 U
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	**2,800 J**	1,400	56 U	80	52 U	56 U	56 U	56 U	710	54 U	56 U
Volatile Organic Compounds (VOCs)																	
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.0013 U	0.0009 U	0.00096 U	0.0011 U	0.00095 U	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.0065 U	0.0045 U	0.0048 U	0.0053 U	0.0048 U	0.0051 U	0.0049 U	0.0054 U	0.0052 U	0.0052 U	0.0054 U
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.0013 U	0.0009 U	0.00096 U	0.0011 U	0.00095 U	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.0026 U	0.0018 U	0.0019 U	0.0021 U	0.0019 U	0.002 U	0.002 U	0.0022 U	0.0021 U	0.0021 U	0.0022 U
o-Xylene	mg/kg	9	700,000	14	NE	10	0.0013 U	0.0009 U	0.00096 U	0.0011 U	0.00095 U	0.001 U	0.00099 U	0.0011 U	0.0012	0.001 U	0.0011 U
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.0013 U	0.0009 U	0.00096 U	0.0011 U	0.00095 U	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.0013 U	0.0009 U	0.00096 U	0.0011 U	0.00095 U	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.0013 U	0.0009 U	0.00096 U	0.0011 U	0.00095 U	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.0013 U	0.0009 U	0.00096 U	0.0011 U	0.00095 U	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U
Vinyl Chloride	mg/kg	NE	87.50	0.0017	NE	6.46	0.0013 U	0.0009 U	0.00096 U	0.0011 U	0.00095 U	0.001 U	0.00099 U	0.0011 U	0.001 U	0.001 U	0.0011 U

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not Established
NL	Not listed or not shown for this chemical but detected concentration is accounted for in the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.

TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High Molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.5.4-5
PAAOC Scrubber Effluent System in SWMU 16 and Southeast Plant Area RI Soil Results Summary
Columbia Gorge Aluminum Smelter, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	RI Analytical Results														
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-SB-CU01-0.5	PAAOC-SB-CU01-3	PAAOC-SB-CU01-23	PAAOC-SB-SE11-5.5	PAAOC-SB-SE11-2	PAAOC-SB-SE12-2	PAAOC-SB-SE12-13	PAAOC-SB-SE16-3	PAAOC-SB-SE16-6	PAAOC-SB-SE16-10	PAAOC-SB-SE17-3	PAAOC-SB-SE17-6	PAAOC-SB-SE17-15	PAAOC-SB-SE17-20	PAAOC-SB-SE17-25
Aluminum Smelting																					
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.17	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.78 UJ	0.25 UJ	0.05 UJ	0.05 UJ	0.05 UJ
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**3,300**	**4,600**	**700**	21	30 J	140	5 U	45 J	68 J	23 J	**8,300 J**	**550 J**	**210 J**	39 J	33 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	22	160	260	21	10 U	26	12	16 U	10 U	10 U	80	160	60	14 U	44
Polynuclear Aromatic Hydrocarbons (PAHs)																					
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.73 U	0.0074 U	0.017 U	0.007 U	0.0071 U	0.072 U	0.0081 U	0.0077 U	0.0077 U	0.007 U	3.2	41	0.015 U	0.014 U	0.016 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.73 U	0.0074 U	0.017 U	0.007 U	0.0071 U	0.072 U	0.0081 U	0.0077 U	0.0077 U	0.007 U	5.1	48	0.015 U	0.014 U	0.016 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.73 U	0.0074 U	0.017 U	0.007 U	0.0071 U	0.072 U	0.0081 U	0.0077 U	0.0077 U	0.007 U	17	330	0.062	0.014 U	0.016 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.73 U	0.0074 U	0.017 U	0.007 U	0.0071 U	0.072 U	0.0081 U	0.0077 U	0.0077 U	0.007 U	0.31 U	30 U	0.015 U	0.014 U	0.016 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.73 U	0.0074 U	0.017 U	0.007 U	0.0071 U	0.11	0.0081 U	0.0077 U	0.0077 U	0.007 U	17	510	0.07	0.014 U	0.016 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	1.6	0.11	0.08	0.0081	0.014	0.96	0.0081 U	0.0077 U	0.0077 U	0.007 U	55	990	0.22	0.028	0.049
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	2.2	0.15	0.13	0.011	0.018	1.4	0.0081 U	0.0077 U	0.0077 U	0.007 U	65	1,000	0.27	0.037	0.062
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	3.3	0.36	0.29	0.016	0.025	2.1	0.01	0.0077 U	0.0077 U	0.0071	80	1,300	0.31	0.044	0.072
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	1.9	0.24	0.19	0.011	0.015	1.4	0.0081 U	0.0077 U	0.0077 U	0.007 U	44	680	NA	0.029	0.047
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	1	0.072	0.058	0.007 U	0.01	0.59	0.0081 U	0.0077 U	0.0077 U	0.007 U	28	460	0.12	0.018	0.03
Chrysene	mg/kg	NA	NL	NL	NE	NL	2	0.26	0.18	0.0097	0.016	1.3	0.0081 U	0.0077 U	0.0077 U	0.007 U	60	950	0.22	0.031	0.055
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.73 U	0.039	0.03	0.007 U	0.0071 U	0.29	0.0081 U	0.0077 U	0.0077 U	0.007 U	9.2	160	0.044	0.014 U	0.016 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	2.4	0.17	0.14	0.014	0.022	1.6	0.0089	0.0077 U	0.0077 U	0.007 U	110	2,200	0.43	0.047	0.095
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.73 U	0.0074 U	0.017 U	0.007 U	0.0071 U	0.072 U	0.0081 U	0.0077 U	0.0077 U	0.007 U	7.2	180	0.029	0.014 U	0.016 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	1.9	0.18	0.14	0.0096	0.015	1.3	0.0081 U	0.0077 U	0.0077 U	0.007 U	47	770	0.16	0.025	0.038
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.73 U	0.001 U	0.017 U	0.007 U	0.0071 U	0.072 U	0.0081 U	0.011	0.0095	0.007 U	0.03	10	0.0044	0.014 U	0.016 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.98	0.011	0.017 U	0.007 U	0.0071 U	0.66	0.0081 U	0.0077 U	0.0098	0.007 U	84	2,200	0.35	0.033	0.074
Pyrene	mg/kg	NA	110,000	650	NE	NL	2.3	0.16	0.13	0.014	0.022	1.4	0.0084	0.0077 U	0.0077 U	0.007 U	100	1,800	0.38	0.045	0.088
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	3	0.23	0.2	0.15	0.025	1.94	0.001	0.0077	0.0077	0.0007	**87.5**	**1,377.50**	0.36	0.05	0.08
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	3.4	0.18	0.14	0.014	0.022	2.4	0.0089	0.0077	0.0193	0.0007	**235.23**	**5,430**	0.94	0.08	0.17
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**16.2**	**1.6**	**1.23**	0.08	0.135	**10.74**	0.0184	0.0077	0.0077	0.0071	**488.2**	**8,110**	**2.1**	0.26	0.44
Polychlorinated Biphenyls (PCBs)																					
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.055 U	0.056 U	0.05 U	0.053 U	0.053 U	0.054 UJ	0.061 U	0.057 U	0.058 U	0.053 U	0.058 U	0.056 UJ	0.055 U	0.054 U	0.059 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.056 U	0.05 U	0.053 U	0.053 U	0.054 UJ	0.061 U	0.057 U	0.058 U	0.053 U	0.058 U	0.056 UJ	0.055 U	0.054 U	0.059 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.056 U	0.05 U	0.053 U	0.053 U	0.054 UJ	0.061 U	0.057 U	0.058 U	0.053 U	0.058 U	0.056 UJ	0.055 U	0.054 U	0.059 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.056 U	0.05 U	0.053 U	0.053 U	0.054 UJ	0.061 U	0.057 U	0.058 U	0.053 U	0.058 U	0.056 UJ	0.055 U	0.054 U	0.059 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.055 U	0.056 U	0.05 U	0.053 U	0.053 U	0.054 UJ	0.061 U	0.057 U	0.058 U	0.053 U	0.058 U	0.056 UJ	0.055 U	0.054 U	0.059 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.055 U	0.056 U	0.05 U	0.053 U	0.053 U	0.054 UJ	0.061 U	0.057 U	0.058 U	0.053 U	0.058 U	0.056 UJ	0.055 U	0.054 U	0.059 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.055 U	0.056 U	0.05 U	0.053 U	0.053 U	0.054 UJ	0.061 U	0.057 U	0.058 U	0.053 U	0.058 U	0.056 UJ	0.055 U	0.054 U	0.059 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.055	0.056	0.05	0.053	0.053	0.054	0.061	0.057	0.058	0.053	0.058	0.056	0.055	0.054	0.059
Metals																					
Aluminum	mg/kg	NA	3,500,000	480000	28,299	NE	17,000	8,600	16,000	2,100	3,500	6,100 J	9,600 J	5,900	7,800	4,600	22,000	7,300	5,500	6,100	4,000
Arsenic	mg/kg	20	88	2.9	7.61	132	11 U	11 U	13 U	11 U	11 U	11 U	12 U	11 U	12 U	11 U	12 U	11 U	11 U	11 U	12 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.55 U	0.56 U	0.65 U	0.53 U	0.53 U	0.54 U	0.61 U	0.57 U	0.58 U	0.53 U	0.58 U	0.56 U	0.55 U	0.54 U	0.59 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	38	12	10	2.4	3.8	6.9	4	5	3.5	3	12	9	3.9	5.1	3.1
Copper	mg/kg	NA	140,000	280	28.4	217	18	10	22	12	12	18	17	11	16	14	20	26	13	12	9.1
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.5 U	5.6 U	6.5 U	5.3 U	5.3 U	5.4 U	6.1 U	5.7 U	5.8 U	5.3 U	5.8 U	27	5.5 U	5.4 U	5.9 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.27 U	0.28 U	0.33 U	0.26 U	0.27 U	0.27 U	0.3 U	0.29 U	0.29 U	0.26 U	0.29 U	0.28 U	0.28 U	0.27 U	0.29 U
Nickel	mg/kg	NA	70,000	130	24.54	980	21	10	5.9	3.2	4.6	11	3.6	5.5	2.9	4.4	79	25	5.1	4.9	2.9 U
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	11 U	11 U	13 U	11 U	11 U	11 U	12 U	11 U	12 U	11 U	12 U	11 U	11 U	11 U	12 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	64	37	56	30	30	52	48	36	29	51	19	46	30	38	40
Total Petroleum Hydrocarbons (TPHs)																					
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	280 U	28 U	33 U	26 U	27 U	270 U	30 U	29 U	29 U	26 U	1,400	**21,000**	28 U	27 U	29 U
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	1,200	56 U	65 U	53 U	53 U	**6,300**	61 U	57 U	58 U	53 U	**5,900**	**57,000**	56	54 U	59 U
Volatile Organic Chemicals (VOCs)																					
Benzene	mg/kg	0.03	2,400	0.027	NE	0.255	0.001 U	0.001 U	0.0013 U	0.00099 U	0.00096 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0011 U	0.0011 U	0.0013 U	0.001 U	0.001 U	0.0013 U
Toluene	mg/kg	7	280,000	4.5	NE	5.45	0.005 U	0.0052 U	0.0063 U	0.005 U	0.0048 U	0.0053 U	0.006 U	0.0058 U	0.0057 U	0.0056 U	0.0055 U	0.0064 U	0.005 U	0.0051 U	0.0066 U
Ethylbenzene	mg/kg	6	350,000	5.9	NE	5.16	0.001 U	0.001 U	0.0013 U	0.00099 U	0.00096 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0011 U	0.0011 U	0.0016	0.001 U	0.001 U	0.0013 U
m,p-Xylene	mg/kg	9	700,000	14	NE	10	0.002 U	0.0021 U	0.0025 U	0.002 U	0.0019 U	0.0021 U	0.0024 U	0.0023 U	0.0023 U	0.0023 U	0.0022 U	0.0026 U	0.002 U	0.002 U	0.0026 U
o-Xylene	mg/kg	9	700,000	14	NE	10	0.001 U	0.001 U	0.0013 U	0.00099 U	0.00096 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0011 U	0.0013	0.0029	0.001 U	0.001 U	0.0013 U
1,1,1-Trichloroethane	mg/kg	2	7,000	1.5	NE	29.8	0.001 U	0.001 U	0.0013 U	0.00099 U	0.00096 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0011 U	0.0038	0.0013 U	0.001 U	0.001 U	0.0013 U
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	0.078	NE	30.2	0.001 U	0.001 U	0.0013 U	0.00099 U	0.00096 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0011 U	0.0011 U	0.0013 U	0.001 U	0.001 U	0.0013 U
Tetrachloroethene	mg/kg	0.05	21,000	0.05	NE	9.92	0.001 U	0.001 U	0.0013 U	0.00099 U	0.00096 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0011 U	0.0011 U	0.0013 U	0.001 U	0.001 U	0.0013 U
Trichloroethene	mg/kg	0.03	800	0.025	NE	12.4	0.001 U	0.001 U	0.0013 U	0.00099 U	0.00096 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0011 U	**0.04**	**0.74**	0.001 U	0.001 U	0.0013 U
Vinyl Chloride	mg/kg	NE	87.50	0.0017	NE	6.46	0.001 U	0.001 U	0.0013 U	0.00099 U	0.00096 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0011 U	0.0011 U	0.0013 U	0.001 U	0.001 U	0.0013 U

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for in the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.

TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Initial RI results for Courtyard A soil samples (Table 2.5.4-3) indicate that total cyanide, PCBs, most metals (except for cadmium, selenium, and zinc), TPH-Dx as diesel, and VOCs do not exceed MTCA Method C, protection of groundwater, and/or the ecological wildlife screening levels.

Fluoride was detected in 12 out of 57 soil samples at concentrations that exceed the protection of groundwater screening level of 147.6 mg/kg. Fluoride does not exceed the protection of groundwater screening level below a depth of approximately 3 ft bgs except in soil borings SB-SE08, and SB-VS01. Soil borings SB-SE08 and SB-VS01 were both identified as Investigation Areas (SB-SE08 Investigation Area and SB-VS01 Investigation Area), that were addressed during the WPA phase of investigation and are discussed in the previous Section 2.2.

Sulfate was detected in soil three out of 57 soil samples at concentrations that exceed the protection of groundwater screening level of 2,150 mg/kg but did not exceed in deeper depth samples except for sample SB-SE05-8 which was collected at the total boring depth. The Scrubber Effluent manhole invert in the vicinity of SB-SE05 is approximately 8.5 ft bgs. Sulfate concentrations in SB-SE05 increase vertically with depth, from 840 J mg/kg at 3 ft bgs, to 2,000 J mg/kg at 6 ft bgs, to 4,100 mg/kg ft bgs, with the mass of sulfate in soil above the Scrubber Effluent line invert. A smaller clarifier, SWMU 5 Line A Secondary Scrubber Recycle Station, was located approximately 300 ft east of SB-SE05 and may be a source of sulfate in subsurface soil in this vicinity.

Detected concentrations of PAHs as TTEC exceed the protection of groundwater screening level in seven of 43 samples (SB-BC01-3, SB-SE01-3, SB-SE07-6, SB-SE08-11, SB-SE14-3, and SB-VS01-11) with detected concentrations ranging from 4.8 to 174.5 mg/kg. PAHs as TTEC was detected in one sample SB-VS01 at a concentration of 174.5 mg/kg that exceeds the MTCA Method C screening level. TTEC did not exceed the soil screening levels in samples from deeper depths in these borings except for SB-SE08 and SB-VS01, which were both identified as Investigation Areas and further investigated during the WPA phase of investigation and discussed in the previous Section 2.2.

Calculated concentrations of total LMW PAH was detected in one sample SB-VS01-11 at a concentration of 181 mg/kg that exceeds the ecological wildlife screening level. Calculated concentrations of total HMW PAH were detected in 16 of 43 samples at concentrations that range from 1.3 mg/kg to 882 mg/kg that exceeds the ecological wildlife screening. Total LMW and total

HMW PAHs did not exceed the ecological wildlife soil screening level in samples from deeper depths in these borings except for SB-SE08, SB-SWMU2403, and SB-VS01. These borings are in the SB-SE08 Investigation Area and SB-VS01 Investigation Area and were further investigated during the WPA phase of investigation and discussed in the previous Section 2.2.

Metals that were detected at concentrations that exceed soil screening levels include cadmium, selenium, and zinc. Cadmium was detected in three of 43 samples at concentrations ranging from 0.97 mg/kg to 3 mg/kg that exceed the protection of groundwater screening level but did not exceed the screening level in deeper depth samples. Selenium was detected in one sample SB-SE01 at a concentration of 16 mg/kg and exceeded both the protection of groundwater and ecological wildlife screening levels but did not exceed screening levels in deeper depth samples. Zinc was detected in three of 43 samples at concentrations ranging from 770 mg/kg to 930 mg/kg that exceeds the ecological wildlife screening level but did not exceed in deeper depth samples.

TPH-Dx as residual range organics were detected in three of 43 samples at concentrations ranging from 2,500 mg/kg to 7,100 mg/kg that exceeds MTCA Method A Industrial and the ecological wildlife screening level of 2,000 mg/kg but did not exceed at deeper depth samples.

2.5.4.3.5 Soil Sample Results for Courtyard C

Eleven Scrubber Effluent soil borings were completed in Courtyard C, and 34 soil samples collected from the borings (Figure 2.5.4-3). Scrubber Effluent Line 1 extends eastward for the length of Courtyard Segments C1 through C3 to Passage No. 3, and Scrubber Effluent Line 2 extends eastward from Passage No. 3 for the length of Courtyard Segments C4 and C5. Courtyard C has a relatively consistent elevation along its length and Lines 1 and 2 slope toward collector Line 3 running north to south beneath Passage No. 3. Line 1 slopes eastward toward Passage No. 3 with its western manhole MH7L1 invert at approximately 2 ft bgs to its eastern end at MH1L3 at approximately 9.5 ft bgs. Line 2 slopes westward toward Passage No. 3 from its eastern manhole MH5L2 at approximately 4.5 ft bgs to its western end at MH1L3 at approximately 9.5 ft bgs.

Soil samples collected from the 11 Scrubber Effluent soil borings were analyzed for total cyanide, fluoride, sulfate, cPAHs, PCBs, metals, TPH-Dx, and VOCs. Soil analytical results are summarized in Table 2.5.4-4 (PAAOC Scrubber Effluent System in Courtyard B Soil Results Summary). Soil data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC soil screening levels. Natural background concentrations for the site have been used to adjust screening levels during the screening process. Laboratory analytical reports are included in Volume 5 Appendix H-2, and data validation reports are included in Volume 5 Appendix I-2. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). For soil in Courtyard C, reporting limits for arsenic exceed the protection of groundwater soil screening level, and for selenium exceed the protection of groundwater and ecological wildlife soil screening level, in all samples analyzed.

Initial RI results for Courtyard C soil (Table 2.5.4-4) indicate that total cyanide, PAH as total LMW PAH, PCBs, metals, and VOCs do not exceed MTCA Method C, protection of groundwater, and/or the ecological wildlife screening levels.

Fluoride was detected at concentrations of up to 1,200 mg/kg that exceeds the protection of groundwater screening level in seven out of 35 samples. Fluoride exceeds the protection of groundwater screening level to depths of 3 ft bgs except in sample SB-SE09-8, the deepest depth sample in that boring. Sulfate was detected at concentrations up to 7,500 mg/kg in boring SB-BH03 and at 2,200 mg/kg in boring SB-SE18 that exceed the protection of groundwater screening level. Borings SB-BH03 and SB-SE09 are in the Crucible Cleaning Room Investigation Area and SB-SE18 is in the SB-SE18 Investigation Area that were further investigated during the WPA phase of investigation and discussed in the previous Section 2.2.

PAHs as TTEC were detected in three of 35 samples at concentrations ranging from 17.81 mg/kg to 47.91 mg/kg and exceed the protection of groundwater screening level but do not exceed at depths greater than 3 ft bgs in those borings. Calculated concentrations of total HMW PAH up to 323.5 mg/kg exceeds the ecological wildlife screening level in nine of 35 of samples but does not exceed at depths greater than 3 ft bgs in those borings.

TPH-Dx as diesel range organics were detected in one of 35 samples (SB-AST02-1) at a concentration of 2,800 mg/kg that exceeds MTCA Method A Industrial and the ecological wildlife screening level but does not exceed at deeper depth samples. TPH-Dx as residual range organics were detected in two of 35 samples (SB-AST02-1 and SB-SE10-3) at concentrations of 7,500 mg/kg and 2,800 J mg/kg, respectively that exceeds MTCA Method A Industrial and the ecological wildlife screening level, but do not exceed at deeper depths in those borings.

2.5.4.3.6 Soil Samples Results for Tertiary Treatment Plant and Southeast Plant Areas

Five Scrubber Effluent soil borings were completed in the Tertiary Treatment Plant and southeast areas, and 15 soil samples collected from the borings (Figure 2.5.4-3). Three borings were completed in the Tertiary Treatment Plant area, however, subsequent WPA investigation determined that the Scrubber Effluent System is not present in this area and does not extend north from MH1L3 in Passage No. 3. Based on this discovery, soil conditions from these three soil borings are not discussed further in this section but are addressed in the Crucible Cleaning Room Investigation Area (Section 2.2.2). Two Scrubber Effluent soil borings were completed, and eight soil samples collected from the borings in the southeast plant area where Line 4 extends between MH17L4 in Courtyard Segment A5, to the southeast then southwest to its outfall near NPDES Pond A. Ground elevations vary along this segment of Line 4 but the horizontal line slopes at a consistent grade and manhole inverts are consistent with the line grade. Manhole invert elevations in the vicinity of borings SB-SE16 and SB-SE17 are approximately 465 to 467 ft.

Eight soil samples collected from the two Scrubber Effluent soil borings in the southeast plant area were analyzed for total cyanide, fluoride, sulfate, cPAHs, PCBs, metals, TPH-Dx, and VOCs. Soil analytical results are summarized in Table 2.5.4-5 (PAAOC Scrubber Effluent System in Tertiary Treatment Plant and Southeast Plant Areas Soil Results Summary). Soil data are compared to MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC soil screening levels. Natural background concentrations for the site have been used to adjust screening levels during the screening process. Laboratory analytical reports are included in Volume 5 Appendix H-2, and data validation reports are included in Volume 5 Appendix I-2. All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). For soil along the Scrubber Effluent System alignment, reporting limits for arsenic exceed the protection of groundwater soil screening level, and for selenium exceed the protection of groundwater and ecological wildlife soil screening level, in all samples analyzed.

SE soil boring SB-SE16 is located approximately halfway between Scrubber Effluent Line 4 manholes MH17L4 and MH18L4. The depth of the boring at 11 ft bgs did not extend to the Line 4 elevation of approximately 467 ft. None of the site COPCs analyzed for the three soil samples from SB-SE16 exceeded Plant Area AOC soil screening levels.

SE soil boring SB-SE17 is located near Scrubber Effluent Line 4 manhole MH18L4. The depth of the boring at 25 ft bgs was at the approximately elevation of Line 4 of 465 ft. Fluoride, PAHs as TTEC, total LMW and total HMW PAH, TPH-Dx, and trichloroethene exceed at least one Plant Area AOC soil screening level in samples collected from 3 ft bgs, 6 ft bgs, and 15 ft bgs. Soil screening exceedances are summarized as follows.

- Fluoride decreases in concentrations from 8,300 J mg/kg at 3 ft bgs to 210 J mg/kg at 15 ft bgs, exceeding the protection of groundwater screening level.
- PAH as TTEC increases from 87.5 mg/kg at 3 ft bgs to 1,377.5 mg/kg at 6 ft bgs exceeding MTCA Method C and protection of groundwater screening levels, then does not exceed at deeper depths.
- Total LMW PAH increases from 235.23 mg/kg at 3 ft bgs to 5,430 mg/kg at 6 ft bgs exceeding ecological wildlife screening level, then does not exceed at deeper depths.
- Total HMW PAH increases from 488.2 mg/kg at 3 ft bgs to 8,110 mg/kg at 6 ft bgs, then decreases to 2.1 mg/kg at 15 ft bgs exceeding the ecological screening level, then does not exceed at deeper depths.
- TPH-Dx as diesel increases from 1,400 mg/kg at 3 ft bgs, below the ecological wildlife soil screening level, to 21,000 mg/kg at 6 ft bgs exceeding MTCA Method A Industrial and the ecological wildlife soil screening level, then does not exceed at deeper depths.
- TPH-Dx as residual range organics increases from 5,900 mg/kg at 3 ft bgs to 57,000 mg/kg at 6 ft bgs exceeding MTCA Method A Industrial and the ecological wildlife soil screening level, but does not exceed at deeper depths. Concentrations greater than about 10,000 mg/kg indicate potential non-aqueous phase liquid.
- Trichloroethene increases from 0.04 mg/kg at 3 ft bgs to 0.74 mg/kg at 6 ft bgs exceeding the protection of groundwater screening level, then does not exceed at deeper depths.

