HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD – COVER SHEET

Name of Site: Bradford Island

EPA ID No.: ORSFN1002228

Contact Persons

Site Investigation: URS, *Upland and River Operable Units, Remedial Investigation Report, Bradford Island, Cascade Locks, Oregon,* prepared for the U.S. Army Corps of Engineers, June 2012

Documentation Record: Ken Marcy, National Priorities List Coordinator
U.S. Environmental Protection Agency, Region 10
Portland, Oregon

Linda Ader, Project Manager
Ecology and Environment, Inc., Member of WSP
Seattle, Washington

Pathways, Components, or Threats Not Scored

The ground water migration pathway, ground water-to-surface water component and drinking water threat component of the surface water migration pathway, soil exposure and subsurface intrusion pathway, and air migration pathway were not scored as part of this Hazard Ranking System (HRS) Documentation Record. These pathways/components were not included because a release to these media does not significantly affect the overall site score and because the overland flow/flood component of the surface water migration pathway produces an overall site score well above the minimum required for the site to qualify for inclusion on the National Priorities List. These pathways are of concern to the U.S. Environmental Protection Agency (EPA) and may be considered during future evaluations.

HRS DOCUMENTATION RECORD

Name of Site:	Bradford Island
Date Prepared:	September 2021
EPA Region:	10
Street Address of Site*:	Star Route (No street number is available)
City, County, State, Zip Code:	Cascade Locks, Multnomah, Oregon, 97014
General Location in the State:	Northwestern Oregon
Topographic Map:	Bonneville Dam, OR-WA 2017 (Ref. 3).
Latitude:	45° 38’ 32.44” North
Longitude:	-121° 56’ 08.80” West
Ref.:	Ref. 3 as determined near the center of the Landfill AOPC (source 1); See Figure 5 of this HRS documentation record

** The street address, coordinates, and contaminant locations presented in this HRS documentation record identify the general area where the site is located. They represent one or more locations EPA considers to be part of the site based on the screening information EPA used to evaluate the site for NPL listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, not precisely delineated boundaries. A site is defined as where a hazardous substance has been "deposited, stored, disposed, or placed, or has otherwise come to be located." Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under CERCLA. Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.*

Scores

Ground Water[1] Pathway	NS
Surface Water Pathway	100.00
Soil Exposure and Subsurface Intrusion Pathway	NS
Air Pathway	NS
HRS SITE SCORE	**50.00**

NS = Not Scored

1 - “Ground water” and “groundwater” are synonymous; the spelling is different due to “ground water” being codified as part of the HRS, while “groundwater” is the modern spelling.

WORKSHEET FOR COMPUTING HRS SITE SCORE

		S	S^2
1.	Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	NS	NS
2a.	Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	100	10,000
2b.	Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	NS	NS
2c.	Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	100	10,000
3a.	Soil Exposure Component Score (S_{se}) (from Table 5-1, line 22)	NS	NS
3b.	Subsurface Intrusion Component Score (S_{ssi}) (from Table 5-11, line 12)	NS	NS
3c.	Soil Exposure and Subsurface Intrusion Pathway Score (S_{sessi}) (from Table 5-11, line 13)	NS	NS
4.	Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	NS	NS
5.	Total of $S_{gw}^2 + S_{sw}^2 + S_{sessi}^2 + S_a^2$	100	10,000
6.	**HRS Site Score** Divide the value on line 5 by 4 and take the square root	**50.00**	

NS = Not Scored

HRS TABLE 4-1 -Surface Water Overland/Flood Migration Component Scoresheet

Factor categories and factors	Maximum Value	Value Assigned	
Drinking Water Threat			
Likelihood of Release:			
1. Observed Release	550	550	
2. Potential to Release by Overland Flow:			
2a. Containment	10		
2b. Runoff	25		
2c. Distance to Surface Water	25		
2d. Potential to Release by Overland Flow [lines 2a x (2b + 2c)]	500		
3.Potential to Release by Flood:			
3a. Containment (Flood)	10		
3b. Flood Frequency	50		
3c. Potential to Release by Flood (lines 3a x 3b)	500		
4. Potential to Release (lines 2d + 3c, subject to a maximum of 500)	500		
5. Likelihood of Release (higher of lines 1 and 4)	550		550
Waste Characteristics:			
6. Toxicity/Persistence	(a)		
7. Hazardous Waste Quantity	(a)		
8. Waste Characteristics	100		NS
Targets:			
9. Nearest Intake	50		
10. Population:			
10a. Level I Concentrations	(b)		
10b. Level II Concentrations	(b)		
10c. Potential Contamination	(b)		
10d. Population (lines 10a + 10b + 10c)	(b)		
11. Resources	5		
12. Targets (lines 9 + 10d + 11)	(b)		NS
Drinking Water Threat Score:			
13. Drinking Water Threat Score [(lines 5 x 8 x 12)/82,500, subject to a max of 100]	100		NS
Factor categories and factors	Maximum Value	Value Assigned	
Human Food Chain Threat			
Likelihood of Release:			
14. Likelihood of Release (same value as line 5)	550		550
Waste Characteristics:			
15. Toxicity/Persistence/Bioaccumulation	(a)	5×10^8	
16. Hazardous Waste Quantity	(a)	100	
17. Waste Characteristics	1,000		320
Targets:			
18. Food Chain Individual	50	50	
19. Population			
19a. Level I Concentrations	(b)	0.3	
19b. Level II Concentrations	(b)	NS	
19c. Potential Human Food Chain Contamination	(b)	0.000031	
19d. Population (lines 19a + 19b + 19c)	(b)	0.300031	
20. Targets (lines 18 + 19d)	(b)		50.300031

Human Food Chain Threat Score:				
	21. Human Food Chain Threat Score [(lines 14 x 17 x 20)/82,500, subject to max of 100]	100		100
Factor categories and factors		Maximum Value	Value Assigned	
Environmental Threat				
Likelihood of Release:				
	22. Likelihood of Release (same value as line 5)	550		550
Waste Characteristics:				
	23. Ecosystem Toxicity/Persistence/Bioaccumulation	(a)	5×10^8	
	24. Hazardous Waste Quantity	(a)	100	
	25. Waste Characteristics	1,000		320
Targets:				
	26. Sensitive Environments			
	26a. Level I Concentrations	(b)	NS	
	26b. Level II Concentrations	(b)	475	
	26c. Potential Contamination	(b)	NS	
	26d. Sensitive Environments (lines 26a + 26b + 26c)	(b)	475	
	27. Targets (value from line 26d)	(b)		475
Environmental Threat Score:				
	28. Environmental Threat Score [(lines 22 x 25 x 27)/82,500, subject to a max of 60]	60		60
	29. Watershed Score[c] (lines 13 + 21 + 28, subject to a maximum of 100)	100		100
	30. Component Score (S_{of})[c] (highest score from line 29 for all watersheds evaluated, subject to a maximum of 100)	100		100

[a] Maximum value applies to waste characteristics category.
[b] Maximum value not applicable.
[c] Do not round to nearest integer.

NS = Not Scored

REFERENCES

Reference Number	Description of the Reference
1.	U.S. Environmental Protection Agency (EPA). Hazard Ranking System, Title 40 Code of Federal Regulations (CFR) Part 300, Appendix A (55 Federal Register [FR] 51583, Dec. 14, 1990, as amended at 82 FR 2779, Jan. 9, 2017; 83 FR 38037, Aug. 3, 2018), as published in the Code of Federal Regulations on July 1, 2019, with two attachments. Attachment A: Federal Register Vol. 55, No. 241. December 14, 1990. Hazard Ranking System Preamble. Attachment B: Federal Register Vol. 82, No. 5, January 9, 2017. Addition of a Subsurface Intrusion Component to the Hazard Ranking System Preamble. Available at https://semspub.epa.gov/src/document/HQ/100002489. 197 pages.
2.	U.S. Environmental Protection Agency, Data Extracted on July 1, 2021, Superfund Chemical Data Matrix (SCDM) query, available online at https://www.epa.gov/superfund/superfund-chemical-data-matrix-scdm , 48 pages.
3.	U.S. Geological Survey (USGS), 2017, 7.5-minute series topographic map, Bonneville Dam Quadrangle, OR-WA, modified by Ecology and Environment, Inc., a member of WSP, 1 page.
4.	URS, June 2012, *Bradford Island, Cascade Locks, Oregon, Upland and River Operable Units, Remedial Investigation Report*, prepared for United States Army Corps of Engineers, Portland District, 140,365 pages.
5.	United States Environmental Protection Agency, November 1996, *Using Qualified Data to Document an Observed Release and Observed Contamination*, EPA 540-F-94-028, 18 pages.
6.	URS, October 2002, *Final Technical Memorandum, In-Water Removal Work, Bradford Island Landfill, Cascade Locks, Oregon*, prepared for the U.S. Army Corps of Engineers, 100 pages.
7	URS, April 2016, *Final Report, Baseline Human Health and Ecological Risk Assessment, River Operable Unit, Bradford Island, Cascade Locks, Oregon*, prepared for the U.S. Army Corps of Engineers, Portland District, 374 pages.
8	Western Regional Climatic Center, February 2020, Cascade Locks, OR, Total Precipitation (Inches) (351407), webpage https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?or1407, 4 pages.
9	USGS, webpage https://waterdata.usgs.gov/nwis/nwismap/?site_no=14128870&agency_cd=USGS accessed January 22, 2020, USGS 14128870 Columbia River Below Bonneville Dam, OR, Site Map, 3 pages.
10	USGS, webpage https://waterdata.usgs.gov/nwis/nwismap/?site_no=14105700&agency_cd=USGS accessed January 22, 2020, USGS 14105700 Columbia River at The Dalles, OR, Site Map, 3 pages.
11	USGS, webpage https://waterdata.usgs.gov/nwis/nwismap/?site_no=14144700&agency_cd=USGS accessed January 22, 2020, USGS 14144700 Columbia River at Vancouver, WA, Site Map, 3 pages.

REFERENCES

Reference Number	Description of the Reference
12	USGS, webpage https://waterdata.usgs.gov/nwis/annual/?referred_module=sw&site_no=14105700&por_14105700_113459=546282,00060,113459,1878,2019&start_dt=2018&end_dt=2018&year_type=W&format=html_table&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=parameter_selection_list accessed January 22, 2020, USGS 14105700 Columbia River at The Dalles, OR, Time-Series: Annual Statistics, 2 pages.
13	USGS, webpage https://waterdata.usgs.gov/nwis/annual/?referred_module=sw&site_no=14144700&por_14144700_113609=546390,00060,113609,1964,2020&start_dt=2018&end_dt=2018&year_type=W&format=html_table&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=parameter_selection_list accessed January 22, 2020, USGS 14144700 Columbia River at Vancouver, WA, Time-Series: Annual Statistics, 2 pages.
14.	URS, December 2004, *Draft Post-Removal Sediment Investigation, Stage 2 Data Report, Bonneville Dam Forebay, Cascade Locks, Oregon*, prepared for the U.S. Army Corps of Engineers, Portland District, 355 pages.
15.	Weymann, David and Heather Patterson, February 14, 2013, Senior Project Manager and Risk Assessor, URS Corporation, letter to Mike Gross, U.S. Army Corps of Engineers, Portland District, regarding FINAL Analytical Results for Sediment, Clams and Bass collected from Forebay September/October 2011 and Bass collected from Reference Area August 2011, Bradford Island Pre-Feasibility Study, Bonneville Dam Forebay, Cascade Locks, Oregon, Contract No W9128F-04-D-0001, Task Order No. DT-02, with attached Figures, Tables, Final Quality Control Summary Report for Analytical Chemistry and Field Reports and Field Data Sheets, 88 pages.
16.	Huang & Associates, Inc., December 2007, *Project Closeout Report, Bradford Island Contaminated Sediment Removal, Bonneville Dam, Cascade, Oregon*, submitted to U.S. Army Corps of Engineers – Portland District, 150 pages.
17.	Ward, Paul, Yakama Nation Fisheries, Manager, March 10, 2020, letter to US Environmental Protection Agency, R10, c/o Ken Marcy, National Priorities List Coordinator, regarding Bradford Island – Yakama Use, Treaty Rights, and Health Concerns, 9 pages.
18.	Oregon Health Authority and Washington State Department of Health, September 2013, *Fish Consumption Advisory, Middle Columbia River, Fact Sheet September 2013*, 2 pages.
19.	Oregon Department of Fish and Wildlife, Generated October 30, 2019, 2018 Sport Fishing Catch – *Spring Chinook*, 8 pages.
20.	Oregon Department of Fish and Wildlife, Generated October 30, 2019, 2018 Sport Fishing Catch – *Fall Chinook*, 8 pages.

REFERENCES

Reference Number	Description of the Reference
21.	Oregon Department of Fish and Wildlife, Generated October 30, 2019, 2018 Sport Fishing Catch – *Summer Steelhead*, 8 pages.
22.	Oregon Department of Fish and Wildlife, Generated October 30, 2019, 2018 Sport Fishing Catch – *Winter Steelhead*, 8 pages.
23.	Oregon Department of Fish and Wildlife, Generated October 30, 2019, 2018 Sport Fishing Catch – *Coho*, 9 pages.
24.	Ecology and Environment, Inc., a member of WSP, February 26, 2020, Columbia River from Bonneville Dam to I-5 Bridge, 1 page.
25.	Wydoski, Richard S. and Whitney, Richard R, 2003, American Fisheries Society, *Inland Fishes of Washington*, 21 pages excerpted.
26.	Kraig, Eric and Tracey Scalici, September 2019, State of Washington, *Washington State Sport Catch Report 2017*, 83 pages.
27.	Ecology and Environment, Inc., a member of WSP, February 26, 2020, Columbia River from Bonneville Dam to an Imaginary Line drawn between Tongue Point, Oregon to Rocky Point, Washington, 1 page.
28.	Washington State Department of Fish and Wildlife, last updated on February 14, 2020, *Washington Sport Fishing Rules, Effective July 1, 2019 – June 30, 2020 (including Sport Fishing Rules Pamphlet Corrections and Updates/Clarifications)*, 140 pages.
29.	U.S. Environmental Protection Agency, Data extracted on July, 1 2021, Superfund Chemical Data Matrix (SCDM), Bis(2-ethyhexyl)phthalate and Polychlorinated biphenyls (PCBs), 3 pages. A complete copy of SCDM is available at https://www.epa.gov/superfund/superfund-chemical-data-matrix-scdm.
30.	White, Kathryn, Fisheries Biologist, Ecology and Environment, Inc., Member of WSP, November 12, 2020 memorandum with attached figures and references, to Linda Ader, START-IV Team Leader, Ecology and Environment, Inc., Member of WSP, regarding Bradford Island Landfill Sensitive Environments, Cascade Locks, Oregon, 66 pages.
31.	Electronic Code of Federal Regulations, March 20, 2020, *Critical habitat for 15 District Populations Segments (DPSs) of salmon and steelhead (Oncorhynchus spp.) in Washington, Oregon and Idaho*, Title 50 (Wildlife and Fisheries), Chapter II, Subchapter C, Part 226 (Designated Critical Habitat), 303 pages.
32.	U.S. Geological Survey, November 4, 2020, https://nas.er.usgs.gov/viewer/omap.aspx?SpeciesID=92 accessed on November 4, 2020, NAS – Nonindigenous Aquatic Species, *Corbicula fluminea*, Asian Clam, Mollusks-Bivalves, Exotic, 1 page.

REFERENCES

Reference Number	Description of the Reference
33.	U.S. Environmental Protection Agency, January 28, 2020 and May 2020, https://www.epa.gov/risk/regional-screening-levels-rsls, accessed November 9, 2020, Regional Screening Levels (RSLs), 15 pages.
34.	Northwest Regional Sediment Evaluation Team Agencies: U.S. Army Corps of Engineers (Northwestern Division and Portland, Seattle, and Walla Walla Districts); U.S. Environmental Protection Agency, Region 10; NOAA Fisheries, West Coast Region; U.S. Fish and Wildlife Service, Pacific Region; Oregon Department of Environmental Quality; Idaho Department of Environmental Quality; Washington Department of Ecology; and Washington Department of Natural Resources, May 2018, *Sediment Evaluation Framework for the Pacific Northwest*, 278 pages.
35.	Washington Department of Ecology, December 2019, Sediment Cleanup User's Manual (SCUM), Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC, 601 pages.
36.	U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, August 2005, *Toxicological Profile for Tin and Tin Compounds*, 426 pages.
37.	Woodke, Mark, START-IV Chemist, WSP USA, Inc., November 17, 2020, Memorandum to Linda Ader, START-IV Team Leader, WSP USA, Inc. regarding Data Bias Assignments, USACE Bradford Island, Cascade Locks, Oregon, 12 pages.
38.	Department of the Interior, Fish and Wildlife Service, October 6, 2004, 50 CFR Part 17, *Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Klamath River and Columbia River Populations of Bull Trout; Final Rule*, Federal Register, Volume 69, No. 193, pp. 59996-60076, 82 pages.
39.	Department of the Interior, Fish and Wildlife Service, October 18, 2010, 50 CFR Part 17, *Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for Bull Trout in the Coterminous United States; Final Rule*, Federal Register, Volume 75, No. 200. Available online at: https://www.govinfo.gov/content/pkg/FR-2010-10-18/pdf/2010-25028.pdf. 6 pages, excerpt.

BRADFORD ISLAND SITE SUMMARY:

The Bradford Island site is located within the Bonneville Dam complex on Bradford Island within the Columbia River at river mile (RM) 146.1, approximately 40 miles east of Portland, Oregon (Ref. 3; Ref. 4, p. 20) (see Figure 1 of this HRS Documentation Record). This complex is a multipurpose facility that consists of the First and Second Powerhouses, the Old and New Navigation Locks, the Bonneville Dam and Spillway, and a fish hatchery (Ref. 4, pp. 20 and 46) (see Figure 2 of this HRS Documentation Record). The United States Army Corp of Engineers (USACE) operates and maintains the Bonneville Lock and Dam for hydropower, fish and wildlife protection, recreation, and navigation (Ref. 4, p. 46). Numerous environmental investigations have been performed by the USACE and their contractors since 1997, focusing on two operable units (OUs): the Upland OU and the River OU (Ref. 4, p. 20) (see Figure 3 of this HRS Documentation Record). The Upland OU includes four areas of potential concern (AOPCs): the Landfill AOPC, Sandblast Area AOPC, Pistol Range AOPC, and Bulb Slope AOPC (see Figure 4 of this HRS Documentation Record); while the River OU consists only of portions of the Columbia River within the Bonneville Dam Forebay (see Figure 3 of this HRS Documentation Record). The sources scored in this HRS Documentation Record include the Landfill AOPC (Source 1), the Spent Sandblast Grit Disposal Area (Source 2) and the Equipment Laydown Area (Source 3) within the Sandblast Area AOPC, the Bulb Slope AOPC (Source 4), and the River OU Former Debris Piles (Source 5).

The Landfill AOPC, Source 1, is a former waste disposal area at the tip of Bradford Island that was used from the early 1940s until the early 1980s (Ref. 4, p. 20). Waste disposed of in the landfill included household waste, project-related wastes (grease, light bulbs, sandblast grit), electrical debris, ballasts, broken glass, rubber tires, metal debris, wood debris, metal cables, asbestos containing building materials, burned debris, ceramic insulators, and mercury vapor lamps (Ref. 4, p. 20).

The Spent Sandblast Grit Disposal Area, Source 2, is where spent sandblast grit was disposed in the area immediately east of the former sandblast building for an unknown period prior to 1994; resulting in the release of metals and butyltins into the soil (Ref. 4, p. 20).

The Equipment Laydown Area, Source 3, is where industrial equipment and materials are stored along the northern and southern portions of the Landfill access road (Ref. 4, p. 21). Soils in this area have become contaminated (Ref. 4, p. 21).

The Bulb Slope AOPC, Source 4, consists of a fan-shaped accumulation of glass and electrical light bulb debris that extends across a steep slope between the Columbia River and the Landfill access road (Ref. 20, p. 21).

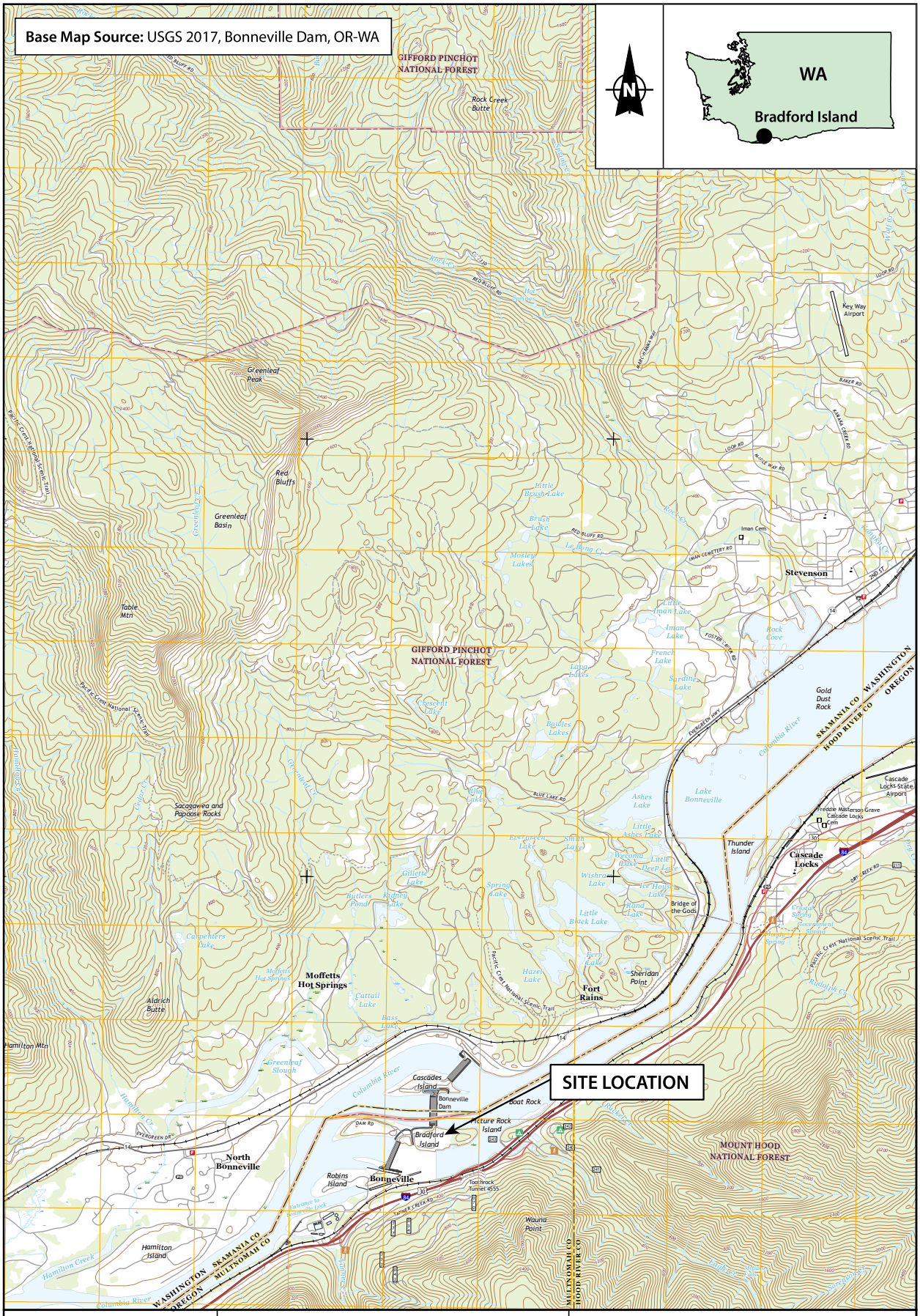
The River OU Former Debris Piles, Source 5, consists of the former location of numerous pieces of electrical equipment and other solid waste that were discovered in the Columbia River adjacent to the Landfill AOPC (Ref. 4, p. 29). The electrical equipment debris included polychlorinated biphenyls (PCB)-containing light ballasts, lightning arresters, and electrical capacitors (Ref. 6, pp. 3 and 16 [Table 4-1]). The electrical debris contaminated the surrounding sediment with PCBs, polycyclic aromatic hydrocarbons (PAHs), and metals (Ref. 4, p. 53; Ref. 6, pp. 3 and 15 [Table 5-2]). Removal of equipment and debris from the Columbia River took place in December 2000 and in February and March 2002 (Ref. 6, pp. 3 and 11).

In June 2012, a Remedial Investigation (RI) of the upland and River OUs was completed on behalf of the USACE (Ref. 4, p. 1). The RI report documents the investigation activities that have taken place over the past 10 years since the report was written (i.e., approximately the period from 2002 to 2012) (Ref. 4, p. 20); including new sampling work conducted during the RI in 2007 and 2009 to fill identified data gaps (Ref. 4, p. 72). Analytical results contained within the RI indicate the presence of hazardous substances in Sources

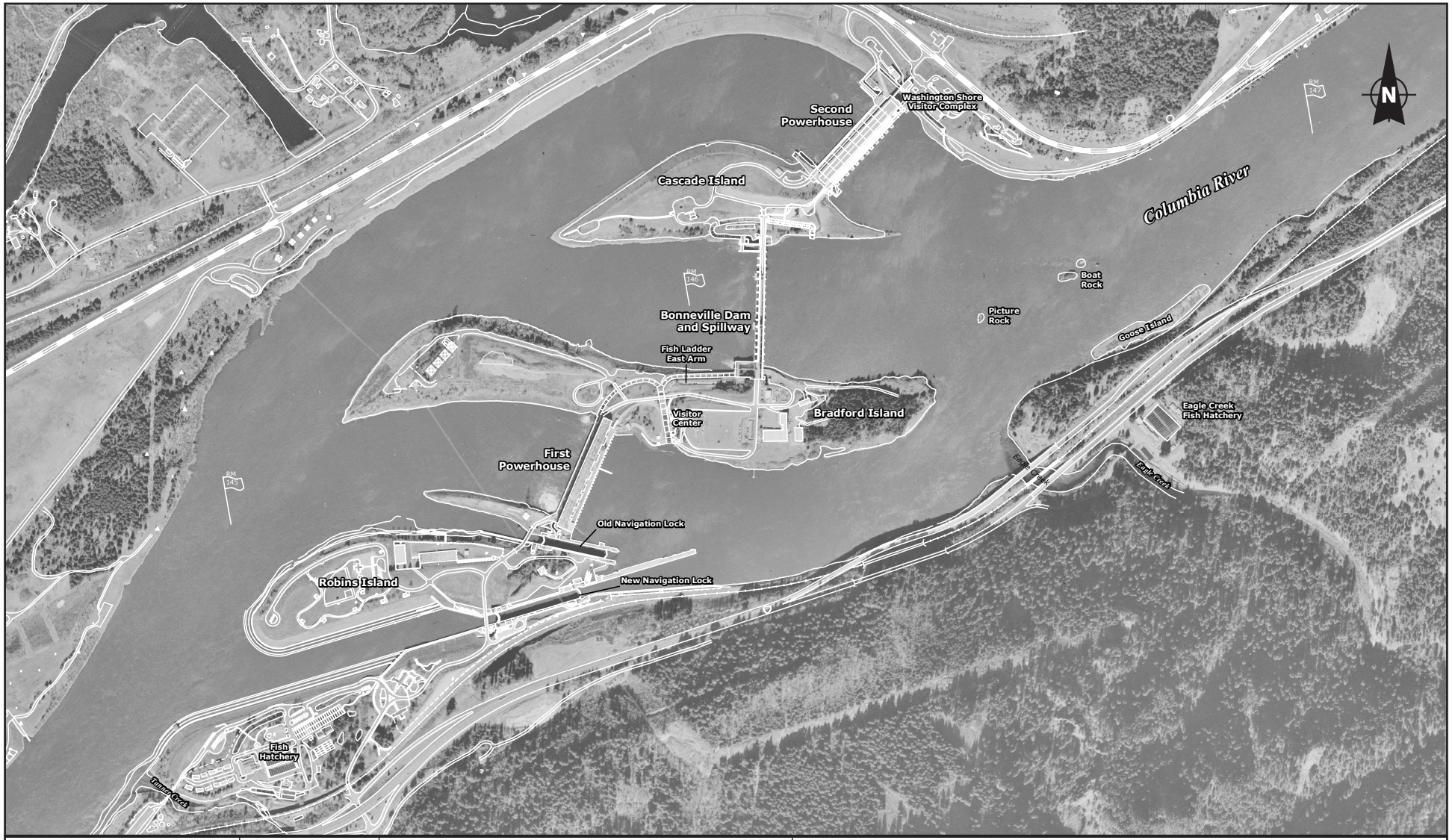
1, 2, 3, and 4 including butyltins, herbicides, metals, PCBs, pesticides, semi volatile organic compounds (SVOCs), and volatile organic compounds (VOCs); while other analytical results obtained during the electrical equipment removal action document the presence of PCBs in Source 5 (see Section 2.2.2, Source Characterization, Tables 1 through 11 of this HRS Documentation Record).

Figure 6 of this HRS Documentation Record depicts the surface water migration pathway 15-mile target distance limit (TDL). In 2011, sediment, clam (*Corbicula fluminea;* also known as Asian clam) tissue, and smallmouth bass (*Micropterus dolomieu*) tissue samples were collected from the Bonneville Dam Forebay Area (Ref. 15, pp. 1, 80 through 86; Ref. 32, p. 1). Analytical results indicate the presence of Aroclor-1254 at elevated concentrations in sediment samples collected from the Forebay Area with respect to background concentrations and the presence of Aroclor-1254 at elevated concentrations in the clam and smallmouth bass tissue samples collected from the dam Forebay Area with respect to background concentrations (see Section 4.1.2.1.1, Observed Release, Chemical Analysis, of this HRS Documentation Record for reference citations). A Zone of Actual Contamination is present along the north shore of Bradford Island (see Section 4.1.2.1.1 and Figure 5 of this HRS Documentation Record).

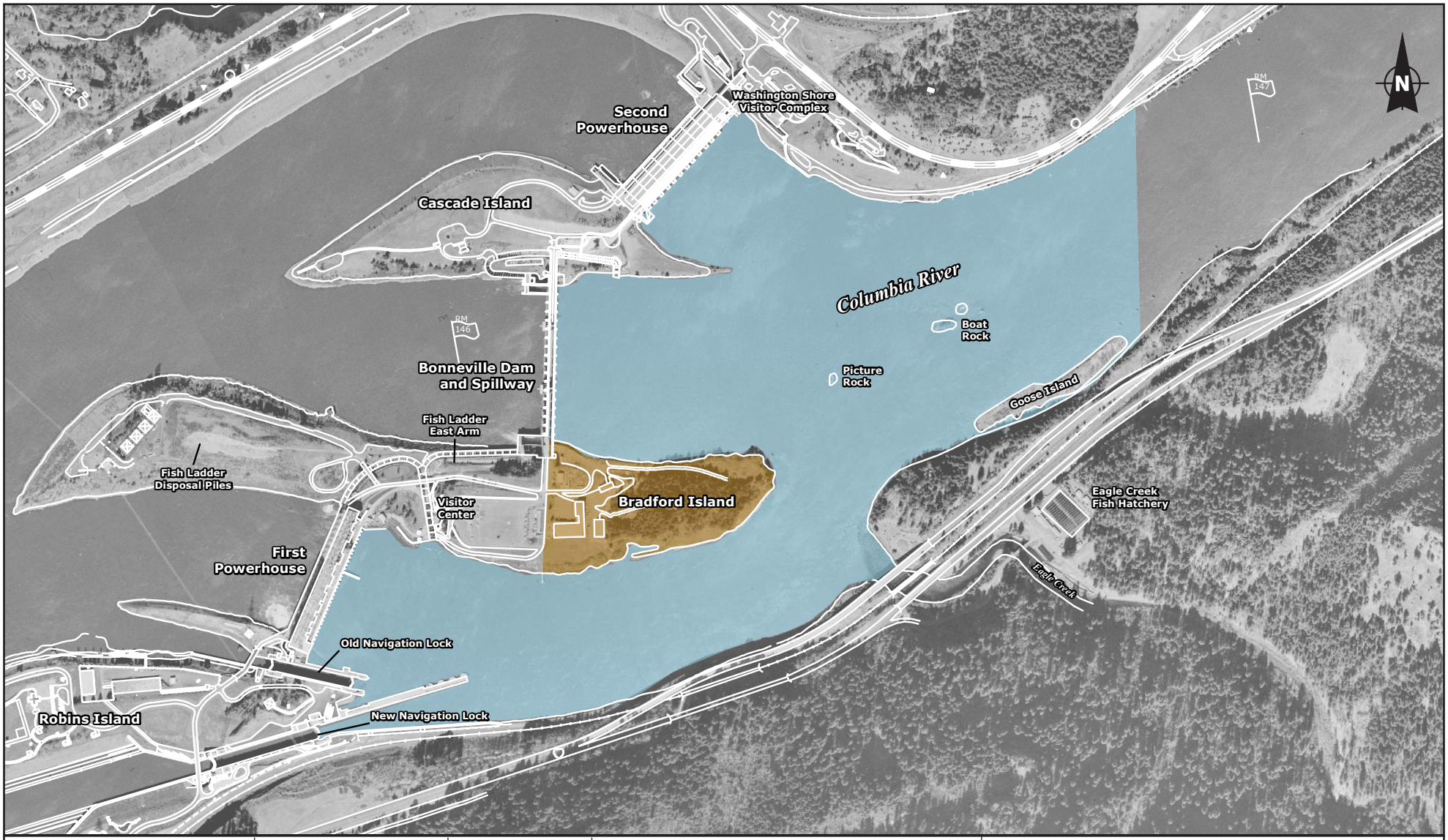
In relation to targets in the surface water migration pathway, it has been documented that a fishery, critical habitats for several fish species, and other threatened or endangered species are present within the Zone of Actual Contamination (see Section 4.1.4.3.1.2).



ecology and environment, inc. Member of WSP	BRADFORD ISLAND Cascade Locks, Oregon 0 .5 1 Approximate Scale in Miles	**Figure 1** **Vicinity Map**		
		Date: 2-4-20	Drawn by: AGM	1004530.F230.001.01\Fig1



ecology and environment, inc. Member of WSP	Source: Ref. 4, p. 295.	BRADFORD ISLAND Cascade Locks, Oregon	**Figure 2 Bonneville Dam Complex**		
		0 .25 .5 Approximate Scale in Miles	Date: 2-4-20	Drawn by: SB	1004530.F230.001.01\Fig2



ecology and environment, inc.
Member of WSP

Legend

- Upland OU
- River OU and Dam Forebay Area

Source: Ref 4, p. 296.

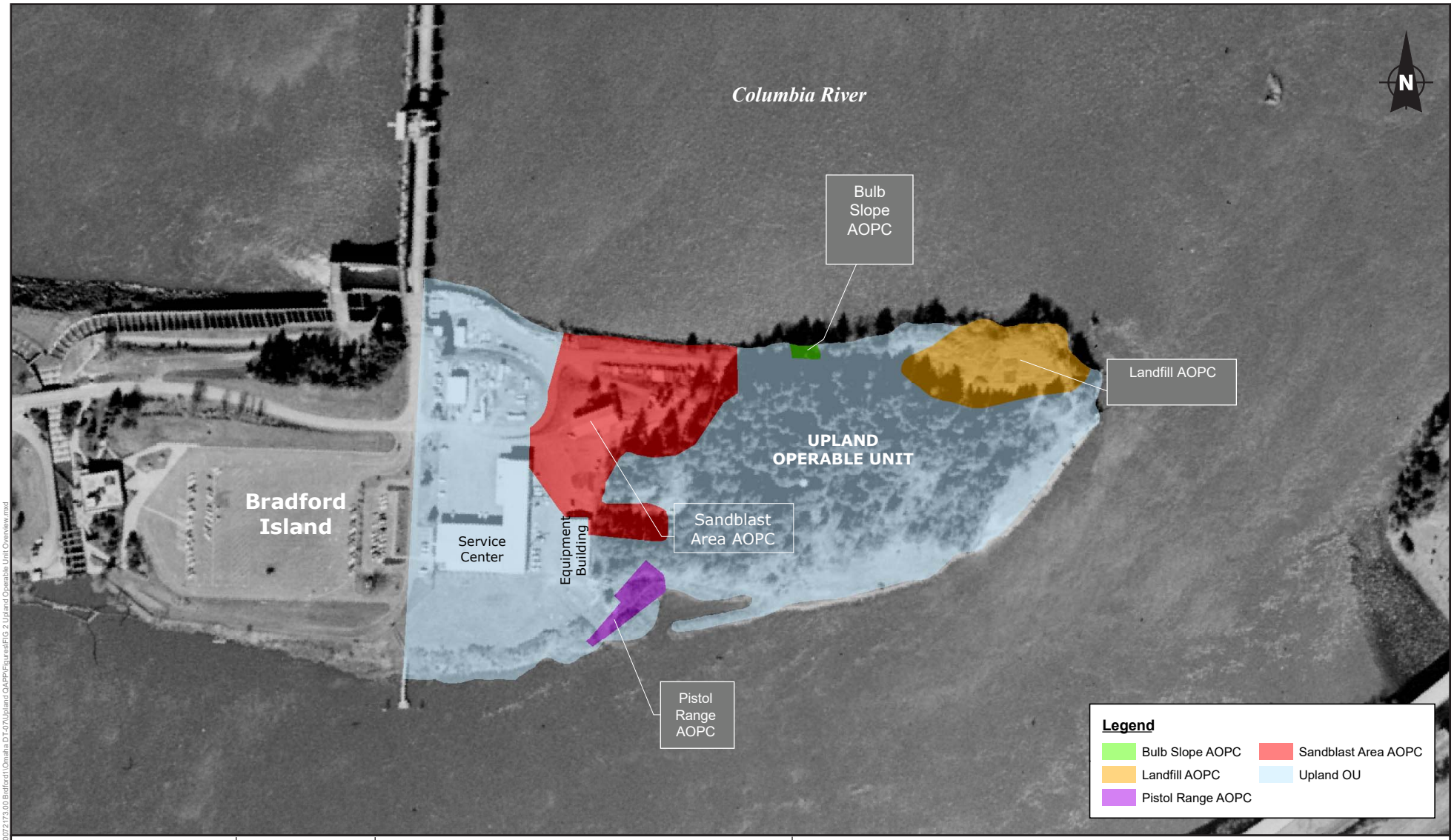
Note: Forebay Location in legend added by E&E from Ref. 4. p. 310 [Figure 6-1].

BRADFORD ISLAND
Cascade Locks, Oregon

0 .2 .4
Approximate Scale in Miles

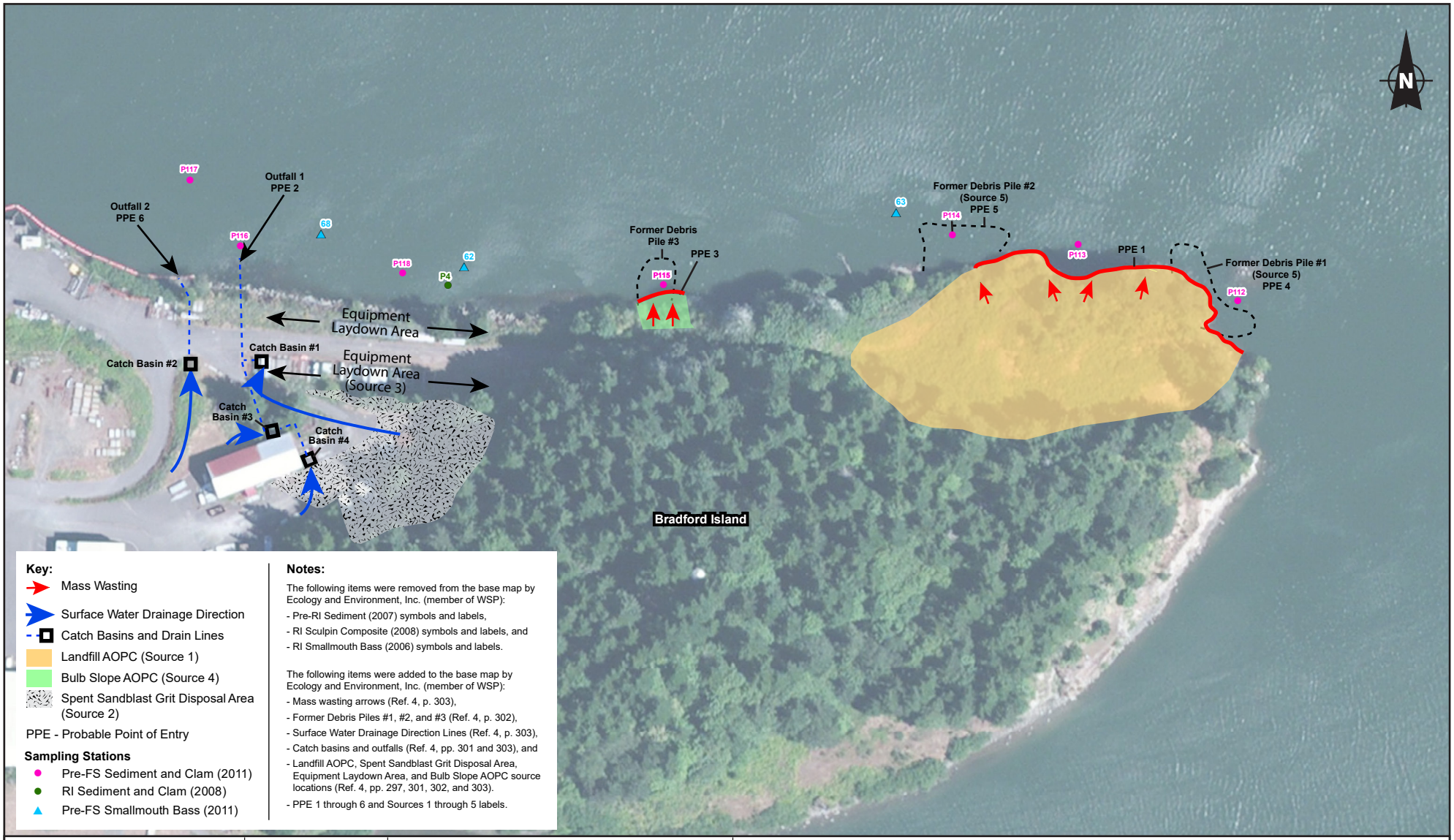
Figure 3
Location of Operable Units

Date:	Drawn by:	
2-4-20	SB	1004530.F230.001.01\Fig3



0072173.00 Bidford\Omaha DT-07\Upland OAPP\Figures\FIG 2 Upland Operable Unit Overview.mxd

ecology and environment, inc. Member of WSP	Source: Ref 4, p. 297.	BRADFORD ISLAND Cascade Locks, Oregon	**Figure 4 Upland Operable Unit Overview**		
		0 250 500 Approximate Scale in Feet	Date: 2-4-20	Drawn by: SB	1004530.F230.001.01\Fig4



ecology and environment, inc.
Member of WSP

Source:
Ref. 7, p. 212.