Soil boring SB-SE17 was completed in the subsequently identified footprint of SWMU 17 East End Landfill (see RI Volume 2, Section 17). Potential landfill materials were encountered between about 2 ft bgs and 10 ft bgs, including a black silt layer at approximately 6 ft bgs to 8 ft bgs. Concentrations of COPCs detected in SB-SE17 are likely associated with SWMU 17 East End Landfill, and not indicative of leakage of waste and wastewater from the Scrubber Effluent System at this location.

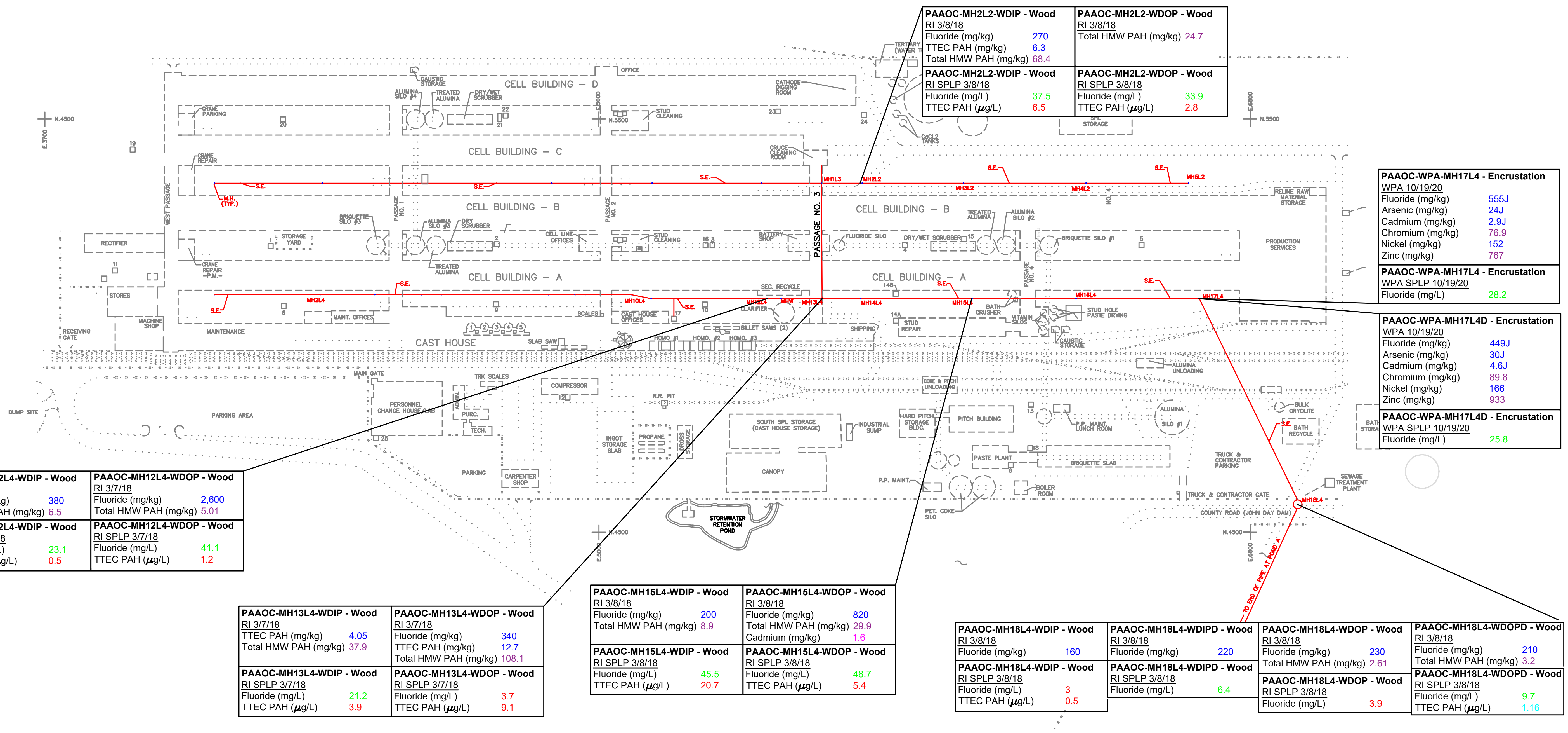
2.5.4.3.7 Collection of Wood Samples

The integrity of the Scrubber Effluent System wooden horizontal pipes was investigated by collection of wood samples representing the inner layer of wood, and the “outer” layer of wood at the base of manholes that would have been exposed to flows of wastewater during operation of the original air scrubber system. The purpose of evaluating the inner and outer layers of wood was to determine whether there is evidence of leakage of waste and wastewater through the wood staves. Five wood samples and one duplicate sample were collected from Scrubber Effluent Manholes MH2L2, MH12L4, MH13L4, MH15L4, and MH18L4 (Figure 2.5.4-4).

The five wood samples were collected from the manhole barrel sidewall, at the interface with the horizontal wood pipe. There was no access to the actual outside layer of wood, therefore two successive 1-inch cores of wood drilled from the inside of the manhole barrel were collected at each location sampled, with the deeper core (in the center of the wood stave) as the “outer” layer. Multiple cores were drilled at each sample location until enough volume was accumulated to perform chemical analyses and SPLP tests.

Wood samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, and metals. Wood sample SPLP tests analyzed for PAHs, PCBs, and metals.

Wood sample analytical results are summarized on Table 2.5.4-6, and wood sample SPLP results are summarized on Table 2.5.4-7. Inner wood surface samples are noted as WDIP, and outer wood samples are noted as WDOP. Wood data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC soil screening levels. Laboratory analytical reports are included in Volume 5, Appendix H-2, and data validation reports are included in Volume 5, Appendix I-2, All samples have been collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and the Supplemental Remedial Investigation Work Plan (PGG 2017). Reporting limits for arsenic exceed the protection of groundwater screening level, and for selenium exceed the protection of groundwater and ecological wildlife soil screening levels.



PAAOC-MH2L2-WDIP - Wood
RI 3/8/18

Fluoride (mg/kg)	270
TTEC PAH (mg/kg)	6.3
Total HMW PAH (mg/kg)	68.4

PAAOC-MH2L2-WDOP - Wood
RI 3/8/18

Total HMW PAH (mg/kg)	24.7

PAAOC-MH2L2-WDIP - Wood
RI SPLP 3/8/18

Fluoride (mg/L)	37.5
TTEC PAH (μg/L)	6.5

PAAOC-MH2L2-WDOP - Wood
RI SPLP 3/8/18

Fluoride (mg/L)	33.9
TTEC PAH (μg/L)	2.8

PAAOC-WPA-MH17L4 - Encrustation
WPA 10/19/20

Fluoride (mg/kg)	555J
Arsenic (mg/kg)	24J
Cadmium (mg/kg)	2.9J
Chromium (mg/kg)	76.9
Nickel (mg/kg)	152
Zinc (mg/kg)	767

PAAOC-WPA-MH17L4 - Encrustation
WPA SPLP 10/19/20

Fluoride (mg/L)	28.2

PAAOC-WPA-MH17L4D - Encrustation
WPA 10/19/20

Fluoride (mg/kg)	449J
Arsenic (mg/kg)	30J
Cadmium (mg/kg)	4.6J
Chromium (mg/kg)	89.8
Nickel (mg/kg)	166
Zinc (mg/kg)	933

PAAOC-WPA-MH17L4D - Encrustation
WPA SPLP 10/19/20

Fluoride (mg/L)	25.8

PAAOC-MH12L4-WDIP - Wood
RI 3/7/18

Fluoride (mg/kg)	380
Total HMW PAH (mg/kg)	6.5

PAAOC-MH12L4-WDOP - Wood
RI 3/7/18

Fluoride (mg/kg)	2,600
Total HMW PAH (mg/kg)	5.01

PAAOC-MH12L4-WDIP - Wood
RI SPLP 3/7/18

Fluoride (mg/L)	23.1
TTEC PAH (μg/L)	0.5

PAAOC-MH12L4-WDOP - Wood
RI SPLP 3/7/18

Fluoride (mg/L)	41.1
TTEC PAH (μg/L)	1.2

PAAOC-MH13L4-WDIP - Wood
RI 3/7/18

TTEC PAH (mg/kg)	4.05
Total HMW PAH (mg/kg)	37.9

PAAOC-MH13L4-WDOP - Wood
RI 3/7/18

Fluoride (mg/kg)	340
TTEC PAH (mg/kg)	12.7
Total HMW PAH (mg/kg)	108.1

PAAOC-MH13L4-WDIP - Wood
RI SPLP 3/7/18

Fluoride (mg/L)	21.2
TTEC PAH (μg/L)	3.9

PAAOC-MH13L4-WDOP - Wood
RI SPLP 3/7/18

Fluoride (mg/L)	3.7
TTEC PAH (μg/L)	9.1

PAAOC-MH15L4-WDIP - Wood
RI 3/8/18

Fluoride (mg/kg)	200
Total HMW PAH (mg/kg)	8.9

PAAOC-MH15L4-WDOP - Wood
RI 3/8/18

Fluoride (mg/kg)	820
Total HMW PAH (mg/kg)	29.9
Cadmium (mg/kg)	1.6

PAAOC-MH15L4-WDIP - Wood
RI SPLP 3/8/18

Fluoride (mg/L)	45.5
TTEC PAH (μg/L)	20.7

PAAOC-MH15L4-WDOP - Wood
RI SPLP 3/8/18

Fluoride (mg/L)	48.7
TTEC PAH (μg/L)	5.4

PAAOC-MH18L4-WDIP - Wood
RI 3/8/18

Fluoride (mg/kg)	160

PAAOC-MH18L4-WDIPD - Wood
RI 3/8/18

Fluoride (mg/kg)	220

PAAOC-MH18L4-WDOP - Wood
RI 3/8/18

Fluoride (mg/kg)	230
Total HMW PAH (mg/kg)	2.61

PAAOC-MH18L4-WDOPD - Wood
RI 3/8/18

Fluoride (mg/kg)	210
Total HMW PAH (mg/kg)	3.2

PAAOC-MH18L4-WDIP - Wood
RI SPLP 3/8/18

Fluoride (mg/L)	3
TTEC PAH (μg/L)	0.5

PAAOC-MH18L4-WDIPD - Wood
RI SPLP 3/8/18

Fluoride (mg/L)	6.4

PAAOC-MH18L4-WDOP - Wood
RI SPLP 3/8/18

Fluoride (mg/L)	3.9

PAAOC-MH18L4-WDOPD - Wood
RI SPLP 3/8/18

Fluoride (mg/L)	9.7
TTEC PAH (μg/L)	1.16

Source: Goldendale Aluminum Company, Plant Drawing A1/1752, "Underground Storm & Sanitary Sewer Piping W/Chem'l & Oil Str'g Areas"

Legend

── SCRUBBER EFFLUENT LINE

RRO	TPH-Dx as Residual Range Organics
RI	Initial RI Phase
WPA	WPA Phase

Soil Screening Levels

red	Exceeds MTCA Method C
blue	Exceeds Protection of Groundwater
purple	Exceeds Ecological Wildlife and for TPH diesel and residual range organics exceeds MTCA Method A

Notes

J	Estimated Concentration
Z	Chromatographic fingerprint does not resemble a petroleum product

Water Screening Levels

cyan	Exceeds MTCA Method A
red	Exceeds MTCA Method C
green	Exceeds WA MCL

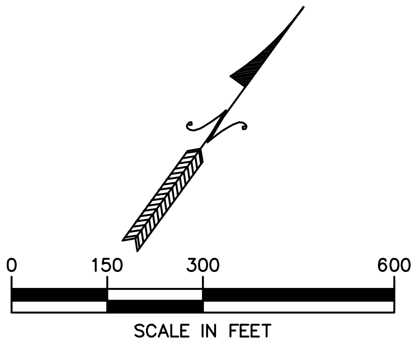


Figure 2.5.4-4

Plant Area AOC

Scrubber Effluent System
Wood, Encrustation, and SPLP Sample Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Table 2.5.4-6
PAAOC Scrubber Effluent System RI Wood Sample Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	RI Analytical Results											
Parameter Name	Units	MTCA Method A Industrial	Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-MH2L2-WDIP	PAAOC-MH2L2-WDOP	PAAOC-MH12L4-WDIP	PAAOC-MH12L4-WDOP	PAAOC-MH13L4-WDIP	PAAOC-MH13L4-WDOP	PAAOC-MH15L4-WDIP	PAAOC-MH15L4-WDOP	PAAOC-MH18L4-WDIP	PAAOC-MH18L4-WDIPD	PAAOC-MH18L4-WDOP	PAAOC-MH18L4-WDOPD
Aluminum Smelting																		
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.068	0.059	0.05 U	0.05 U	0.05 U	0.16	0.11	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**270**	130	**380**	**2,600**	16	**340**	**200**	**820**	**160**	**220**	**230**	**210**
Sulfate	mg/kg	NA	NE	2,150	NE	NE	210	23	550	81	210	260	72	780	110	340	32	170
Polynuclear Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.014	0.0067 U	0.0067 U	0.0067 U	0.0069	3.3 U	0.012	0.0076	0.0087	0.008	0.0089	0.008
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.015	0.0067 U	0.0067 U	0.0067 U	0.0075	3.3 U	0.013	0.0078	0.011	0.01	0.011	0.0096
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.032	0.024	0.0067 U	0.017	0.016	3.3 U	0.015	0.012	0.019	0.014	0.031	0.02
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.077	0.077	0.0067 U	0.0067 U	0.017	3.3 U	0.012	0.047	0.017	0.018	0.012	0.011
Anthracene	mg/kg	NA	NE	2,300	NE	NL	1.7 U	1.7 U	0.068	0.089	0.39	3.3 U	0.046	0.27	0.022	0.033	0.051	0.056
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	4.9	1	0.47	0.38	3.6	7.7	0.39	1.6	0.084	0.044	0.27	0.23
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	3.8	0.99	0.37	0.42	2.4	8.1	0.31	2.3	0.11	0.032	0.33	0.26
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	11	3.1	0.88	1.1	7.1	20	0.8	6.5	0.16	0.075	0.55	0.65
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	3.7	3.7	0.34	0.58	2.3	8.2	0.32	3.2	0.093	0.037	0.28	0.26
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	3.3	0.81	0.34	0.29	2.1	7.5	0.2	1.6	0.052	0.023	0.16	0.14
Chrysene	mg/kg	NA	NL	NL	NE	NL	29	4.1	3.4	0.79	11	43	1.1	9.3	0.11	0.1	0.39	0.62
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	1.7 U	0.3	0.11	0.14	0.7	3.3 U	4.3	0.75	0.024	0.012	0.067	0.074
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	9.1	9.1	0.38	0.9	6.9	5.7	1.1	2.1	0.16	0.23	0.64	0.7
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.15	0.15	0.023	0.035	0.067	3.3 U	0.04	0.047	0.0465	0.054	0.052	0.06
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	2.9	0.91	0.27	0.48	1.9	6.6	0.25	2.4	0.078	0.03	0.023	0.21
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.025	0.025	0.049	0.019	0.014	3.3 U	0.014	0.011	0.029	0.024	0.029	0.023
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	2.6	2.6	0.34	1	1.1	3.3 U	0.38	0.56	0.26	0.48	0.6	1.6
Pyrene	mg/kg	NA	110,000	650	NE	NL	9.8	9.8	0.35	0.83	6.8	7	1.2	2.2	0.13	0.22	0.54	0.72
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**6.3**	1.64	0.61	0.7	**4.05**	**12.7**	0.92	3.7	0.15	0.05	0.44	0.4
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	9.4	9.4	0.86	2.1	47.11	5.7	1.61	2.5	0.6	0.9	1.4	2.5
Total MHW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**68.4**	**24.7**	**6.5**	**5.01**	**37.9**	**108.1**	**8.9**	**29.9**	0.84	0.6	**2.61**	**3.2**
Polychlorinated Biphenyls (PCBs)																		
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Metals																		
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	2,800	700	360 J	770 J	690 J	1,100 J	1,600 J	860 J	120 J	96 J	220 J	290 J
Arsenic	mg/kg	20	87.5	2.9	7.61	132	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.5 U	0.5 U	0.5 U	0.5 U	0.85	0.5 U	0.5 U	**1.6**	0.5 U	0.5 U	0.5 U	0.5 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	0.81	0.56	0.5 U	0.9	0.77	3.5	2.6	0.65	0.5 U	0.5 U	0.5 U	0.5 U
Copper	mg/kg	NA	140,000	280	28.4	217	130	5.3	2.8	25	31	170	150	32	1 U	1 U	1 U	1 U
Lead	mg/kg	1,000	NE	3,000	13.1	118	56	6.1	5 U	18	22	29	86	27	5 U	5 U	5 U	5 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.73	0.25 U	0.25 U	0.25 U	0.25 U	0.25	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Nickel	mg/kg	NA	70,000	130	24.54	980	19	6.1	5	16	9.3	11	16	9	2.5 U	2.5 U	2.5 U	2.5 U
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Zinc	mg/kg	NA	1,100,000	6,000	80.9	360	120	46	23 J	50 J	16 J	20 J	63 J	110 J	5 UJ	5 UJ	5 UJ	5 UJ

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.5.4-7
PAAOC Scrubber Effluent System RI Wood Sample SPLP Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels						RI SPLP Analytical Results											
Parameter Name	Units	MTCA Method A	MTCA Method B	MTCA Method C	WA MCL	Natural Background	PAAOC-MH2L2-WDIP	PAAOC-MH2L2-WDOP	PAAOC-MH12L4-WDIP	PAAOC-MH12L4-WDOP	PAAOC-MH13L4-WDIP	PAAOC-MH13L4-WDOP	PAAOC-MH15L4-WDIP	PAAOC-MH15L4-WDOP	PAAOC-MH18L4-WDIPD	PAAOC-MH18L4-WDIP	PAAOC-MH18L4-WDOPD	PAAOC-MH18L4 WDOP
Aluminum Smelting																		
Cyanide, free	mg/L	NE	0.01	0.022	0.2	ND	0.005	0.008	0.006	0.007	0.009	0.008	0.008	0.007	0.005 U	0.005 U	0.005 U	0.006
Fluoride	mg/L	NE	0.96	2	4	0.72	**37.5**	**33.9**	**23.1**	**41.1**	**21.2**	**3.7**	**45.5**	**48.7**	**6.4**	**3**	**9.7**	**3.9**
Sulfate	mg/L	NE	NE	NE	250	32	14.2	2.3	5	31	26.2	22.8	18.8	37	10.9	5.8	19.8	10
Polynuclear Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	ug/L	NA	1.5	15	NE	NE	0.16	0.18	0.12 U	0.12 U	0.21	0.12 U	0.11 U	0.11 U	0.11 U	0.15	0.11 U	0.15
2-Methylnaphthalene	ug/L	NL	32	70	NE	NE	0.14	0.18	0.12 U	0.12 U	0.21	0.12 U	0.11 U	0.11 U	0.11	0.19	0.12	0.19
Acenaphthene	ug/L	NA	960	2,100	NE	NE	0.24	0.24	0.12 U	0.12 U	0.52	0.12 U	0.11 U	0.13	0.11 U	0.22	0.14	0.21
Acenaphthylene	ug/L	NA	NE	NE	NE	NE	0.46	0.27	0.12 U	0.12 U	0.44	0.28	0.77	0.33	0.17	0.33	0.15	0.24
Anthracene	ug/L	NA	4800	11,000	NE	NE	1.3	0.38	0.12	0.43	0.57	1.8	2.8	1.2	0.11 U	0.11 U	0.21	0.11 U
Benzo(a)anthracene	ug/L	NL	NL	NL	NE	NE	3.6	1.1	0.14	0.52	1.8	5.5	6.9	2.3	0.034	0.11 U	0.085	0.039
Benzo(a)pyrene	ug/L	0.1	0.023	0.88	NE	NE	3.9	1.6	0.32	0.74	2.5	5.2	13	3	0.073	0.49	0.13	0.066 U
Benzo(b)fluoranthene	ug/L	NL	NL	NL	NE	NE	11	5.9	0.52	2	6.2	20	36	8.8	0.12	0.046 U	0.32 U	0.081 U
Benzo(g,h,i)perylene	ug/L	NA	NE	NE	NE	NE	5.3	3.2	0.32	0.92	3.1	6.9	22	10	0.079	0.035	0.16	0.064
Benzo(k)fluoranthene	ug/L	NL	NL	NL	NE	NE	3.7	1.4	0.2	0.51	1.5	3.9	8.5	2.6	0.054 U	0.034 U	0.12 U	0.075 U
Chrysene	ug/L	NL	NL	NL	NE	NE	17	3.3	0.54	2.2	4.7	25	52	17	0.11	0.06	0.21	0.11
Dibenzo(a,h)anthracene	ug/L	NL	NL	NL	NE	NE	1.3	0.71	0.16	0.27	0.75	1.6	4.3	1.6	0.054 U	0.011 U	0.034	0.014
Fluoranthene	ug/L	NA	640	1,400	NE	NE	7.2	2.5	0.23	1.2	4.6	9.2	5.1	2.5	0.23	0.011 U	0.7	0.4
Fluorene	ug/L	NA	640	1,400	NE	NE	0.85	0.73	0.25	0.14	1.4	0.26	0.6	0.77	0.22	0.33	0.46	0.52
Indeno(1,2,3-cd)pyrene	ug/L	NL	NL	NL	NE	NE	4.5	2.8	0.28	0.84	2.9	5.2	16	7.3	0.059 J	0.031	0.14	0.052
Naphthalene	ug/L	160	160	350	NE	NE	0.62	0.51	0.38	0.58	0.53	0.25	0.16	0.36	0.59	1.1	0.48	1.2
Phenanthrene	ug/L	NA	NE	NE	NE	NE	0.78	2.5	0.4	0.12	5.2	3.3	1.1	1.1	0.71	0.33	1.9	1.4
Pyrene	ug/L	NA	480	1,100	NE	NE	7.3	2.3	0.2	1	5.3	8.9	5	2.5	0.19	0.11 U	0.58	0.3
TTEC cPAH (calc)	ug/L	0.1	0.2	0.2	NE	NE	**6.5**	**2.8**	**0.5**	**1.2**	**3.9**	**9.1**	**20.7**	**5.4**	0.1	**0.5**	**0.16**	0.01
Polychlorinated Biphenyls (PCBs)																		
Aroclor 1016	ug/L	NA	1.1	2.5	NE	ND	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U
Aroclor 1221	ug/L	NA	NE	NE	NE	ND	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U
Aroclor 1232	ug/L	NA	NE	NE	NE	ND	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U
Aroclor 1242	ug/L	NA	NE	NE	NE	ND	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U
Aroclor 1248	ug/L	NA	NE	NE	NE	ND	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U
Aroclor 1254	ug/L	NA	0.044	0.44	NE	ND	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U
Aroclor 1260	ug/L	NA	0.044	0.44	NE	ND	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U
Total PCBs (calc)	ug/L	0.1	0.044	0.44	0.5	ND	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Metals																		
Aluminum	mg/L	NE	16	35	NE	1.4	6.9	7.2	3.5	6.9	4.9	1.2	6.9	6.9	0.23 J	0.11 UJ	0.29 J	0.12 J
Arsenic	mg/L	0.005	0.000058	0.001	0.01	0.0069	0.0033 U	0.0033 U	0.0033 U	0.0033 U	0.0033 U	0.0033 U	0.0033 U	0.0038	0.0033 U	0.0033 U	0.0033 U	0.0033 U
Cadmium	mg/L	0.005	0.008	0.018	0.05	NE	0.0044 U	0.0044 U	0.0044 U	0.0044 U	0.0044 U	0.0044 U	0.0044 U	0.0044 U	0.0044 U	0.0044 U	0.0044 U	0.0044 U
Chromium	mg/L	0.05	24	53	0.1	0.3	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U
Copper	mg/L	NE	0.64	1.4	13	NE	0.069	0.011 U	0.014	0.067	0.011 U	0.03	0.091	0.084	0.011 U	0.011 U	0.011 U	0.011 U
Lead	mg/L	0.015	NE	NE	0.015	0.00046	0.026	0.0072	0.0038	0.029	0.0048	0.0022 U	0.014	0.04	0.0022 U	0.0022 U	0.0023	0.0022 U
Mercury	mg/L	0.002	NE	NE	0.002	NE	0.00025 U	0.00025 U	0.00025 U	0.00025 U	0.00025 U	0.00025 U	0.00057	0.00082	0.00025 U	0.00025 U	0.00025 U	0.00025 U
Nickel	mg/L	NA	0.000096	0.00096	0.1	0.065	0.032	0.022 U	0.022 U	0.049	0.022 U	0.022 U	0.022 U	0.031	0.022 U	0.022 U	0.022 U	0.022 U
Selenium	mg/L	NA	0.08	0.18	0.05	NE	0.0056 U	0.0056 U	0.0056 U	0.0056 U	0.0056 U	0.0056 U	0.0056 U	0.0056 U	0.0056 U	0.0056 U	0.0056 U	0.0056 U
Zinc	mg/L	NA	4.8	11	NE	NE	0.18	0.061	0.04	0.15	0.028 U	0.036	0.039	0.15	0.028 U	0.028 U	0.028 U	0.028 U

Notes:

J	Estimated Concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.
ND	Not detected.