BRADFORD ISLAND
Cascade Locks, Oregon

0 125 250
Approximate Scale in Feet

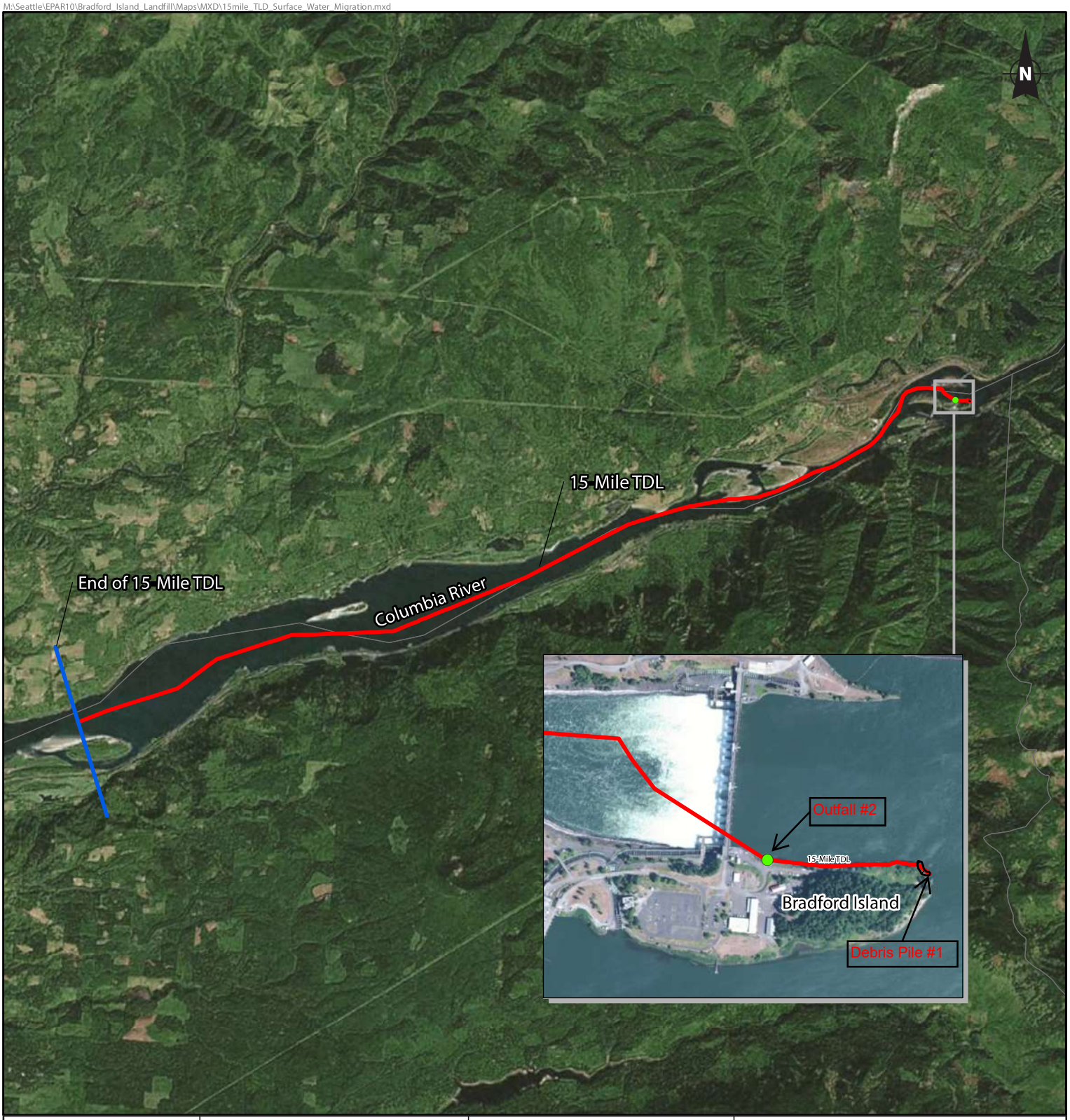
Figure 5
Contaminated Sediment and Tissue Sample Locations

Date:
2-7-20

Drawn by:
SB

1004530.F230.001.01\Fig5

M:\Seattle\EPAR10\Bradford_Island_Landfill\Maps\MXD\15mile_TLD_Surface_Water_Migration.mxd



ecology and environment, inc.
Member of WSP

KEY:

- Outfall #2 (Ref. 15, p.6)
- 15-Mile TDL
- End of 15-Mile TDL
- Debris Pile #1 (Ref. 15, p.6)
- **TDL** Target Distance Limit

BRADFORD ISLAND
Cascade Locks, Oregon

0 1 2
Miles

Figure 6
Surface Water Migration Pathway
15-Mile Target Distance Limit

Date:	Drawn by:	
2-4-20	AGM	1004530.F230.001.01\Fig6

Note: Feature labels, TDL-related lines, Outfall #2, and Debris Pile #1 added to basemap by Ecology and Environment, Inc., a member of WSP

SOURCE DESCRIPTION

2.2 SOURCE CHARACTERIZATION

Number of the Source: 1

Name and description of the source: Landfill AOPC (Landfill)

The Landfill AOPC is a former waste disposal site at the tip of Bradford Island that was used from the early 1940s until the early 1980s (Ref. 4, p. 20). Waste disposed of in the Landfill included: household waste, project-related wastes (grease, light bulbs, sandblast grit), electrical debris, up to 50 ballasts, broken glass, rubber tires, metal debris, wood debris, metal cables, asbestos-containing building materials, burned debris, ceramic insulators, and mercury vapor lamps (Ref. 4, p. 20). By 1982, the surface of the Landfill AOPC had been capped with soil, and another layer of soil was added in 1989 (Ref. 4, p. 20).

Historical investigations at the Landfill began in 1998 (Ref. 4, p. 48). In general, the investigations found that for approximately 40 years, the USACE managed, stored, and disposed of waste materials at the landfill in excavated pits or existing depressions on the eastern end of Bradford Island (Ref. 4, p, 48). Some additional wastes were disposed of over the northern and eastern edges of the island (Ref. 4, p. 48).

In 1998, a Site Inspection (SI) was conducted on the landfill to assess the potential for historical disposal practices to have adversely impacted the environment and to assess whether additional investigation or remediation was necessary (Ref. 4, p. 62). The SI report concluded that past disposal practices had impacted soil and groundwater in the Landfill with petroleum hydrocarbons, organochlorine pesticides, PCB Aroclor 1260, PCE, SVOCs, arsenic, and lead (Ref. 4, p. 62). A supplementary investigation of the Landfill was deemed necessary in order to evaluate potential remedial alternatives (Ref. 4, p. 62). Analytical results from the SI were not utilized in the RI Report for multiple reasons (i.e., sample reporting limits did not meet established data quality objectives, depth of soil samples were incompatible with target depths needed for risk evaluations, etc.) (Ref. 4, p. 62).

In 1999 and 2000, a Supplemental Site Inspection (SSI) of the Landfill AOPC was conducted by URS for the USACE (Ref. 4, p. 62). The purpose of the SSI was to augment information presented in the 1998 SI report, fill data gaps, conduct a risk evaluation, and provide a list of alternatives for the long-term management of the Landfill (Ref. 4, pp. 62 and 63). In addition to other work, the SSI included:

- Collection and analysis of 11 surface soil samples (i.e., BIL01SSI through BIL06SSI, BIL09SSI through BIL13SSI) from the Landfill AOPC,
- Installation of a groundwater monitoring well (i.e., MW-5) in September 1999,
- Collection and analysis of groundwater samples from the four monitoring wells (MW-1 through MW-4) in July 1999, and from five monitoring wells (MW-1 through MW-5) in November 1999 and January 2000 (Ref. 4, pp. 63 and 427) (see Ref. 4, p. 305 [Figure 5-1] for sample locations).

Based on comments received from the Oregon Department of Environmental Quality (ODEQ) regarding the conclusions made in the Draft SSI report, the USACE elected not to finalize the report (Ref. 4, p. 63). ODEQ and USACE agreed that additional investigation and analysis were necessary to address ODEQ comments on the SSI report (Ref. 4, p. 63). SSI surface soil samples (i.e., 0 to 0.5 feet below ground surface [bgs]) revealed the presence of PCBs (Aroclor 1260), metals (antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, thallium, and zinc), herbicides (2,4,5-T), pesticides (4,4'-DDE

and BHC [beta]), VOCs (PCE and toluene), and SVOCs (acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene) (Ref. 4, pp. 427 through 432 [Table 5-1a, Table 5-1b, and Table 5-1c]) (see Table 1 of this HRS Documentation Record). The locations of all SSI surface soil samples are depicted on Figure 5-1 of Reference 4, p. 305.

In 2001/2002, site characterization of the Landfill AOPC was conducted by URS for the USACE, also referred to as a Phase II Supplemental Landfill Site Investigation or Inspection (Ref. 4, pp. 64, 290, and 441). The objective of the additional site characterization investigation was to collect site information to assist in the characterization of known or suspected potential environmental concerns at the Landfill (Ref. 4, p. 64). In addition to other work, the site characterization included:

- Collecting and analyzing 10 primary soil samples from a test pit in the gully area (BIL13 through BIL22);
- Removing mercury vapor lamps from a known area of disposal at the Landfill, and collection and analysis of seven primary soil samples from the Mercury Vapor-Lamp Test Pit (i.e., excavation) area (BIL05 through BIL11);
- Completing a geophysical evaluation of the Landfill using electrical resistivity and seismic refraction methods to estimate the extent of the Landfill;
- Installing and developing four monitoring wells (MW-6, MW-7, MW-8, MW-9);
  Collecting and analyzing nine primary groundwater samples (one each) from MW-1 through MW-9;
- Collecting and analyzing six Lead Hot Spot Test Pit (i.e., primary) soil samples at the Landfill (BIL24, BIL26, BIL27, BIL30, BIL31, and BIL32);
- Collecting and analyzing six composite soil samples excavated from the gully test pit (BIL01TPG, BIL02TPG, BIL03TPG, and BIL05TPG) and the mercury vapor-lamp test pit (BIL28TPM, BIL29TPM), which were then backfilled at their respective test pits at the Landfill (Ref. 4, pp. 64, 65, and 305 [Figure 5-1]).

Figure 5-1 in Reference 4, p. 305 depicts most sample locations for the Phase II Supplemental Landfill Site Investigation (Inspection); however; some locations are not shown including those for composite samples BIL01TPG, BIL02TPG, BIL03TPG, BIL05TPG, BIL28TPM, and BIL29TPM. For this reason, these samples have not been used in this HRS Documentation Record to demonstrate hazardous substances associated with Source 1.

Gully Test Pit soil samples obtained from depths ranging from 1 to 8 feet bgs within the Landfill AOPC revealed the presence of PCBs (Aroclor 1260), metals (antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, thallium, and zinc), VOCs (PCE and toluene), and SVOCs (acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dibenz(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene) (Ref. 4, pp. 305, 441 through 448 [Table 5-2a, Table 5-2b, and Table 5-2c]) (see Table 2 of this HRS Documentation Record). Mercury Vapor-Lamp Test Pit soil samples obtained from 5 to 8 feet bgs within the Landfill AOPC revealed the presence of PCBs (Aroclor 1254 and Aroclor 1260) and metals (antimony, copper, lead, and mercury), and Lead Hot Spot Test Pits samples obtained from 2 and 3 feet bgs within the Landfill AOPC revealed the presence of lead (Ref. 4, pp. 305, 441 through 442 [Table 5-2a], and 449 [Table 5-2d]) (see Table 3 of this HRS Documentation Record).

In 2007, an Upland Source Evaluation of the Landfill AOPC was conducted by URS for the USACE to qualitatively evaluate the need for source control measures (Ref. 4, pp. 66 and 290). The focus of the evaluation was on direct transport of impacted soil to surface water, either through erosion and transport by storm water or by mass wasting (Ref. 4, p. 66). Six surface soil samples (BIL01USE, BIL02USE, BIL03USE, BIL07USE, BIL08USE, and BIL09USE) were collected from the north slope of the Landfill AOPC between the landfill and the Columbia River and three surface soil samples (BIL04USE, BIL05USE, and BIL06USE) were collected outside of the landfill on the eastern tip of Bradford Island (Ref. 4, pp. 66 and 305 [Figure 5-1]). The samples collected on the north side of the landfill were obtained from 0.5 feet bgs and revealed the presence of PCBs (Aroclor 1254 and Aroclor 1260), metals (chromium, lead, mercury, and nickel), and pesticides (4,4'DDT) (Ref. 4, pp. 305 and 456 [Table 5-3a]) (see Table 4 of this HRS Documentation Record).

In 2009, an Upland OU Data Gaps Report was completed by URS in support of the RI by URS (Ref. 4, pp. 72 and 73). The focus of this work was to fill data gaps related to understanding the nature and extent of contamination, and to provide sufficient information for conducting risk evaluations (Ref. 4, p. 72). During this investigation, a total of eight soil samples were collected from the Gully Area at the Landfill AOPC (Ref. 4, p. 72). These samples were obtained from four test pits (L1 through L4) at depths of 0-1 feet and 1-3 feet bgs; that is two samples per test pit (Ref. 4, pp. 72 and 306 [Figure 5-2]). The samples revealed the presence of polycyclic aromatic hydrocarbons (PAHs) (acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene) (Ref. 4, p. 504 [Table 6-2a]) (see Table 5 of this HRS Documentation Record).

Location of the source, with reference to a map:
The Landfill AOPC is located on the eastern end of Bradford Island, Oregon (Figure 5 of this HRS Documentation Record; Ref. 4, p. 297).

Containment
Release to Surface Water via Overland Migration and/or Flood: By 1982, the surface of the Landfill AOPC had been capped with soil, and another layer of soil was added in 1989 (Ref. 4, p. 20). A release from this source to surface water exists (see sections 4.1.1.1 and 4.1.2.1.1 of this HRS documentation record). The Landfill AOPC is unlined (Ref. 4, p. 37). A surface water containment factor value of 10 is assigned (Ref. 1, Table 4-2).

Containment Factor Value: 10

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

The RI report documents the investigation activities that have taken place over the past 10 years since the report was written (i.e., approximately the period from 2002 to 2012) (Ref. 4, p. 20); including new sampling work conducted during the RI in 2007 and 2009 to fill identified data gaps (Ref. 4, p. 72). The RI states that due to the relatively static physical environment of the Upland OU, environmental data collected over the past decade prior to the RI can be considered representative of current conditions (Ref. 4, p. 59). The RI report included laboratory data forms from these investigations as Appendix E. For this reason, the primary reference for information contained in tables within this section are taken from this appendix.

USACE SSI 1999/2000:

- Source Samples: Eleven surface soil samples (i.e., BIL01SSI through BIL06SSI, BIL09SSI through BIL13SSI) were collected from the Landfill AOPC during the USACE 1999/2000 SSI as presented in Table 1 below (Ref. 4, pp. 63 and 427). The RI report states that laboratory reports for some landfill samples collected during the SSI could not be located (Ref. 4, p. 875). Of the 11 surface soil samples collected for the SSI at the landfill, laboratory reports were only located for sample BIL13SSI (Ref. 4, p. 1082). For this reason, the method reporting limits for the remaining samples is not known. All samples underwent a quality assurance/quality control (QA/QC) review following the procedures specified in the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review and Inorganic Data Review (Ref. 4, pp. 138788 and 138795). The samples were collected and analyzed according to the Sampling and Analysis Plan (Ref. 4, p. 138788 and 138795). The samples were analyzed for Total Metals by EPA SW-846 Methods 1312/6010B/6020/7000A Series, SVOCs by EPA SW-846 Method 8270B or C, VOCs by EPA SW-846 Method 8260B, PCBs by EPA SW-846 Methods 8081A/8082, and Chlorinated Herbicides by EPA SW-846 Method 8151A (Ref. 4, pp. 138788 and 138795). Sample custody was maintained under the chain-of-custody (COC) forms and was properly executed upon during sample transfer (Ref. 4, pp. 1115, 138789, and 138796). Samples BIL10SSI and BIL12SSI are used in this HRS Documentation Record to represent background concentrations due to the relatively low concentrations of contaminants in these samples (Ref. 4, pp. 427 through 432 [Table 5-1a, Table 5-1b, and Table 5-1c]). Although not required by the HRS, background concentrations are provided to show the relative increase of contaminant levels in the source over background. In Table 1, the highest concentration of each analyte between the two background samples was used to determine whether source sample results were elevated over background; and are in bold font in the table. The SSI surface soil sample locations are depicted on Figure 5-1 of Reference 4, p. 305.

Table 1
Analytical Results for Source 1 – USACE SSI 1999/2000
Surface Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MRL	Units (Dry weight)	Reference
Background Surface Soil Samples							
BIL10SSI 990920BIL10SS	0.0 to 0.5	Antimony	2.60 U	mg/kg	NK	NA	Ref. 4, p. 427
		Arsenic	**3.10**	mg/kg	NK	NA	Ref. 4, p. 427

Table 1 Analytical Results for Source 1 – USACE SSI 1999/2000 Surface Soil Samples							
Sample ID	**Sample Depth (feet bgs)**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (Dry weight)**	**MRL**	**Units (Dry weight)**	**Reference**
(Cont.) BIL10SSI 990920BIL10SS	0.0 to 0.5	Cadmium	0.260 U	mg/kg	NK	NA	Ref. 4, p. 427
		Chromium	16.3	mg/kg	NK	NA	Ref. 4, p. 427
		Copper	**25.5**	mg/kg	NK	NA	Ref. 4, p. 427
		Lead	19.3	mg/kg	NK	NA	Ref. 4, p. 427
		Mercury	**0.110 U**	mg/kg	NK	NA	Ref. 4, p. 427
		Nickel	**14.9**	mg/kg	NK	NA	Ref. 4, p. 427
		Thallium	**0.260 U**	mg/kg	NK	NA	Ref. 4, p. 427
		Zinc	**69.6**	mg/kg	NK	NA	Ref. 4, p. 427
		2,4,5-T	9.00 U	ug/kg	NK	NA	Ref. 4, p. 427
		BHC (Beta)	**1.80 U**	ug/kg	NK	NA	Ref. 4, p. 428
		Tetrachloroethene	**2.10 U**	ug/kg	NK	NA	Ref. 4, p. 430
		Toluene	**2.10 U**	ug/kg	NK	NA	Ref. 4, p. 430
		Bis(2-ethylhexyl)phthalate	770	ug/kg	NK	NA	Ref. 4, p. 431
		Dibenzofuran	**180 U**	ug/kg	NK	NA	Ref. 4, p. 431
		Acenaphthene	**180 U**	ug/kg	NK	NA	Ref. 4, p. 432
		Anthracene	**180 U**	ug/kg	NK	NA	Ref. 4, p. 432
		Fluorene	**180 U**	ug/kg	NK	NA	Ref. 4, p. 432
		Phenanthrene	**36.0 J (360)**	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 15
		Benzo(a)anthracene	**60.0 J (600)**	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 14
		Benzo(a)pyrene	**70.0 J (700)**	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 14
		Benzo(b)fluoranthene	**58.0 J (580)**	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 14
		Benzo(g,h,i)perylene	**51.0 J (510)**	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 14
		Benzo(k)fluoranthene	**64.0 J (640)**	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 14
		Chrysene	**79.0 J (790)**	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 14
		Dibenz(a,h)anthracene	**24.0 J (240)**	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 14
		Fluoranthene	**88.0 J (880)**	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 15
		Indeno(1,2,3-cd)pyrene	**48.0 J (480)**	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 15
		Pyrene	**98.0 J (1,162.28)**	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 15

Table 1 Analytical Results for Source 1 – USACE SSI 1999/2000 Surface Soil Samples							
Sample ID	**Sample Depth (feet bgs)**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (Dry weight)**	**MRL**	**Units (Dry weight)**	**Reference**
BIL12SSI 990921BIL12SS	0.0 to 0.5	Antimony	**2.70 U**	mg/kg	NK	NA	Ref. 4, p. 427
		Arsenic	2.80	mg/kg	NK	NA	Ref. 4, p. 427
		Cadmium	**0.270 U**	mg/kg	NK	NA	Ref. 4, p. 427
		Chromium	**17.3**	mg/kg	NK	NA	Ref. 4, p. 427
		Copper	23.5	mg/kg	NK	NA	Ref. 4, p. 427
		Lead	**22.8**	mg/kg	NK	NA	Ref. 4, p. 427
		Mercury	0.100 U	mg/kg	NK	NA	Ref. 4, p. 427
		Nickel	13.6	mg/kg	NK	NA	Ref. 4, p. 427
		Thallium	**0.250 U**	mg/kg	NK	NA	Ref. 4, p. 427
		Zinc	69.0	mg/kg	NK	NA	Ref. 4, p. 427
		2,4,5-T	**11.0 U**	ug/kg	NK	NA	Ref. 4, p. 427
		BHC (Beta)	**1.80 U**	ug/kg	NK	NA	Ref. 4, p. 428
		Tetrachloroethene	**2.10 U**	ug/kg	NK	NA	Ref. 4, p. 430
		Toluene	**2.10 U**	ug/kg	NK	NA	Ref. 4, p. 430
		Bis(2-ethylhexyl)phthalate	**1,900**	ug/kg	NK	NA	Ref. 4, p. 431
		Dibenzofuran	**180 U**	ug/kg	NK	NA	Ref. 4, p. 431
		Acenaphthene	**180 U**	ug/kg	NK	NA	Ref. 4, p. 432
		Anthracene	**180 U**	ug/kg	NK	NA	Ref. 4, p. 432
		Fluorene	**180 U**	ug/kg	NK	NA	Ref. 4, p. 432
		Phenanthrene	13.0 J (130)	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 15
		Benzo(a)anthracene	29.0 J (290)	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 14
		Benzo(a)pyrene	28.0 J (280)	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 14
		Benzo(b)fluoranthene	34.0 J (340)	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 14
		Benzo(g,h,i)perylene	20.0 J (200)	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 14
		Benzo(k)fluoranthene	40.0 J (400)	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 14
		Chrysene	62.0 J (620)	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 14
		Dibenz(a,h)anthracene	18.0 J (180)	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 14
		Fluoranthene	42.0 J (420)	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 15

Table 1 Analytical Results for Source 1 – USACE SSI 1999/2000 Surface Soil Samples							
Sample ID	**Sample Depth (feet bgs)**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (Dry weight)**	**MRL**	**Units (Dry weight)**	**Reference**
(Cont.) BIL12SSI 990921BIL12SS	0.0 to 0.5	Indeno(1,2,3-cd)pyrene	18.0 J (180)	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 15
		Pyrene	43.0 J (509.98)	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 15
Contaminated Surface Soil Samples							
BIL01SSI 990920BIl01SS	0.0 to 0.3	Antimony	2.80	mg/kg	NK	NA	Ref. 4, p. 427
		Lead	74.5	mg/kg	NK	NA	Ref. 4, p. 427
		2,4,5-T	93.0	ug/kg	NK	NA	Ref. 4, p. 427
BIL02SSI 990920BIL02SS	0.0 to 0.5	Lead	153	mg/kg	NK	NA	Ref. 4, p. 427
BIL03SSI 990920BIL03SS	0.0 to 0.5	Lead	362	mg/kg	NK	NA	Ref. 4, p. 427
		Mercury	1.40	mg/kg	NK	NA	Ref. 4, p. 427
		2,4,5-T	63.0	ug/kg	NK	NA	Ref. 4, p. 427
		Tetrachloroethene	15.0	ug/kg	NK	NA	
BIL04SSI 990920BIL04SS	0.0 to 0.5	Cadmium	0.440	mg/kg	NK	NA	Ref. 4, p. 427
		Lead	699	mg/kg	NK	NA	Ref. 4, p. 427
		Mercury	0.120	mg/kg	NK	NA	Ref. 4, p. 427
		Tetrachloroethene	23.0	ug/kg	NK	NA	Ref. 4, p. 429
		Bis(2-etheylhexyl)phthalate	21,000	ug/kg	NK	NA	Ref. 4, p. 431
		Dibenzofuran	380	ug/kg	NK	NA	Ref. 4, p. 431
		Acenaphthene	2,600 J (260)	ug/kg	NK	NA	Ref. 4, p. 432; Ref. 5, p. 14
		Anthracene	2,700	ug/kg	NK	NA	Ref. 4, p. 432
		Fluorene	1,200	ug/kg	NK	NA	Ref. 4, p. 432
		Phenanthrene	12,000	ug/kg	NK	NA	Ref. 4, p. 432

Table 1 Analytical Results for Source 1 – USACE SSI 1999/2000 Surface Soil Samples							
Sample ID	**Sample Depth (feet bgs)**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (Dry weight)**	**MRL**	**Units (Dry weight)**	**Reference**
(Cont.) BIL04SSI 990920BIL04SS	0.0 to 0.5	Benzo(a)anthracene	32,000	ug/kg	NK	NA	Ref. 4, p. 432
		Benzo(a)pyrene	33,000	ug/kg	NK	NA	Ref. 4, p. 432
		Benzo(b)fluoranthene	65,000	ug/kg	NK	NA	Ref. 4, p. 432
		Benzo(g,h,i)perylene	18,000	ug/kg	NK	NA	Ref. 4, p. 432
		Benzo(k)fluoranthene	65,000	ug/kg	NK	NA	Ref. 4, p. 432
		Chrysene	32,000	ug/kg	NK	NA	Ref. 4, p. 432
		Dibenz(a,h)anthracene	9,900	ug/kg	NK	NA	Ref. 4, p. 432
		Fluoranthene	54,000	ug/kg	NK	NA	Ref. 4, p. 432
		Indeno(1,2,3-cd)pyrene	19,000	ug/kg	NK	NA	Ref. 4, p. 432
		Pyrene	40,000	ug/kg	NK	NA	Ref. 4, p. 432
BIL05SSI 990920BIL05SS	0.0 to 0.5	Antimony	4.20	mg/kg	NK	NA	Ref. 4, p. 427
		Arsenic	30.1	mg/kg	NK	NA	Ref. 4, p. 427
		Cadmium	1.30	mg/kg	NK	NA	Ref. 4, p. 427
		Chromium	237	mg/kg	NK	NA	Ref. 4, p. 427
		Copper	494	mg/kg	NK	NA	Ref. 4, p. 427
		Lead	486	mg/kg	NK	NA	Ref. 4, p. 427
		Mercury	0.840	mg/kg	NK	NA	Ref. 4, p. 427
		Nickel	170	mg/kg	NK	NA	Ref. 4, p. 427
		Zinc	635	mg/kg	NK	NA	Ref. 4, p. 427
		Tetrachloroethene	65.0	ug/kg	NK	NA	Ref. 4, p. 429
		Toluene	5.30	ug/kg	NK	NA	Ref. 4, p. 429
		Acenaphthene	500	ug/kg	NK	NA	Ref. 4, p. 432
		Anthracene	460	ug/kg	NK	NA	Ref. 4, p. 432
		Phenanthrene	1,900	ug/kg	NK	NA	Ref. 4, p. 432
		Benzo(a)anthracene	2,200	ug/kg	NK	NA	Ref. 4, p. 432
		Benzo(a)pyrene	2,200	ug/kg	NK	NA	Ref. 4, p. 432
		Benzo(g,h,i)perylene	1,800	ug/kg	NK	NA	Ref. 4, p. 432
		Fluoranthene	3,300	ug/kg	NK	NA	Ref. 4, p. 432
		Indeno(1,2,3-cd)pyrene	1,700	ug/kg	NK	NA	Ref. 4, p. 432
BIL06SSI 990920BIL06SS	0.0 to 0.5	Antimony	3.90	mg/kg	NK	NA	Ref. 4, p. 427

Table 1
Analytical Results for Source 1 – USACE SSI 1999/2000
Surface Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MRL	Units (Dry weight)	Reference
(Cont.) BIL06SSI 990920BIL06SS	0.0 to 0.5	Cadmium	1.75	mg/kg	NK	NA	Ref. 4, p. 427
		Copper	143	mg/kg	NK	NA	Ref. 4, p. 427
		Lead	168	mg/kg	NK	NA	Ref. 4, p. 427
		Mercury	4.15	mg/kg	NK	NA	Ref. 4, p. 427
		Phenanthrene	1,230	ug/kg	NK	NA	Ref. 4, p. 432
		Benzo(b)fluoranthene	2,350	ug/kg	NK	NA	Ref. 4, p. 432
		Benzo(k)fluoranthene	2,350	ug/kg	NK	NA	Ref. 4, p. 432
BIL09SSI 990920BIL09SS	0.0 to 0.5	Mercury	0.120	mg/kg	NK	NA	Ref. 4, p. 427
BIL11SSI 009021BIL11SS	0.0 to 0.5	Arsenic	11.3	mg/kg	NK	NA	Ref. 4, p. 427
		BHC (beta)	2.60	ug/kg	NK	NA	Ref. 4, p. 428
BIL13SSI 000413BIL13SS	0.0 to 0.5	Cadmium	0.387	mg/kg	0.287	mg/kg	Ref. 4, p. 1083
		Thallium	0.378	mg/kg	0.287	mg/kg	Ref. 4, p. 1083

Notes:
Bold font indicates the concentration is the highest of the two background samples.

The direction of bias for sample results having a J qualifier is not known. In this table, background J qualified sample results were assumed to be biased low and contaminated J qualified sample results were assumed to be high.

Key:

()	=	The direction of bias for the qualified result was not reported (Ref. 4, p. 428 and 432) and is assumed to be unknown for the purposes of adjusting the data as per Ref. 5, pp. 7 and 8. The adjusted result was rounded to two decimal places when applicable.
bgs	=	below ground surface.
ID	=	Identification.
J	=	The reported value is an estimate and the direction of bias was not reported (Ref. 4, pp. 428 and 432).
MRL	=	Method reporting limit.
mg/kg	=	milligrams per kilogram.
NA	=	Not applicable.
NK	=	Not known.
U	=	The analyte was not detected at or above the MDL (Ref. 4, pp. 428, 430, and 432).
ug/kg	=	micrograms per kilogram.

USACE Phase II Supplemental Landfill Site Investigation (Inspection) 2001/2002

- Gully Test Pit Source Samples: Ten soil samples (i.e., BIL13 through BIL22) were collected from the Gully Test Pit excavated within the Landfill AOPC during the USACE 2001/2002 USACE Phase II Supplemental Landfill Site Investigation as presented in Table 2 below (Ref. 4, p. 64). All samples underwent a quality assurance/quality control (QA/QC) review following the procedures specified in the EPA's *Contract Laboratory Program National Functional Guidelines for Organic Data Review and Inorganic Data Review* (Ref. 4, p. 138839). The samples were collected and analyzed according to the Sampling and Analysis Plan (Ref. 4, p. 138839). The samples were analyzed for Metals by EPA SW-846 Methods 6010B/6020, mercury by EPA SW-846 Method 7471A, SVOCs by EPA SW-846 Method 8270C, VOCs by EPA SW-846 Method 8260B, PCBs by EPA SW-846 Methods 8082, Chlorinated Pesticides by EPA SW-846 Method 8081A, and Chlorinated Herbicides by EPA SW-846 Method 8151A (Ref. 4, pp. 138839 and 138846). Sample custody was maintained under the chain-of-custody (COC) forms and was properly executed upon during sample transfer (Ref. 4, pp. 8778 and 138840). Sample BIL14 is used in this HRS Documentation Record to represent background concentrations due to the relatively low concentrations of contaminants in this sample (Ref. 4, pp. 441 through 448 [Table 5-2a, Table 5-2b, and Table 5-2c]). Although not required by the HRS, background concentrations are provided to show the relative increase of contaminant levels in the source over background. The Phase II Supplemental Landfill Site Investigation Gully Test Pit soil sample locations are depicted on Figure 5-1 of Reference 4, p. 305.

Table 2
Analytical Results for Source 1 – Phase II Supplemental Landfill Site Investigation (Inspection) 2001/2002
Gully Test Pit Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MDL, MRL, or PQL	Units (Dry weight)	Reference
Background Gully Test Pit Soil Sample							
BIL14 011016BIL14SS	6.0	Aroclor 1254	ND	ug/kg	10.9	ug/kg	Ref. 4, pp. 443 and 8545
		Aroclor 1260	15	ug/kg	10.9	ug/kg	Ref. 4, p. 8545
		Antimony	0.984	mg/kg	0.619	mg/kg	Ref. 4, p. 8620
		Chromium	28.1	mg/kg	0.206	mg/kg	Ref. 4, p. 8620
		Copper	27.4 JL (33.43)	mg/kg	2.06	mg/kg	Ref. 4, pp. 8619 and 138849; Ref. 5, pp. 8 and 18; Ref. 37, p. 5
		Lead	57.6 JH	mg/kg	0.412	mg/kg	Ref. 4, pp. 8620 and 138849; Ref. 5, p. 8; Ref. 37, p. 5
		Mercury	0.015 JQ	mg/kg	0.0192	mg/kg	Ref. 4, p. 8621; Ref. 37, p. 5
		Nickel	34.4 JL	mg/kg	2.06	mg/kg	Ref. 4, pp. 8619 and 138849; Ref. 5, p. 8; Ref. 37, p. 5

Table 2 Analytical Results for Source 1 – Phase II Supplemental Landfill Site Investigation (Inspection) 2001/2002 Gully Test Pit Soil Samples							
Sample ID	**Sample Depth (feet bgs)**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (Dry weight)**	**MDL, MRL, or PQL**	**Units (Dry weight)**	**Reference**
(Cont.) BIL14 011016BIL14SS	6.0	Dibutyltin	ND	ug/kg	2.04	ug/kg	Ref. 4, p. 8503
		Monobutyltin	ND	ug/kg	2.72	ug/kg	Ref. 4, p. 8503
		Tributyltin	ND	ug/kg	2.72	ug/kg	Ref. 4, p. 8503
		BHC (alpha)	ND	ug/kg	1.1	ug/kg	Ref. 4, p. 8525
		Chlordane	ND	ug/kg	11	ug/kg	Ref. 4, p. 8525
		Heptachlor	ND	ug/kg	1.1	ug/kg	Ref. 4, p. 8525
		Heptachlor Epoxide	ND	ug/kg	1.1	ug/kg	Ref. 4, p. 8525
		Tetrachloroethene	0.605	ug/kg	0.424	ug/kg	Ref. 4, p. 8450
		Toluene	0.269 JQ	ug/kg	0.424	ug/kg	Ref. 4, p. 8450; Ref. 37, p. 5
		Bis(2-ethylhexyl)phthalate	237 JQ	ug/kg	338	ug/kg	Ref. 4, p. 8474; Ref. 37, p. 5
		Butyl Benzyl Phthalate	ND	ug/kg	135	ug/kg	Ref. 4, p. 8474
		Dibenzofuran	ND	ug/kg	135	ug/kg	Ref. 4, p. 8474
		Pentachlorophenol	ND	ug/kg	135	ug/kg	Ref. 4, p. 8474
		Acenaphthene	23	ug/kg	13.5	ug/kg	Ref. 4, p. 8474
		Acenaphthylene	ND	ug/kg	13.5	ug/kg	Ref. 4, p. 8474
		Anthracene	62.3	ug/kg	13.5	ug/kg	Ref. 4, p. 8474
		Fluorene	17.6	ug/kg	13.5	ug/kg	Ref. 4, p. 8474
		Naphthalene	ND	ug/kg	13.5	ug/kg	Ref. 4, p. 8473
		Phenanthrene	194	ug/kg	13.5	ug/kg	Ref. 4, p. 8474
		Benzo(a)anthracene	418	ug/kg	27.1	ug/kg	Ref. 4, p. 8474
		Benzo(a)pyrene	533	ug/kg	13.5	ug/kg	Ref. 4, p. 8474
		Benzo(g,h,i)perylene	318	ug/kg	13.5	ug/kg	Ref. 4, p. 8474
		Chrysene	437	ug/kg	27.1	ug/kg	Ref. 4, p. 8474
		Dibenz(a,h)anthracene	52.8	ug/kg	13.5	ug/kg	Ref. 4, p. 8474
		Fluoranthene	1,100	ug/kg	13.5	ug/kg	Ref. 4, p. 8474
		Indeno(1,2,3-cd)pyrene	382	ug/kg	13.5	ug/kg	Ref. 4, p. 8474
		Pyrene	1,220	ug/kg	13.5	ug/kg	Ref. 4, p. 8474
Contaminated Gully Test Pit Soil Samples							
BIL13 011016BIL13SS	4.0	Aroclor 1254	499	ug/kg	11.2	ug/kg	Ref. 4, pp. 443 and 8544
		Aroclor 1260	158	ug/kg	11.2	ug/kg	Ref. 4, p. 8544
		Antimony	3.9	mg/kg	0.626	mg/kg	Ref. 4, p. 8617

Table 2 Analytical Results for Source 1 – Phase II Supplemental Landfill Site Investigation (Inspection) 2001/2002 Gully Test Pit Soil Samples							
Sample ID	**Sample Depth (feet bgs)**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (Dry weight)**	**MDL, MRL, or PQL**	**Units (Dry weight)**	**Reference**
(Cont.) BIL13 011016BIL13SS	4.0	Copper	312 JL	mg/kg	2.09	mg/kg	Ref. 4, p. 8616; Ref. 5, p. 8; Ref. 37, p. 5
		Lead	488 JH (338.89)	mg/kg	0.417	mg/kg	Ref. 4, p. 8617; Ref. 5, pp. 8 and 18; Ref. 37, p. 5
		Mercury	0.444	mg/kg	0.0237	mg/kg	Ref. 4, p. 8618
		Chlordane	409	ug/kg	11.2	ug/kg	Ref. 4, p. 8524
		Tetrachloroethene	8.12	ug/kg	0.483	ug/kg	Ref. 4, p. 8448
		Bis(2-ethylhexyl)phthalate	2,370	ug/kg	389	ug/kg	Ref. 4, p. 8472
		Acenaphthene	540	ug/kg	15.6	ug/kg	Ref. 4, p. 8472
		Acenaphthylene	65.4	ug/kg	15.6	ug/kg	Ref. 4, p. 8472
		Anthracene	872	ug/kg	15.6	ug/kg	Ref. 4, p. 8472
		Fluorene	272	ug/kg	15.6	ug/kg	Ref. 4, p. 8472
		Naphthalene	82.5	ug/kg	15.6	ug/kg	Ref. 4, p. 8471
		Phenanthrene	3,110	ug/kg	15.6	ug/kg	Ref. 4, p. 8472
		Benzo(a)anthracene	10,100	ug/kg	31.1	ug/kg	Ref. 4, p. 8472
		Benzo(a)pyrene	9,840	ug/kg	15.6	ug/kg	Ref. 4, p. 8472
		Benzo(g,h,i)perylene	5,060	ug/kg	15.6	ug/kg	Ref. 4, p. 8472
		Chrysene	8,190	ug/kg	31.1	ug/kg	Ref. 4, p. 8472
		Dibenz(a,h)anthracene	685	ug/kg	15.6	ug/kg	Ref. 4, p. 8472
		Fluoranthene	19,500	ug/kg	15.6	ug/kg	Ref. 4, p. 8472
		Indeno(1,2,3-cd)pyrene	6,260	ug/kg	15.6	ug/kg	Ref. 4, p. 8472
		Pyrene	23,100	ug/kg	15.6	ug/kg	Ref. 4, p. 8472
BIL15 011016BIL15SS	8.0	Aroclor 1260	52.4	ug/kg	11	ug/kg	Ref. 4, pp. 443 and 8546
		Mercury	0.021	mg/kg	0.018	mg/kg	Ref. 4, p. 8624
		Bis(2-ethylhexyl)phthalate	1,170	ug/kg	362	ug/kg	Ref. 4, p. 8477
		Acenaphthene	113	ug/kg	14.5	ug/kg	Ref. 4, p. 8477
		Acenaphthylene	27.5	ug/kg	14.5	ug/kg	Ref. 4, p. 8477
		Anthracene	307	ug/kg	14.5	ug/kg	Ref. 4, p. 8477
		Fluorene	89.7	ug/kg	14.5	ug/kg	Ref. 4, p. 8477
		Phenanthrene	1,240	ug/kg	14.5	ug/kg	Ref. 4, p. 8477
		Benzo(a)anthracene	3,020	ug/kg	28.9	ug/kg	Ref. 4, p. 8477
		Benzo(a)pyrene	3,160	ug/kg	14.5	ug/kg	Ref. 4, p. 8477
		Benzo(g,h,i)perylene	1,850	ug/kg	14.5	ug/kg	Ref. 4, p. 8477
		Chrysene	2,990	ug/kg	28.9	ug/kg	Ref. 4, p. 8477

Table 2
Analytical Results for Source 1 – Phase II Supplemental Landfill Site Investigation (Inspection) 2001/2002
Gully Test Pit Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MDL, MRL, or PQL	Units (Dry weight)	Reference
(Cont.) BIL15 011016BIL15SS	8.0	Dibenz(a,h)anthracene	324	ug/kg	14.5	ug/kg	Ref. 4, p. 8477
		Fluoranthene	6,830	ug/kg	14.5	ug/kg	Ref. 4, p. 8477
		Indeno(1,2,3-cd)pyrene	2,140	ug/kg	14.5	ug/kg	Ref. 4, p. 8477
		Pyrene	7,670	ug/kg	14.5	ug/kg	Ref. 4, p. 8477
BIL16 011016BIL16SS	4.0	Aroclor 1260	445	ug/kg	10.5	ug/kg	Ref. 4, pp. 443, and 8547
		Tetrachloroethene	5.19	ug/kg	0.416	ug/kg	Ref. 4, p. 8454
		Bis(2-ethylhexyl)phthalate	1,160	ug/kg	372	ug/kg	Ref. 4, p. 8479
		Butyl Benzyl Phthalate	152	ug/kg	149	ug/kg	Ref. 4, p. 8479
		Acenaphthene	87.9	ug/kg	14.9	ug/kg	Ref. 4, p. 8479
		Acenaphthylene	35.8	ug/kg	14.9	ug/kg	Ref. 4, p. 8479
		Anthracene	295	ug/kg	14.9	ug/kg	Ref. 4, p. 8479
		Fluorene	71.5	ug/kg	14.9	ug/kg	Ref. 4, p. 8479
		Naphthalene	34.3	ug/kg	14.9	ug/kg	Ref. 4, p. 8478
		Phenanthrene	798	ug/kg	14.9	ug/kg	Ref. 4, p. 8479
		Benzo(a)anthracene	4,590	ug/kg	29.8	ug/kg	Ref. 4, p. 8479
		Benzo(a)pyrene	3,310	ug/kg	14.9	ug/kg	Ref. 4, p. 8479
		Benzo(g,h,i)perylene	1,780	ug/kg	14.9	ug/kg	Ref. 4, p. 8479
		Chrysene	3,380	ug/kg	29.8	ug/kg	Ref. 4, p. 8479
		Dibenz(a,h)anthracene	280	ug/kg	14.9	ug/kg	Ref. 4, p. 8479
		Fluoranthene	9,800	ug/kg	14.9	ug/kg	Ref. 4, p. 8479
		Indeno(1,2,3-cd)pyrene	1,990	ug/kg	14.9	ug/kg	Ref. 4, p. 8479
		Pyrene	11,600	ug/kg	14.9	ug/kg	Ref. 4, p. 8479
BIL17 011016BIL17SS	1.0	Aroclor 1254	78.6	ug/kg	12.4	ug/kg	Ref. 4, pp. 443 and 8548
		Aroclor 1260	68	ug/kg	12.4	ug/kg	Ref. 4, p. 8548
		Lead	741 JH (514.58)	mg/kg	0.467	mg/kg	Ref. 4, pp. 8629 and 138849; Ref. 5, pp. 8 and 18; Ref. 37, p. 5
		Mercury	0.122	mg/kg	0.0237	mg/kg	Ref. 4, p. 8630
		Dibutyltin	20.2	ug/kg	2.41	ug/kg	Ref. 4, p. 8506