Detected concentrations shown in **bold** exceed one or more site water screening levels.

All wood sample analytical results for COPCs that exceed Plant Area AOC soil and water screening levels are compiled and presented on Figure 2.5.4-4. The initial RI results indicate that total cyanide, sulfate, total LMW PAH, PCBs, and most metals do not exceed soil screening levels. Fluoride was detected in the wood at concentrations ranging from 160 to 2,600 mg/kg that exceed the protection of groundwater screening level.

PAHs as TTEC were detected at concentrations that exceed the protection of groundwater screening level in two wood samples, with concentrations decreasing to the outer layer in sample MH2L2 and increasing to the outer layer in sample MH13L4. Calculated total HMW PAH concentrations were at up to 108.9 mg/kg in 11 out of 12 samples, with half of the samples resulting in decreasing concentrations to the outer layer and the other half increasing to the outer layer. Cadmium was detected at a concentration of 1.6 mg/kg in outer layer sample MH15L4 that exceeds the protection of groundwater screening level.

Initial RI results for SPLP tests for the wood samples indicate fluoride and PAHs as TTEC exceeds site water screening levels. Fluoride was detected at concentrations in all samples ranging from 3 to 48.7 mg/L that exceeds MTCA Method C water screening level and/or the WA MCL. TTEC was detected at concentrations in nine out of 12 samples ranging from 0.5 µg/L to 20.7 µg/L that exceeds all water screening levels.

2.5.4.3.8 Initial RI Phase Investigation Conclusions

Results from the system inspection indicated significant blockage of the lines from sediment accumulation in manholes MH17L4, MH16L4, and MH15L4, and a precipitated encrustation in Line 4 leading up to and beyond MH17L4. This prevented evaluations of the potential source of water flowing through the Scrubber Effluent lines. The sediment blockage could be residue from previous cleaning of the lines and/or influx of surface debris during plant demolition activities.

Sediment sample analytical results indicate that several COPCs exceed one or more Plant Area AOC soil screening levels MTCA Method A Industrial, MTCA Method C, protection of groundwater, and/or ecological wildlife in all samples analyzed. COPCs that exceed screening levels include fluoride, PAHs as TTEC, total LMW and total HMW PAHs, total PCBs, and metals including arsenic, cadmium, chromium, copper, lead, nickel, selenium, and zinc.

Subsurface soil along the Scrubber Effluent System alignment in Courtyards A and C, and in the southeast plant area was investigated to determine whether the lines may have leaked waste and wastewater into the subsurface. COPCs that exceed Plant Area AOC soil screening levels were detected at depths of up to 3 ft bgs and are present above the Scrubber Effluent manhole and horizontal wooden line invert depths and associated with other features or structures. The data indicates there is no subsurface soil evidence that the Scrubber Effluent System manholes and horizontal lines have leaked waste and wastewater to subsurface soil.

Where COPCs exceed soil screening levels below approximately 3 ft bgs, the borings are in identified Investigation Areas that have other apparent sources than the Scrubber Effluent System manholes and horizontal lines. Investigation Areas were further addressed during the WPA phase investigation and discussed in previous Section 2.2. Soil analytical results for Courtyard A indicate that COPCs that exceed Plant Area AOC soil screening levels below approximately 3 ft bgs are in borings SB-SE08 and SB-VS01 and are discussed in the SB-SE08 and SB-VS01 Investigation Areas in Section 2.2.

Soil analytical results for Courtyard C indicate that COPCs that exceed Plant Area AOC soil screening levels below approximately 3 ft bgs are in borings SB-BH03, SB-SE09, and SB-SE18 in the Crucible Cleaning Room and SB-SE18 Investigation Areas were discussed in Section 2.2. Soil analytical results for the southeast plant area indicate that COPCs that exceed soil screening levels were detected at depths in boring SB-SE17 that are consistent with the known interval of landfill materials in SWMU 17 East End Landfill.

Wood sample analytical results indicate that constituents of waste conveyed by the Scrubber Effluent lines has penetrated the wood structure of the manholes. SPLP results do not clearly indicate consistent outward movement of waste and wastewater from the Scrubber Effluent System manholes. The gradient of concentrations between the inside pipe and outside pipe samples shows increasing concentrations in half the samples and decreasing concentrations in the other half of samples. The specific differences in concentrations of leached constituents between sample pairs (inside and outside pipe samples at one manhole) is relatively the same. The potential for leaching does not appear to be higher for the samples collected from inside the pipe versus for samples outside the pipe.

2.5.4.4 WPA Phase Investigation Scope

The Scrubber Effluent System was investigated during the WPA phase in 2020 and 2021. The objectives for the WPA phase of investigation were as follows.

- **Sample water and sediment** from selected Scrubber Effluent line manholes in courtyards A4, A5, C4, and C5.
- **Sample the encrustation material** from the wooden Scrubber Effluent horizontal line system at manhole MH17L4.
- **Conduct a video survey** of the Scrubber Effluent horizontal line system to determine overall integrity and whether cleanup of the Scrubber Effluent line system is warranted.
- **Confirm source of water** discharging from the Scrubber Effluent System outfall near the head of NPDES Pond A.
- **Estimate volume of flow** for the water discharging from the Scrubber Effluent System outfall at the head of NPDES pond A.

2.5.4.5 WPA Phase Investigation Results

WPA investigation results for collection of sediment, water, and encrustation samples, and video surveys of selected Scrubber Effluent line segments are discussed in the following sections. For clarity, video surveys conducted during the initial RI and the WPA phases of investigation are discussed together in Section 2.5.4.6.3 below.

2.5.4.5.1 Collection of Sediment Samples from the Scrubber Effluent System

The Scrubber Effluent System was investigation during the WPA phase in 2020 and 2021, by collection of sediment samples from four Scrubber Effluent Manholes MH3L2, MH4L2, MH5L2, and MH13L4. Manhole sediment samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals, TPH-Gx, and TPH-Dx.

Sediment sample analytical results are summarized in Table 2.5.4-8 (PAAOC Scrubber Effluent System WPA Sediment Results Summary). Sediment sample data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife Plant Area AOC soil screening levels. Natural background concentrations for the site have been used to adjust screening levels where applicable in the screening process. Laboratory analytical reports are included in Volume 5, Appendix H-4, and data validation reports are included in Volume 5,

Table 2.5.4-8
PAAOC Scrubber Effluent System WPA Sediment Results Summary
Columbia Gorge Aluminum Smelter, Goldendale, Washington

Parameter Name	Screening Levels					Ecological Screening Levels	WPA Analytical Results			
	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-WPA-MH3L2-SD01	PAAOC-WPA-MH4L2-SD01	PAAOC-WPA-MH5L2-SD01	PAAOC-WPA-13L4-SD01
Aluminum Smelting										
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.15 J	0.1 J	0.12 J	NA
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**2,210 J**	**1,840 J**	**622 J**	**641**
Sulfate	mg/kg	NA	NE	2,150	NE	NE	195	59.3	48.4	612
Polynuclear Aromatic Hydrocarbons (PAHs)										
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	NA	NA	NA	NA
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.66	0.16	0.38	NA
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	5.7	1.9	4	NA
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.27	0.14	0.28	NA
Anthracene	mg/kg	NA	NE	2,300	NE	NL	21	3.5	8.7	NA
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	110	20	39	NA
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	94	21	40	NA
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	190	43	79	NA
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	62	20	35	NA
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	55	13	23	NA
Chrysene	mg/kg	NA	NL	NL	NE	NL	160	31	59	NA
Dibenzo(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	17	4.4	7.6	NA
Dibenzofuran	mg/kg	NA	NE	NE	NE	NL	2.1	0.49	1.3	NA
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	200	44	88	NA
Fluorene	mg/kg	NL	140,000	100	NE	NL	5.2	1.2	3	NA
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	79	23	42	NA
Naphthalene	mg/kg	5	70	4.5	NE	NL	1	0.2	0.49	NA
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	74	15	34	NA
Pyrene	mg/kg	NA	110,000	650	NE	NL	200	41	84	NA
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**140.7**	**31.7**	**59.7**	NA
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	**300.2**	65.9	**138.5**	NA
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**967**	**216.4**	**408.6**	NA
Polychlorinated Biphenyls (PCBs)										
Aroclor 1016	mg/kg	NA	250	NE	NE	NE	0.069 U	0.061 U	0.053 Ui	NA
Aroclor 1221	mg/kg	NA	NE	NE	NE	NE	0.14 U	0.13 U	0.1 U	NA
Aroclor 1232	mg/kg	NA	NE	NE	NE	NE	0.069 U	0.061 U	0.053 Ui	NA
Aroclor 1242	mg/kg	NA	NE	NE	NE	NE	0.21 JPD	0.061 U	0.053 Ui	NA
Aroclor 1248	mg/kg	NA	NE	NE	NE	NE	0.069 U	0.061 U	0.061 Ui	NA
Aroclor 1254	mg/kg	NA	66	0.71	NE	NE	0.5 D	0.19	0.26 D	NA
Aroclor 1260	mg/kg	NA	66	NE	NE	NE	1.9 Ui	0.51 Ui	0.55 Ui	NA
Aroclor 1262	mg/kg	NA	NL	NE	NE	NE	NA	NA	NA	NA
Aroclor 1268	mg/kg	NA	NL	NE	NE	NE	NA	NA	NA	NA
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	**0.71**	0.19	0.26	NA
Metals										
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	36,100	43,400	46,900	104,000
Arsenic	mg/kg	20	87.5	2.9	7.61	132	**29.8 J**	**15.3 J**	**30.7 J**	**79 J**
Cadmium	mg/kg	2	3,500	0.69	0.81	14	**6.08**	**4**	**4.42**	**5.3**
Chromium	mg/kg	2,000	5,300,000	490,000	32	67	**141 J**	**97.1 J**	**168**	**104**
Copper	mg/kg	NA	140,000	280	28.4	217	126 J	70.8 J	**402 J**	106
Lead	mg/kg	1,000	NE	3,000	13	118	65.6 J	34.9 J	36.9	74
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.054	0.079	0.019	0.333
Nickel	mg/kg	NA	70,000	130	24.54	980	**193**	126	**198**	**305**
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	**2.3**	**1.1**	**1.6**	82 U
Zinc	mg/kg	NA	1,100,000	6,000	81	360	**1,130**	**766**	**997**	**782**
Total Petroleum Hydrocarbons (TPHs)										
Gasoline Range Organics	mg/kg	100	NE	NA	NE	1,000	NA	NA	NA	NA
Diesel Range Organics	mg/kg	2,000	NE	NA	NE	2,000	**5,200 H**	950 H	1,100 H	NA
Residual Range Organics	mg/kg	2,000	NE	NA	NE	2,000	**19,000 Z**	**3,500 Z**	**5,400 Z**	NA

Notes:

H	Holding time is immediately after sample collection. Samples were analyzed as soon as possible after receipt by laboratory.
i	Method Reporting Limit is elevated due to a matrix interference.
J	Estimated Concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for in the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.

Z	Chromatographic fingerprint does not resemble a petroleum product.
P	GC confirmation criteria exceeded. Relative percent difference is greater than 40%.
D	The reported result is from a dilution.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Appendix I-4. All samples were collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The reporting limit objectives have been met.

All sediment analytical results for COPCs that exceed Plant Area AOC soil screening levels are compiled and presented on Figure 2.5.4-5 (PAAOC Scrubber Effluent System Sediment Sample Locations and Exceedance Summary). Sediment sample analytical results indicate total cyanide, sulfate, and TPH-Gx were not detected at concentrations that exceed soil screening levels.

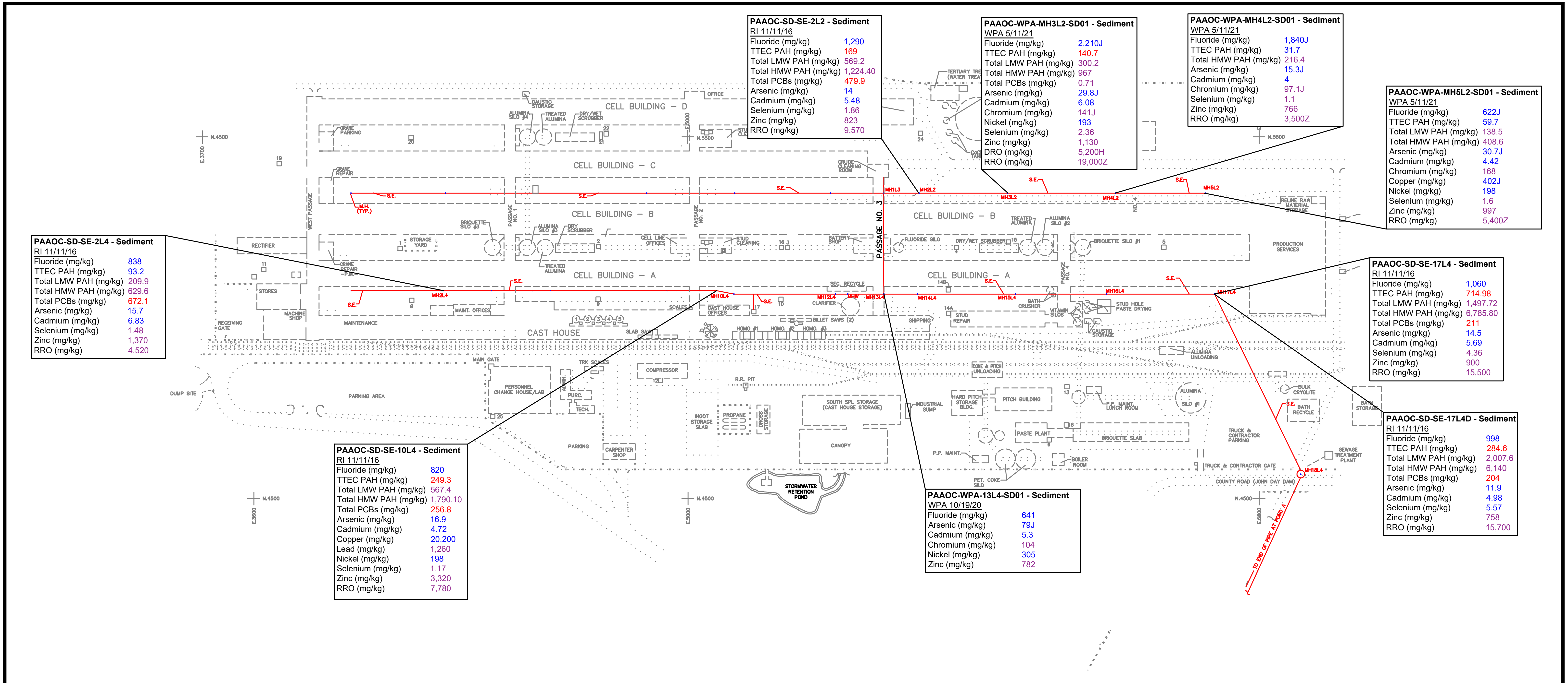
Fluoride was detected at concentrations that range from 622 mg/kg to 2,210 mg/kg that exceed the protection of groundwater screening level in all four samples.

PAHs as TTEC were detected in three of four samples analyzed for PAHs at concentrations ranging from 31.7 mg/kg to 140.7 mg/kg, that exceed the protection of groundwater screening level in three samples, and also exceeds the MTCA Method C screening level in one sample. Calculated concentrations of total LMW PAH were detected in samples MH3L2-SD01 and MH5L2-SD01 at concentrations of 300.2 mg/kg and 138.5 mg/kg, respectively, that exceed the ecological wildlife screening. Calculated concentrations of total HMW PAH were detected in three of four samples at concentrations that range from 216.4 mg/kg to 967 mg/kg, exceeding the ecological wildlife screening level.

PCBs were detected in one sample MH3L2-SD01 at a concentration of 0.71 mg/kg that exceeds the ecological wildlife screening level.

Seven metals were detected at concentrations that exceed soil screening levels. Arsenic at 15.3 mg/kg to 79 J mg/kg, cadmium at 4 mg/kg to 6.08 mg/kg, and nickel at 193 mg/kg to 305 mg/kg, exceed the protection of groundwater screening level. Chromium at 97.1 mg/kg to 168 mg/kg, selenium at 1.1 mg/kg to 2.3 mg/kg, and zinc at 766 mg/kg to 1,130 mg/kg, exceed the ecological wildlife screening level. Copper, detected in one sample at 402 mg/kg, exceeds the protection of groundwater and ecological wildlife screening levels.

TPH-Dx as diesel range organics were detected in sample MH3L2-SD01 at a concentration of 5,200 mg/kg that exceeds MTCA Method A Industrial and the ecological wildlife screening level. TPH-Dx as residual range organics were detected in three of four samples analyzed at concentrations ranging from 3,500 mg/kg to 19,000 mg/kg that exceeds MTCA Method A Industrial and the ecological wildlife screening level.



PAAOC-SD-SE-2L2 - Sediment
RI 11/11/16

Fluoride (mg/kg)	1,290
TTEC PAH (mg/kg)	169
Total LMW PAH (mg/kg)	569.2
Total HMW PAH (mg/kg)	1,224.40
Total PCBs (mg/kg)	479.9
Arsenic (mg/kg)	14
Cadmium (mg/kg)	5.48
Selenium (mg/kg)	1.86
Zinc (mg/kg)	823
RRO (mg/kg)	9,570

PAAOC-WPA-MH3L2-SD01 - Sediment
WPA 5/11/21

Fluoride (mg/kg)	2,210J
TTEC PAH (mg/kg)	140.7
Total LMW PAH (mg/kg)	300.2
Total HMW PAH (mg/kg)	967
Total PCBs (mg/kg)	0.71
Arsenic (mg/kg)	29.8J
Cadmium (mg/kg)	6.08
Chromium (mg/kg)	141J
Nickel (mg/kg)	193
Selenium (mg/kg)	2.36
Zinc (mg/kg)	1,130
DRO (mg/kg)	5,200H
RRO (mg/kg)	19,000Z

PAAOC-WPA-MH4L2-SD01 - Sediment
WPA 5/11/21

Fluoride (mg/kg)	1,840J
TTEC PAH (mg/kg)	31.7
Total HMW PAH (mg/kg)	216.4
Arsenic (mg/kg)	15.3J
Cadmium (mg/kg)	4
Chromium (mg/kg)	97.1J
Selenium (mg/kg)	1.1
Zinc (mg/kg)	766
RRO (mg/kg)	3,500Z

PAAOC-WPA-MH5L2-SD01 - Sediment
WPA 5/11/21

Fluoride (mg/kg)	622J
TTEC PAH (mg/kg)	59.7
Total LMW PAH (mg/kg)	138.5
Total HMW PAH (mg/kg)	408.6
Arsenic (mg/kg)	30.7J
Cadmium (mg/kg)	4.42
Chromium (mg/kg)	168
Copper (mg/kg)	402J
Nickel (mg/kg)	198
Selenium (mg/kg)	1.6
Zinc (mg/kg)	997
RRO (mg/kg)	5,400Z

PAAOC-SD-SE-2L4 - Sediment
RI 11/11/16

Fluoride (mg/kg)	838
TTEC PAH (mg/kg)	93.2
Total LMW PAH (mg/kg)	209.9
Total HMW PAH (mg/kg)	629.6
Total PCBs (mg/kg)	672.1
Arsenic (mg/kg)	15.7
Cadmium (mg/kg)	6.83
Selenium (mg/kg)	1.48
Zinc (mg/kg)	1,370
RRO (mg/kg)	4,520

PAAOC-SD-SE-17L4 - Sediment
RI 11/11/16

Fluoride (mg/kg)	1,060
TTEC PAH (mg/kg)	714.98
Total LMW PAH (mg/kg)	1,497.72
Total HMW PAH (mg/kg)	6,785.80
Total PCBs (mg/kg)	211
Arsenic (mg/kg)	14.5
Cadmium (mg/kg)	5.69
Selenium (mg/kg)	4.36
Zinc (mg/kg)	900
RRO (mg/kg)	15,500

PAAOC-SD-SE-17L4D - Sediment
RI 11/11/16

Fluoride (mg/kg)	998
TTEC PAH (mg/kg)	284.6
Total LMW PAH (mg/kg)	2,007.6
Total HMW PAH (mg/kg)	6,140
Total PCBs (mg/kg)	204
Arsenic (mg/kg)	11.9
Cadmium (mg/kg)	4.98
Selenium (mg/kg)	5.57
Zinc (mg/kg)	758
RRO (mg/kg)	15,700

PAAOC-SD-SE-10L4 - Sediment
RI 11/11/16

Fluoride (mg/kg)	820
TTEC PAH (mg/kg)	249.3
Total LMW PAH (mg/kg)	567.4
Total HMW PAH (mg/kg)	1,790.10
Total PCBs (mg/kg)	256.8
Arsenic (mg/kg)	16.9
Cadmium (mg/kg)	4.72
Copper (mg/kg)	20,200
Lead (mg/kg)	1,260
Nickel (mg/kg)	198
Selenium (mg/kg)	1.17
Zinc (mg/kg)	3,320
RRO (mg/kg)	7,780

PAAOC-WPA-13L4-SD01 - Sediment
WPA 10/19/20

Fluoride (mg/kg)	641
Arsenic (mg/kg)	79J
Cadmium (mg/kg)	5.3
Chromium (mg/kg)	104
Nickel (mg/kg)	305
Zinc (mg/kg)	782

Source: Goldendale Aluminum Company, Plant Drawing A1/1752, "Underground Storm & Sanitary Sewer Piping W/Chem'l & Oil Str'g Areas"

Legend

SCRUBBER EFFLUENT LINE

RRO	TPH-Dx as Residual Range Organics
RI	Initial RI Phase
WPA	WPA Phase

Soil Screening Levels

red	Exceeds MTCA Method C
blue	Exceeds Protection of Groundwater
purple	Exceeds Ecological Wildlife and for TPH diesel and residual range organics exceeds MTCA Method A

Water Screening Levels

red	Exceeds MTCA Method C
green	Exceeds WA MCL

Notes

H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.
J	Estimated Concentration
Z	Chromatographic fingerprint does not resemble a petroleum product

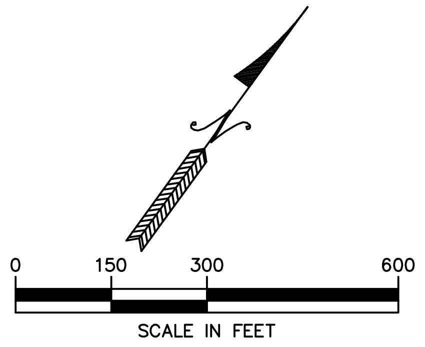


Figure 2.5.4-5

Plant Area AOC

Scrubber Effluent System Sediment Sample Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

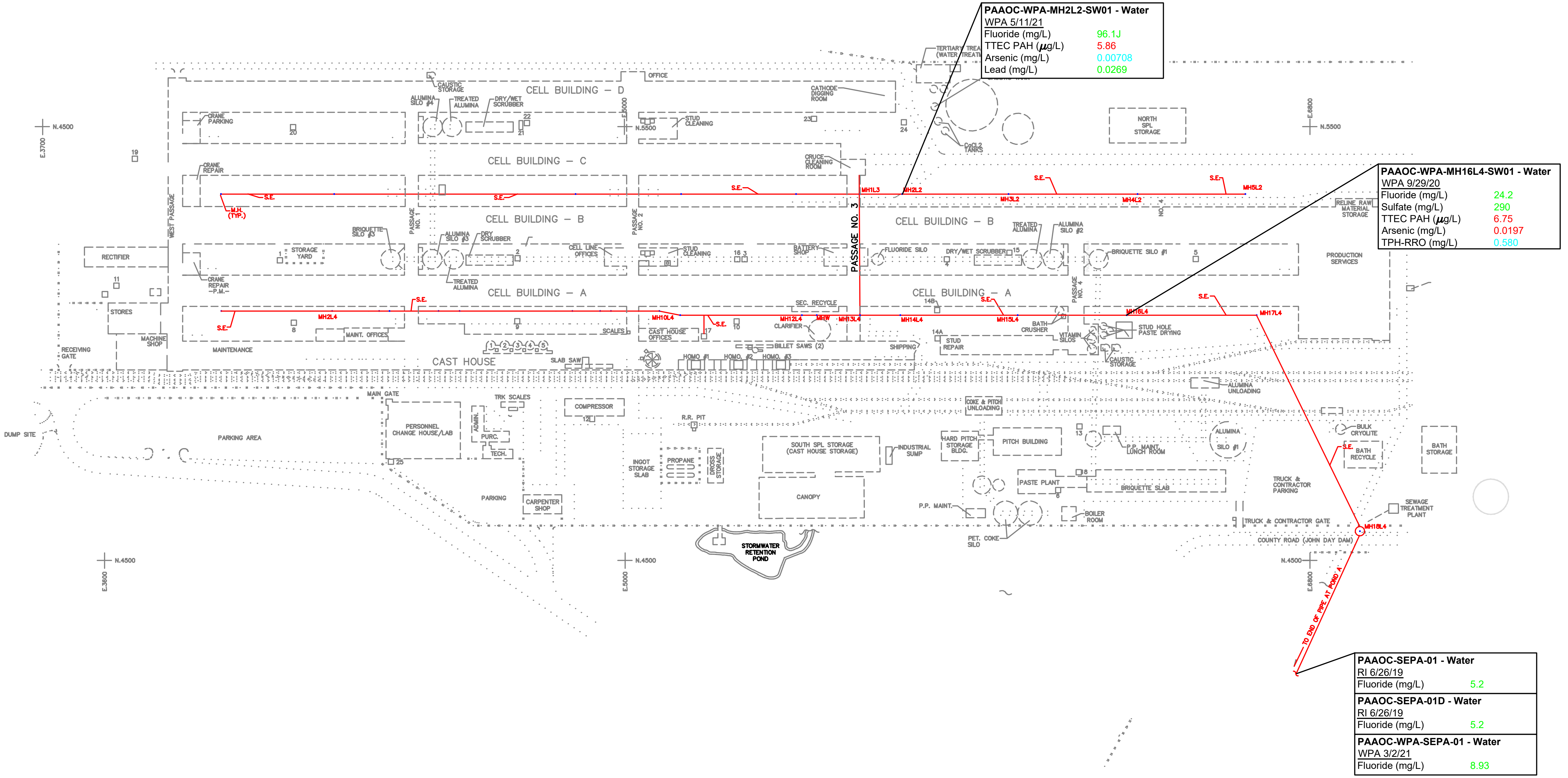
2.5.4.5.2 Collection of Water Samples from Scrubber Effluent System Manholes

During the WPA phase investigation, water samples were collected from Scrubber Effluent System manholes MH2L2 and MH16L4. In addition, water samples were collected from the water discharging at the Scrubber Effluent System outfall at the head of NPDES Pond A discharge (Figure 2.5.4-6). Scrubber Effluent manhole and discharge water samples were analyzed for free cyanide, fluoride, sulfate, PAHs, PCBs, metals, VOCs, TPH-Gx, and TPH-Dx.