Table 2
Analytical Results for Source 1 – Phase II Supplemental Landfill Site Investigation (Inspection) 2001/2002
Gully Test Pit Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MDL, MRL, or PQL	Units (Dry weight)	Reference
(Cont.) BIL17 011016BIL17SS	1.0	Monobutyltin	9.08	ug/kg	3.22	ug/kg	Ref. 4, p. 8506
		Tributyltin	9.01	ug/kg	3.22	ug/kg	Ref. 4, p. 8506
		Chlordane	1,560	ug/kg	12	ug/kg	Ref. 4, p. 8528
		Heptachlor	2.83	ug/kg	1.2	ug/kg	Ref. 4, p. 8528
		Heptachlor Epoxide	14.4	ug/kg	1.2	ug/kg	Ref. 4, p. 8528
		Bis(2-ethylhexyl)phthalate	3,960	ug/kg	390	ug/kg	Ref. 4, p. 8481
		Pentachlorophenol	201	ug/kg	156	ug/kg	Ref. 4, p. 8481
		Acenaphthene	323	ug/kg	15.6	ug/kg	Ref. 4, p. 8481
		Acenaphthylene	78.1	ug/kg	15.6	ug/kg	Ref. 4, p. 8481
		Anthracene	773	ug/kg	15.6	ug/kg	Ref. 4, p. 8481
		Fluorene	244	ug/kg	15.6	ug/kg	Ref. 4, p. 8481
		Naphthalene	78.1	ug/kg	15.6	ug/kg	Ref. 4, p. 8480
		Phenanthrene	2,910	ug/kg	15.6	ug/kg	Ref. 4, p. 8481
		Benzo(a)anthracene	9,620	ug/kg	31.2	ug/kg	Ref. 4, p. 8481
		Benzo(a)pyrene	10,500	ug/kg	15.6	ug/kg	Ref. 4, p. 8481
		Benzo(g,h,i)perylene	6,150	ug/kg	15.6	ug/kg	Ref. 4, p. 8481
		Chrysene	8,430	ug/kg	31.2	ug/kg	Ref. 4, p. 8481
		Dibenz(a,h)anthracene	695	ug/kg	15.6	ug/kg	Ref. 4, p. 8481
		Fluoranthene	19,400	ug/kg	15.6	ug/kg	Ref. 4, p. 8481
		Indeno(1,2,3-cd)pyrene	6,990	ug/kg	15.6	ug/kg	Ref. 4, p. 8481
		Pyrene	22,900	ug/kg	15.6	ug/kg	Ref. 4, p. 8481
BIL 18 011016BIL18SS	2.0	Aroclor 1254	48.4	ug/kg	10.5	ug/kg	Ref. 4, pp. 443 and 8549
		Chromium	1,950	mg/kg	1.94	mg/kg	Ref. 4, p. 8631
		Lead	1,660 JH (1,152.78)	mg/kg	1.94	mg/kg	Ref. 4, pp. 8631 and 138849; Ref. 5, pp. 8 and 18; Ref. 37, p. 5
		Nickel	1,610 JL	mg/kg	1.94	mg/kg	Ref. 4, pp. 8631 and 138849; Ref. 5, p. 8; Ref. 37, p. 5
		BHC (alpha)	2.02	ug/kg	1.07	ug/kg	Ref. 4, p. 8529
		Dibenzofuran	419	ug/kg	145	ug/kg	Ref. 4, p. 8483
		Bis(2-ethylhexyl)phthalate	2,030	ug/kg	361	ug/kg	Ref. 4, p. 8483
		Acenaphthene	2,530	ug/kg	14.5	ug/kg	Ref. 4, p. 8483
		Acenaphthylene	111	ug/kg	14.5	ug/kg	Ref. 4, p. 8483

Table 2
Analytical Results for Source 1 – Phase II Supplemental Landfill Site Investigation (Inspection) 2001/2002
Gully Test Pit Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MDL, MRL, or PQL	Units (Dry weight)	Reference
(Cont.) BIL 18 01106BIL18 SS	2.0	Anthracene	8,440	ug/kg	14.5	ug/kg	Ref. 4, p. 8483
		Fluorene	1,610	ug/kg	14.5	ug/kg	Ref. 4, p. 8483
		Naphthalene	176	ug/kg	14.5	ug/kg	Ref. 4, p. 8482
		Phenanthrene	21,900	ug/kg	14.5	ug/kg	Ref. 4, p. 8483
		Benzo(a)anthracene	28,200	ug/kg	28.9	ug/kg	Ref. 4, p. 8483
		Benzo(a)pyrene	34,000	ug/kg	14.5	ug/kg	Ref. 4, p. 8483
		Benzo(g,h,i)perylene	17,000	ug/kg	14.5	ug/kg	Ref. 4, p. 8483
		Chrysene	35,300 JK (3,530)	ug/kg	28.9	ug/kg	Ref. 4, p. 8483; Ref. 5, pp. 8 and 9; Ref. 37, p. 5
		Dibenz(a,h)anthracene	1,940	ug/kg	14.5	ug/kg	Ref. 4, p. 8483
		Fluoranthene	48,300	ug/kg	14.5	ug/kg	Ref. 4, p. 8483
		Indeno(1,2,3-cd)pyrene	20,000	ug/kg	14.5	ug/kg	Ref. 4, p. 8483
		Pyrene	67,100	ug/kg	14.5	ug/kg	Ref. 4, p. 8483
BIL19 011016BIL19SS	5.0	Aroclor 1254	54.9	ug/kg	10.6	ug/kg	Ref. 4, pp. 443 and 8550
		Aroclor 1260	74.6	ug/kg	10.6	ug/kg	Ref. 4, p. 8550
		Chromium	1,920	mg/kg	1.95	mg/kg	Ref. 4, p. 8634
		Lead	931 JH (646.53)	mg/kg	0.39	mg/kg	Ref. 4, pp. 8635 and 138849; Ref. 5, pp. 8 and 18; Ref. 37, p. 5
		Nickel	1,760 JL	mg/kg	1.95	mg/kg	Ref. 4, pp. 8634 and 138849; Ref. 5, p. 8; Ref. 37, p. 5
		Bis(2-ethylhexyl)phthalate	1,720	ug/kg	344	ug/kg	Ref. 4, p. 8485
		Anthracene	5,640	ug/kg	13.7	ug/kg	Ref. 4, p. 8485
		Fluorene	977	ug/kg	13.7	ug/kg	Ref. 4, p. 8485
		Naphthalene	77	ug/kg	13.7	ug/kg	Ref. 4, p. 8484
		Benzo(a)anthracene	31,200	ug/kg	27.5	ug/kg	Ref. 4, p. 8485
		Benzo(a)pyrene	19,200	ug/kg	13.7	ug/kg	Ref. 4, p. 8485
		Benzo(g,h,i)perylene	9,530	ug/kg	13.7	ug/kg	Ref. 4, p. 8485
		Chrysene	24,000	ug/kg	27.5	ug/kg	Ref. 4, p. 8485
		Fluoranthene	30,700	ug/kg	13.7	ug/kg	Ref. 4, p. 8485
		Indeno(1,2,3-cd)pyrene	11,300	ug/kg	13.7	ug/kg	Ref. 4, p. 8485
		Pyrene	37,700	ug/kg	13.7	ug/kg	Ref. 4, p. 8485

Table 2
Analytical Results for Source 1 – Phase II Supplemental Landfill Site Investigation (Inspection) 2001/2002
Gully Test Pit Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MDL, MRL, or PQL	Units (Dry weight)	Reference
BIL20 011016BIL20SS	8.0	Mercury	0.0836	mg/kg	0.0235	mg/kg	Ref. 4, pp. 443 and 8639
		Tetrachloroethene	3.42	ug/kg	0.458	ug/kg	Ref. 4, p. 8464
		Toluene	0.984	ug/kg	0.458	ug/kg	Ref. 4, p. 8464
BIL21 011016BIL21SS	5.0	Aroclor 1254	37.2	ug/kg	10	ug/kg	Ref. 4, pp. 443 and 8552
		Chromium	2,300	mg/kg	1.92	mg/kg	Ref. 4, p. 8640
		Lead	912 JH (633.33)	mg/kg	1.92	mg/kg	Ref. 4, pp. 8640 and 138849; Ref. 5, pp. 8 and 18; Ref. 37, p. 5
		Nickel	684 JL	mg/kg	1.92	mg/kg	Ref. 4, pp. 8640 and 138849; Ref, 5, p. 8; Ref. 37, p. 5
		Bis(2-ethylhexyl)phthalate	1,510	ug/kg	330	ug/kg	Ref. 4, p. 8489
		Acenaphthene	978	ug/kg	13.2	ug/kg	Ref. 4, p. 8489
		Acenaphthylene	71.4	ug/kg	13.2	ug/kg	Ref. 4, p. 8489
		Anthracene	4,650	ug/kg	13.2	ug/kg	Ref. 4, p. 8489
		Fluorene	673	ug/kg	13.2	ug/kg	Ref. 4, p. 8489
		Naphthalene	44.9	ug/kg	13.2	ug/kg	Ref. 4, p. 8488
		Phenanthrene	9,370	ug/kg	13.2	ug/kg	Ref. 4, p. 8489
		Benzo(a)anthracene	23,100	ug/kg	26.4	ug/kg	Ref. 4, p. 8489
		Benzo(a)pyrene	15,800	ug/kg	13.2	ug/kg	Ref. 4, p. 8489
		Benzo(g,h,i)perylene	7,360	ug/kg	13.2	ug/kg	Ref. 4, p. 8489
		Chrysene	19,800	ug/kg	26.4	ug/kg	Ref. 4, p. 8489
		Fluoranthene	25,800	ug/kg	13.2	ug/kg	Ref. 4, p. 8489
		Indeno(1,2,3-cd)pyrene	8,930	ug/kg	13.2	ug/kg	Ref. 4, p. 8489
		Pyrene	31,600	ug/kg	13.2	ug/kg	Ref. 4, p. 8489
BIL22 011016BIL22SS	3.0	Aroclor 1254	86.1	ug/kg	10.4	ug/kg	Ref. 4, pp. 443 and 8553
		Aroclor 1260	64.5	ug/kg	10.4	ug/kg	Ref. 4, p. 8553
		Chromium	767	mg/kg	1.01	mg/kg	Ref. 4, p. 8644
		Copper	315	mg/kg	2.02	mg/kg	Ref. 4, p. 8643
		Lead	1,310	mg/kg	2.02	mg/kg	Ref. 4, p. 8644
		Nickel	708	mg/kg	2.02	mg/kg	Ref. 4, p. 8643
		Tetrachloroethene	4.08	ug/kg	0.431	ug/kg	Ref. 4, p. 8468

Table 2
Analytical Results for Source 1 – Phase II Supplemental Landfill Site Investigation (Inspection) 2001/2002
Gully Test Pit Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MDL, MRL, or PQL	Units (Dry weight)	Reference
(Cont.) BIL22 011016BIL22SS	3.0	Bis(2-ethylhexyl)phthalate	941	ug/kg	335	ug/kg	Ref. 4, p. 8491
		Acenaphthene	601	ug/kg	14.2	ug/kg	Ref. 4, p. 8491
		Acenaphthylene	52.6	ug/kg	14.2	ug/kg	Ref. 4, p. 8491
		Anthracene	2,000	ug/kg	14.2	ug/kg	Ref. 4, p. 8491
		Fluorene	381	ug/kg	14.2	ug/kg	Ref. 4, p. 8491
		Naphthalene	49.8	ug/kg	14.2	ug/kg	Ref. 4, p. 8490
		Phenanthrene	5,360	ug/kg	14.2	ug/kg	Ref. 4, p. 8491
		Benzo(a)anthracene	11,000	ug/kg	28.4	ug/kg	Ref. 4, p. 8491
		Benzo(a)pyrene	8,670	ug/kg	14.2	ug/kg	Ref. 4, p. 8491
		Benzo(g,h,i)perylene	3,020	ug/kg	14.2	ug/kg	Ref. 4, p. 8491
		Chrysene	8,790	ug/kg	28.4	ug/kg	Ref. 4, p. 8491
		Dibenz(a,h)anthracene	573	ug/kg	14.2	ug/kg	Ref. 4, p. 8491
		Fluoranthene	19,900	ug/kg	14.2	ug/kg	Ref. 4, p. 8491
		Indeno(1,2,3-cd)pyrene	3,660	ug/kg	14.2	ug/kg	Ref. 4, p. 8491
		Pyrene	26,700	ug/kg	14.2	ug/kg	Ref. 4, p. 8491

Key:

() = Adjusted concentration as per Ref. 5, pp. 12, 14, and 18; rounded to two decimal places when applicable.
bgs = below ground surface.
H = High bias.
ID = Identification.
J = The analyte was positively identified; the associated numerical value is an estimate of the concentration of the analyte in the sample (Ref. 4, p. 138850).
K = Unknown bias.
L = Low bias.
MDL = Method detection limit.
mg/kg = milligrams per kilogram.
MRL = Method reporting limit.
ND = Not detected.
U = Undetected at the quantitation limit (Ref. 4, p. 138850).
PQL = Practical quantitation limit.
Q = The sample result was between the PQL and the MRL or MDL (Ref. 4, p. 8450, 8474, and 8621; Ref. 37, p. 1).
ug/kg = micrograms per kilogram.

- Mercury Vapor-Lamp Test Pit and Lead Hot Spot Test Pits Source Samples: Seven soil samples (i.e., BIL05 through BIL11) were collected from the Mercury Vapor-Lamp Test Pit and six soil samples (i.e., BIL24, BIL26, BIL27, BIL30, BIL31, and BIL32) were collected from Lead Hot Spot Test Pits excavated within the Landfill AOPC during the USACE 2001/2002 USACE Phase II Supplemental Landfill Site Investigation as presented in Table 3 below (Ref. 4, pp. 64, 65, and 305 [Figure 5-1]). All samples underwent a quality assurance/quality control (QA/QC) review following the procedures specified in the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review and Inorganic Data Review (Ref. 4, p. 138839). The samples were collected and analyzed according to the Sampling and Analysis Plan (Ref. 4, p. 138839). The Mercury Vapor-Lamp Test Pit samples were analyzed for Metals by EPA SW-846 Methods 6010B/6020, mercury by EPA SW-846 Method 7471, and PCBs by EPA SW-846 Method 8082 (Ref. 4, pp. 138839 and 138846). The Lead Hot Spot Test Pit samples were analyzed for lead by EPA SW-846 Method 6010B (Ref. 4, pp. 138839 and 138846). Sample custody was maintained under the COC forms and was properly executed upon during sample transfer (Ref. 4, pp. 8777, 138840 and 138846). Sample BIL08 is used in this HRS Documentation Record to represent background concentrations for Mercury Vapor-Lamp Test Pit and Lead Hot Spot Test Pits samples due to the relatively low concentrations of contaminants in this sample (Ref. 4, pp. 441 through 444 [Table 5-2a] and 449 [Table 5-2d]). Although not required by the HRS, background concentrations are provided to show the relative increase of contaminant levels in the source over background. The Phase II Supplemental Landfill Site Investigation Gully Test Pit soil sample locations are depicted on Figure 5-1 of Reference 4, p. 305.

Table 3
Analytical Results for Source 1 – Phase II Supplemental Landfill Site Investigation (Inspection) 2001/2002 Mercury Vapor-Lamp and Lead Hot Spot Test Pit Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	PQL	Units (Dry weight)	Reference
Background Mercury Vapor-Lamp and Lead Hot Spot Test Pit Soil Samples							
BIL08 011016BIL08SS	5.0	Aroclor 1254	ND U	ug/kg	10.7	ug/kg	Ref. 4, pp. 441 and 8541
		Aroclor 1260	ND U	ug/kg	10.7	ug/kg	Ref. 4, p. 8541
		Antimony	0.783	mg/kg	0.643	mg/kg	Ref. 4, p. 8601
		Copper	17.9 JL (21.84)	mg/kg	2.14	mg/kg	Ref. 4, pp. 8600 and 138849; Ref. 5, pp. 8 and 18; Ref. 37, p. 6
		Lead	70.7 JH	mg/kg	0.429	mg/kg	Ref. 4, pp. 8601 and 138849; Ref. 5, p. 8; Ref. 37, p. 6
		Mercury	0.0238	mg/kg	0.0215	mg/kg	Ref. 4, p. 8602
Contaminated Mercury Vapor-Lamp Test Pit Soil Samples							
BIL05 011016BIL05SS	8.0	Mercury	0.0763	mg/kg	0.0232	mg/kg	Ref. 4, pp. 441 and 8593

Table 3
Analytical Results for Source 1 – Phase II Supplemental Landfill Site Investigation (Inspection) 2001/2002
Mercury Vapor-Lamp and Lead Hot Spot Test Pit Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	PQL	Units (Dry weight)	Reference
BIL06 011016BIL06SS	8.0	Aroclor 1254	26.7	ug/kg	10.8	ug/kg	Ref. 4, pp. 441 and 8539
		Aroclor 1260	12.8	ug/kg	10.8	ug/kg	Ref. 4, p. 8539
		Mercury	0.479	mg/kg	0.0228	mg/kg	Ref. 4, p. 8596
BIL07 011016BIL07SS	5.0	Aroclor 1260	36.7	ug/kg	10.6	ug/kg	Ref. 4, pp. 441 and 8540
		Antimony	8.19	mg/kg	0.659	mg/kg	Ref. 4, p. 8598
		Copper	120 JL	mg/kg	2.2	mg/kg	Ref. 4, pp. 8597 and 138849; Ref. 5, p. 8; Ref. 37, p. 6
		Lead	697 JH (484.02)	mg/kg	0.439	mg/kg	Ref. 4, pp. 8598 and 138849; Ref. 5, pp. 8 and 18; Ref. 37, p. 6
		Mercury	0.215	mg/kg	0.0226	mg/kg	Ref. 4, p. 8599
BIL09 011016BIL09SS	6.0	Aroclor 1260	55.3	ug/kg	11.5	ug/kg	Ref. 4, pp. 441 and 8542
		Antimony	2.58	mg/kg	0.675	mg/kg	Ref. 4, p. 8604
		Lead	966 JH (670.83)	mg/kg	0.45	mg/kg	Ref. 4, pp. 8604 and 138849; Ref. 5, pp. 8 and 18; Ref. 37, p. 6
		Mercury	1.04	mg/kg	0.0176	mg/kg	Ref. 4, p. 8605
BIL11 011016BIL11SS	8.0	Aroclor 1254	55.3	ug/kg	13.4	ug/kg	Ref. 4, pp. 441 and 8536
		Aroclor 1260	36.1	ug/kg	13.4	ug/kg	Ref. 4, p. 8536
		Antimony	2.55	mg/kg	0.832	mg/kg	Ref. 4, p. 8586
		Mercury	0.252	mg/kg	0.0278	mg/kg	Ref. 4, p. 8587
Contaminated Lead Hot Spot Test Pit Soil Samples							
BIL24 011017BIL24SS	3	Lead	815 B2/JH (565.97)	mg/kg	0.452	mg/kg	Ref. 4, pp. 449 and 8609; Ref. 5, pp. 8 and 18; Ref. 37, p. 6

Table 3
Analytical Results for Source 1 – Phase II Supplemental Landfill Site Investigation (Inspection) 2001/2002
Mercury Vapor-Lamp and Lead Hot Spot Test Pit Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	PQL	Units (Dry weight)	Reference
BIL26 011017BIL26SS	2	Lead	711 B2/JH (493.75)	mg/kg	0.399	mg/kg	Ref. 4, pp. 449 and 8611; Ref. 5, pp. 8 and 18; Ref. 37, p. 7
BIL27 011017BIL27SS	3	Lead	954 B2/JH (662.5)	mg/kg	0.419	mg/kg	Ref. 4, pp. 449 and 8612; Ref. 5, pp. 8 and 18; Ref. 37, p. 7

Key:

()	=	Adjusted concentration as per Ref. 5, p. 18; rounded to two decimal places when applicable.
B2	=	This analyte was detected in the associated method blank (Ref. 4, p. 8769). The analyte concentration was determined to be significantly higher than the method blank (greater than ten times the concentration reported in the blank) (Ref. 4, p. 8769).
bgs	=	below ground surface.
H	=	High bias.
ID	=	Identification.
J	=	The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity (Ref. 4, p. 8437).
L	=	Low bias.
mg/kg	=	milligrams per kilogram.
PQL	=	Practical quantitation limit.
U	=	The analyte was not detected at or above the MDL (Ref. 4, p. 444).
ug/kg	=	micrograms per kilogram.

USACE Upland Source Evaluation 2007

- North Slope Source Samples: Six soil samples (i.e., BIL01USE, BIL02USE, BIL03USE, BIL07USE, BIL08USE, and BIL09USE) were collected from the northern slope of the Landfill AOPC during the 2007 USACE Upland Source Evaluation as presented in Table 4 below (Ref. 4, p. 66). All samples underwent a quality assurance/quality control (QA/QC) review following the procedures specified in the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review and Inorganic Data Review (Ref. 4, pp. 138884 and 138889). The samples were analyzed for Total Metals by EPA SW-846 Methods 6010B/200.8, mercury by EPA SW-846 Method 7471A, SVOCs by EPA SW-846 Method 8270D, PCBs by EPA SW-846 Methods 8082-M, and Organochlorine Pesticides by EPA SW-846 Method 8081A (Ref. 4, pp. 138884 and 138889). Sample custody was maintained under the COC forms and was properly executed upon during sample transfer (Ref. 4, pp. 48029, 48030, and 138885). Sample BIL05USE (collected east of the landfill) is used in this HRS Documentation Record to represent background concentrations due to the relatively low concentrations of contaminants in this sample (Ref. 4, p. 456 [Table 5-3a]). Although not required by the HRS, background concentrations are provided to show the relative increase of contaminant levels in the source over background. The Upland Source Evaluation soil samples are depicted on Figure 5-1 of Reference 4, p. 305.

Table 4
Analytical Results for Source 1 – USACE Upland Source Evaluation 2007
North Slope Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	RL	Units (Dry weight)	Reference
Background Soil Sample							
BIL05USE 070410BIL05SS	0.5	Aroclor 1254	4.0 U	ug/kg	4.0	ug/kg	Ref 4. pp. 456 and 48102
		Aroclor 1260	12	ug/kg	4.0	ug/kg	Ref 4. p. 48102
		Chromium	16.1	mg/kg	0.6	mg/kg	Ref. 4. p. 48122
		Lead	49 JL (70.56)	mg/kg	1	mg/kg	Ref. 4. pp. 48122 and 138890; Ref. 5, pp. 8 and 18; Ref. 37, p. 7
		Nickel	15	mg/kg	1	mg/kg	Ref. 4. p. 48122
Contaminated North Slope Soil Samples							
BIL01USE 070410BIL01SS	0.5	Aroclor 1254	25	ug/kg	12	ug/kg	Ref. 4. pp. 456 and 48098
		Aroclor 1260	42	ug/kg	12	ug/kg	Ref. 4. p. 48098
BIL02USE 070410BIL02SS	0.5	Aroclor 1254	27	ug/kg	3.9	ug/kg	Ref. 4. pp. 456 and 48099

Table 4
Analytical Results for Source 1 – USACE Upland Source Evaluation 2007
North Slope Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	RL	Units (Dry weight)	Reference
BIL03USE 070410BIL03SS	0.5	Aroclor 1254	19	ug/kg	3.9	ug/kg	Ref. 4. pp. 456 and 48100
BIL07USE 070410BIL07SS	0.5	Aroclor 1254	46	ug/kg	12	ug/kg	Ref. 4. pp. 456 and 48106
		Aroclor 1260	60	ug/kg	12	ug/kg	Ref. 4. P. 48106
		Chromium	801	mg/kg	2	mg/kg	Ref. 4. P. 48124
		Lead	680	mg/kg	10	mg/kg	Ref. 4. P. 48124; Ref. 5, p. 18
		Nickel	570	mg/kg	3	mg/kg	Ref. 4. P. 48124
BIL08USE 070410BIL08SS	0.5	Aroclor 1254	23	ug/kg	12	ug/kg	Ref. 4. pp. 456 and 48108
		Aroclor 1260	40	ug/kg	12	ug/kg	Ref. 4. p. 48108
		Chromium	117	mg/kg	0.6	mg/kg	Ref. 4. p. 48125
		Nickel	72	mg/kg	1	mg/kg	Ref. 4. p. 48125
BIL09USE 070410BIL09SS	0.5	Aroclor 1254	5.5	ug/kg	3.8	ug/kg	Ref. 4. pp. 456 and 48109

Key:

() = Adjusted concentration as per Ref. 5, p. 18; rounded to two decimal places when applicable.
bgs = below ground surface.
ID = Identification.
J = The analyte was positively identified, the associated numerical value is the approximate concentration of the analyte in the sample (Ref. 4, p. 138885).
L = Low bias.
mg/kg = milligrams per kilogram.
RL = Reporting limit.
U = The analyte was analyzed for but was not detected above the reported sample quantitation limit (Ref. 4, p. 138885).
ug/kg = micrograms per kilogram.