Water sample analytical results are summarized in Table 2.5.4-9 (PAAOC Scrubber Effluent System WPA Water Results Summary). Water data are compared to MTCA Method A, MTCA Method B, MTCA Method C and WA MCL Plant Area AOC water screening levels. Natural background concentrations for the site have been used to adjust screening levels where applicable during the screening process. Laboratory analytical reports are included in Volume 5, Appendices H-2 and I-4, and data validation reports are included in Volume 5, Appendices I-2 and I-4. Samples were collected as proposed in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The reporting limit objectives have been met.

Water sample analytical results for COPCs that exceed Plant Area AOC water screening levels are compiled and presented on Figure 2.5.4-6 (PAAOC Scrubber Effluent System Water Sample Locations and Exceedance Summary). The Scrubber Effluent System manhole water sample analytical results indicate that free cyanide, PCBs, most metals, VOCs, TPH-Gx, and TPH-Dx did not exceed water screening levels. The Scrubber Effluent System outfall discharge water sample analytical results indicate that free cyanide, sulfate, PAHs, PCBs, metals, VOCs, TPH-Gx, and TPH-Dx do not exceed water screening levels.

Fluoride was detected in all five water samples (manholes and outfall discharge) at concentrations that range from 5.2 mg/L to 96.1 mg/L that exceed the MTCA Method C and WA MCL screening levels. Sulfate was detected in sample MH16L4-SW01 at a concentration of 290 mg/L that exceeds the WA MCL screening level. Fluoride is the only site COPC that exceeds water screening levels in the Scrubber Effluent System outfall discharge water samples.



PAAOC-WPA-MH2L2-SW01 - Water
WPA 5/11/21

Fluoride (mg/L)	96.1J
TTEC PAH (µg/L)	5.86
Arsenic (mg/L)	0.00708
Lead (mg/L)	0.0269

PAAOC-WPA-MH16L4-SW01 - Water
WPA 9/29/20

Fluoride (mg/L)	24.2
Sulfate (mg/L)	290
TTEC PAH (µg/L)	6.75
Arsenic (mg/L)	0.0197
TPH-RRO (mg/L)	0.580

PAAOC-SEPA-01 - Water
RI 6/26/19

Fluoride (mg/L)	5.2

PAAOC-SEPA-01D - Water
RI 6/26/19

Fluoride (mg/L)	5.2

PAAOC-WPA-SEPA-01 - Water
WPA 3/2/21

Fluoride (mg/L)	8.93

Source: Goldendale Aluminum Company, Plant Drawing A1/1752, "Underground Storm & Sanitary Sewer Piping W/Chem'l & Oil Str'g Areas"

Legend

SCRUBBER EFFLUENT LINE

RRO	TPH-Dx as Residual Range Organics
RI	Initial RI Phase
SEPA	Scrubber Effluent Pond A
WPA	WPA Phase

Water Screening Levels

cyan	Exceeds MTCA Method A
red	Exceeds MTCA Method C
green	Exceeds WA MCL

Notes

J	Estimated Concentration
Z	Chromatographic fingerprint does not resemble a petroleum product

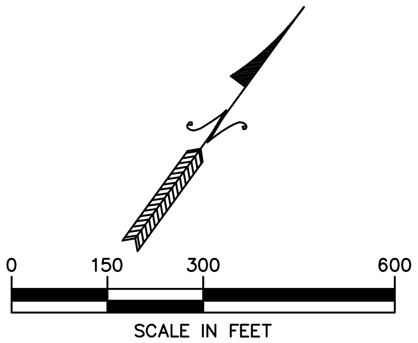


Figure 2.5.4-6

Plant Area AOC

Scrubber Effluent System Water Sample Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Table 2.5.4-9
PAAOC Scrubber Effluent System WPA Water Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

		Screening Levels					WPA Analytical Results				
Parameter Name	**Units**	**MTCA Method A**	**MTCA Method B**	**MTCA Method C**	**WA MCL**	**Natural Background**	**PAAOC-SEPA-01 6/26/2019**	**PAAOC-SEPA-01D 6/26/2019**	**PAAOC-WPA-MH16L4-SW01 9/9/2020**	**PAAOC-WPA-SEPA-01 3/2/2021**	**PAAOC-WPA-MH2L2-SW01 5/11/2021**
Aluminum Smelting											
Cyanide, Free	mg/L	NE	0.01	0.022	0.2	ND	0.005 U	0.005 U	NA	0.002 U	0.002 U
Fluoride	mg/L	NE	0.96	2.1	4	0.72	**5.2**	**5.2**	**24.2**	**8.93**	**96.1 J**
Sulfate	mg/L	NE	NE	NE	250	32	130	130	**290**	212	47.6
Polynuclear Aromatic Hydrocarbons (PAHs)											
1-Methylnaphthalene	ug/L	NA	1.5	15	NE	NE	0.1 U	0.1 U	NA	NA	NA
2-Methylnaphthalene	ug/L	NL	32	70	NE	NE	0.1 U	0.1 U	0.011 J	0.02 U	0.0043 J
Acenaphthene	ug/L	NA	960	2,100	NE	NE	0.1 U	0.1 U	0.13	0.02 U	0.038
Acenaphthylene	ug/L	NA	NE	NE	NE	NE	0.1 U	0.1 U	0.0008 J	0.02 U	0.06
Anthracene	ug/L	NA	4800	11,000	NE	NE	0.1 U	0.1 U	1	0.0012 J	0.49
Benzo(a)anthracene	ug/L	NL	NL	NL	NE	NE	0.01 U	0.01 U	6.7	0.0026 J	2.8
Benzo(a)pyrene	ug/L	0.1	0.023	0.88	0.2	NE	0.01 U	0.01 U	4.4	0.02 U	3.4
Benzo(b)fluoranthene	ug/L	NL	NL	NL	NE	NE	0.01 U	0.01 U	8.3	0.0023 J	13
Benzo(g,h,i)perylene	ug/L	NA	NE	NE	NE	NE	0.01 U	0.01 U	2.9	0.0024 J	4.9
Benzo(k)fluoranthene	ug/L	NL	NL	NL	NE	NE	0.01 U	0.01 U	2.7	0.02 U	2.6
Chrysene	ug/L	NL	NL	NL	NE	NE	0.01 U	0.01 U	12	0.0011 J	6.6
Dibenzo(a,h)anthracene	ug/L	NL	NL	NL	NE	NE	0.01 U	0.01 U	0.86	0.02 U	0.91
Dibenzofuran	ug/L	NL	NL	NE	NE	NE	NA	NA	0.12	0.001 J	0.03
Fluoranthene	ug/L	NA	640	1,400	NE	NE	0.1 U	0.1 U	31	0.0032 J	4.3
Fluorene	ug/L	NA	640	1,400	NE	NE	0.1 U	0.1 U	0.41	0.02 U	0.055
Indeno(1,2,3-cd)pyrene	ug/L	NL	NL	NL	NE	NE	0.01 U	0.01 U	3.7	0.0016 J	4.6
Naphthalene	ug/L	160	160	350	NE	NE	0.1 U	0.1 U	0.022 B	0.002 J	0.058
Phenanthrene	ug/L	NA	NE	NE	NE	NE	0.1 U	0.1 U	2	0.02 U	0.88
Pyrene	ug/L	NA	480	1,100	NE	NE	0.1 U	0.1 U	20	0.0025 J	4.9
TTEC cPAH (calc)	ug/L	0.1	0.2	0.2	NE	NE	0.01	0.01	**6.75**	0.0007	**5.86**
Polychlorinated Biphenyls (PCBs)											
Aroclor 1016	ug/L	NA	1.1	3	NE	ND	0.05 U	0.05 U	0.005 U	0.005 U	0.005 U
Aroclor 1221	ug/L	NA	NE	NE	NE	ND	0.05 U	0.05 U	0.01 U	0.01 U	0.01 U
Aroclor 1232	ug/L	NA	NE	NE	NE	ND	0.05 U	0.05 U	0.005 U	0.005 U	0.005 U
Aroclor 1242	ug/L	NA	NE	NE	NE	ND	0.05 U	0.05 U	0.005 U	0.005 U	0.005 U
Aroclor 1248	ug/L	NA	NE	NE	NE	ND	0.05 U	0.05 U	0.005 U	0.005 U	0.005 U
Aroclor 1254	ug/L	NA	0.044	0.44	NE	ND	0.05 U	0.05 U	0.0085 Ui	0.005 U	0.005 U
Aroclor 1260	ug/L	NA	0.044	0.44	NE	ND	0.05 U	0.05 U	0.012 Ui	0.005 U	0.005 U
Total PCBs (calc)	ug/L	0.1	0.044	0.44	0.5	ND	0.05	0.05	0.01	0.01	0.01
Metals											
Aluminum	mg/L	NE	16	35	NE	1.14	0.1 U	0.1 U	6.74	NA	16.5 J
Arsenic	mg/L	0.005	0.000058	0.00058	0.01	0.0069	0.0033 U	0.0033 U	**0.0197**	NA	**0.00708**
Cadmium	mg/L	0.005	0.008	0.0175	0.05	NE	0.0044 U	0.0044 U	0.00124	NA	0.00154
Chromium	mg/L	0.05	24	52.5	0.1	0.03	0.011 U	0.011 U	0.02	NA	0.0128
Copper	mg/L	NE	0.64	1.4	13	NE	0.011 U	0.011 U	0.0121	NA	0.038
Lead	mg/L	0.015	NE	NE	0.015	0.0004632	0.0011 U	0.0011 U	0.0104	NA	**0.0269**
Mercury	mg/L	0.002	NE	NE	0.002	NE	0.0005 U	0.0005 U	0.00029	NA	0.002 U
Nickel	mg/L	NA	0.000096	0.001	0.1	0.0651	0.022 U	0.022 U	0.0460	NA	0.0725
Selenium	mg/L	NA	0.08	0.175	0.05	NE	0.0056 U	0.0056 U	0.0006 J	NA	0.0017
Zinc	mg/L	NA	4.8	11	NE	NE	0.028 U	0.028 U	0.11	NA	0.28
Volatile Organic Compounds (VOCs)											
Benzene	ug/L	5	0.8	8	5	NE	0.2 U	0.2 U	0.5 U	0.5 U	NA
Toluene	ug/L	1,000	640	1,400	1,000	NE	0.1 U	0.1 U	0.5 U	0.5 U	NA
Ethylbenzene	ug/L	700	800	1,800	700	NE	0.2 U	0.2 U	0.5 U	0.5 U	NA
m,p-Xylene	ug/L	1,000	1,600	3,500	10,000	NE	0.4 U	0.4 U	0.5 U	0.5 U	NA
o-Xylene	ug/L	1,000	1,600	3,500	10,000	NE	0.2 U	0.2 U	0.5 U	0.5 U	NA
1,1,1-Trichloroethane	ug/L	200	16,000	35,000	200	NE	0.2 U	0.2 U	0.5 U	0.5 U	NA
Cis-1,2-Dichloroethene	ug/L	NE	16	35	70	NE	0.2 U	0.2 U	0.5 U	0.5 U	NA
Tetrachloroethene	ug/L	5	21	110	5	NE	0.2 U	0.2 U	0.5 U	0.5 U	NA
Trichloroethene	ug/L	5	0.54	8.8	5	NE	0.2 U	0.2 U	0.5 U	0.5 U	NA
Vinyl Chloride	ug/L	0.2	0.029	0.29	2	NE	0.2 U	0.2 U	0.5 U	0.5 U	NA
Total Petroleum Hydrocarbons (TPHs)											
Gasoline Range Organics	mg/L	1	NE	NE	NE	NE	0.1 U	0.1 U	NA	NA	NA
Diesel Range Organics	mg/L	0.5	NE	NE	NE	NE	0.25 U	0.25 U	0.25 J	0.018 J	0.12 J
Residual Range Organics	mg/L	0.5	NE	NE	NE	NE	0.41 U	0.41 U	**0.58 O**	0.028 J	0.46 J

Notes:

B	The sample result is five times less than the blank contamination and cross-contamination is suspected.
i	Method Reporting Limit is elevated due to a matrix interference.
J	Estimated concentration.
MCL	Maximum Contaminant Level.
NA	Not applicable or not analyzed
ND	Not detected.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
O	Chromatograph fingerprint of sample resembles an oil but does not match the calibration standard.
U	Chemical was not detected. The associated value represents the method reporting limit.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.

Detected concentrations shown in **bold** exceed one or more site groundwater screening levels.

PAHs as TTEC were detected in manhole samples MH2L2-SW01 and MH16L4-SW01 at concentrations of 5.86 µg/L and 6.75 µg/L, respectively, that exceed all water screening level. In addition, benzo(a)pyrene was detected in these two manhole samples at concentrations of 3.4 µg/L and 4 µg/L, respectively, that exceed the WA MCL screening level.

Two metals, including arsenic and lead, were detected in manhole water samples at concentrations that exceed one or more water screening levels. Arsenic was detected at concentrations from 0.00708 mg/L to 0.0197 mg/L that exceeds the MTCA Method C and WA MCL screening levels. Lead was detected in sample MH2L2-SW01 at a concentration of 0.0269 and exceeds the WA MCL.

2.5.4.5.3 Collection of Encrustation Sample from the Scrubber Effluent System Manhole MH17L4

Encrustation inside the horizontal pipe segments at Scrubber Effluent System connecting to and from manhole MH17L4 prevented video survey access in some of this portion of the Scrubber Effluent System. One sample of the encrustation and a duplicate sample was collected from MH17L4 for chemical analysis and SPLP tests. The purpose of the analyses was to determine the composition of the encrusted material and whether it would be a significant source of leachable fluoride. Chemical analysis was focused on identifying cation composition, and analyzed for fluoride, sulfate, metals and additional chemicals including chloride, calcium, iron, magnesium, and manganese. Through discussion with ALS Global analytical laboratory, after chemical analyses were complete, SPLP tests of the encrusted material was conducted focusing on metals, including arsenic, cadmium, chromium, lead, mercury, and selenium, and additional chemicals including chloride, fluoride, sulfate, and barium.

Encrustation chemical solids analytical results are summarized on Table 2.5.4-10 (PAAOC Scrubber Effluent System WPA Encrustation Sample Results Summary) and encrustation sample SPLP analytical results are summarized on Table 2.5.4-11 (PAAOC Scrubber Effluent System WPA Encrustation Sample SPLP Results Summary). The encrustation solid data is compared to MTCA Method C and Washington MCL. The encrustation SPLP data is compared to MTCA Method A, MTCA Method B, MTCA Method C, and the WA MCL. Natural background concentrations are included for reference. Laboratory analytical reports are included in Volume 5, Appendix H-4, and data validation reports are included in Volume 5, Appendix I-4. Encrustation samples were not

Table 2.5.4-10
PAAOC Scrubber Effluent System WPA Encrustation Sample Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels				Ecological Screening Levels	WPA Analytical Results	
Parameter Name	Units	Method C	Protection of Groundwater	Natural Background	Wildlife	PAAOC-WPA-MH17L4-Waste	PAAOC-WPA-MH17L4D-Waste
Aluminum Smelting							
Cyanide, Total	mg/kg	2,200	1.9	NE	5	NA	NA
Fluoride, Total	mg/kg	210,000	147.6	14.11	NE	**555 J**	**449 J**
Sulfate	mg/kg	NE	2,150	NE	NE	140	164
Polynuclear Aromatic Hydrocarbons (PAHs)							
1-Methylnaphthalene	mg/kg	NL	NL	NE	NL	NA	NA
2-Methylnaphthalene	mg/kg	NL	NL	NE	NL	NA	NA
Acenaphthene	mg/kg	NL	NL	NE	NL	NA	NA
Acenaphthylene	mg/kg	NE	NE	NE	NL	NA	NA
Anthracene	mg/kg	NE	NL	NE	NL	NA	NA
Benzo(a)anthracene	mg/kg	NL	NL	NE	NL	NA	NA
Benzo(a)pyrene	mg/kg	NL	NL	NE	NL	NA	NA
Benzo(b)fluoranthene	mg/kg	NL	NL	NE	NL	NA	NA
Benzo(g,h,i)perylene	mg/kg	NE	NE	NE	NL	NA	NA
Benzo(k)fluoranthene	mg/kg	NL	NL	NE	NL	NA	NA
Chrysene	mg/kg	NL	NL	NE	NL	NA	NA
Dibenzo(a,h)anthracene	mg/kg	NL	NL	NE	NL	NA	NA
Fluoranthene	mg/kg	NL	NL	NE	NL	NA	NA
Fluorene	mg/kg	NL	NL	NE	NL	NA	NA
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NE	NL	NA	NA
Naphthalene	mg/kg	NL	NL	NE	NL	NA	NA
Phenanthrene	mg/kg	NE	NE	NE	NL	NA	NA
Pyrene	mg/kg	NL	NL	NE	NL	NA	NA
TTEC cPAH (calc)	mg/kg	130	3.9	NE	NE	NA	NA
Total LMW PAH (calc)	mg/kg	NE	NE	NE	100	NA	NA
Total MHW PAH (calc)	mg/kg	NE	NE	NE	1.1	NA	NA
Polychlorinated Biphenyls (PCBs)							
Aroclor 1016	mg/kg	NL	NE	NE	NE	NA	NA
Aroclor 1221	mg/kg	NE	NE	NE	NE	NA	NA
Aroclor 1232	mg/kg	NE	NE	NE	NE	NA	NA
Aroclor 1242	mg/kg	NE	NE	NE	NE	NA	NA
Aroclor 1248	mg/kg	NE	NE	NE	NE	NA	NA
Aroclor 1254	mg/kg	NL	NE	NE	NE	NA	NA
Aroclor 1260	mg/kg	NL	NE	NE	NE	NA	NA
Total PCBs (calc)	mg/kg	66	NE	NE	0.65	NA	NA
Metals							
Aluminum	mg/kg	3,500,000	480,000	28,299	NE	41,800	50,500
Arsenic	mg/kg	88	2.9	7.61	132	**24 J**	**30 J**
Cadmium	mg/kg	3,500	0.69	0.81	14	**2.9 J**	**4.6 J**
Chromium	mg/kg	5,300,000	490,000	31.88	67	**76.9**	**89.8**
Copper	mg/kg	140,000	280	28.4	217	190	198
Lead	mg/kg	NE	3,000	13.1	118	46	41
Mercury	mg/kg	NE	2.1	0.04	5.5	0.033 J	0.061 J
Nickel	mg/kg	70,000	130	24.54	980	**152**	**166**
Selenium	mg/kg	18,000	5.2	0.29	0.3	6.1 U	50 U
Zinc	mg/kg	1,100,000	6,000	80.9	360	**767**	**933**
Encrustation-Specific Chemicals							
Chloride	mg/kg	NA	NA	NA	NA	14.6	13.3
Calcium	mg/kg	NA	NA	NA	NA	29,500	43,600
Iron	mg/kg	NA	NA	NA	NA	149,000 J	112,000 J
Magnesium	mg/kg	NA	NA	NA	NA	6,070	6,470
Manganese	mg/kg	NA	NA	NA	NA	1,150	949

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established in lookup tables.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 2.5.4-11
PAAOC Scrubber Effluent System WPA Encrustation Sample SPLP Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

		Screening Levels					WPA SPLP Analytical Results	
Parameter Name	**Units**	**MTCA Method A**	**MTCA Method B**	**MTCA Method C**	**WA MCL**	**Natural Background**	**PAAOC-WPA-MH17L4-Waste**	**PAAOC-WPA-MH17L4D-Waste**
Polynuclear Aromatic Hydrocarbons (PAHs)								
1-Methylnaphthalene	ug/L	NL	1.5	NL	NE	NE	NA	NA
2-Methylnaphthalene	ug/L	NL	32	NL	NE	NE	NA	NA
Acenaphthene	ug/L	NA	960	NL	NE	NE	NA	NA
Acenaphthylene	ug/L	NA	NE	NL	NE	NE	NA	NA
Anthracene	ug/L	NA	4800	NL	NE	NE	NA	NA
Benzo(a)anthracene	ug/L	NL	NL	NL	NE	NE	NA	NA
Benzo(a)pyrene	ug/L	0.1	NL	NL	NE	NE	NA	NA
Benzo(b)fluoranthene	ug/L	NL	NL	NL	NE	NE	NA	NA
Benzo(g,h,i)perylene	ug/L	NL	NE	NE	NE	NE	NA	NA
Benzo(k)fluoranthene	ug/L	NL	NL	NL	NE	NE	NA	NA
Chrysene	ug/L	NL	NL	NL	NE	NE	NA	NA
Dibenzo(a,h)anthracene	ug/L	NL	NL	NL	NE	NE	NA	NA
Fluoranthene	ug/L	NL	640	NL	NE	NE	NA	NA
Fluorene	ug/L	NL	640	NL	NE	NE	NA	NA
Indeno(1,2,3-cd)pyrene	ug/L	NL	NL	NL	NE	NE	NA	NA
Naphthalene	ug/L	160	160	NL	NE	NE	NA	NA
Phenanthrene	ug/L	NA	NL	NE	NE	NE	NA	NA
Pyrene	ug/L	NA	480	NL	NE	NE	NA	NA
TTEC cPAH (calc)	ug/L	0.1	0.2	0.2	NE	NE	NA	NA
Polychlorinated Biphenyls (PCBs)								
Aroclor 1016	ug/L	NA	NE	NL	NE	ND	NA	NA
Aroclor 1221	ug/L	NA	NE	NE	NE	ND	NA	NA
Aroclor 1232	ug/L	NA	NE	NE	NE	ND	NA	NA
Aroclor 1242	ug/L	NA	NE	NE	NE	ND	NA	NA
Aroclor 1248	ug/L	NA	NE	NE	NE	ND	NA	NA
Aroclor 1254	ug/L	NA	0.044	0.44	NE	ND	NA	NA
Aroclor 1260	ug/L	NA	0.044	0.44	NE	ND	NA	NA
Total PCBs (calc)	ug/L	0.1	0.044	0.44	0.5	ND	NA	NA
Metals								
Aluminum	mg/L	NE	16	35	NE	1.4	NA	NA
Arsenic	mg/L	0.005	0.000058	0.001	0.01	0.0069	0.010 U	0.010 U
Cadmium	mg/L	0.005	0.008	0.018	0.05	NE	0.010 U	0.010 U
Chromium	mg/L	0.05	24	53	0.1	0.3	0.010 U	0.010 U
Copper	mg/L	NE	0.64	1.4	13	NE	NA	NA
Lead	mg/L	0.015	NE	NE	0.015	0.00046	0.010 U	0.010 U
Mercury	mg/L	0.002	NE	NE	0.002	NE	0.0010 U	0.0010 U
Nickel	mg/L	NA	0.000096	0.00096	0.1	0.065	NA	NA
Selenium	mg/L	NA	0.08	0.18	0.05	NE	0.020 U	0.010 U
Zinc	mg/L	NA	4.8	11.00	NE	NE	NA	NA
Encrustation-Specific Chemicals								
Chloride	mg/L	NA	NA	NA	NA	NA	0.44 J	0.08 J
Fluoride	mg/L	NE	0.96	2.1	4	0.72	**28.2**	**25.8**
Sulfate	mg/L	NE	NE	NE	250	32	29.4 J	19.1 J
Barium	mg/L	NA	NA	NA	NA	NA	0.20 U	0.20 U

Notes:

J	Estimated Concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration is accounted for by the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
TTEC cPAH (calc)	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site water screening levels.

specified in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) but were collected at a moment of opportunity when MH17L4 became accessible during confined space entry procedures for cleanout of MH17L4 in preparation for the subsequent video survey. Reporting limits for selenium exceed the protection of groundwater screening level.

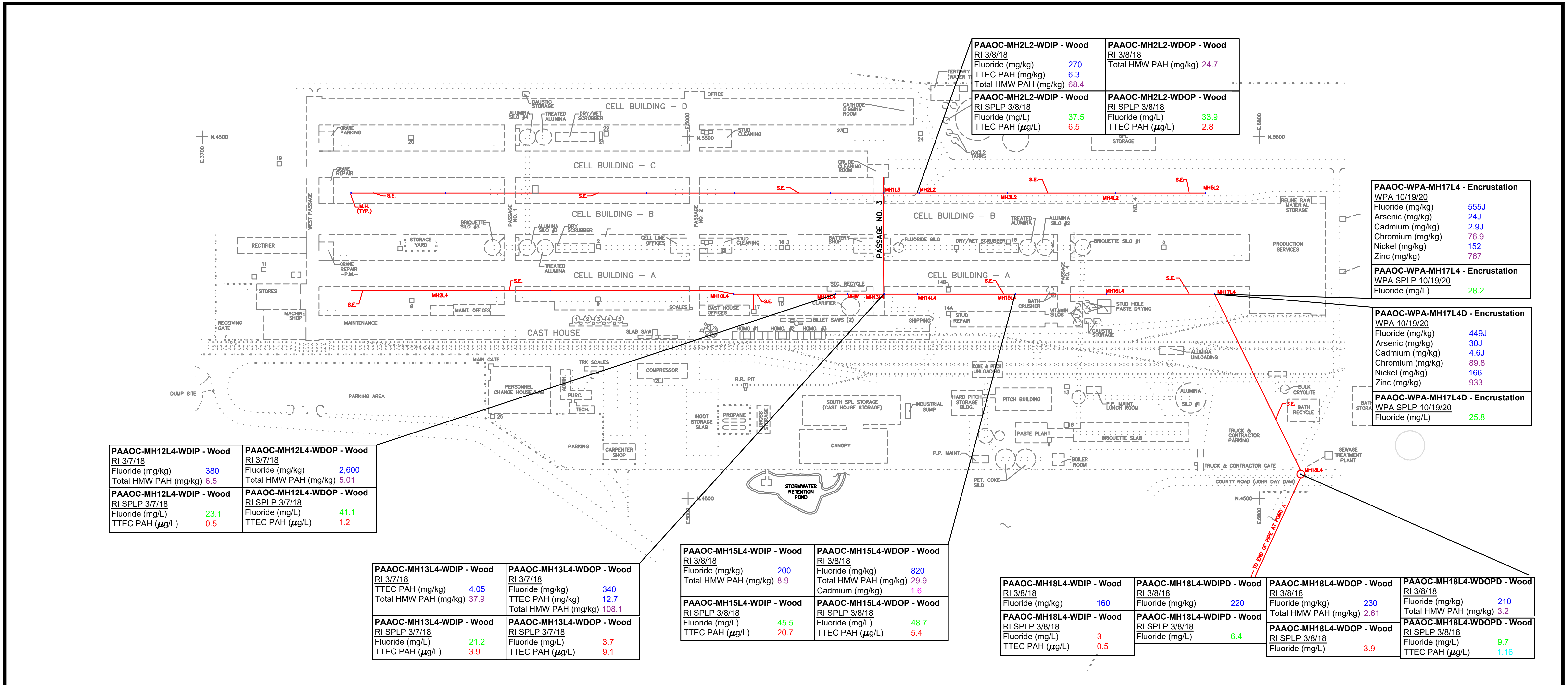
Sample solids analytical and SPLP results that exceed Plant Area AOC soil and water screening levels are compiled and presented on Figure 2.5.4-7 (PAAOC Scrubber Effluent System Wood, Encrustations, and SPLP Sample Locations and Exceedance Summary). WPA solids analytical results indicate that fluoride and five metals (arsenic, cadmium, chromium, nickel, and zinc) are detected at concentrations that exceed the protection of groundwater screening level. Fluoride was detected at 449 mg/kg and 555 mg/kg, arsenic was detected at 24 J mg/kg and 30 J mg/kg, cadmium was detected at 2.9 mg/kg and 4.6 mg/kg, chromium was detected at 152 mg/kg and 166 mg/kg, nickel was detected at 152 mg/kg and 166 mg/kg, and zinc was detected at 767 mg/kg and 933 mg/kg. Results for other encrustation-specific chemical analytes indicate that the encrusted material is predominantly composed of calcium and iron.

SPLP test results indicate that fluoride is the only site COPCs analyte that exceed water screening levels in the SPLP leachate. Detected concentrations of fluoride in the SPLP leachate were 28.2 mg/L and 25.8 mg/L that exceeds the MTCA Method B, MTCA Method C, and WA MCL screening levels. Scrubber Effluent System outfall discharge water samples detected concentrations of fluoride ranging from 5.2 mg/L to 8.93 mg/L.

2.5.4.5.4 Video Survey Investigation Scope

Video surveys of selected Scrubber Effluent horizontal line segments was completed during March 13 through 15, 2017 and September 28 through October 1, 2020. The video surveys were performed to evaluate construction materials and integrity of pipes, the presence of sediment in manholes, and the source of water discharging at the head of NPDES Pond A.

The survey was completed using a Rausch steerable four-wheel drive L 135 Tractor with an electric lift and camera to allow for continuous monitoring and recording. The video survey was limited by pipe diameter, presence of water, and thickness of accumulated sediment. Selected sections of Scrubber Effluent lines that were video surveyed are further documented in Table 2.5.4-12 (PAAOC Scrubber Effluent System 2017 Video Survey Results) and Table 2.5.4-13 (PAAOC Scrubber



PAAOC-MH2L2-WDIP - Wood
RI 3/8/18

Fluoride (mg/kg)	270
TTEC PAH (mg/kg)	6.3
Total HMW PAH (mg/kg)	68.4

PAAOC-MH2L2-WDOP - Wood
RI 3/8/18

Total HMW PAH (mg/kg)	24.7

PAAOC-MH2L2-WDIP - Wood
RI SPLP 3/8/18

Fluoride (mg/L)	37.5
TTEC PAH (µg/L)	6.5

PAAOC-MH2L2-WDOP - Wood
RI SPLP 3/8/18

Fluoride (mg/L)	33.9
TTEC PAH (µg/L)	2.8

PAAOC-WPA-MH17L4 - Encrustation
WPA 10/19/20

Fluoride (mg/kg)	555J
Arsenic (mg/kg)	24J
Cadmium (mg/kg)	2.9J
Chromium (mg/kg)	76.9
Nickel (mg/kg)	152
Zinc (mg/kg)	767

PAAOC-WPA-MH17L4 - Encrustation
WPA SPLP 10/19/20

Fluoride (mg/L)	28.2

PAAOC-WPA-MH17L4D - Encrustation
WPA 10/19/20

Fluoride (mg/kg)	449J
Arsenic (mg/kg)	30J
Cadmium (mg/kg)	4.6J
Chromium (mg/kg)	89.8
Nickel (mg/kg)	166
Zinc (mg/kg)	933

PAAOC-WPA-MH17L4D - Encrustation
WPA SPLP 10/19/20

Fluoride (mg/L)	25.8

PAAOC-MH12L4-WDIP - Wood
RI 3/7/18

Fluoride (mg/kg)	380
Total HMW PAH (mg/kg)	6.5

PAAOC-MH12L4-WDOP - Wood
RI 3/7/18

Fluoride (mg/kg)	2,600
Total HMW PAH (mg/kg)	5.01

PAAOC-MH12L4-WDIP - Wood
RI SPLP 3/7/18

Fluoride (mg/L)	23.1
TTEC PAH (µg/L)	0.5

PAAOC-MH12L4-WDOP - Wood
RI SPLP 3/7/18

Fluoride (mg/L)	41.1
TTEC PAH (µg/L)	1.2

PAAOC-MH13L4-WDIP - Wood
RI 3/7/18

TTEC PAH (mg/kg)	4.05
Total HMW PAH (mg/kg)	37.9

PAAOC-MH13L4-WDOP - Wood
RI 3/7/18

Fluoride (mg/kg)	340
TTEC PAH (mg/kg)	12.7
Total HMW PAH (mg/kg)	108.1

PAAOC-MH13L4-WDIP - Wood
RI SPLP 3/7/18

Fluoride (mg/L)	21.2
TTEC PAH (µg/L)	3.9

PAAOC-MH13L4-WDOP - Wood
RI SPLP 3/7/18

Fluoride (mg/L)	3.7
TTEC PAH (µg/L)	9.1

PAAOC-MH15L4-WDIP - Wood
RI 3/8/18

Fluoride (mg/kg)	200
Total HMW PAH (mg/kg)	8.9

PAAOC-MH15L4-WDOP - Wood
RI 3/8/18

Fluoride (mg/kg)	820
Total HMW PAH (mg/kg)	29.9
Cadmium (mg/kg)	1.6

PAAOC-MH15L4-WDIP - Wood
RI SPLP 3/8/18

Fluoride (mg/L)	45.5
TTEC PAH (µg/L)	20.7

PAAOC-MH15L4-WDOP - Wood
RI SPLP 3/8/18

Fluoride (mg/L)	48.7
TTEC PAH (µg/L)	5.4

PAAOC-MH18L4-WDIP - Wood
RI 3/8/18

Fluoride (mg/kg)	160

PAAOC-MH18L4-WDIP - Wood
RI SPLP 3/8/18

Fluoride (mg/L)	3
TTEC PAH (µg/L)	0.5

PAAOC-MH18L4-WDIPD - Wood
RI 3/8/18

Fluoride (mg/kg)	220

PAAOC-MH18L4-WDIPD - Wood
RI SPLP 3/8/18

Fluoride (mg/L)	6.4

PAAOC-MH18L4-WDOP - Wood
RI 3/8/18

Fluoride (mg/kg)	230
Total HMW PAH (mg/kg)	2.61

PAAOC-MH18L4-WDOP - Wood
RI SPLP 3/8/18

Fluoride (mg/L)	3.9

PAAOC-MH18L4-WDOPD - Wood
RI 3/8/18

Fluoride (mg/kg)	210
Total HMW PAH (mg/kg)	3.2

PAAOC-MH18L4-WDOPD - Wood
RI SPLP 3/8/18

Fluoride (mg/L)	9.7
TTEC PAH (µg/L)	1.16

Source: Goldendale Aluminum Company, Plant Drawing A1/1752, "Underground Storm & Sanitary Sewer Piping W/Chem'l & Oil Str'g Areas"

Legend

—— SCRUBBER EFFLUENT LINE

RRO	TPH-Dx as Residual Range Organics
RI	Initial RI Phase
WPA	WPA Phase

Soil Screening Levels

red	Exceeds MTCA Method C
blue	Exceeds Protection of Groundwater
purple	Exceeds Ecological Wildlife and for TPH diesel and residual range organics exceeds MTCA Method A

Water Screening Levels

cyan	Exceeds MTCA Method A
red	Exceeds MTCA Method C
green	Exceeds WA MCL

Notes

J	Estimated Concentration
Z	Chromatographic fingerprint does not resemble a petroleum product

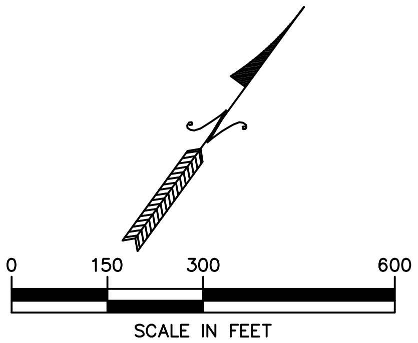


Figure 2.5.4-7

Plant Area AOC

Scrubber Effluent System
Wood, Encrustation, and SPLP Sample Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Table 2.5.4-12
PAA0C Scrubber Effluent System 2017 Video Survey Results
Columbia Gorge Aluminum Smelter, Goldendale Wasghington

Survey Start Point	Survey End Point	Survey Distance (Ft)	Horizontal Pipe Size and type	Water Present (Y/N)	Sediment Present (Y/N)	Survey Description and Comments
NPDES Pond A	MH18L4	369.1	24-inch concrete pipe	Y	Y	Survey halted because of encrustation build up at 369 feet.
MH18L4	NPDES Pond A	11.9	21-inch wood pipe	Y	N	Survey halted because of encrustation build up at 11 feet but connection to NPDES Pond A confirmed.
MH18L4	MH17L4	0	21-inch wood pipe	Y	N	Survey halted because of blockage. No sediment was visible.
MH13L4	MH14L4	70.9	21-inch wood pipe	Y	N/A	Wood line contained too much water and survey halted. Other SE manholes MH14L4, MH15L4, and MH16L4 also contained water.
MH13L4	MH12L4	117.9	21-inch wood pipe	Y	N/A	Wood line contained too much water. Damage to interior of line visible at 120 feet where a hole was cut into horizontal pipe for some type of access modification. Could not reach MH12L4.
MH13L4	MH1L3	4.7	21-inch wood pipe	Y	N/A	Survey halted because of blockage in line to the north in Passage No. 3.

Notes:

Y	Yes
N	No
NA	Not Applicable

Table 2.5.4-13
PAAOC Scrubber Effluent System 2020 Video Survey Results
Columbia Gorge Aluminum Smelter, Goldendale, Washington

SurveyStart Point	Survey End Point	Survey Distance (Ft)	Horizontal Pipe Size and Type	Water Present (Y/N)	Sediment Present (Y/N)	Survey Description and Comments
SE14 (MH15L4)	SE15 (MH15L4)	282.2 feet	21-inch wood pipe	Y	Y	Suvery encountered small water channels in the line but was able to push through sediment to reach MH14L4.
SE15 (MH15L4)	SE16 (MH16L4)	282.7 feet	21-inch wood pipe	Y	Y	Water in channels in line, breach located on south wall at 152 feet (4 feet long) with broken boards and exposed soil. During seasonal high water table, groundwater flows into the horizontal pipe through the breach and discharges downstream at the end of the SE line at the head of NPDES Pond A. During seasonal low water table, groundwater ceases to flow into the horizontal pipe and the discharge at the head of NPDES Pond A ceases. Standing water from 160 - 282 feet.
SE16 (MH16L4)	SE17 (MH17L4)	2.5 feet	21-inch wood pipe	Y	Y	Standing water in line. Unable to move vehicle more than 2.5 feet.
SE18 (MH18L4)	SE17 (MH17L4)	6.9 feet	21-inch wood pipe	Y	N	Survey halted at 6.9 feet because of encrustation in channels in the horizontal pipe.
SE13 (MH13L4)	SE12 (MH12L4)	94.4 feet	21-inch wood pipe	Y	Y	Survey halted at 95 feet towards MH12L4 because camera became stuck in sludge/sediment in horizontal pipe.
SE13 (MH13L4)	SE14 (MH14L4)	74.7 feet	21-inch wood pipe	Y	Y	Survey halted at 74 feet because of standing water.
MH1L3	Small PVC pipe north	7.5 feet	8-inch pvc pipe	Y	Y	Surveyed north in small 8-inch pipe for 7 feet when the line abrutply turns 90 degrees upwards and survey halted.

Notes:

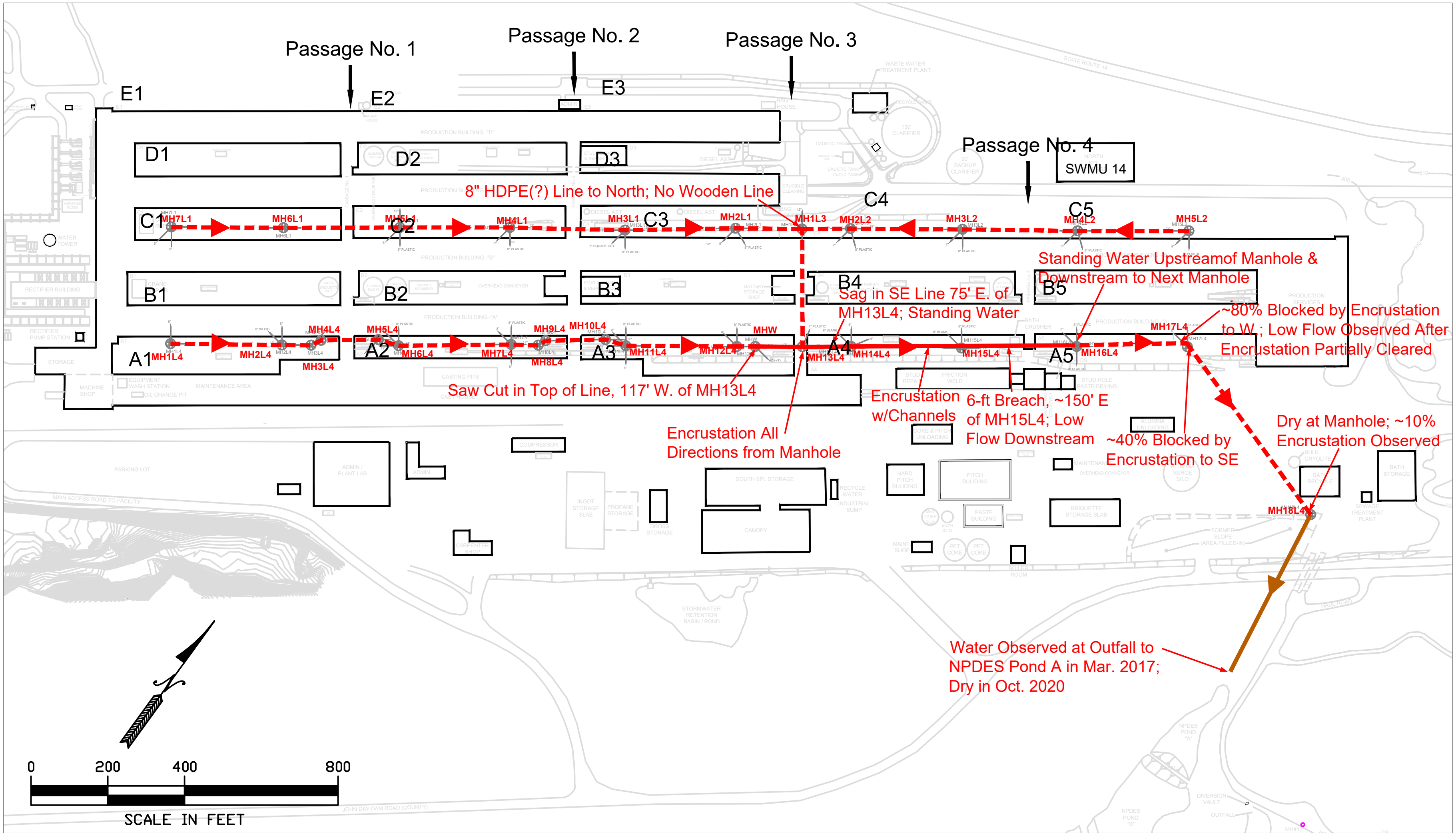
Y	Yes
N	No
NA	Not Applicable

Effluent System 2020 Video Survey Results), and on Figure 2.5.4-8. Video clips of the selected line segments from March 2017 and October 2020, which are included in Volume 5, Appendix G-2. In the following section, discussion of specific video clips is noted with a parenthetical citation (2017 video Pond A to MH18L4) and extracted photos are noted with the parenthetical citation (Photo O – Appendix G-2). Additional Scrubber Effluent Line Cross-Section Location Figure 2.5.4-9 and Scrubber Effluent Line Cross-Section A-A' Figure 2.5.4-10 are included to show the location of the Scrubber Effluent line in courtyards A4, A5, and the south part of the plant and where a breach was observed in the Scrubber Effluent line. All tables, figures, video survey clips, and extracted photos of the selected line segments described below should be referenced while reviewing this section.

2.5.4.5.5 Video Survey Results

During the 2017 video survey inspection, and after a tarp was removed from the base of the manhole, water was observed flowing southward through Scrubber Effluent Manhole MH18L4 via 21-inch horizontal concrete pipe segment and discharging to NPDES Pond A. Videoing the horizontal concrete line segment from NPDES Pond A to Scrubber Effluent Manhole MH18L4 indicated the line is in good condition but had caked materials on the interior of the concrete line segment (2017 video Pond A to MH18L4. The horizontal line segment from the Scrubber Effluent Manhole MH18L4 south to NPDES Pond A appears to meet with a 21-inch concrete line segment approximately 10 ft southeast of Scrubber Effluent Manhole MH18L4 (2017 video MH18L4 to Pond A). Water was observed flowing south through Scrubber Effluent Manhole MH18L4, but no sediment was observed. Based on plant drawings and conversations with site personnel, prior to the construction of John Day Dam Rd. in approximately 1981, the Scrubber Effluent line previously daylighted where the wooden line segment currently meets with the existing concrete line (Figure 2.5.4-10).