URS Upland OU Data Gaps Sampling Report 2009

- Landfill Gully Area Test Pit Source Samples: Eight soil samples were collected from four test pits (L1 through L4) in the Gully Area of the Landfill AOPC during the URS Upland OU Data Gaps Sampling event as presented in Table 5 below (Ref. 4, p. 73). Within each test pit, one sample was collected from 0 to 1 feet bgs and one sample was collected from 1 to 3 feet bgs (Ref. 4, p. 73). All samples underwent a quality assurance/quality control (QA/QC) review following the procedures specified in the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review and Inorganic Data Review (Ref. 4, pp. 138941, 138942, and 138953). Samples for this investigation were collected following the guidance contained in related quality assurance project plans (Ref. 4, pp. 72, 290, 291, and 138940). The samples were analyzed for SVOCs and PAHs by EPA SW-846 Method 8270C (Ref. 4, pp. 136329 and 137545). The samples were received consistent with the accompanying COC forms (Ref. 4, pp. 136329, 136331, 137545, and 137547). Background soil samples (i.e., referred to as "Reference" samples) were collected from 14 locations (R1 through R14) (Ref. 4, p. 74). Although not required by the HRS, background concentrations are provided to show the relative increase of contaminant levels in the source over background. The locations of Upland OU Data Gaps Sampling soil sample locations are depicted on Figure 5-1 of Reference 4, p. 305. The locations of associated reference samples are depicted on Figure 6-1 of Reference 4, p. 309. In Table 5, the highest concentration of each analyte among the reference samples is provided as the background concentration. A table summarizing reference soil sample results is provided as Table 6-5a of Reference 4, p. 526; and indicates that the sample collected from location R-03 (090128-R-R3-0-0.5so) from 0.0 to 0.5 feet bgs had the highest concentrations for all analytes among the reference samples for low molecular weight PAHs and for high molecular weight PAHs. This observation is confirmed by the associated laboratory analytical data sheets (Ref. 4, pp. 137493 through 137507). For this reason, only data for sample R-03 is provided in Table 5 for representing background concentrations.

Table 5
Analytical Results for Source 1 – Upland OU Data Gaps Report 2009
Gully Area Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MRL	Units (Dry weight)	Reference
Background Soil Sample							
R-03 090128-R-R3-0-0.5so	0.0 to 0.5	Acenaphthene	3.4 JQ	ug/kg	10	ug/kg	Ref. 4, p. 137495; Ref. 37, p. 8
		Acenaphthylene	1.6 JQ	ug/kg	10	ug/kg	Ref. 4, p. 137495; Ref. 37, p. 8
		Anthracene	4.9 JQ	ug/kg	10	ug/kg	Ref. 4, p. 137495; Ref. 37, p. 8
		Fluorene	3.2 JQ	ug/kg	10	ug/kg	Ref. 4, p. 137495; Ref. 37, p. 8
		Naphthalene	2.2 JQ	ug/kg	10	ug/kg	Ref. 4, p. 137495; Ref. 37, p. 8
		Phenanthrene	34	ug/kg	10	ug/kg	Ref. 4, p. 137495
		Benzo(a)anthracene	34	ug/kg	10	ug/kg	Ref. 4, p. 137495
		Benzo(a)pyrene	45	ug/kg	10	ug/kg	Ref. 4, p. 137495
		Benzo(b)fluoranthene	55	ug/kg	10	ug/kg	Ref. 4, p. 137495

Table 5 Analytical Results for Source 1 – Upland OU Data Gaps Report 2009 Gully Area Soil Samples							
Sample ID	**Sample Depth (feet bgs)**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (Dry weight)**	**MRL**	**Units (Dry weight)**	**Reference**
(Cont.) R-03 090128-R-R3-0-0.5so	0.0 to 0.5	Benzo(g,h,i)perylene	32	ug/kg	10	ug/kg	Ref. 4, p. 137495
		Benzo(k)fluoranthene	19	ug/kg	10	ug/kg	Ref. 4, p. 137495
		Chrysene	45	ug/kg	10	ug/kg	Ref. 4, p. 137495
		Dibenz(a,h)anthracene	6.9 JQ	ug/kg	10	ug/kg	Ref. 4, p. 137495; Ref. 37, p. 8
		Fluoranthene	66	ug/kg	10	ug/kg	Ref. 4, p. 137495
		Indeno(1,2,3-cd)pyrene	34	ug/kg	10	ug/kg	Ref. 4, p. 137495
		Pyrene	64	ug/kg	10	ug/kg	Ref. 4, p. 137495
Contaminated Landfill Gully Area Soil Samples							
L-01 090129-L-L1-0-1So	0.0 to 1.0	Acenaphthene	66	ug/kg	0.50	ug/kg	Ref. 4, p. 138554
		Anthracene	99	ug/kg	0.50	ug/kg	Ref. 4, p. 138554
		Fluorene	33	ug/kg	0.50	ug/kg	Ref. 4, p. 138554
		Phenanthrene	350	ug/kg	0.50	ug/kg	Ref. 4, p. 138554
		Benzo(a)anthracene	690	ug/kg	20	ug/kg	Ref. 4, p. 138554
		Benzo(a)pyrene	820	ug/kg	10	ug/kg	Ref. 4, p. 138554
		Benzo(b)fluoranthene	990	ug/kg	10	ug/kg	Ref. 4, p. 138554
		Benzo(g,h,i)perylene	460	ug/kg	10	ug/kg	Ref. 4, p. 138554
		Benzo(k)fluoranthene	310	ug/kg	0.50	ug/kg	Ref. 4, p. 138554
		Chrysene	790	ug/kg	10	ug/kg	Ref. 4, p. 138554
		Dibenz(a,h)anthracene	130	ug/kg	0.50	ug/kg	Ref. 4, p. 138554
		Fluoranthene	1,200	ug/kg	10	ug/kg	Ref. 4, p. 138554
		Indeno(1,2,3-cd)pyrene	620	ug/kg	10	ug/kg	Ref. 4, p. 138554
		Pyrene	1,200	ug/kg	10	ug/kg	Ref. 4, p. 138554
L-01 090129-L-L1-1-3So	1.0 to 3.0	Acenaphthene	170	ug/kg	2.5	ug/kg	Ref. 4, p. 138555
		Acenaphthylene	12	ug/kg	2.5	ug/kg	Ref. 4, p. 138555
		Anthracene	400	ug/kg	2.5	ug/kg	Ref. 4, p. 138555
		Fluorene	99	ug/kg	2.5	ug/kg	Ref. 4, p. 138555
		Naphthalene	22	ug/kg	5.0	ug/kg	Ref. 4, p. 138555
		Phenanthrene	1,500	ug/kg	2.5	ug/kg	Ref. 4, p. 138555
		Benzo(a)anthracene	4,500	ug/kg	20	ug/kg	Ref. 4, p. 138555
		Benzo(a)pyrene	5,800	ug/kg	10	ug/kg	Ref. 4, p. 138555
		Benzo(b)fluoranthene	7,100	ug/kg	10	ug/kg	Ref. 4, p. 138555

Table 5 Analytical Results for Source 1 – Upland OU Data Gaps Report 2009 Gully Area Soil Samples							
Sample ID	**Sample Depth (feet bgs)**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (Dry weight)**	**MRL**	**Units (Dry weight)**	**Reference**
(Cont.) L-01 090129-L-L1-1-3So	1.0 to 3.0	Benzo(g,h,i)perylene	3,300	ug/kg	10	ug/kg	Ref. 4, p. 138555
		Benzo(k)fluoranthene	2,400	ug/kg	10	ug/kg	Ref. 4, p. 138555
		Chrysene	5,000	ug/kg	10	ug/kg	Ref. 4, p. 138555
		Dibenz(a,h)anthracene	970	ug/kg	2.5	ug/kg	Ref. 4, p. 138555
		Fluoranthene	7,700	ug/kg	10	ug/kg	Ref. 4, p. 138555
		Indeno(1,2,3-cd)pyrene	4,500	ug/kg	10	ug/kg	Ref. 4, p. 138555
		Pyrene	7,500	ug/kg	10	ug/kg	Ref. 4, p. 138555
L-02 090129-L-L2-0-1So	0.0 to 1.0	Acenaphthene	220	ug/kg	2.5	ug/kg	Ref. 4, p. 138556
		Acenaphthylene	15	ug/kg	2.5	ug/kg	Ref. 4, p. 138556
		Anthracene	650	ug/kg	2.5	ug/kg	Ref. 4, p. 138556
		Fluorene	130	ug/kg	2.5	ug/kg	Ref. 4, p. 138556
		Naphthalene	14	ug/kg	5.0	ug/kg	Ref. 4, p. 138556
		Phenanthrene	2,000	ug/kg	2.5	ug/kg	Ref. 4, p. 138556
		Benzo(a)anthracene	4,100	ug/kg	20	ug/kg	Ref. 4, p. 138556
		Benzo(a)pyrene	4,700	ug/kg	10	ug/kg	Ref. 4, p. 138556
		Benzo(b)fluoranthene	5,700	ug/kg	10	ug/kg	Ref. 4, p. 138556
		Benzo(g,h,i)perylene	2,500	ug/kg	10	ug/kg	Ref. 4, p. 138556
		Benzo(k)fluoranthene	2,000	ug/kg	10	ug/kg	Ref. 4, p. 138556
		Chrysene	4,900	ug/kg	10	ug/kg	Ref. 4, p. 138556
		Dibenz(a,h)anthracene	710	ug/kg	2.5	ug/kg	Ref. 4, p. 138556
		Fluoranthene	7,000	ug/kg	10	ug/kg	Ref. 4, p. 138556
		Indeno(1,2,3-cd)pyrene	3,500	ug/kg	10	ug/kg	Ref. 4, p. 138556
		Pyrene	6,700	ug/kg	10	ug/kg	Ref. 4, p. 138556
L-02 090129-L-L2-1-3So	1.0 to 3.0	Acenaphthene	1,900	ug/kg	10	ug/kg	Ref. 4, p. 138557
		Acenaphthylene	41	ug/kg	10	ug/kg	Ref. 4, p. 138557
		Anthracene	2,100	ug/kg	10	ug/kg	Ref. 4, p. 138557
		Fluorene	630	ug/kg	10	ug/kg	Ref. 4, p. 138557
		Naphthalene	140	ug/kg	20	ug/kg	Ref. 4, p. 138557
		Phenanthrene	7,400	ug/kg	10	ug/kg	Ref. 4, p. 138557
		Benzo(a)anthracene	11,000	ug/kg	200	ug/kg	Ref. 4, p. 138557
		Benzo(a)pyrene	16,000	ug/kg	100	ug/kg	Ref. 4, p. 138557
		Benzo(b)fluoranthene	16,000	ug/kg	100	ug/kg	Ref. 4, p. 138557

Table 5 Analytical Results for Source 1 – Upland OU Data Gaps Report 2009 Gully Area Soil Samples							
Sample ID	**Sample Depth (feet bgs)**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (Dry weight)**	**MRL**	**Units (Dry weight)**	**Reference**
(Cont.) L-02 090129-L-L2-1-3So	1.0 to 3.0	Benzo(g,h,i)perylene	9,500	ug/kg	100	ug/kg	Ref. 4, p. 138557
		Benzo(k)fluoranthene	5,900	ug/kg	10	ug/kg	Ref. 4, p. 138557
		Chrysene	14,000	ug/kg	100	ug/kg	Ref. 4, p. 138557
		Dibenz(a,h)anthracene	2,300	ug/kg	10	ug/kg	Ref. 4, p. 138557
		Fluoranthene	21,000	ug/kg	100	ug/kg	Ref. 4, p. 138557
		Indeno(1,2,3-cd)pyrene	13,000	ug/kg	100	ug/kg	Ref. 4, p. 138557
		Pyrene	21,000	ug/kg	100	ug/kg	Ref. 4, p. 138557
L-03 090129-L-L3-0-1So	0.0 to 1.0	Acenaphthene	700	ug/kg	10	ug/kg	Ref. 4, p. 138558
		Acenaphthylene	13	ug/kg	10	ug/kg	Ref. 4, p. 138558
		Anthracene	880	ug/kg	10	ug/kg	Ref. 4, p. 138558
		Fluorene	340	ug/kg	10	ug/kg	Ref. 4, p. 138558
		Naphthalene	49	ug/kg	20	ug/kg	Ref. 4, p. 138558
		Phenanthrene	3,400	ug/kg	10	ug/kg	Ref. 4, p. 138558
		Benzo(a)anthracene	4,500	ug/kg	20	ug/kg	Ref. 4, p. 138558
		Benzo(a)pyrene	5,900	ug/kg	10	ug/kg	Ref. 4, p. 138558
		Benzo(b)fluoranthene	6,400	ug/kg	10	ug/kg	Ref. 4, p. 138558
		Benzo(g,h,i)perylene	3,300	ug/kg	10	ug/kg	Ref. 4, p. 138558
		Benzo(k)fluoranthene	2,300	ug/kg	10	ug/kg	Ref. 4, p. 138558
		Chrysene	5,000	ug/kg	10	ug/kg	Ref. 4, p. 138558
		Dibenz(a,h)anthracene	1,000	ug/kg	10	ug/kg	Ref. 4, p. 138558
		Fluoranthene	8,200	ug/kg	20	ug/kg	Ref. 4, p. 138558
		Indeno(1,2,3-cd)pyrene	4,600	ug/kg	10	ug/kg	Ref. 4, p. 138558
		Pyrene	7,900	ug/kg	10	ug/kg	Ref. 4, p. 138558
L-03 090129-L-L3-1-3So	1.0 to 3.0	Acenaphthene	360	ug/kg	9.9	ug/kg	Ref. 4, p. 138559
		Acenaphthylene	15	ug/kg	9.9	ug/kg	Ref. 4, p. 138559
		Anthracene	900	ug/kg	9.9	ug/kg	Ref. 4, p. 138559
		Fluorene	210	ug/kg	9.9	ug/kg	Ref. 4, p. 138559
		Naphthalene	49	ug/kg	20	ug/kg	Ref. 4, p. 138559
		Phenanthrene	2,800	ug/kg	9.9	ug/kg	Ref. 4, p. 138559
		Benzo(a)anthracene	4,800	ug/kg	20	ug/kg	Ref. 4, p. 138559
		Benzo(a)pyrene	5,800	ug/kg	9.9	ug/kg	Ref. 4, p. 138559
		Benzo(b)fluoranthene	6,500	ug/kg	9.9	ug/kg	Ref. 4, p. 138559

Table 5 Analytical Results for Source 1 – Upland OU Data Gaps Report 2009 Gully Area Soil Samples							
Sample ID	**Sample Depth (feet bgs)**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (Dry weight)**	**MRL**	**Units (Dry weight)**	**Reference**
(Cont.) L-03 090129-L-L3-1-3So	1.0 to 3.0	Benzo(g,h,i)perylene	3,100	ug/kg	9.9	ug/kg	Ref. 4, p. 138559
		Benzo(k)fluoranthene	2,400	ug/kg	9.9	ug/kg	Ref. 4, p. 138559
		Chrysene	5,400	ug/kg	9.9	ug/kg	Ref. 4, p. 138559
		Dibenz(a,h)anthracene	900	ug/kg	9.9	ug/kg	Ref. 4, p. 138559
		Fluoranthene	8,700	ug/kg	20	ug/kg	Ref. 4, p. 138559
		Indeno(1,2,3-cd)pyrene	4,400	ug/kg	9.9	ug/kg	Ref. 4, p. 138559
		Pyrene	9,400	ug/kg	20	ug/kg	Ref. 4, p. 138559
L-04 090129-L-L4-0-1So	0.0 to 1.0	Acenaphthene	2,100	ug/kg	10	ug/kg	Ref. 4, p. 138560
		Acenaphthylene	26	ug/kg	10	ug/kg	Ref. 4, p. 138560
		Anthracene	1,700	ug/kg	10	ug/kg	Ref. 4, p. 138560
		Fluorene	890	ug/kg	10	ug/kg	Ref. 4, p. 138560
		Naphthalene	120	ug/kg	20	ug/kg	Ref. 4, p. 138560
		Phenanthrene	6,900	ug/kg	10	ug/kg	Ref. 4, p. 138560
		Benzo(a)anthracene	5,900	ug/kg	20	ug/kg	Ref. 4, p. 138560
		Benzo(a)pyrene	7,600	ug/kg	10	ug/kg	Ref. 4, p. 138560
		Benzo(b)fluoranthene	8,300	ug/kg	20	ug/kg	Ref. 4, p. 138560
		Benzo(g,h,i)perylene	4,200	ug/kg	10	ug/kg	Ref. 4, p. 138560
		Benzo(k)fluoranthene	2,900	ug/kg	10	ug/kg	Ref. 4, p. 138560
		Chrysene	6,700	ug/kg	10	ug/kg	Ref. 4, p. 138560
		Dibenz(a,h)anthracene	1,200	ug/kg	10	ug/kg	Ref. 4, p. 138560
		Fluoranthene	12,000	ug/kg	20	ug/kg	Ref. 4, p. 138560
		Indeno(1,2,3-cd)pyrene	5,800	ug/kg	10	ug/kg	Ref. 4, p. 138560
		Pyrene	11,000	ug/kg	20	ug/kg	Ref. 4, p. 138560
L-04 090129-L-L4-1-3So	1.0 to 3.0	Acenaphthene	420	ug/kg	10	ug/kg	Ref. 4, p. 138561
		Acenaphthylene	13	ug/kg	10	ug/kg	Ref. 4, p. 138561
		Anthracene	740	ug/kg	10	ug/kg	Ref. 4, p. 138561
		Fluorene	240	ug/kg	10	ug/kg	Ref. 4, p. 138561
		Naphthalene	57	ug/kg	20	ug/kg	Ref. 4, p. 138561
		Phenanthrene	2,800	ug/kg	10	ug/kg	Ref. 4, p. 138561
		Benzo(a)anthracene	4,800	ug/kg	20	ug/kg	Ref. 4, p. 138561
		Benzo(a)pyrene	6,200	ug/kg	10	ug/kg	Ref. 4, p. 138561
		Benzo(b)fluoranthene	7,200	ug/kg	10	ug/kg	Ref. 4, p. 138561

Table 5
Analytical Results for Source 1 – Upland OU Data Gaps Report 2009
Gully Area Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MRL	Units (Dry weight)	Reference
(Cont.) L-04 090129-L-L4-1-3So	1.0 to 3.0	Benzo(g,h,i)perylene	3,500	ug/kg	10	ug/kg	Ref. 4, p. 138561
		Benzo(k)fluoranthene	2,500	ug/kg	10	ug/kg	Ref. 4, p. 138561
		Chrysene	5,600	ug/kg	10	ug/kg	Ref. 4, p. 138561
		Dibenz(a,h)anthracene	1,100	ug/kg	10	ug/kg	Ref. 4, p. 138561
		Fluoranthene	8,600	ug/kg	20	ug/kg	Ref. 4, p. 138561
		Indeno(1,2,3-cd)pyrene	4,900	ug/kg	10	ug/kg	Ref. 4, p. 138561
		Pyrene	8,600	ug/kg	20	ug/kg	Ref. 4, p. 138561

Key:

bgs = below ground surface.
ID = Identification.
J = The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL. (Ref. 4, pp. 136325 and 136326).
MDL = Method detection limit.
MRL = Method reporting limit.
PQL = Practical quantitation limit.
Q = The sample result was between the MRL and the MDL (Ref. 4, p. 137495; Ref. 37, pp. 2 and 3).
ug/kg = micrograms per kilogram.

List of Hazardous Substances Associated with Source

PCBs (Aroclor 1254 and Aroclor 1260), metals (antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, thallium, and zinc), herbicides (2,4,5-T), pesticides (BHC [alpha], BHC [beta], chlordane, heptachlor, and heptachlor epoxide), VOCs (PCE and toluene), SVOCs (acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, chrysene, dibenz(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, pentachlorophenol, phenanthrene, and pyrene), and butyltins (dibutyltin, monobutyltin, and tributylin).

Butyltins are pollutants/contaminants found at this site (see Table 2 of this HRS documentation record). Butyltins are a class of compounds that bioaccumulate in sediment and fish tissue and are known to have effects on human health and wildlife (Ref. 35, p. 63). One study found that rats whose mothers were exposed to tributyltin during pregnancy showed altered performance in some neurological tests conducted when they were young adults (Ref. 36, p. 27). Another study, also with tributyltin, found that exposure during gestation, lactation, and post-lactation affected some developmental landmarks in female rats (Ref. 36, p. 27). Dibutyltin, and tributyltin, when administered during pregnancy, have induced developmental and reproductive effects in rodents (Ref. 36, p. 33).

The EPA has developed risk-based residential soil regional screening levels (RSLs) for dibutyltin compounds (i.e., 19 mg/kg) and for tri-n-butyltin (i.e., 23 mg/kg) (Ref. 33, pp. 2, 7, and 15). The Regional Sediment Evaluation Team (RSET) has determined that tributyltin is a bioaccumulative chemical of concern in Oregon, including the Columbia River where it borders Oregon and Washington (Ref. 34, p. 142). RSET has proposed freshwater benthic screening levels for dibutyltin, monobutyltin, and tributyltin (Ref. 34, p. 190) and water quality-based screening levels for tributyltin (Ref. 34, p. 195).