The source of the flowing water could not be determined due encrustation accumulation and water in the line segments upstream from Scrubber Effluent Manhole MH18L4. These segments included Scrubber Effluent Manholes MH18L4, MH17L4, MH16L4, and MH15L4 and are in the south portion of the plant, Courtyard A5 and Courtyard A4. A video survey of the horizontal line segments through Scrubber Effluent Manholes MH18L4, MH17L4, MH16L4, and MH15L4 could also not be completed due to standing water in these manholes blocking the horizontal pipes. Sediment



Source: Goldendale Aluminum Company, Plant Drawing A1/1752, "Underground Storm & Sanitary Sewer Piping W/Chem'l & Oil Str'g Areas"

Legend

Naming Convention:

MHW	Manhole #W Not Labeled on Drawing A1/1752
MH13L4	Manhole #13 Along Line #4
A1	Courtyard Segment A1

Lines Inspected Are Color-Coded by Piping System As Follows:

Red = Scrubber Effluent System

◀ Direction of Water Flow Within Pipe Segment

━ Wooden Horizontal Line Segment Video Inspected

━ Concrete Horizontal Line Segment Video Inspected

╍ Horizontal Line Segment Not Video Inspected; Assumed Connection Based on Drawings and Visual Evidence

Figure 2.5.4-8

Plant Area AOC

Scrubber Effluent Collection System
Video Survey Locations and Observations

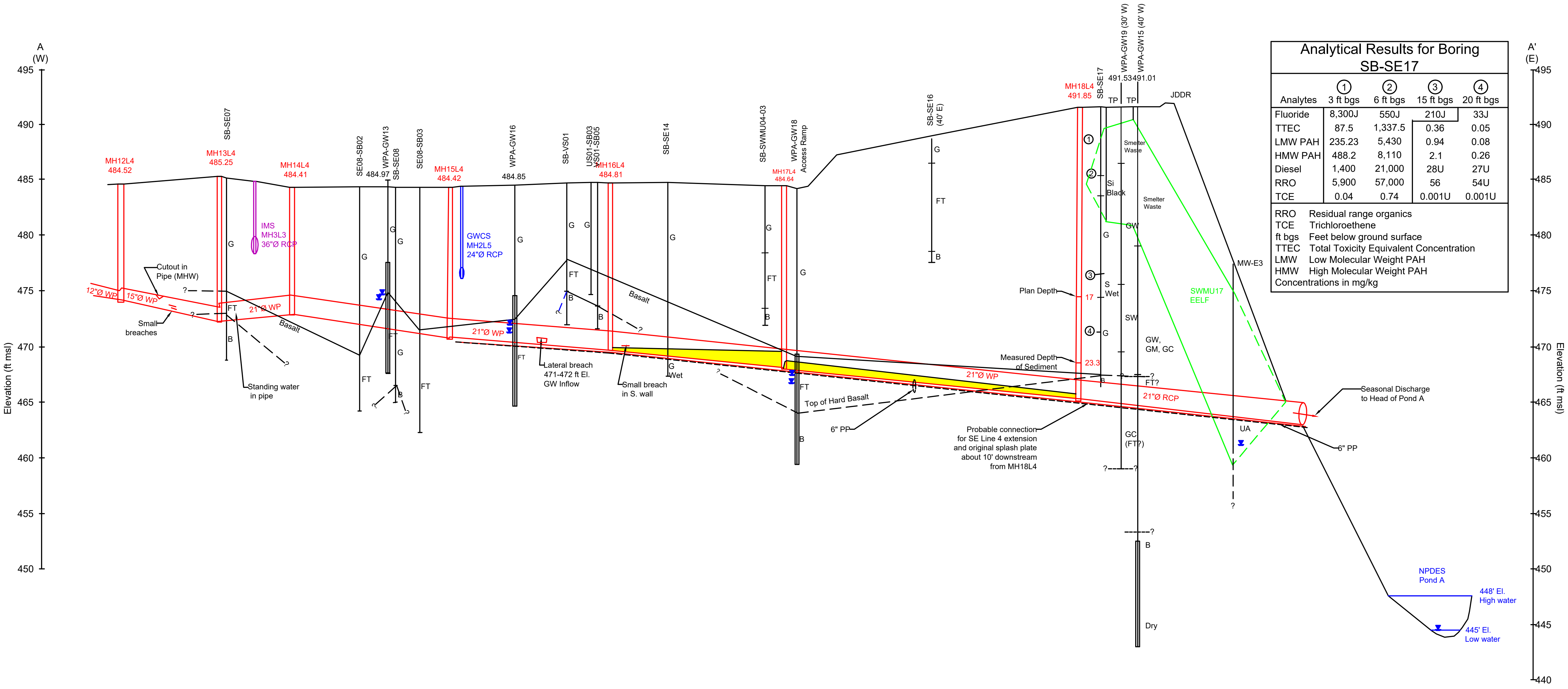
Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Figure 2.5.4-9

Plant Area AOC

PAAOC Scrubber Effluent System
SE Line Cross Section Location

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington



Analytical Results for Boring SB-SE17

Analytes	① 3 ft bgs	② 6 ft bgs	③ 15 ft bgs	④ 20 ft bgs
Fluoride	8,300J	550J	210J	33J
TTEC	87.5	1,337.5	0.36	0.05
LMW PAH	235.23	5,430	0.94	0.08
HMW PAH	488.2	8,110	2.1	0.26
Diesel	1,400	21,000	28U	27U
RRO	5,900	57,000	56	54U
TCE	0.04	0.74	0.001U	0.001U

RRO	Residual range organics
TCE	Trichloroethene
ft bgs	Feet below ground surface
TTEC	Total Toxicity Equivalent Concentration
LMW	Low Molecular Weight PAH
HMW	High Molecular Weight PAH

Concentrations in mg/kg

Source: Plateau Geosciences Group

Legend

G	Gravel
Si	Silt
S	Sand
FT	Flow top
▲	Encrustation inside pipe
B	Basalt
Ø	Diameter
WP	Wooden pipe
RCP	Reinforced concrete
PP	Perforated pipe

Screened Interval

▼ Water level

▼ Water level, 5/11/21

▼ Water level, 12/2/20

Data Sources

Elevations for manholes, soil borings - Tennison May 2021 survey
Distances between manholes, soil borings - ArcGIS
SE Line pipe dimensions - Plant Drawings A0-0200
SE, GWC, I&M manhole depths - Tables 2.5.4-1, 2.5.2-1, 2.5.3-1
Grounwater levels - intepreted high-low seasonal levels
Material descriptions - RI, WPA boring logs

100 0 200 400
HORIZONTAL SCALE IN FEET

Figure 2.5.4-10

PAAOC Scrubber Effluent System Cross Section A-A'

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

accumulation may also be contributing to the standing water in the upstream Scrubber Effluent System horizontal line segments from Scrubber Effluent manhole MH13L4 through MH14L4 (2017 video MH13L4 to MH14L4). Accumulated encrustation material approximately 10 ft north of MH13L4 did not allow the video survey to be completed in this horizontal line segment; however, water was visually observed flowing south from Scrubber Effluent Manhole MH1L3 in passage no. 3 to Scrubber Effluent Manhole MH13L4 (2017 video MH1L3_MH13L4).

Prior to video surveying any Scrubber Effluent horizontal line segments in Courtyard A during the WPA Investigation in March 2020, a vacuum truck was used to remove small rocks, wood pieces, sludge, sediment, and potentially water from selected Scrubber Effluent line manholes. The base of Scrubber Effluent Manhole MH14L4, located in courtyard A4, was clean for the video camera to enter the approximately 21-inch horizontal wooden line and no vacuuming was necessary. The video survey was completed between Scrubber Effluent Manholes MH14L4 and MH15L4 and showed encrusted material and various older water channels where small amounts of standing water were observed (2020 video MH14L4 to MH15L4). Approximately 282 ft of the wooden Scrubber Effluent horizontal line segment was video surveyed between Scrubber Effluent Manholes MH14L4 and MH15L4 and no breaches or breaks were found.

Before being able to video the horizontal line segment from Scrubber Effluent Manholes MH15L4 to MH16L4, the vacuum truck had to remove some water, sludge, sediment, and other materials from Scrubber Effluent Manhole MH15L4 so the horizonal line segment would be exposed. The same encrusted material and older water line channels that were observed in the line segments between Scrubber Effluent Manholes MH14L4 and MH15L4 are also located in the horizontal line segment from Scrubber Effluent Manholes MH15L4 to MH16L4 (2020 video MH15L4 to MH16L4). A small amount of water was also visible when the video tractor moved forward. The water was not flowing unless the video tractor was pushing it through the channels. At approximately 150 ft, a lateral breach on the southern wooden wall was observed. The wooden pipes are constructed with staves parallel to the length of the pipe. Wooden pieces on the southern wall from 150 to 156 ft in the horizontal line segment were separated and water was observed flowing from the lateral breach (Photo O – Appendix G-2). Some of wooden boards had also broken off the wall and fallen into the water and soil was exposed where the boards had been. Water depth substantially increases once the video tractor passed 158 ft and continued to rise steadily until the video survey was stopped at 282.7 ft due to standing water. Scrubber Effluent Manhole MH16L4 can be seen in the end of the video and was approximately 20 ft away when the videoing stopped.

Before any videoing continued, a water sample of backed up water located in Scrubber Effluent Manhole MH16L4 was taken via disposable plastic sampling container. This was done to determine the water quality after the breach at approximately 150 ft. in the horizontal line segment between Scrubber Effluent Manholes MH15L4 to MH16L4. After the sample was collected, the vacuum truck removed water to expose the lateral horizontal wooden line; however, the video tractor could not move once it entered the horizontal line segment at Scrubber Effluent Manhole MH16L4 (2020 video MH16L4 to MH17L4). The video did show a small break in the line approximately 20 ft into MH16L4 on the south wall, but it appeared to be dry.

Scrubber Effluent Manhole MH17L4 was then opened, and no water was observed flowing. There were numerous large pieces of what appeared to be concrete, encrustation material, small pieces of wood, and larger rocks located in the basin of Scrubber Effluent Manhole MH17L4 that the vacuum truck was unable to retrieve. Therefore, confined space entry was determined to be the only way to access the manhole. Bravo Environmental completed all confined space entry forms, completed an oxygen check, set up a harness/tripod/winch system, and equipped the entrant with a gas alert microchip. The entrant entered Scrubber Effluent Manhole MH17L4 under supervision and communication with the attendant. Materials were removed from the base of the manhole and a small amount of water began flowing. The entrant was able to see that the majority of horizonal wooded line segment heading west from Scrubber Effluent Manhole MH17L4 to MH16L4 was over 80% blocked by the same encrustation material noted in the previous Scrubber Effluent line segments (Photo Q – Appendix G-2). The entrant also mentioned that the horizontal wood line segment heading southeast from Scrubber Effluent Manhole MH17L4 to MH18L4 had the same encrustation material caked along the northeast wall at the entrance to Scrubber Effluent Manhole MH17L4. The encrustation also appeared to be located throughout the horizontal line segment connecting Scrubber Effluent Manhole MH17L4 to MH18L4 (Photo R – Appendix G-2).

A sediment sample and an encrustation sample were taken from Scrubber Effluent Manhole MH17L4 while the entrant was in the manhole. It was impossible to get the video tractor to move through either of the horizontal line segments from Scrubber Effluent Manhole MH17L4 due to blockage of the wooden lines at the horizontal segments from encrustation buildup. A small amount of water was observed entering the horizontal line segment at Scrubber Effluent Manhole MH17L4 and flowing into the horizontal line segment connecting southeast to Scrubber Effluent Manhole MH18L4 once some of the encrustation was removed from the horizontal line segment.

Scrubber Effluent Manhole MH18L4 was then opened, and it was determined there was no need to use the vacuum truck as there was not a lot of sediment, material or any water located in the base of the manhole. The video tractor was placed down 25 ft into Scrubber Effluent Manhole MH18L4 but encountered the same issue with the encrusted materials observed in the previous line segments and was unable to move (2020 video MH18L4 to MH17L4). No water or sediment was observed in Scrubber Effluent Manhole MH18L4 and periodic checks at the head of NPDES pond A confirmed the line was dry.

After completing the video survey of the Scrubber Effluent line segments located in courtyard A4 and A5, the next segments for the video survey were at Scrubber Effluent Manhole MH13L4, located at the southern end and atop of Passage No. 3 and north of courtyards A3 and A4. Scrubber Effluent Manhole MH13L4 was opened, and it was determined there was no need to use the vacuum truck as there was not a lot of material located in the base of the manhole.

Scrubber Effluent Manhole MH13L4 has wooden horizontal lines entering from the east (connecting with Scrubber Effluent Manhole MH14L4), one from the west (connecting to Scrubber Effluent Manhole MH12L4) and one line entering from the north (connecting with Scrubber Effluent Manhole MH1L3 through Passage No. 3). A video survey of the line to the north was attempted (approximately 11 ft) from Scrubber Effluent Manhole MH13L4 but immediately noticed the same type of encrustation channels that were evident in the Scrubber Effluent line segments in courtyards A4 and A5 (Photo S – Appendix G-2). Small amounts of water were observed flowing south into Scrubber Effluent Manhole MH13L4 and a sediment sample was collected. An encrustation sample was unable to be collected from Scrubber Effluent Manhole MH13L4 as the encrustation was too far into the horizontal line segment to reach, approximately 10 ft north of MH13L4.

The horizontal line segment from Scrubber Effluent Manhole MH13L4 to MH12L4 had sediment and water markings on the wall of the pipe up to 35% of the depth of the line (2020 video MH13L4 to MH12L4). At approximately 6 ft into the line segment to the west, there is sediment build up with encrustation and water channels in the line. The sediment is in the center of the pipe with the channels located on both sides. This was quite evident throughout this horizontal line segment for approximately 30 ft and then the channels flattened. Sediment was observed throughout this line segment and two small breaches in the line were noted but were dry at approximately 75 ft and 78 ft. The video was completed to 94.4 ft before the sediment accumulation on the wheels bogged the vehicle down. The video survey from March 2017 also shows this same section of line segment with standing water, encrustation in the line, and a cut out at approximately 117 ft, which is where MHW is noted on the figure (2017 video MH13L4 to MH12L4 and Photo T – Appendix G-2).

The horizontal line segment east from Scrubber Effluent Manhole MH13L4 to Scrubber Effluent Manhole MH14L4 was then videoed (2020 video survey MH13L4 to MH14L4). Sediment is still visible in the center of the line for approximately 6 ft into the line and then at approximately 10 ft, water can be seen being moved by the video tractor. Water continues to increase in depth until approximately 74 ft where standing water covers over 30% of the line. The water is stagnant, there appears to be a sag in the line, and we know Scrubber Effluent Manhole MH14L4 further to the west is dry (2020 video survey MH14L4 to MH15L4).

The video investigation then moved to Scrubber Effluent Manhole MH1L3, located in the northern portion of passage no. 3, in the passageway between courtyards C3 and C4. Scrubber Effluent Manhole MH1L3 has wooden horizontal lines entering from the east (connecting with Scrubber Effluent Manhole MH2L2), one from the west (connecting to Scrubber Effluent Manhole MH2L1), one line exiting to the south (connecting with Scrubber Effluent Manhole MH13L4 south through passage no. 3), and a small 8-inch PVC pipe connecting to the north. Both wooden horizontal line segments connecting to Scrubber Effluent Manhole MH1L3 from the east and west were under water and the lines were not accessible to video.

Scrubber Effluent Manhole MH1L3 had some standing water but the horizontal approximately 18-inch wooden line located on the south side was accessible. The video tractor was placed into this horizontal wooden line segment at approximately 6 ft from the ground surface. The video was expected to reach Scrubber Effluent Manhole MH13L4 to the south through Passage No. 3, but the line was too backed up with encrustation material and excess water to get a reliable video.

The only pipe segment located along the northern wall of Scrubber Effluent Manhole MH1L3 was an 8-inch PVC pipe, approximately 3 ft from ground surface, and this line was video surveyed (MH1L3 north in small PVC pipe). The video of this line went for approximately 8 ft before the line bent abruptly at 45 degrees for about 6 inches and then turned up 90 degrees and the video ended. It appears that this line may connect to the previous operations associated with the Tertiary Treatment Plant.

2.5.4.5.6 Source of Water Discharging at Scrubber Effluent System Outfall

Water discharges seasonally from the Scrubber Effluent System outfall located near the head of NPDES Pond A. By 1981 and construction of John Day Dam Road south of the plant area, the original wet air scrubbing system was no longer in use and waste and wastewater was no longer being conveyed by the Scrubber Effluent System. Presently, discharge from the Scrubber Effluent System outfall appears to be water but from an unknown source since the Scrubber Effluent System is no longer in use. Typically, flow begins at the outfall in November or December, then flows at a relatively constant rate measured at approximately 10 gpm until flow ceases in early summer, in May or June. Fluoride has been detected in the outfall discharge based upon RI and WPA water sample results, which raises a concern for potential recontamination of soil in the vicinity of Pond A, after the 2010 NPDES Ponds cleanup and closure (ARCADIS 2011), as well as potential impact to shallow groundwater.

An objective of the PAAOC initial RI and WPA phases of investigation has been to identify the source of the water discharging from the pipe located at NPDES Pond A. Of particular interest was potential connection with other site conveyance systems, such as Stormwater Collection and Groundwater Collection Systems, with water flow that could enter the Scrubber Effluent System through a potentially previously unknown connection. System Identification conducted during the initial RI phase inspected all identified catch basins and manholes for the SE, Stormwater, Groundwater, and I&M Systems and noted where either stagnant or flowing water was present.

The source of water flow in the Scrubber Effluent System was investigated primarily through video surveys. Initial RI video survey objectives with respect to the source of water were to determine whether connections existed between the Stormwater and Groundwater Collection Systems and the Scrubber Effluent System in the area of Passage No. 3 and Courtyard Segment A4 and identify potential breaches in the Scrubber Effluent lines. No previously unknown connections were identified but water was observed flowing in the Scrubber Effluent Line 4 in Courtyards A3 through A5; however, due to the encrustation blocking Scrubber Effluent Line 4 at MH17L4, a flow rate could not be determined. Other observations regarding breaches and loss of integrity in system pipes included destruction of manhole MHA at the head of I&M System near the Tertiary Treatment Plant with flowing water and evidence of past flow visible inside the line. Breaches in the Scrubber Effluent System lines were not identified during this phase. Results of the initial RI video survey did not establish the source of water discharging at the Scrubber Effluent System outfall.

WPA phase video survey objectives for source of water included more extensive video of the Scrubber Effluent System to identify breaches in the line and determine whether the integrity of the lines in the vicinity of the Tertiary Treatment Plant may have been impacted as a result of plant demolition. The WPA video survey included more extensive surveys of the Scrubber Effluent System Line 4 in Courtyard Segments A3 through A5 and to the NPDES Pond A, the I&M System in the area of the Tertiary Treatment Plant, and the Groundwater Collection System in Courtyards C3 through C5 and the diagonal Line 5.

Several significant findings were made during the WPA Phase video survey. A cross-section along Scrubber Effluent System Line 4 was constructed from MH12L4 to NPDES Pond A (refer to Figure 2.5.4-9 for the Scrubber Effluent System Line Cross-Section Location) to evaluate the findings of the video surveys. These findings are illustrated on Cross-Section A-A' (see Figure 2.5.4-10), to show the intersectional relationships between the I&M and Groundwater Systems where loss of integrity occurs, breaches that were observed in the Scrubber Effluent Line 4, and interpreted seasonal shallow groundwater elevations that may result in seasonal discharge of water at the Scrubber Effluent System outfall:

- A large lateral breach was observed in Scrubber Effluent Line 4 between MH15L4 and MH16L4 with active inflow of groundwater at an estimated rate of 0.5 gpm.
- Two smaller areas of breach were identified in Scrubber Effluent Line 4 between MH12L4 and MH13L4, and immediately downstream from MH16L4. Groundwater inflow was not observed, and the breaches were dry at the time of the October 2020 video survey.
- Significant loss of integrity of the I&M line in Passage No. 3 was observed where water flowing in the line may be leaking out to the subsurface.

- The I&M line crosses the Scrubber Effluent Line 4 between MH13L4 and MH14L4 and is within 5 ft elevation above the Scrubber Effluent Line 4 at a point of sag in the line where stagnant water is present.

- Significant loss of integrity of the Groundwater Collection System Line 5 occurs upstream stream from manhole MH3L5, and very near the point where the large lateral breach was identified in the Scrubber Effluent Line 4.

- Stratigraphy along the alignment based on borehole logs indicating that the large breach in the Scrubber Effluent Line 4 is potentially within the basalt flow top which in many locations is saturated and part of the site UA shallow groundwater aquifer.

- The large breach identified in the Scrubber Effluent Line 4 is at an elevation of approximately 470 ft to 472 ft.

- Shallow groundwater across the site indicates a groundwater elevation of about 12 ft to 14 ft in the area of Scrubber Effluent Line 4, near the large observed breach in with groundwater inflow. Groundwater is discussed further in Groundwater AOC, Volume 4, Section 2.

- Leakage of collected groundwater in the Groundwater Line 5 where loss of line integrity occurs near Scrubber Effluent Line 4 may contribute to a localized mounding in the shallow groundwater.

- The source of water discharging from the Scrubber Effluent System outfall appears to be groundwater that flows into the Scrubber Effluent Line 4 at the large breach, and potentially other nearby breaches, when the shallow groundwater rises to above the elevation of the large breach.

- When water is observed flowing in Scrubber Effluent Line 4 between MH14L4 and MH17L4 but is not in MH18L4 and/or discharging at the Scrubber Effluent System outfall, it is possible another breach or line separation occurs in the vicinity of MH18L4. MH18L4 is the connection point for 1981 extension of the Scrubber Effluent System from MH18L4 to its current outfall with addition of some 400 ft of 21-inch reinforced concrete pipe.

Based on results of the initial RI and WPA phases video surveys, stratigraphy, and groundwater elevation measurements, the source of seasonal flow at the Scrubber Effluent System outfall is concluded to be groundwater flowing into the Scrubber Effluent System through line breaches located at approximately 150 ft to 156 ft east from manhole MH15L4. The water quality of the outfall flow is related to shallow groundwater quality in the vicinity of the breaches and is influenced by the presence of a site wide fluoride plume, and water flowing in and leaking out of both the I&M and Groundwater Systems near and upgradient from Scrubber Effluent Line 4 breaches and in the vicinity of Passage No. 3. During portions of the year when water flows in Scrubber Effluent Line 4 but does not flow at the Scrubber Effluent System outfall, there may be enough leakage from the Scrubber Effluent Line 4 near MH18L4 to preclude discharge at the outfall.

2.5.4.5.7 WPA Phase Investigation Conclusions

Sediment analytical results indicate that detected concentrations of fluoride, PAHs as TTEC and total LMW PAH and total HMW PAH, total PCBs, and TPH-Dx as diesel and residual range organics, exceeds one or more soil screening levels in Scrubber Effluent System manholes sampled. While some accessible manholes were cleaned in 2010, demolition activities that continued after manhole cleaning may have reintroduced surface contamination into the Scrubber Effluent System.

Water analytical results for two sampled manholes indicate that detected concentrations of fluoride, sulfate, PAHs at TTEC and benzo(a)pyrene, metals (arsenic and lead), exceed one or more water screening levels. Water analytical results for Scrubber Effluent System outfall discharge water indicates that fluoride is the only site COPC detected at concentrations that exceed water screening levels present in water that flows from the outfall into NPDES Pond A.

One sample and a duplicate of encrustation material that partially blocks the Scrubber Effluent lines between MH16L4 and MH18L4 was collected to determine the general composition of the solids and whether it may be a potential source of leachable fluoride. Analytical results indicate that the solids contain fluoride and five metals (arsenic, cadmium, chromium, nickel, and zinc) at concentrations that exceed the protection of groundwater soil screening level. Other analyses indicate that the solids appear to be primarily a calcium/iron precipitate. SPLP test on the encrustation solids indicate that the test leachate contained fluoride at concentrations of 25.8 mg/L and 28.2 mg/L. Scrubber Effluent System outfall discharge water contains fluoride concentrations of 5.2 mg/L to 8.93 mg/L.

Specific findings of the video survey include the following:

- An observed lateral breach in the wood staves is located at approximately 150 ft into the horizontal line between Scrubber Effluent Manholes MH15L4 and MH16L4, at approximately 470 ft elevation. Groundwater was observed flowing into the line at an estimated 0.5 gpm.

- A substantial amount of water is backed up in the horizontal wooden line segment west of Scrubber Effluent Manhole MH17L4, which is blocked by the buildup of over 80% of encrustation material.

- Water flow was observed at manhole MH17L4 once some of the encrustation materials were removed from the lateral line segment to the west but there was no water flow was observed through manhole MH18L4 or at the system outfall at the head of NPDES Pond A. A breach is suspected in the horizontal line segment between Scrubber Effluent Manholes MH17L4 and MH18L4, and/or potentially at or just downstream from MH18L4 where the 1981 21-inch reinforced concrete pipe extension to Pond A joins the original Scrubber Effluent System allowing flow to leak from the line into the subsurface.

- When the Stormwater Retention Pond is nearing capacity, the stored water backs up into Groundwater Line 5 to a point upstream from MH3L5 and upstream from where the line integrity appears to have been compromised, and leakage may occur into the subsurface (Figure 2.5.2-5). This area of backed up stored water is above the locations in Scrubber Effluent Line 4 where the large lateral breach with inflow of groundwater is located (Figure 2.5.4-10).

- The 24-inch concrete I&M line (invert at 7 ft bgs to 8 ft bgs) crosses over the 24-inch wooden Scrubber Effluent line segment (invert at approximately 12 ft bgs) in courtyard A4, at 60 to 70 ft east of Scrubber Effluent Manhole MH13L4. The large diameter I&M line is within 4 to 5 ft in depth above the Scrubber Effluent line and may have contributed to the downward bend in the Scrubber Effluent line segment where standing water was observed in the downward bend. Very large demolition equipment operating in this area may also have contributed to the apparent bend in the Scrubber Effluent line.

- MH1L3 had wooden horizontal lateral connectors to the east, south, and west, but only an 8-inch PVC pipe connecting to the north. This appears to be the northern extend of the Scrubber Effluent System in Passage No. 3.

2.5.4.6 RI Conclusions and Recommendations

Based on the results of the video surveys, soil boring program in the plant footprint, and groundwater investigation in the shallow groundwater in the area of Courtyard A, the source of water discharging at the Scrubber Effluent System outfall appears to be groundwater entering the Scrubber Effluent System in Line 4 through lateral breaches from the broken wooden staves in the line.

The entire Scrubber Effluent Line System is recommended for further evaluation in the FS to address encrustation in the horizontal lines, the lateral breach in Line 4, the water flowing at the head of NPDES Pond A, and the potential for the wooden pipe material to act as a source of contamination to groundwater. The Scrubber Effluent Line System may also act as a preferential pathway for contaminate transport.

2.5.5 Sanitary Sewer Collection System

The sanitary sever collection system consists of a series of horizontal lines present at the administrative building, up near the Tertiary Treatment Plant area, in Courtyard Segments C1 and C2, throughout Courtyard segment B, and down by the southeast portion of the plant area. A sewage ejector is located in Courtyard B3 and at the far east end of the production services building. The sewage treatment plant, Sanitary Sewer Collection System which is the end point for all horizontal lines associated with sanitary sewer system, is located at the southeast corner of the plant area.

2.5.5.1 Previous Investigations

No previous investigation was conducted for the Sanitary Sewer System prior to issuance of the Agreed Order (Ecology 2014).

2.5.5.2 Initial RI Phase Investigation Scope

The Sanitary Sewer Collection System was investigated during the initial RI phase of investigation in 2016 and 2017. Investigation objectives described in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) are as follows:

- **System identification** to locate and document the system layout.
- **Collection of a sediment sample** from the Sewage Treatment Plant Sump located in the southeast corner of the plant area.

2.5.5.3 Initial RI Phase Investigation Results

The following sections describe the work performed to meet the objectives stated above.

2.5.5.3.1 System Identification

System identification was completed in 2016 consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b).

The Sanitary Sewer Collection System was located using historic site plans and engineering plans obtained from onsite plant construction files. All manholes were located by assessing its relative location on maps and drawings and comparing orientations of the manholes against the plans. Some manholes shown on plant maps could not be located or were buried. The Sanitary Sewer Collection System layout is shown on Figure 2.5.5-1.

2.5.5.3.2 Collection of a Sediment Sample

Investigation of the Sewage Treatment Plant Sump was previously conducted as part of the SWMU 32/Plant Area AOC lines investigation reported in Volume 2, RI SWMU 32 Summary.

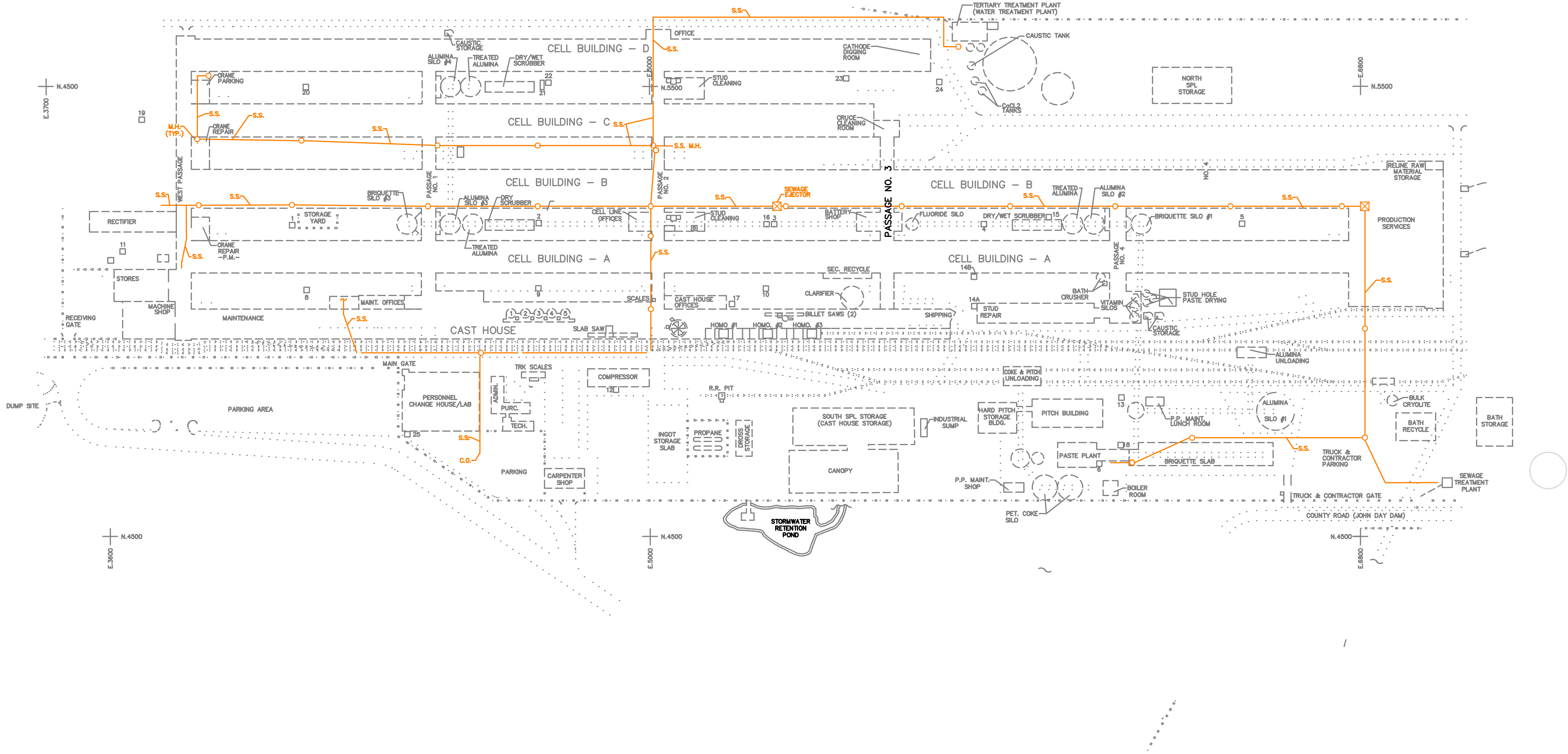
No sediment was present in the Sewage Treatment Plant Sump and therefore it was not sampled.

2.5.5.4 Initial RI Investigation Conclusions

The Sanitary Sewer Collection System is not recommended for further evaluation in the FS.

2.6 MAJOR FINDINGS AND RECOMMENDATIONS FOR THE FEASIBILITY STUDY

This section summarizes the Revised RI recommendations for Volume 3 for the Rectifier Yard AOC and the Plant Area AOC. The sampling program for Volume 3 Rectifier Yard AOC and Plant Area AOC are fully described in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) and the WPA (Tetra Tech et al. 2019b). Table 2.6-1 provides a summary of the primary Revised RI Findings for the Rectifier Yard AOC and the Plant Area AOC, including identifying recommendations for further evaluation in the FS.



Source: Goldendale Aluminum Company, Plant Drawing A1/1752, "Underground Storm & Sanitary Sewer Piping W/Chem'l & Oil Str'g Areas"

Legend

1☐	ELECTRICAL SUBSTATIONS
○	SANITARY SEWER MANHOLE
☒	SEWAGE EJECTOR

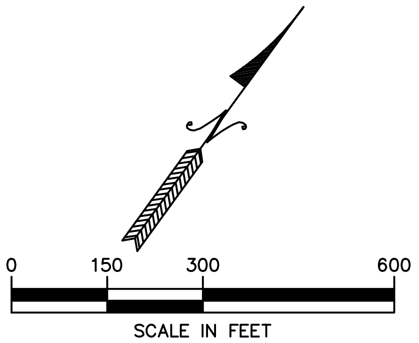


Figure 2.5.5-1

Plant Area AOC

Sanitary Sewer System
System Layout

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Table 2.6-1
Rectifier Yard AOC and Plant Area AOC Major Findings and Recommendation Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
(Page 1 of 6)

Areas of Concern (AOC)	Major RI Findings Summary	RI Recommendations	FS Evaluation [a] (Yes/No)
RECTIFIER YARD AOC			
	• PCBs were generally detected in soil below MTCA Method A and C Industrial levels and do not represent the main chemical of concern at the Rectifier Yard AOC. • Oil lines remain in place north and south of the Rectifier Building. The lines (where exposed) appeared to be empty and in adequate condition with no observed cracks or holes. Petroleum hydrocarbons and PAHs have been detected above screening levels in proximity of the lines in some locations where the lines are still present. Soils in the areas where the lines have been previously removed on the north side of the Rectifier Building and Oil House are generally below soil screening levels. • Sampled soils for borings beneath Rectifier Building were below Method C Industrial screening levels, soil screening levels for groundwater, and terrestrial ecological screening levels for wildlife protection, and accordingly, this area is not recommended for inclusion in the FS. • Sampled solids/sludges from catch basins and sumps near the Oil House and in the Rectifier Building basement contained elevated concentration of PAHs, diesel-range petroleum hydrocarbons, PCBs, and metals (As, Cd, Cu, Hg, and Zn). The catch basin and sumps were lined with concrete, were in adequate condition, and appeared to be connected to the industrial line sump located south of the Rectifier Yard. • Elevated concentrations of cPAHs and diesel-range petroleum hydrocarbons were consistently detected in soils at most of the interior plant transformer substations. It appears that the cPAH contamination may be related to historical plant operations, rather than transformer operations. • Concentrations for soil in the northwest portion of the Rectifier Yard generally did not exceed screening levels, and accordingly, this area is not recommended for inclusion in the FS.	• The Rectifier Yard AOC will be further evaluated in the Feasibility Study (FS) based on the occurrence of TPH-Dx, cPAHs, PCBs, and metals (As, Cd, Cu, Hg, Ni, Se, and Zn) above soil screening levels for protection of groundwater and/or terrestrial ecological soil screening levels for wildlife protection. FS considerations include the following: • Contaminated soil and oil line removal will be further evaluated in the FS. • The catch basins and sumps will be further evaluated in the FS. • The interior plant transformers, including Substation 5 (location of historic spill) will be evaluated as part of comprehensive assessment of soil contamination in each of the courtyard segments under the Plant Area AOC.	**Yes**
PLANT AREA AOC			
2.2 WPA Investigation Areas			
2.2.1 Crucible Cleaning Room	• Fluoride was detected in initial RI boring SB-CU01 at concentrations that exceed the protection of groundwater screening level that decrease to 700 mg/kg in the sample at 23 ft bgs, which was collected in the basalt in the apparent UA aquifer zone. • The WPA investigation did not identify a significant source of fluoride contamination to shallow groundwater. • Sulfate was detected in initial RI boring SB-BH03 to 8 ft bgs at concentrations that exceed the protection of groundwater screening level. • The WPA investigation did not identify a significant sulfate soil source of contamination to shallow groundwater. • Fluoride and sulfate concentrations in shallow groundwater exceed MTCA Method C and WA MCL water screening levels. Fluoride concentrations are consistent with the interpreted fluoride plume in shallow groundwater measured during quarterly groundwater monitoring at 4 to 15 mg/L (GWAOC Volume 4 Section 2). • PAHs concentrations detected in shallow soil exceed the ecological wildlife screening levels. • Stormwater, I&M, and Groundwater lines in this area are not a current source of fluoride/sulfate contamination to shallow groundwater. There is no corresponding soil/groundwater contamination relative to COPCs conveyed by these systems if they had leaked during plant operations. • The likely source of fluoride/sulfate contamination is underground piping associated with the Tertiary Treatment Plant (SWMU 8) and Lines B, C, D Secondary Scrubber Recycle Station (SWMU 6) that conveyed wastewater with high concentrations of fluoride/sulfate to the Tertiary Treatment Plant.	The Crucible Cleaning Room Investigation Area is recommended for further evaluation in the FS for soil contamination at depth associated with fluoride and sulfate, but it does not appear to be a soil source of contamination for shallow groundwater. Other elements within this area are recommended for further evaluation in the FS. • Groundwater evaluation beneath SWMUs 6 and 8. • The SO2 dry/wet scrubber purge line. • PAH contamination in shallow soil for concentrations of PAH that exceed ecological wildlife soil screening levels. Contamination present in shallow groundwater and resulting conclusions and recommendations will be addressed in the GWAOC (Volume 4, Section 2). Soil contamination in the Courtyard Segments C3, C4, D3, and E3, and resulting conclusions and recommendations, are addressed in the Courtyard Segment Soil Contamination Section 2.3.4.	**Yes**
2.2.2 Soil Boring SB-SV01	• SB-SV01 Investigation Area does not appear to be a significant source of Fluoride, sulfate, PAHs, TPH-Dx, and metals contamination to shallow groundwater and were either not detected or detected below screening levels in shallow groundwater. • Fluoride was detected in shallow groundwater at concentrations of 2.69 to 3.23 mg/L, below interpreted concentrations of fluoride in the areawide plume in shallow groundwater (4 and 10 mg/L, Groundwater AOC, Volume 4, Section 2). • Sulfate concentrations detected in shallow groundwater exceed the WA MCL with no corresponding soil concentrations that exceed the protection of groundwater screening levels. • Air pollution control water treatment system and associated piping is the most likely source of sulfate. The SB-SV01 Investigation Area is located downgradient from a dry/wet scrubber located in Courtyard Segment B4. • Video survey identified a significant breach in the SE Line 4 that does not appear to be a current source of PAH and TPH-Dx contamination. The positioning of the breach below the local water table, mere inches of water flow inside the pipe, and no other nearby breach with water outflow, suggests that groundwater that flows into the pipe continues flowing downstream until the Line 4 outfall at the head of Pond A. • The source of PAH and TPH-Dx in SB-SV01 at 11 ft bgs remains unclear.	The SB-SV01 Investigation Area is recommended for further evaluation in the FS for fluoride, PAHs, metals, and TPH-Dx contamination in two deeper soil samples. The SE line system in discussed further in Section 2.5.4 and includes conclusions and recommendations. Shallow soil contamination in Courtyard Segment A4, and resulting conclusions and recommendations, are addressed in the following Courtyard Segment Soil Contamination Section 2.3.4.	**Yes**
2.2.3 Coke and Pitch Unloading Sump	• Coke and Pitch Sump sediment PAH and TPH-Dx contamination has impacted standing water within the sump but does not appear to have impacted shallow groundwater immediately downgradient from the sump. • WPA groundwater results indicate only fluoride was detected at concentrations that exceed screening levels and are consistent with a site wide fluoride plume in shallow groundwater (Groundwater AOC, Volume 4, Section 2).	The Coke and Pitch Unloading Sump is recommended for evaluation in the FS for contaminated sediments that remain in the sump from former plant operations.	**Yes**

Table 2.6-1
Rectifier Yard AOC and Plant Area AOC Major Findings and Recommendation Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
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Areas of Concern (AOC)	Major RI Findings Summary	RI Recommendations	FS Evaluation [a] (Yes/No)
2.2.4 Former AST05	• Soil in the SB-AST05 Investigation Area becomes thinner from west to east. Basalt bedrock was encountered in borings at up to 10 ft bgs in the west, and at less than 4 ft bgs in the east. Shallow groundwater was not encountered in any of the soil borings, and a monitoring well was not installed, and no shallow groundwater samples were collected. • TPH-Dx was detected in soil at concentrations that exceed ecological wildlife screening levels in shallow soil (<1 ft bgs). Fluoride and PAHs also were detected in shallow soil at concentrations that exceeded either the protection of groundwater or ecological wildlife soil screening levels.	The SB-AST05 Investigation Area is recommended for further evaluation in the FS for TPH-Dx, fluoride, and PAH contamination in shallow soil. The SB-AST05 Investigation Area overlaps with SWMU 12 East SPL Storage Area (Volume 2, Section 12) and will be evaluated jointly with SWMU 12 in the FS.	**Yes**
2.2.5 Friction Weld Building	• WPA borings did not detect fluoride in soil at concentrations that would indicate a significant soil source of contamination to shallow groundwater. • WPA shallow groundwater samples indicate fluoride is detected at concentrations that are consistent with the interpreted sitewide shallow groundwater fluoride plume.	The Friction Weld Building Investigation Area is recommended for further evaluation in the FS.	**Yes**
2.2.6 Soil Boring SB-SE08	• Fluoride and PAHs, and metals do not appear to potential soil sources of contamination to shallow groundwater. No other COPCs were detected at concentrations that exceed soil screening levels. • Sulfate soil contamination may have impacted shallow groundwater in a localized area. Sulfate was detected at concentrations that exceed the protection of groundwater screening level in two WPA soil samples above 3 ft bgs. • No breaches in the SE line with actively outflowing water were observed during the video survey suggesting that the line is not a current source of contamination in soil in the vicinity of SB-SE08. • The most likely sources of sulfate onsite are SO2 wet scrubbers and piping that returns to the Tertiary Treatment Plant through Passage No. 4. The SB-SE08 Investigation Area is located downgradient from a dry/wet scrubber located in Courtyard Segment B4.	The SB-SE08 Investigation Area is recommended for further evaluation in the FS for fluoride and sulfate in soil. Shallow soil contamination in Courtyard Segment A4, and resulting conclusions and recommendations, are addressed in the following Courtyard Segment Soil Contamination Section 2.3.4.	**Yes**
2.2.7 Soil Boring SB-SE18	• Sulfate was detected in initial RI boring SB-SE18 at 9 ft bgs at 2,200 mg/kg exceeding the protection of groundwater screening level. • Fluoride and sulfate soil sources of contamination to shallow groundwater were not identified during the WPA phase of investigation. The area of investigation was broadened to include the SWMU 14 building and nearby areas. The investigation identified a thick layer of silty clay/clay beneath the SWMU 14 building that would restrict downward infiltration of surface water. • Groundwater Collection, Scrubber Effluent, and Stormwater Collection lines present beneath Courtyard Segments C4 and C5 may have been a past source of contamination to shallow groundwater. However, the three system lines are well above the local measured water table, no evidence exists for breaches or leakage from the lines, and there are no corresponding elevated concentrations in groundwater of other COPCs that are present in the lines at concentrations that exceed soil or water screening levels. • Surface runoff from Highway 14 to the north is not a likely source of fluoride or sulfate contamination to shallow groundwater but may be a water contribution to shallow groundwater as the water ultimately discharges into courtyard segment C4. • Concentrations of fluoride and sulfate detected in WPA groundwater samples most likely result from potential leakage from piping associated with the air pollution control wastewater treatment system. For fluoride the most likely source is the Tertiary Treatment Plant and associated piping in the Crucible Cleaning Room Investigation Area (Section 2.2.1). For sulfate the most likely source is the return lines running from the south dry/wet scrubber in segment B4 north along Passage No. 4.	The SB-SE18 Investigation Area is recommended for further evaluation in the FS for fluoride, sulfate, and PAH contamination in two deep samples, but does not appear to be a soil source of contamination to shallow groundwater for fluoride or sulfate. Other elements within this area are recommended for further evaluation in the FS. • Soil contamination in the Courtyard Segments, and resulting conclusions and recommendations, are addressed in the following Courtyard Segment Soil Contamination Section 2.3.4. • Soil stockpiles to the west and east of SWMU 14 are recommended for further evaluation in the FS for PAH contamination that exceed ecological wildlife soil screening levels. • The Scrubber Effluent line system is discussed further in Section 2.5.4 and includes conclusions and recommendations	**Yes**
2.2.8 Vertical Extent of Contamination in Courtyards	• The vertical extent of soil contamination in Courtyard Segment soil was evaluated with 63 soil samples that focused on PAH and TPH-Dx, but other COPCs that also exceed soil screening levels at depth are noted in the summary Table 2.2.8-1. • Vertical extent of PAH contamination has not been defined at all sample locations. • Other COPCs, including fluoride, sulfate, and metals, were detected at concentrations that exceed soil screening levels. These COPCs will be considered together with PAH contamination in each courtyard segment.	The Vertical Extent of Contamination in Courtyards Investigation Area is recommended for further evaluation in the. Each Courtyard Segment is addressed separately in the Section 2.3.	**Yes**
2.3 Courtyard Segment Soil			
2.3.1 Segment A1	• Fluoride, PAHs as HMW, selenium, and zinc are detected in shallow soil at depths up to 2 ft bgs, but not in deeper depths sampled.	Based on fluoride, PAH, and metals exceedance of soil screening levels in the upper 2 ft of soil, Segment A1 is recommended for further evaluation in the FS.	**Yes**
2.3.2 Segment A2	• Fluoride, sulfate, PAHs as TTEC and HMW, TPH as diesel and residual range organics, cadmium, selenium, nickel, and zinc were detected at concentrations that exceed soil screening levels to depths of up to 4 ft bgs. • The maximum detected concentration of fluoride is 2,500 mg/kg at 1 ft bgs decreasing to 1,040 mg/kg at 4 ft bgs, in the central portion of the segment.	Based on fluoride, sulfate, PAH, TPH-Dx, and metals exceedance of soil screening levels to depths of 4 ft bgs, Segment A2 is recommended for further evaluation in the FS.	**Yes**
2.3.3 Segment A3	• The vertical extent of sulfate contamination has not been defined to at a depth of 8 ft bgs in one location. Sulfate in soil may be associated SWMU 5 underground piping potential subsurface leaks. • The vertical extent of fluoride, PAH as HMW, and metals contamination has not been defined to 4 ft bgs the deepest depth of sampling.	Based on fluoride, sulfate, and PAH exceedance of soil screening levels to depths of 4 ft bgs, and sulfate exceedance at 8 ft bgs, Segment A3 is recommended for further evaluation in the FS.	**Yes**
2.3.4 Segment A4	• Fluoride is detected in soil to depths of 7.5 ft bgs, the deepest depth sampled. Deeper initial RI soil samples may have been collected from below the water table, within the basalt flow top, and likely reflects in part the site-wide fluoride plume in shallow groundwater.	Based on fluoride exceedance of soil screening levels to depths of 7.5 ft bgs, Segment A4 is recommended for further evaluation in the FS.	**Yes**
2.3.5 Segment A5	• The vertical extent of fluoride and PAHs as TTEC and HMW has not been defined below depths of 4 ft bgs, the deepest depth sampled.	Based on fluoride and PAH exceedance of soil screening levels to depths up to 4 ft bgs or deeper, Segment A5 is recommended for further evaluation in the FS.	**Yes**