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The hazardous constituent quantity for Source No. 1 could not be adequately determined according to the HRS requirements; that is, the total mass of all Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances in the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). There are insufficient historical and current data (Manifests, PRP records, State records, Permits, Waste concentration data, etc.) available to adequately calculate the total mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source No. 1 with reasonable confidence.

Hazardous Constituent Quantity Value (S): NS

2.4.2.1.2 Hazardous Wastestream Quantity

The hazardous wastestream quantity for Source No. 1 could not be adequately determined according to the HRS requirements; that is, the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants in the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). There are insufficient historical and current data (Manifests, PRP records, State records, permits, etc.) available to adequately calculate the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous wastestream quantity for Source No. 1 with reasonable confidence.

Hazardous Wastestream Quantity (W): NS

2.4.2.1.3 Volume

Based on information from site investigations including electrical resistivity data, seismic refraction data, and boring logs, the volume of landfilled material was estimated in the RI report to be between 7,500 cubic yards (cy) and 9,900 cy, with a maximum depth of 15 feet below ground surface (bgs) (Ref. 4, p. 48).

Using the lower estimated landfill volume of 7,500 cy, the volume measure of the source is conservatively calculated to be 3 (i.e., 7,500 cy / 2,500 for a landfill) (Ref. 1, Section 2.4.2.1.3).

Volume Assigned Value (V): 3

2.4.2.1.4 Area

An area measure of 0 is assigned since the volume of the source could be determined (Ref. 1, Sections 2.4.2.1.3 and 2.4.2.1.4).

Area Assigned Value (A): 0

Source Hazardous Waste Quantity Factor Value (Ref. 1, Section 2.4.2.1.5): 3

SOURCE DESCRIPTION

2.2 SOURCE CHARACTERIZATION

Number of the Source: 2

Name and description of the source: Spent Sandblast Grit Disposal Area (Contaminated Soil)

The Spent Sandblast Grit Disposal Area is within the Sandblast Area AOPC (Ref. 4, p. 66). The Sandblast Area AOPC generally consists of a north facing slope (Ref. 4, p. 40). A variety of equipment associated with the Bonneville Dam complex has historically been painted with materials that contained metallic (including lead and zinc chromate systems) and organometallic compounds (Ref. 4, p. 50). This equipment was periodically stripped with blast material and repainted in the former sandblast building (Ref. 4, p. 50). The former sandblast building was used for sandblasting operations and painting from approximately 1958 to 1988 (Ref. 4, p. 50). After 1988, the sandblasting and painting operations moved to the service center building (Ref. 4, p. 50). No records of disposal activities for sandblast grit were kept from 1958 to 1994 (Ref. 4, p. 50). Application of lead-based paints has reportedly not occurred at the dam complex since the early 1980s (Ref. 4, p. 50). A record of disposal from 1994 shows 215,680 pounds of sandblast grit were disposed of as Resource Conservation and Recovery Act (RCRA) hazardous waste, and after 1997 waste disposal records indicate that on average, approximately 70 tons of spent blast media were generated per year from sandblasting operations (Ref. 4, p. 50).

Based on the presence of sandblast grit adjacent to the former sandblast building (Ref. 4, p. 301 [Figure 3-4]) spent sandblast grit was historically spread onsite for an unknown period prior to 1994 (Ref. 4, p. 50). Previous investigations concluded that the primary source of soil contamination in the Sandblast Area is from the open disposal of sandblast grit (Ref. 4, p. 50). The disposal of spent sandblast grit in the area immediately east of the former sandblast building has resulted in the release of metallic and organometallic constituents, which were used in historical painting operations, into the surface and subsurface soil (Ref. 4, p. 50). This material has subsequently been transported across the site by surface water runoff into the stormwater drainage features (Ref. 4, p. 50 and p. 301 [Figure 3-4]).

In 2001, a preliminary assessment/site inspection (PA/SI) of the Sandblast Area AOPC was conducted by URS to aid in the characterization of environmental concerns associated with a transformer maintenance area and a former hazardous materials storage area (also referred to as the former drum storage area) (Ref. 4, pp. 67 and 289). This work included the collection of several samples within the Spent Sandblast Grit Disposal Area (Ref. 4, pp. 67 and 306 [Figure 5-2]). Samples collected within the Spent Sandblast Girt Disposal Area include SBB01, SBB03 through SBB07, SBB10, SBB11, SBB12, SBB14, SBB15, SBB17, SBB18, SBB23, and SBB24 Area (Ref. 4, pp. 67 and 306 [Figure 5-2]). These samples were collected from 0 to 0.5 feet bgs with the exception of sample SBB14 (collected at 2.0 feet bgs) and sample SBB15 (collected from 1.0 feet bgs) (Ref. 4, pp. 464 and 465). Co-located deeper soil samples were collected at SBB17 (collected from 3.0 feet bgs) and at SBB18 (collected from 2.5 feet bgs) (Ref. 4, p. 465). Analytical results revealed the presence of PCBs (Aroclor 1260), metals (antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc; among other metals), and organotins (dibutyltin, monobutyltin, and tributyltin) (Ref. 4, pp. 464 and 465 [Table 5-4d]) (See Table 6 of this HRS Documentation Record).

In 2004, sampling for an SSI of the Sandblast Area AOPC was conducted to assist in the characterization of known or suspected potential environmental concerns (Ref. 4, p. 68). This work included sampling of 10 locations (i.e., locations DP10, DP11, DP12, HA4 through HA8, HA11, and HA12) within the Spent Sandblast Grit Disposal Area (Ref. 4, pp. 68 and 306 [Figure 5-2]). The soil interval sampled ranged from

the ground surface to as deep as 12 feet bgs, and varied by the location sampled (Ref. 4, pp. 467, 468, and 469 [Table 5-5a]). Analytical results revealed the presence of the metals chromium and lead; among other metals (Ref. 4, pp. 467, 468, and 469 [Table 5-5a]) (See Table 7 of this HRS Documentation Record).

Location of the source, with reference to a map:
The Spent Sandblast Grit Disposal Area is located on the eastern side of Bradford Island, Oregon (see Figure 5 of this HRS Documentation Record; and Ref. 4, pp. 297 and 301).

Containment
Release to Surface Water via Overland Migration and/or Flood: A surface water containment factor value of 10 (Ref. 1, Table 4-2) is assigned because the Spent Sandblast Grit Disposal Area is unlined and uncovered (i.e., the source has no maintained engineered cover, or functioning and maintained run-on control system and runoff management system) (Ref. 4, p. 40).

Containment Factor Value: 10

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

The RI report documents the investigation activities that have taken place over the past 10 years since the report was written (i.e., approximately the period from 2002 to 2012) (Ref. 4, p. 20); including new sampling work conducted during the RI in 2007 and 2009 to fill identified data gaps (Ref. 4, p. 72). The RI states that due to the relatively static physical environment of the Upland OU, environmental data collected over the past decade prior to the RI can be considered representative of current conditions (Ref. 4, p. 59). The RI report included laboratory data forms from these investigations as Appendix E. For this reason, the primary reference for information contained in tables within this section are taken from this appendix.

URS PA/SI 2001:

- Source Samples: Seventeen sandblast grit and soil samples (i.e., SBB01, SBB03 through SBB07, SBB10, SBB11, SBB12, SBB14, SBB15, SBB17 [two samples], SBB18 [two samples], SBB23, and SBB24) were collected from the Spent Sandblast Grit Disposal Area during the URS 2001 PA/SI as presented in Table 6 below (Ref. 4, pp. 67 and 306 [Figure 5-2]). The samples were analyzed for organotin compounds in accordance with Puget Sound Estuary Protocols, PCBs using EPA SW-846 Method 8082, and metals using EPA SW-846 Methods 6010B, 6020, and 7470A or 7471A (Ref. 4, pp. 1196, 1198, 1199, and 1201). All samples were maintained under COC (Ref. 4, pp. 1195, 1787, 1790, 1791, 138802). All samples underwent a quality assurance/quality control (QA/QC) review following the procedures specified in the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review and Inorganic Data Review (Ref. 4, pp. 138801, 138810, and 138811). Some of these samples were labeled as "sandblast grit" based on field observations to indicate samples containing higher quantities of sandblast (Ref. 4, pp. 67, and 464 and 465 [Table 5-4d]). Soil sample SBB18 is used in this HRS Documentation Record to represent background concentrations due to the relatively low concentrations of contaminants in this sample and since this sample is of soil rather than a soil/sandblast grit mix (Ref. 4, pp. 464 and 465 [Table 5-4d]). Although not required by the HRS, background concentrations are provided to show the relative increase of contaminant levels in the source over background. The locations of all PA/SI samples are depicted on Figure 5-2 of Reference 4, p. 306.

Table 6
Analytical Results for Source 2 – URS PA/SI 2001
Sandblast Grit/Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	PQL	Units (Dry weight)	Reference
Background Soil Sample							
SBB18 011205SBB20SS	2.5	Aroclor 1260	ND	ug/kg	13.2	ug/kg	Ref. 4, pp. 465 and 1336[a]
		Arsenic	1.64	mg/kg	1.34	mg/kg	Ref. 4, p. 1491[a]
		Antimony	0.597 U	mg/kg	4.01	mg/kg	Ref. 4, p. 1491[a]
		Cadmium	0.867	mg/kg	0.669	mg/kg	Ref. 4, p. 1491[a]
		Chromium	25.1	mg/kg	2.68	mg/kg	Ref. 4, p. 1490[a]
		Copper	65.7	mg/kg	2.68	mg/kg	Ref. 4, p. 1490[a]

Table 6 Analytical Results for Source 2 – URS PA/SI 2001 Sandblast Grit/Soil Samples							
Sample ID	**Sample Depth (feet bgs)**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (Dry weight)**	**PQL**	**Units (Dry weight)**	**Reference**
(Cont.) SBB18 011205SBB20SS	2.5	Lead	31.2	mg/kg	0.669	mg/kg	Ref. 4, p. 1491[a]
		Nickel	23.9	mg/kg	2.68	mg/kg	Ref. 4, p. 1490[a]
		Zinc	77.6 JL (116.4)	mg/kg	2.68	mg/kg	Ref. 4, p. 1490[a]; Ref. 5, pp. 8 and 18; Ref. 37, p. 8
		Dibutyltin	ND	ug/kg	2.64	ug/kg	Ref. 4, p. 1253[a]
		Monobutyltin	ND	ug/kg	3.52	ug/kg	Ref. 4, p. 1253[a]
		Tributyltin	ND	ug/kg	3.52	ug/kg	Ref. 4, p. 1253[a]
Contaminated Sandblast Grit and Soil Samples							
SBB01 011205SBB01SBG	0.0 to 0.5	Chromium	1,130	mg/kg	2.11	mg/kg	Ref. 4, pp. 464 and 1492
		Lead	120	mg/kg	0.527	mg/kg	Ref. 4, p. 1493
		Nickel	1,080	mg/kg	2.11	mg/kg	Ref. 4, p. 1492
SBB03 011205SBB03SBG	0.0 to 0.5	Aroclor 1260	30.6	ug/kg	11.2	ug/kg	Ref. 4, pp. 464 and 1339
		Chromium	536	mg/kg	2.17	mg/kg	Ref. 4, p. 1500
		Lead	1,200 JH (833.33)	mg/kg	0.577	mg/kg	Ref. 4, p. 1501; Ref. 5, pp. 8 and 18; Ref. 37, p. 8
		Nickel	382	mg/kg	2.17	mg/kg	Ref. 4, p. 1500
		Dibutyltin	37.4	ug/kg	1.98	ug/kg	Ref. 4, p. 1256
		Tributyltin	45.4 JK (4.54)	ug/kg	2.64	ug/kg	Ref. 4, p. 1256; Ref. 5, pp. 8 and 9; Ref. 37, p. 8
SSB04 011205SBB04SBG	0.0 to 0.5	Aroclor 1260	17.7	ug/kg	10.8	ug/kg	Ref. 4, pp. 464 and 1340
		Chromium	358	mg/kg	2.19	mg/kg	Ref. 4, p. 1496
		Lead	262	mg/kg	0.548	mg/kg	Ref. 4, p. 1497
		Nickel	130	mg/kg	2.19	mg/kg	Ref. 4, p. 1496
		Monobutlytin	24	ug/kg	2.71	ug/kg	Ref. 4, p. 1257
		Tributyltin	38.9	ug/kg	2.71	ug/kg	Ref. 4, p. 1257
SBB05 011205SB05SSBG	0.0 to 0.5	Aroclor 1260	23.7	ug/kg	11.7	ug/kg	Ref. 4, pp. 464 and 1341
		Lead	300	mg/kg	0.59	mg/kg	Ref. 4, p. 1499

Table 6 Analytical Results for Source 2 – URS PA/SI 2001 Sandblast Grit/Soil Samples							
Sample ID	**Sample Depth (feet bgs)**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (Dry weight)**	**PQL**	**Units (Dry weight)**	**Reference**
SBB06 011206SBB06SBG	0.0 to 0.5	Aroclor 1260	15.5	ug/kg	11.4	ug/kg	Ref. 4, pp. 464 and 1342
		Chromium	880	mg/kg	1.97	mg/kg	Ref. 4, p. 1502
		Lead	501 JH (347.92)	mg/kg	0.492	mg/kg	Ref. 4, p. 1503; Ref. 5, pp. 8 and 18; Ref. 37, p. 8
		Nickel	597	mg/kg	1.97	mg/kg	Ref. 4, p. 1502
SBB07 011205SBB07SBG	0.0 to 0.5	Arsenic	4.6	mg/kg	1.37	mg/kg	Ref. 4, pp. 464 and 1505
		Chromium	127	mg/kg	2.75	mg/kg	Ref. 4, p. 1504
		Nickel	107	mg/kg	2.75	mg/kg	Ref. 4, p. 1504
SBB10 011205SBB10SBG	0.0 to 0.5	Aroclor 1260	26	ug/kg	10.7	ug/kg	Ref. 4, pp. 464 and 1346
		Arsenic	6.02	mg/kg	1.07	mg/kg	Ref. 4, p. 1511
		Chromium	637	mg/kg	2.13	mg/kg	Ref. 4, p. 1510
		Lead	272 JH (188.89)	mg/kg	0.534	mg/kg	Ref. 4, p. 1511; Ref. 5, pp. 8 and 18; Ref. 37, p. 9
		Nickel	844	mg/kg	2.13	mg/kg	Ref. 4, p. 1510
SBB11 011205SBB11SBG	0.0 to 0.5	Aroclor 1260	52.1	ug/kg	10.6	ug/kg	Ref. 4, pp. 464 and 1347
		Chromium	648	mg/kg	2.22	mg/kg	Ref. 4, p. 1512
		Lead	415 JH (288.19)	mg/kg	0.554	mg/kg	Ref. 4, p. 1513; Ref. 5, pp. 8 and 18; Ref. 37, p. 9
		Nickel	296	mg/kg	2.22	mg/kg	Ref. 4, p. 1512
SBB12 011205SBB12SBG	0.0 to 0.5	Aroclor 1260	202	ug/kg	11.3	ug/kg	Ref. 4, pp. 464 and 1348
		Arsenic	6.24	mg/kg	1.09	mg/kg	Ref. 4, p. 1515
		Antimony	13.7	mg/kg	3.28	mg/kg	Ref. 4, p. 1515
		Chromium	705	mg/kg	2.19	mg/kg	Ref. 4, p. 1514
		Lead	863 JH (599.31)	mg/kg	0.546	mg/kg	Ref. 4, p. 1515; Ref. 5, pp. 8 and 18; Ref. 37, p. 9
		Nickel	347	mg/kg	2.19	mg/kg	Ref. 4, p. 1514

Table 6 Analytical Results for Source 2 – URS PA/SI 2001 Sandblast Grit/Soil Samples							
Sample ID	**Sample Depth (feet bgs)**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (Dry weight)**	**PQL**	**Units (Dry weight)**	**Reference**
SBB14 011205SBB14SBG	2.0	Lead	508 JH (352.78)	mg/kg	0.531	mg/kg	Ref. 4, pp. 465 and 1519; Ref. 5, pp. 8 and 18; Ref. 37, p. 9
SBB15 011205SBB15SBG	0.0 to 0.5	Aroclor 1260	64	ug/kg	9.9	ug/kg	Ref. 4, pp. 465 and 1351
		Cadmium	2.61	mg/kg	0.454	mg/kg	Ref. 4, p. 1521
		Chromium	1,100	mg/kg	1.81	mg/kg	Ref. 4, p. 1520
		Lead	280 JH (194.44)	mg/kg	0.454	mg/kg	Ref. 4, p. 1521; Ref. 5, pp. 8 and 18; Ref. 37, p. 9
		Nickel	444	mg/kg	1.81	mg/kg	Ref. 4, p. 1520
		Zinc	1,160	mg/kg	1.81	mg/kg	Ref. 4, p. 1520
SBB15 011205SBB21SS	1.0	Aroclor 1260	20.8	ug/kg	11.1	ug/kg	Ref. 4, pp. 465 and 1356
		Lead	134 JH (93.06)	mg/kg	0.545	mg/kg	Ref. 4, p. 1531; Ref. 5, pp. 8 and 18; Ref. 37, p. 9
SBB17 01120SBB17SBG	0.0 to 0.5	Aroclor 1260	18.7	ug/kg	11.2	ug/kg	Ref. 4, pp. 465 and 1353
		Chromium	625	mg/kg	2.36	mg/kg	Ref. 4, p. 1524
		Lead	516 JH (358.33)	mg/kg	0.589	mg/kg	Ref. 4, p. 1525; Ref. 5, pp. 8 and 18; Ref. 37, p. 9
		Nickel	399	mg/kg	2.36	mg/kg	Ref. 4, p. 1524
		Monobutyltin	8	ug/kg	2.93	ug/kg	Ref. 4, p. 1270
		Tributyltin	39.2	ug/kg	2.93	ug/kg	Ref. 4, p. 1270
SBB18 01120SBB18SBG	0.0 to 0.5	Aroclor 1260	17.4	ug/kg	10.9	ug/kg	Ref. 4, pp. 465 and 1354
		Antimony	9.51	mg/kg	3.36	mg/kg	Ref. 4, p. 1527
		Arsenic	80.9	mg/kg	1.12	mg/kg	Ref. 4, p. 1527
		Chromium	533	mg/kg	2.24	mg/kg	Ref. 4, p. 1526
		Copper	319	mg/kg	2.24	mg/kg	Ref. 4, p. 1526

Table 6
Analytical Results for Source 2 – URS PA/SI 2001
Sandblast Grit/Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	PQL	Units (Dry weight)	Reference
(Cont.) SBB18 01120SBB18SBG	0.0 to 0.5	Lead	258 JH (179.17)	mg/kg	0.561	mg/kg	Ref. 4, p. 1527; Ref. 5, pp. 8 and 18; Ref. 37, p. 9
		Nickel	321	mg/kg	2.24	mg/kg	Ref. 4, p. 1526
		Zinc	703	mg/kg	2.24	mg/kg	Ref. 4, p. 1526
		Dibutyltin	210 JK (21)	ug/kg	2.08	ug/kg	Ref. 4, p. 1271; Ref. 5, pp. 7, 8 and 9; Ref. 37, p. 9
		Monobutyltin	108 JH (10.8)	ug/kg	2.78	ug/kg	Ref. 4, p. 1271; Ref. 5, pp. 7, 8 and 18; Ref. 37, p. 9
		Tributyltin	1,860 JH (186)	ug/kg	2.78	ug/kg	Ref. 4, p. 1271; Ref. 5, pp. 7, 8 and 18; Ref. 37, p. 9

Notes:

a – It appears the sample numbered 011205SBB20SS (i.e., sample SBB18 from 0.0 to 0.5 feet bgs) was mis-reported by the laboratory as sample 011204DSH2055 or 011204DSH20SS based on three lines of evidence: 1) being a hand-written corrections to the sample numbers on laboratory data sheets (see Ref. 4, pp. 1253 and 1787); 2) that the date and time of sample collection for sample 011205SBB20SS provided on its COC exactly matches the date and time of sample 011204DSH2055 in the sample identification list provided by the laboratory (Ref. 4, pp. 1193 and 1787); and 3) that the results reported in Reference 4, Table 5-4d for sample 011205SBB20SS exactly match those reported for sample 011204DSH2055 in the laboratory data sheets (Ref. 4, pp. 464 and 465 [Table 5-4d]; 1253, 1336, 1490, and 1491). The hand-written sample number correction on Ref. 4, p. 1253 appears to have a transcription error as this note provides the sample number as 011205SSB20SS rather than 011205SBB20SS.

Key:

() = Adjusted concentration as per Ref. 5, pp. 7, 8, and 18; rounded to two decimal places when applicable.
bgs = below ground surface.
H = High bias.
ID = Identification.
J = The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity (Ref. 4, p. 1795).
K = Unknown bias.
L = Low bias.
mg/kg = milligrams per kilogram.
NA = Not applicable.
ND = Not detected (Ref. 4, p. 1795).
PQL = Practical quantitation limit (Ref. 4, p. 1795).
ug/kg = micrograms per kilogram.

URS SSI 2004:

- Source Samples: Ten sandblast grit and soil samples (i.e., DP10, DP11, DP12, HA4 through HA8, HA11, and HA12) were collected within the Spent Sandblast Grit Disposal Area during the URS 2004 SSI (Ref. 4, pp. 68 and 306 [Figure 5-2]). The samples were collected in accordance with a sampling and analysis plan (Ref. 4, p. 138852). The samples were analyzed for total metals using EPA SW-846 Methods 6020 (Ref. 4, pp. 39706, 39708, 39712, 39716, 39734, and 138852). All samples were maintained under COC (Ref. 4, pp. 40086, 40088, and 44473). All samples underwent a quality assurance/quality control (QA/QC) review following the procedures specified in the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review and Inorganic Data Review (Ref. 4, pp. 138852 and 138853). Some of these samples were labeled as "sandblast grit" based on field observations to indicate samples containing higher quantities of sandblast (Ref. 4, pp. 468 and 469 [Table 5-5a]). Soil sample HA1 is used in this HRS Documentation Record to represent background concentrations due to the sample's location outside of a potential source area, the relatively low concentrations of contaminants in this sample, and since this sample is of soil rather than a soil/sandblast grit mix (Ref. 4, p. 306 [Figure 5-2] and p. 468 [Table 5-5a]). Although not required by the HRS, background concentrations are provided to show the relative increase of contaminant levels in the source over background. The locations of all SSI samples are depicted on Figure 5-2 of Reference 4, p. 306.