Table 2.6-1
Rectifier Yard AOC and Plant Area AOC Major Findings and Recommendation Summary
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Areas of Concern (AOC)	Major RI Findings Summary	RI Recommendations	FS Evaluation [a] (Yes/No)
2.3.6 Segment B1	• The vertical extent of COPC contamination has not been defined below 4 ft bgs, the deepest depth sampled.	Based on COPC exceedance of soil screening levels to depths up to 4 ft bgs, Segment B1 is recommended for further evaluation in the FS.	**Yes**
2.3.7 Segment B2	• The vertical extent of fluoride, PAH, and metal contamination in soil has not been defined below depths of 4 ft bgs, the deepest depth sampled. • The maximum detected concentration of fluoride is 410 mg/kg collected at 1 ft bgs.	Based on fluoride, PAH, and metals exceedance of soil screening levels to depths up to 4 ft bgs, Segment B2 is recommended for further evaluation in the FS.	**Yes**
2.3.8 Segment B3	• The vertical extent of PAH as HMW and arsenic contamination in soil has not been defined below depths of 4 and 5 ft bgs, the deepest depths sampled. • The vertical extent of fluoride contamination has not been defined at one location to a depth of 1 ft bgs, the deepest depth sampled.	Based on fluoride, PAH, and arsenic exceedance of soil screening levels to depths up to 5 ft bgs, Segment B3 is recommended for further evaluation in the FS.	**Yes**
2.3.9 Segment B4	• The vertical extent of fluoride and PAHs has not been defined below depths of 2 ft bgs in some areas, and 4 ft bgs in other areas, the deepest depths sampled. • The maximum detected concentration of fluoride is 2,800 mg/kg collected at 1 ft bgs.	Based on fluoride and PAH exceedance of soil screening levels to depths up to 4 ft bgs, Segment B4 is recommended for further evaluation in the FS.	**Yes**
2.3.10 Segment B5	• The vertical extent of PAHs as TTEC and HMW contamination has not been defined below depths of 4 and 5 ft bgs, the deepest depth sampled. • The maximum detected concentration of fluoride is 850 J collected at 1 ft bgs.	Based on fluoride and PAH exceedance of soil screening levels to depths up to 4 ft bgs, Segment B5 is recommended for further evaluation in the FS.	**Yes**
2.3.11 Segment C1	• The vertical extent of fluoride, PAHs as HMW, and metals including cadmium and zinc has not been defined at one location below a depth of 4 ft bgs, the deepest depth sampled. • The maximum detected concentration of fluoride is 310 mg/kg collected from 4 ft bgs.	Based on fluoride and PAH exceedance of soil screening levels at 4 ft bgs, Segment C1 is recommended for further evaluation in the FS.	**Yes**
2.3.12 Segment C2	• The vertical extent of fluoride, sulfate, and PAHs as HMW has not been defined below depths of 4 ft bgs, the deepest depth sampled. • The maximum detected concentration of fluoride in soil at one is 1,400 mg/kg collected from 0.5 ft bgs at one location, with concentrations decreasing to 349 mg/kg at 4 ft bgs.	Based on fluoride, sulfate, and PAH exceedance of soil screening levels to depths up to 4 ft bgs, Segment C2 is recommended for further evaluation in the FS.	**Yes**
2.3.13 Segment C3	• The vertical extent of sulfate and fluoride has not been defined below depths of 8 ft bgs for sulfate and 3 ft bgs for fluoride. • The maximum detected concentration of sulfate is 7,500 mg/kg collected from 3 ft bgs in the eastern portion of the segment, with sulfate concentrations remaining elevated to 8 ft bgs which is likely below the water table. Sulfate detected in deeper soil in C3 is likely associated with underground piping leaks in the Crucible Cleaning Room IA and localized elevated concentration of sulfate in shallow groundwater. • The maximum detected concentration of fluoride is 320 mg/kg collected from 3 ft bgs in the western portion of the segment.	Based on sulfate and fluoride exceedance of soil screening levels to depths up to 8 ft bgs, Segment C3 is recommended for further evaluation in the FS.	**Yes**
2.3.14 Segment C4	• The vertical extent of fluoride and PAH contamination has not been defined below depths of 8 and 3 ft bgs, respectively. The maximum detected concentration of fluoride is 1,200 mg/kg in SB-SE09 which was completed through the concrete underpass at the western end of C4, in the Passage No. 3 alignment, potentially collected below the water table, and fluoride is likely associated with underground piping leaks in the Crucible Cleaning Room IA and Passage No. 3, a major underground pipe corridor.	Based on fluoride and PAH exceedance of soil screening levels a depth of 8 ft bgs in the western portion of the segment, Segment C4 is recommended for further evaluation in the FS.	**Yes**
2.3.15 Segment C5	• The vertical extent of fluoride and sulfate contamination has not been defined below a depth of 7.5 and 9 ft bgs, respectively, the deepest depths sampled. Sulfate was detected at in SB-SE18 at 9 ft bgs, may have been collected from below the water table, and likely reflects localized area of elevated sulfate levels in shallow groundwater associated with dry/wet scrubber bleed line leakage in adjacent Passage No. 3. • Soil borings SB-SE18 and SE18-SB01 are further addressed in SE18 Investigation Area Section 2.2.	Based on fluoride and sulfate exceedance of soil screening levels at depths up to 7.5 ft bgs, Segment C5 is recommended for further evaluation in the FS.	**Yes**
2.3.16 Segment D1	• The vertical extent of PAHs as HMW, cadmium, and chromium contamination has not been defined below depths up to 1 ft bgs, the deepest depth sampled.	Based on PAH exceedance of soil screening levels to depths up to 1 ft bgs, Segment D1 is recommended for further evaluation in the FS.	**Yes**
2.3.17 Segment D2	• The vertical extent of PAHs as HMW, cadmium, and zinc has not been defined below depths of 2.66 to 4 ft bgs. Bedrock in this segment is shallow encountered at a minimum 2.66 ft bgs. • The maximum detected concentration of fluoride is 280 J mg/kg collected at the east end of the segment at 0.5 ft bgs.	Based on fluoride, PAH, and metals exceedance of soil screening levels to depths up to 4 ft bgs, Segment D2 is recommended for further evaluation in the FS.	**Yes**
2.3.18 Segment D3	• The vertical extent of fluoride, PAHs as HMW, and cadmium contamination has not been defined below depths of 1 ft bgs, the deepest depth sampled. • The highest detected concentration of fluoride is 150 mg/kg collected at a depth of 1 ft bgs in the central portion of the segment.	Based on fluoride, PAH, and metals exceedance of soil screening levels to depths up to 1 ft bgs, Segment D3 is recommended for further evaluation in the FS.	**Yes**
2.3.19 Segment E1	• The vertical extent of fluoride and PAHs as TTEC and HMW contamination has not been defined below 4 ft bgs, the deepest depth sampled. • The maximum detected concentration of fluoride is 1,800 J mg/kg in a sample collected at 1 ft bgs at the eastern end of the segment but does not exceed at 4 ft bgs at this location.	Based on fluoride and PAH exceedance of soil screening levels to depths up to 4 ft bgs, Segment E1 is recommended for further evaluation in the FS.	**Yes**
2.3.20 Segment E2	• The vertical extent of fluoride, PAHs as TTEC and HMW, and cadmium has not been defined below a depth of 4 ft bgs, the maximum depth sampled. • The maximum detected concentration of fluoride is 1,300 JD mg/kg in the central portion of the segment in a sample collected at 1 ft bgs, with a detected concentration of 362 mg/kg at 4 ft bgs at this location.	Based on fluoride, PAH, and metal exceedance of soil screening levels to depths up to 4 ft bgs, Segment E2 is recommended for further evaluation in the FS.	**Yes**
2.3.21 Segment E3	• The vertical extent of fluoride, PAHs as TTEC and HMW, and selenium has not been defined below a depth of 4 ft bgs. • The highest detected concentration of fluoride is 1,700 mg/kg in a sample collected from SB-BH02 at a depth of 2 ft bgs, the deepest depth sampled, and may be associated with the Crucible Cleaning Room Investigation Area (Section 2.2.1).	Based on fluoride, PAH, and metals exceedance of soil screening levels to depths up to 4 ft bgs or greater, Segment E3 is recommended for further evaluation in the FS.	**Yes**

Table 2.6-1
Rectifier Yard AOC and Plant Area AOC Major Findings and Recommendation Summary
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Areas of Concern (AOC)	Major RI Findings Summary	RI Recommendations	FS Evaluation [a] (Yes/No)
2.4 South Plant Area			
2.4.1 Gasoline USTs West of BPA Substation	• COPCs analyzed for the UST west of the BPA Substation do not exceed Plant Area AOC soil screening levels.	The UST is not recommended for evaluation in the FS.	**No**
2.4.2 Administration – Plant Laboratory Building	• PAHs as TTEC and HMW exceeds soil screening levels in shallow soil at depths up to 2 ft bgs. • TPH as residual range organics exceeds soil screening levels in boring SB-AL02 at depths up to 2 ft bgs, the deepest depth sampled.	Based PAH and TPH exceedance of soil screening levels, the Administration and Plant Laboratory Building boring SB-AL02 area is recommended for further evaluation in the FS.	**Yes**
2.4.3 Carpenter Shop Building	• Only calculated total HMW PAH slightly exceeded the ecological wildlife soil screening level at 0.5 ft in SB-AP02.	Based on the low concentration and limited occurrence of total HMW PAH the Carpenter Shop is not recommended for evaluation in the FS.	**No**
2.4.4 Compressor Building	• Detected concentrations of PAHs, PCBs, cadmium, selenium, and zinc exceed either protection of groundwater or ecological wildlife screening levels in shallow soil. • TPH-Dx as residual range organics exceeds ecological wildlife screening levels in all transformer substation T50 and T51 samples and the vertical extent of contamination is not defined. • TPH-Gx and TPH-Dx exceed soil screening levels in a 3 to 4 ft thick smear zone at a depth in boring SB-UST04 (monitor well RI-GW6) that has likely impacted shallow groundwater.	Based on the results of the initial RI phase of investigation the Compressor Building and associated features will be recommended for further evaluation in the FS for TPH in soil and PAH contamination at the transformer substations. Groundwater near the Compressor Building was characterized during the initial RI, and the results and conclusions and recommendations are summarized in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC.	**Yes**
2.4.5 Dross Storage Building	• Detected concentrations of PAHs as HMW and total cyanide exceed ecological wildlife screening levels, and fluoride exceeds the protection of groundwater screening level in both sample depths in boring SB-AD02. The vertical extent of fluoride in SB-AD02 is not defined but is not expected to exceed at depth based on nearby boring SB-AD01.	Based on the results of the initial RI investigation the Dross Storage Building is recommended for further evaluation in the FS.	**Yes**
2.4.6 Pitch Building Group	• Detected concentrations of PAHs as TTEC, LMW and HMW, and TPH as residual range organics exceed soil screening levels to a maximum depth of 2 ft bgs, except for calculated total HMW PAH which exceeds the ecological wildlife screening level to depths of 4 ft bgs in five out of 20 borings, and 6 ft bgs in one out of 20 borings. • Pitch remains between the aluminum siding and foundation walls.	Based on the results of the initial RI phase of investigation the Pitch Building Group is recommended for further evaluation in the FS.	**Yes**
2.4.7 Briquette Storage Slab	• Fluoride, PAHs as TTEC, LMW, and HMW, chromium, copper, and TPH as residual range organics were detected at concentrations that exceed MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels in soil boring SB-SS03 located at the southeastern margin of the Briquette Storage Slab. This soil boring location overlaps the edge of the East End Landfill (SWMU 17). • In all other borings, PAHs as TTEC, LMW, HMW were detected at concentrations that exceed MTCA Method C, protection of groundwater, and ecological wildlife screening levels in shallow soil samples, but did not exceed in deeper samples except in soil boring SB-SS05-6.	Based on the results of the initial RI the Briquette Storage Slab is recommended for further evaluation in the FS for PAH contamination associated with briquette storage. Potential recommendations for fluoride detected in SB-SS03 are addressed in the East End Landfill (SWMU 17) in Volume 2, Section 17.	**Yes**
2.4.8 Bath Recycle Building	• Fluoride and PAH as HMW exceed soil screening levels for protection of groundwater and ecological wildlife, respectively. Except at TP-BR01, concentrations of fluoride decrease to below the protection of groundwater screening level at deepest depths sampled. Total HMW PAH exceeds the ecological wildlife screening level in all soil samples from TP-BR01.	Based on results of the initial RI investigation the Bath Recycle Building is recommended for further evaluation in the FS.	**Yes**
2.4.9 Production Building Foundations	• Fluoride and sulfate were detected in shallow soil at concentrations that exceed the protection of groundwater screening levels but do not exceed in deeper samples collected from those borings. No other COPC exceeded site soil screening levels. • Detected fluoride and sulfate may be associated with the Crucible Cleaning Room IA (Section 2.2.1) for fluoride, and dry/wet scrubber bleed line leakage in Passage No. 4 for sulfate.	Because the thick production building foundations are expected to remain in place and only two COPCs exceeded screening levels in soils samples collected at shallow depths, but concentrations were not exceeded in deeper soil, the production building foundations are not recommended for further evaluation in the FS.	**No**
2.4.10 Machine Shop and Cast House Foundation	• Fluoride, PAHs as TTEC, LMW, and HMW, and TPH-Dx associated with the Maintenance Area were detected at concentrations that exceed soil screening levels at 0.5 ft bgs, but not in deeper depths sampled. Selenium was detected in one sample at 6 ft bgs that exceeded the ecological wildlife screening level. • Fluoride and PAHs as TTEC associated with the Cast House were detected in shallow soil at concentrations that exceed the protection of groundwater screening level. PAH as HMW, zinc, and TPH-Dx were detected in shallow soil at concentrations that exceed the ecological wildlife screening level. In all cases, these chemicals did not exceed site soil screening levels at deeper samples from the soil borings.	Based on the results of the initial RI investigation, the Machine Shop and Cast House building foundation is recommended for further evaluation in the FS.	**Yes**
2.4.11 Crushed Concrete Stockpiles	• Pre-RI analytical results for crushed concrete indicate that total cyanide, PAH as LMW, most metals analyzed, and TPH-Gx and TPH-Dx do not exceed soil screening levels. The maximum concentrations of fluoride, PAHs as TTEC and HMW, total PCBs, cadmium, and zinc exceed Plant Area AOC soil screening levels. Some COPCs, including sulfate, copper, nickel, and TPH were not analytes or were not analytes for all crushed concrete samples. Other stockpiles of mixed materials were not sampled except for limited sampling of the piles located to the west and east sides of SWMU 14.	Plant area redevelopment includes the intent to reuse the crushed concrete onsite if feasible. The four crushed concrete stockpiles are recommended for further evaluation in the FS to support potential reuse. There is no intent to reuse the other stockpiles based on mixed environmental and construction debris content. The other stockpiles are recommended for evaluation in the FS for potential removal and offsite disposal.	**Yes**
2.4.12 Pitch Building, Alumina Unloading, and Briquette Conveyor Sumps	• Results of the investigation of the Alumina Unloading and Pitch Building sump, vault, and pits structures indicate that site COPCs, including fluoride and PAH as TTEC, were detected at concentrations that exceed water screening levels only in the Alumina Unloading and Pitch Building sumps. No sediment was present in these structural features. The River Water Vault leakage flow rate will be evaluated in the Groundwater in the Uppermost Aquifer AOC, Volume 4, Section 2.	Based on the results of the investigation of the structural features only the Alumina Unloading and Pitch Building sumps are recommended for further evaluation in the FS.	**Yes**

Table 2.6-1
Rectifier Yard AOC and Plant Area AOC Major Findings and Recommendation Summary
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Areas of Concern (AOC)	Major RI Findings Summary	RI Recommendations	FS Evaluation ^{a} (Yes/No)
2.5 Water and Waste Systems			
2.5.1 Stormwater Collection System	• Sediment and water present in the Stormwater Collection System contain site COPCs at concentrations that exceed soil and water screening levels. The source of COPCs in Stormwater System sediment and water samples is likely the impacted surface soil that surrounds each catch basin in the enclosed courtyard areas. These detected compounds have the potential to migrate through the Stormwater Collection System and into the Stormwater Retention Pond where there is further potential for impact to shallow groundwater beneath the Stormwater Retention Pond. • Video survey results indicate that the Stormwater Collection System connects to the Groundwater Collection System at groundwater manholes MH4L5 and MH5L5, where stormwater commingles with collected groundwater before discharging to the Stormwater Retention Pond.	The Stormwater Collection System is recommended for further evaluation in the FS to address sediment contamination in catch basins and horizontal lines. The Stormwater Collection System may also act as a preferential pathway for contaminate transport.	**Yes**
2.5.2 Groundwater Collection System	• Water analytical results indicate that fluoride, PAHs as TTEC, and arsenic are present in groundwater line 2 at concentrations that exceed MTCA Method C water screening levels. The groundwater is discharged to the Stormwater Retention Pond where it has the potential to impact shallow groundwater beneath the pond and is discussed further in Groundwater in the Uppermost Aquifer AOC, Volume 4, Section 2. • Video survey observations indicate that a substantial flow of groundwater enters the groundwater line between manholes MHB and MH3L1 seasonally. The numerous seam breaches and visible accumulated soil observed in the 18-inch perforated CMP line between manholes MHB and MH3L1 could potentially be a source to shallow groundwater. • The out of service holding tank located beneath the groundwater pumping station in Courtyard Segment C2 appears to have been used during major storm events. Note that the 36-inch perforated CMP connected to manhole MHB at the base of the manhole is approximately 2 ft lower the 18-inch perforated CMP connecting to MH3L1. • Accumulated and potentially contaminated water in the groundwater line segment 5 may be leaking into the subsurface to impact shallow groundwater between manholes MH2L5, MH3L5 and MH4L5. This leakage from groundwater line 5 is located approximately 5 ft above a breach in the Scrubber Effluent System located between manholes MH15L4 and MH16L4, in Courtyard A4, where groundwater was observed flowing from the breach into the Scrubber Effluent System.	The Groundwater Collection System is recommended for further evaluation in the FS to investigate contaminated groundwater in the horizontal lines, and potential failed line integrity and leakage into the subsurface. The former groundwater pumping station in Courtyard Segment C2 should be evaluated to determine the volume of water remaining in the tank and possibly sampled for site COPCs. The Groundwater Collection System may also act as a preferential pathway for contaminate transport.	**Yes**
2.5.3 Industrial & Monitoring System and Industrial Sump	• The 36-inch concrete pipe between manhole MHA and the former Tertiary Treatment Plant, and likely the two former clarifiers, is crushed because of demolition activities and debris in the pipe blocks access for further video inspection. • South flowing water (observed in 2017), and evidence of past flow (observed in 2020), was visible in the horizontal line to north of manhole MHA. The source of the water is likely groundwater based on water levels measured in nearby well WPA-GW10 and temporary screened boring WPA-CCR-SB05. • Water flow in the vicinity of manhole MHA during the 2017 survey is visually estimated to be approximately 5 to 10 gallons per minute. This indicates that the portion of crushed line segment approximately 17 ft northeast of manhole MHA in the I&M System acts as a groundwater collection line. • A significant decrease in water flow at manhole MH1L1 during the 2020 survey indicates that the integrity of the line before this point allows flowing water to leak from the pipe. This apparent line damage and decrease in flow indicates potential discharge of water to the subsurface in this area. • Water was visually estimated to be flowing through manhole MH4L1 at approximately 1-2 gallons per minute in the southern portion of passage No. 3. Flow east through the Industrial & Monitoring line segments manholes in Courtyards A4 and A5, and southeast to the bypass discharge sample vault was visually estimated to be 1-2 gallons per minute. • The Industrial Sump is currently connected to manhole MH3L3 in Courtyard A4 (approximately 337 ft north) and this portion of the line is currently in use as the new NPDES Permit discharge bypass line. • Seasonal water entering the I&M system northeast of manhole MHA could potentially comingle at manhole MH3L3 when the stormwater retention pump is pumped through the Industrial Sump and/or at the sample vault along the roadway by NPDES Pond B. • The Industrial & Monitoring System wastewater discharge outfall previously daylighted at the head of the NPDES pond A prior to the construction of the bypass line in approximately 2010. • Sediment present in manholes and the Industrial Sump contain elevated concentrations of several site COPCs that exceed Plant Area AOC soil screening levels.	The Industrial & Monitoring System is recommended for further evaluation in the FS to address contaminated sediment in manholes, contaminated sediment in the Industrial Sump, and seasonal water entering the system north of manhole MHA. The Industrial & Monitoring System may also act as a preferential pathway for contaminate transport.	**Yes**

Table 2.6-1
Rectifier Yard AOC and Plant Area AOC Major Findings and Recommendation Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
(Page 6 of 6)

Areas of Concern (AOC)	Major RI Findings Summary	RI Recommendations	FS Evaluation [a] (Yes/No)
2.5.4 Scrubber Effluent System and Pond A Discharge	• Sediment analytical results indicate that detected concentrations of fluoride, PAHs as TTEC and total LMW PAH and total HMW PAH, total PCBs, and TPH-Dx as diesel and residual range organics, exceeds one or more soil screening levels in SE System manholes sampled. While some accessible manholes were cleaned in 2010, demolition activities that continued after manhole cleaning may have reintroduced surface contamination into the SE System. • Water analytical results for two sampled manholes indicate that detected concentrations of fluoride, sulfate, PAHs at TTEC and benzo(a)pyrene, metals (arsenic and lead), exceed one or more water screening levels. Water analytical results for SE System outfall discharge water indicates that fluoride is the only site COPC detected at concentrations that exceed water screening levels present in water that flows from the outfall into NPDES Pond A. • One sample and a duplicate of encrustation material that partially blocks the SE lines between MH16L4 and MH18L4 was collected to determine the general composition of the solids and whether it may be a potential source of leachable fluoride. Analytical results indicate that the solids contain fluoride and three metals (arsenic, cadmium, and nickel) at concentrations that exceed the protection of groundwater soil screening level. Other analyses indicate that the solids appear to be primarily a calcium/iron precipitate. SPLP test on the encrustation solids indicate that the test leachate contained fluoride at concentrations of 25.8 and 28.2 mg/L. SE System outfall discharge water contains fluoride concentrations of 5.2 to 8.93 mg/L. • An observed significant lateral breach in the wood staves is located at approximately 150 ft. into the horizontal line between SE manholes MH15L4 and MH16L4, at approximately 470 ft elevation. Groundwater was observed flowing into the line at an estimated 0.5 gallons per minute. • A substantial amount of water is backed up in the horizontal wooden line segment west of SE manhole MH17L4, which is blocked by the buildup of encrustation material filling over 80% of the pipe cross sectional areal. • Water flow was observed at manhole MH17L4 after some of the encrustation materials were removed from the lateral line segment to the west, but no water inflow was observed through manhole MH18L4 or at the system outfall at the head of NPDES Pond A. A breach is suspected in the horizontal line segment downstream from MH18L4 where the 1981 21-inch reinforced concrete pipe extension to Pond A joins the original SE System allowing flow to leak from the line into the subsurface. • When the Stormwater Retention Pond is nearing capacity, the stored water backs up into Groundwater Line 5 to a point upstream from MH3L5 and upstream from where the line integrity appears to have been compromised, and leakage may occur into the subsurface (Figure 2.5.2-5). This area of backed up stored water is above the locations in SE Line 4 where the large lateral breach with inflow of groundwater is located (Figure 2.5.4-10). • The 24-inch concrete I&M line (invert at 7 to 8 ft bgs) crosses over the 24-inch wooden SE line segment (invert at approximately 12 ft bgs) in courtyard A4, at 60 to 70 ft east of SE manhole MH13L4. The large diameter Industrial & Monitoring line is within 4 ft to 5 ft in depth above the SE line and may have contributed to the downward bend in the SE line segment where standing water was observed in the downward bend. Very large demolition equipment operating in this area may also have contributed to the apparent bend in the SE line. • MH1L3 had wooden horizontal lateral connectors to the east, south, and west, but only an 8-inch PVC pipe connecting to the north. This appears to be the northern extend of the SE System in Passage No. 3.	Based on the results of the video surveys, soil boring program in the plant footprint, and groundwater investigation in the shallow groundwater in Courtyard A, the source of water discharging at the SE System outfall appears to be groundwater entering the SE System in Line 4 through one significant breach from broken wooden staves in the line. The SE Line System is recommended for further evaluation in the FS to address encrustation in the horizontal lines, the lateral breach in Line 4, the water flowing at the head of NPDES Pond A, and the potential for the wooden pipe material to act as a source of contamination to groundwater. The Scrubber Effluent System may also act as a preferential pathway for contaminate transport.	**Yes**
2.5.5 Sanitary Sewer System	• No sediment was present in the Sewage Treatment Plant Sump and therefore it was not sampled.	The Sanitary Sewer Collection System is not recommended for further evaluation in the FS.	**No**

Notes:

a The application of industrial soil cleanup levels for the site is appropriate based on future land use considerations as discussed in Volume 1, Section 5 of this report. Although no further action is recommended for portions of AOCs, the application of MTCA Method C for site cleanup requires consideration of appropriate institutional controls to be implemented in accordance with the Washington Administrative Code (WAC) 173-340-440. The FS will include evaluation of institutional controls where no further remedial action is recommended.

BPA – Bonneville Power Administration
COPC – Chemicals of Potential Concern
cPAH/PAH – carcinogenic Polynuclear Aromatic Hydrocarbons
ft bgs – feet below ground surface
FS – Feasibility Study
GWAOC – Groundwater Area of Concern
HMW – High molecular weight PAH
LMW – Low molecular weight PAH
MCL –Maximum Contaminant Level for drinking water
mg/kg – Milligrams per kilogram
mg/L – Milligrams per liter
MTCA – Model Toxics Control Act
NPDES – National Pollutant Discharge Elimination System
PCB – Polychlorinated Biphenyls
RYAOC – Rectifier Yard Area of Concern
SE – Scrubber Effluent Line
SWMU – Solid Waste Management Unit
TPH-Dx – Total Petroleum Hydrocarbon, Diesel
TTEC – Total Toxicity Equivalent Concentration
µg/L – Micrograms per liter
UST – Underground storage tank
WA MCL – Washington Maximum Contaminant Level for drinking water
WPA – Work Plan Addendum