Table 7
Analytical Results for Source 2 – URS SSI 2004
Sandblast Grit/Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	RL	Units (Dry weight)	Reference
Background Soil Sample							
HA1 041122SGA14SS	0.5	Chromium	20	mg/kg	0.256	mg/kg	Ref. 4, pp. 468 and 39734
Contaminated Sandblast Grit and Soil Samples							
HA6 041122SGA24SG	0.0	Chromium	2,650	mg/kg	0.225	mg/kg	Ref. 4, pp. 469 and 39706
HA7 041122SGA25SG	0.0	Chromium	2,190	mg/kg	0.237	mg/kg	Ref. 4, pp. 469 and 39708
HA8 041122SGA27SG	0.0	Chromium	2,480	mg/kg	0.273	mg/kg	Ref. 4, pp. 469 and 39712
HA11 041123SGA30SS	1.0	Chromium	221	mg/kg	0.261	mg/kg	Ref. 4, pp. 468 and 44217

Key:

bgs = below ground surface.
ID = Identification.
mg/kg = milligrams per kilogram.
RL = Reporting limit.

List of Hazardous Substances Associated with Source

PCBs (Aroclor 1260), antimony, arsenic, cadmium, chromium, copper, lead, nickel, zinc, dibutyltin, monobutyltin, and tributyltin.

Butyltins are pollutants/contaminants found at this site (see Table 6 of this HRS documentation record). Butyltins are a class of compounds that bioaccumulate in sediment and fish tissue and are known to have effects on human health and wildlife (Ref. 35, p. 63). One study found that rats whose mothers were exposed to tributyltin during pregnancy showed altered performance in some neurological tests conducted when they were young adults (Ref. 36, p. 27). Another study, also with tributyltin, found that exposure during gestation, lactation, and post-lactation affected some developmental landmarks in female rats (Ref. 36, p. 27). Dibutyltin, and tributyltin, when administered during pregnancy, have induced developmental and reproductive effects in rodents (Ref. 36, p. 33).

The EPA has developed risk-based residential soil RSLs for dibutyltin compounds (i.e., 19 mg/kg) and for tri-n-butyltin (i.e., 23 mg/kg) (Ref. 33, pp. 2, 7, and 15). The RSET has determined that tributyltin is a bioaccumulative chemical of concern in Oregon, including the Columbia River where it borders Oregon and Washington (Ref. 34, p. 142). RSET has proposed freshwater benthic screening levels for dibutyltin, monobutyltin, and tributyltin (Ref. 34, p. 190) and water quality-based screening levels for tributyltin (Ref. 34, p. 195).

Source No.: 2

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The hazardous constituent quantity for Source No. 2 could not be adequately determined according to the HRS requirements; that is, the total mass of all Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances in the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). There are insufficient historical and current data (Manifests, PRP records, State records, Permits, Waste concentration data, etc.) available to adequately calculate the total mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source No. 2 with reasonable confidence.

Hazardous Constituent Quantity Value (S): NS

2.4.2.1.2 Hazardous Wastestream Quantity

The hazardous wastestream quantity for Source No. 2 could not be adequately determined according to the HRS requirements; that is, the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants in the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). There are insufficient historical and current data (Manifests, PRP records, State records, permits, etc.) available to adequately calculate the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous wastestream quantity for Source No. 2 with reasonable confidence.

Hazardous Wastestream Quantity (W): NS

2.4.2.1.3 Volume

The URS 2001 PA/SI report estimated that the Spent Sandblast Grit Storage Area covered an area of approximately 20,000 square feet to depths of 1 to 3 feet bgs (Ref. 4, p. 68). Using these measurements the volume of this source is calculated to be between 740 cy (i.e., [20,000 square feet x 1 foot]/27 cubic feet per cy) and 2,222 (i.e., [20,000 square feet x 3 feet]/27 cubic feet per cy). The total volume of sandblast grit present was estimated in this report to be between 1,410 and 2,025 cy (Ref. 4, p. 68). The extent of the Spent Sandblast Grit Storage Area as depicted on Figure 3-4 of Reference 4 shows the approximate extent of the primary sandblast grit disposal area; however, evidence of sandblast grit was also observed in surface soils further to the north (Ref. 4, pp. 68 and 301).

Using the lower estimated volume of 740 cy, the volume measure of the source is conservatively calculated to be 0.296 (i.e., 740 cy / 2,500 for contaminated soil) (Ref. 1, Section 2.4.2.1.3).

Volume Assigned Value (V): 0.296

2.4.2.1.4 Area

An area measure of 0 is assigned since the volume of the source could be determined (Ref. 1, Sections 2.4.2.1.3 and 2.4.2.1.4).

Area Assigned Value (A): 0

Source Hazardous Waste Quantity Factor Value (Ref. 1, Section 2.4.2.1.5): 0.296

SOURCE DESCRIPTION

2.2 SOURCE CHARACTERIZATION

Number of the Source: 3

Name and description of the source: Equipment Laydown Area (Contaminated Soil)

The USACE stores industrial equipment and materials along the northern and southern portions of the Landfill access road (Ref. 4, pp. 52 and 301 [Figure 3-4]). This area is a part of the Sandblast Area AOPC (Ref. 4, p. 49). Periodic grading of the laydown area has been performed to expand storage capacity (Ref. 4, p. 52). Soils in this area have become contaminated with metals, pesticides, PCBs, and PAHs; among other contaminants (Ref. 4, p. 21).

In 2009, an Upland OU Data Gaps Report was completed by URS in support of the RI (Ref. 4, p. 72). The focus of this work was to fill data gaps related to understanding the nature and extent of contamination, and to provide sufficient information for conducting risk evaluations (Ref. 4, p. 72). During this investigation, a total of 10 soil samples were collected from the Equipment Laydown Area at the Sandblast AOPC (Ref. 4, pp. 306 [Figure 5-2] and 508 [Table 6-3a]). These samples were obtained from five test pits (LD-01 through LD-05) at depths of 0-1 feet and 1-3 feet bgs; that is two samples per test pit (Ref. 4, pp. 306 [Figure 5-2] and 508 [Table 6-3a]). The samples revealed the presence of PCBs, metals, butyltins, pesticides, and SVOCs (Ref. 4, p. 508 [Table 6-3a]) (see Table 8 of this HRS Documentation Record).

Also, during this investigation, an additional sixteen soil samples were collected from the Sandblast AOPC (Ref. 4, pp. 73 and 514 [Table 6-3d]). These samples were obtained from eight locations (SB-01 through SB-08) at depths of 0-1 feet and 1-3 feet bgs; that is two samples per location (Ref. 4, pp. 73, 306 [Figure 5-2], and 514 [Table 6-3d]). Each sample was sieved to obtain two size fractions (less than 250 micrometer and less than 2 millimeters) and analyzed for lead (Ref. 4, pp. 17, 73, and 514 [Table 6-3d)]). Of these sample locations, three (SB-01, SB-02, and SB-03) were within the Equipment Laydown Area (Ref. 4, pp. 306 [Figure 5-2]. These samples revealed the presence of lead (Ref. 4, p. 514 [Table 6-3d]) (see Table 9 of this HRS Documentation Record).

Location of the source, with reference to a map:
The Equipment Laydown Area is located on the eastern side of Bradford Island, Oregon (Ref. 4, pp. 297 and 301).

Containment
Release to Surface Water via Overland Migration and/or Flood: A surface water containment factor value of 10 (Ref. 1, Table 4-2) is assigned because the Equipment Laydown Area is flat and unvegetated (i.e., the source has no maintained engineered cover, or functioning and maintained run-on control system and runoff management system) (Ref. 4, p. 40).

Containment Factor Value: 10

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

The RI report documents the investigation activities that have taken place over the past 10 years since the report was written (i.e., approximately the period from 2002 to 2012) (Ref. 4, p. 20); including new sampling work conducted during the RI in 2007 and 2009 to fill identified data gaps (Ref. 4, p. 72). The RI states that due to the relatively static physical environment of the Upland OU, environmental data collected over the past decade prior to the RI can be considered representative of current conditions (Ref. 4, p. 59). The RI report included laboratory data forms from these investigations as Appendix E. For this reason, the primary reference for information contained in tables within this section are taken from this appendix.

URS Upland OU Data Gaps Sampling Report 2009

- Equipment Laydown Area Source Samples: Soil samples were collected from five test pits (LD-01 through LD-05) in the Equipment Laydown Area of the Sandblast AOPC during the URS Upland OU Data Gaps Sampling event as presented in Table 8 below (Ref. 4, pp. 73, 74, 306 [Figure 5-2], and 508 [Table 6-3a]). At each test pit, one sample was collected from 0 to 1 feet bgs and one sample was collected from 1 to 3 feet bgs (Ref. 4, p. 508 [Table 6-3a]). All samples underwent a quality assurance/quality control (QA/QC) review following the procedures specified in the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review and Inorganic Data Review (Ref. 4, p. 138942). Samples for this investigation were collected following the guidance contained in related quality assurance project plans (Ref. 4, pp. 72, 290, and 291). The samples were analyzed for SVOCs by EPA SW-846 Method 8270C, PCBs by EPA SW-846 Method 8082, pesticides by EPA SW-846 Method 8081, total metals by EPA SW-846 6010B and 6020, mercury by EPA SW-845 Method 7471A, and butyltins by Krone; among other analyses (Ref. 4, pp. 131412, 131413 through 131422, 131721, 132264, 132265, 133426, 138941, and 138952). The samples were received consistent with the accompanying COC forms (Ref. 4, pp. 131384 and 131390). Background soil samples (i.e., referred to as "Reference" samples) were collected from 14 locations (R1 through R14) (Ref. 4, p. 74). Although not required by the HRS, background concentrations are provided to show the relative increase of contaminant levels in the source over background. Since none of the reference samples were analyzed for pesticides or butyltins, the samples from test pit LD-04 collected from 0 to 1.0 foot bgs (sample 090320-LD4So-0-1) and from 1.0 to 3.0 feet bgs (sample 090320-LD4So-1-3) will be used in this HRS Documentation Record to represent background concentrations due to these samples' relatively low concentrations of analytes and since they were analyzed for the same compounds as other Equipment Laydown Area source samples (Ref. 4, pp. 508 and 509 [Table 6-3a], 512 and 513 [Table 6-3c], and 138951). Sample 090320-LD4So-0-1 is used in Table 8 as the background sample for comparison to source samples collected from 0 to 1.0 feet bgs; while sample 090320-LD4So-1-3 is used as the background sample for comparison to source samples collected from 1.0 to 3.0 feet bgs. The Upland OU Data Gaps Sampling soil sample locations are depicted on Figure 5-2 of Reference 4, p. 306 (Ref. 4, pp. 306 [Figure 5-2] and 508 [Table 6-3a]).

Table 8 Analytical Results for Source 3 – Upland OU Data Gaps Report 2009 Equipment Laydown Area Soil Samples							
Sample ID	**Sample Depth (feet bgs)**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (Dry weight)**	**MRL**	**Units (Dry weight)**	**Reference**
Background Soil Sample							
LD-04 090320-LD4So-0-1	0.0 to 1.0	Aroclor 1254	ND U	ug/kg	10	ug/kg	Ref. 4, p. 133429
		Aroclor 1260	ND U	ug/kg	10	ug/kg	Ref. 4, p. 133429
		Cadmium	0.235	mg/kg	0.033	mg/kg	Ref. 4, p. 131413
		Lead	279	mg/kg	11.0	mg/kg	Ref. 4, p. 131413
		Mercury	0.017 JQ	mg/kg	0.036	mg/kg	Ref. 4, p. 131413; Ref. 37, p. 10
		Zinc	56.6 JH	mg/kg	2.2	mg/kg	Ref. 4, p. 131413: Ref. 5, p. 8; Ref. 37, p. 10
		Di-n-butyltin	ND U	ug/kg	1.2	ug/kg	Ref. 4, p. 131685
		n-Butyltin	ND U	ug/kg	1.2	ug/kg	Ref. 4, p. 131685
		Tri-n-butyltin	ND U	ug/kg	1.2	ug/kg	Ref. 4, p. 131685
		4,4'-DDT	0.84 JQ	ug/kg	1.0	ug/kg	Ref. 4, p. 132267; Ref. 37, p. 10
		Chlordane (gamma)	ND U	ug/kg	1.0	ug/kg	Ref. 4, p. 132267
		Endosulfan I	ND U	ug/kg	1.0	ug/kg	Ref. 4, p. 132267
		Endosulfan Sulfate	ND U	ug/kg	1.0	ug/kg	Ref. 4, p. 132267
		Endrin	ND U	ug/kg	1.0	ug/kg	Ref. 4, p. 132267
		Endrin Aldehyde	ND U	ug/kg	1.0	ug/kg	Ref. 4, p. 132267
		Methoxychlor	ND U	ug/kg	1.0	ug/kg	Ref. 4, p. 132267
		Bis(2-ethylhexyl)phthalate	170	ug/kg	64	ug/kg	Ref. 4, p. 134373
		Dibenzofuran	ND U	ug/kg	6.4	ug/kg	Ref. 4, p. 134373
		Di-n-butyl phthalate	ND U	ug/kg	6.4	ug/kg	Ref. 4, p. 134373
		Acenaphthene	1.5 JQ	ug/kg	6.4	ug/kg	Ref. 4, p. 134373; Ref. 37, p. 10
		Anthracene	2.0 JQ	ug/kg	6.4	ug/kg	Ref. 4, p. 134373; Ref. 37, p. 10
		Fluorene	ND U	ug/kg	6.4	ug/kg	Ref. 4, p. 134373
		Naphthalene	ND U	ug/kg	6.4	ug/kg	Ref. 4, p. 134372
		Phenanthrene	16	ug/kg	6.4	ug/kg	Ref. 4, p. 134373
		Benzo(a)anthracene	27	ug/kg	6.4	ug/kg	Ref. 4, p. 134373
		Benzo(a)pyrene	38	ug/kg	6.4	ug/kg	Ref. 4, p. 134373
		Benzo(b)fluoranthene	53	ug/kg	6.4	ug/kg	Ref. 4, p. 134373
		Benzo(g,h,i)perylene	42	ug/kg	6.4	ug/kg	Ref. 4, p. 134374
		Benzo(k)fluoranthene	19	ug/kg	6.4	ug/kg	Ref. 4, p. 134373
		Chrysene	39	ug/kg	6.4	ug/kg	Ref. 4, p. 134373
		Dibenz(a,h)anthracene	9.7	ug/kg	6.4	ug/kg	Ref. 4, p. 134374
		Fluoranthene	36	ug/kg	6.4	ug/kg	Ref. 4, p. 134373
		Indeno(1,2,3-cd)pyrene	35	ug/kg	6.4	ug/kg	Ref. 4, p. 134373
		Pyrene	47	ug/kg	6.4	ug/kg	Ref. 4, p. 134373

Table 8
Analytical Results for Source 3 – Upland OU Data Gaps Report 2009
Equipment Laydown Area Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MRL	Units (Dry weight)	Reference
LD-04 090320-LD4So-1-3	1.0 to 3.0	Aroclor 1254	ND U	ug/kg	9.9	ug/kg	Ref. 4, p. 133430
		Aroclor 1260	ND U	ug/kg	9.9	ug/kg	Ref. 4, p. 133430
		Cadmium	0.077	mg/kg	0.033	mg/kg	Ref. 4, p. 131414
		Lead	13.4	mg/kg	11.4	mg/kg	Ref. 4, p. 131414
		Mercury	0.057	mg/kg	0.039	mg/kg	Ref. 4, p. 131414
		Zinc	50.0 JH (75)	mg/kg	2.3	mg/kg	Ref. 4, p. 131414; Ref. 5, pp. 8 and 18; Ref. 37, p. 10
		Di-n-butyltin	ND U	ug/kg	1.2	ug/kg	Ref. 4, p. 131686
		n-Butyltin	ND U	ug/kg	1.2	ug/kg	Ref. 4, p. 131686
		Tri-n-butyltin	ND U	ug/kg	1.2	ug/kg	Ref. 4, p. 131686
		4,4'-DDT	ND U	ug/kg	0.99	ug/kg	Ref. 4, p. 132268
		Chlordane (gamma)	ND U	ug/kg	0.99	ug/kg	Ref. 4, p. 132268
		Endosulfan I	ND U	ug/kg	0.99	ug/kg	Ref. 4, p. 132268
		Endosulfan Sulfate	ND U	ug/kg	0.99	ug/kg	Ref. 4, p. 132268
		Endrin	ND U	ug/kg	0.99	ug/kg	Ref. 4, p. 132268
		Endrin Aldehyde	ND U	ug/kg	0.99	ug/kg	Ref. 4, p. 132268
		Methoxychlor	ND U	ug/kg	0.99	ug/kg	Ref. 4, p. 132268
		Bis(2-ethylhexyl)phthalate	15 JQ	ug/kg	65	ug/kg	Ref. 4, p. 134376; Ref. 37, p. 10
		Dibenzofuran	ND U	ug/kg	6.5	ug/kg	Ref. 4, p. 134376
		Di-n-butyl phthalate	ND U	ug/kg	6.5	ug/kg	Ref. 4, p. 134376
		Acenaphthene	ND U	ug/kg	6.5	ug/kg	Ref. 4, p. 134376
		Anthracene	ND U	ug/kg	6.5	ug/kg	Ref. 4, p. 134376
		Fluorene	ND U	ug/kg	6.5	ug/kg	Ref. 4, p. 134376
		Naphthalene	ND U	ug/kg	6.5	ug/kg	Ref. 4, p. 134375
		Phenanthrene	ND U	ug/kg	6.5	ug/kg	Ref. 4, p. 134376
		Benzo(a)anthracene	ND U	ug/kg	6.5	ug/kg	Ref. 4, p. 134376
		Benzo(a)pyrene	ND U	ug/kg	6.5	ug/kg	Ref. 4, p. 134376
		Benzo(b)fluoranthene	ND U	ug/kg	6.5	ug/kg	Ref. 4, p. 134376
		Benzo(g,h,i)perylene	ND U	ug/kg	6.5	ug/kg	Ref. 4, p. 134377
		Benzo(k)fluoranthene	ND U	ug/kg	6.5	ug/kg	Ref. 4, p. 134376
		Chrysene	1.8 JQ	ug/kg	6.5	ug/kg	Ref. 4, p. 134376; Ref. 37, p. 10
		Dibenz(a,h)anthracene	ND U	ug/kg	6.5	ug/kg	Ref. 4, p. 134377
		Fluoranthene	ND U	ug/kg	6.5	ug/kg	Ref. 4, p. 134376
		Indeno(1,2,3-cd)pyrene	ND U	ug/kg	6.5	ug/kg	Ref. 4, p. 134376
		Pyrene	2.1 JQ	ug/kg	6.5	ug/kg	Ref. 4, p. 134376; Ref. 37, p. 10

Table 8
Analytical Results for Source 3 – Upland OU Data Gaps Report 2009
Equipment Laydown Area Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MRL	Units (Dry weight)	Reference
Equipment Laydown Area Contaminated Soil Samples							
LD-01 090320-LD-1So-0-1	0.0 to 1.0	Aroclor 1254	700	ug/kg	10	ug/kg	Ref. 4, p. 133431
		Aroclor 1260	690	ug/kg	10	ug/kg	Ref. 4, p. 133431
		Cadmium	6.450	mg/kg	0.035	mg/kg	Ref. 4, p. 131415
		Mercury	0.497	mg/kg	0.029	mg/kg	Ref. 4, p. 131415
		Di-n-butyltin	5.8	ug/kg	1.2	ug/kg	Ref. 4, p. 131687
		n-Butyltin	2.2	ug/kg	1.2	ug/kg	Ref. 4, p. 131687
		Tri-n-butyltin	3.0	ug/kg	1.2	ug/kg	Ref. 4, p. 131687
		4,4'-DDT	130	ug/kg	5.0	ug/kg	Ref. 4, p. 132269
		Chlordane (gamma)	40	ug/kg	5.0	ug/kg	Ref. 4, p. 132269
		Bis(2-ethylhexyl)phthalate	7,600	ug/kg	1800	ug/kg	Ref. 4, p. 134379
		Anthracene	330	ug/kg	180	ug/kg	Ref. 4, p. 134379
		Phenanthrene	1,900	ug/kg	180	ug/kg	Ref. 4, p. 134379
		Benzo(a)anthracene	1,500	ug/kg	180	ug/kg	Ref. 4, p. 134379
		Benzo(a)pyrene	1,400	ug/kg	180	ug/kg	Ref. 4, p. 134379
		Benzo(b)fluoranthene	2,000	ug/kg	180	ug/kg	Ref. 4, p. 134379
		Benzo(g,h,i)perylene	950	ug/kg	180	ug/kg	Ref. 4, p. 134380
		Benzo(k)fluoranthene	770	ug/kg	180	ug/kg	Ref. 4, p. 134379
		Chrysene	1,900	ug/kg	180	ug/kg	Ref. 4, p. 134379
		Dibenz(a,h)anthracene	270	ug/kg	180	ug/kg	Ref. 4, p. 134380
		Fluoranthene	3,100	ug/kg	180	ug/kg	Ref. 4, p. 134379
		Indeno(1,2,3-cd)pyrene	1,100	ug/kg	180	ug/kg	Ref. 4, p. 134379
		Pyrene	2,800	ug/kg	180	ug/kg	Ref. 4, p. 134379
LD-01 090320-LD4So-1-3	1.0 to 3.0	Aroclor 1254	23	ug/kg	10	ug/kg	Ref. 4, p. 133432
		Aroclor 1260	22	ug/kg	10	ug/kg	Ref. 4, p. 133432
		Di-n-butyl phthalate	28	ug/kg	6.9	ug/kg	Ref. 4, p. 134382
		Pyrene	29	ug/kg	6.9	ug/kg	Ref. 4, p. 134382
LD-02 090320-LD2So-0-1	0.0 to 1.0	Aroclor 1254	280	ug/kg	10	ug/kg	Ref. 4, p. 133433
		Aroclor 1260	130	ug/kg	10	ug/kg	Ref. 4, p. 133433
		Cadmium	7.920	mg/kg	0.036	mg/kg	Ref. 4, p. 131417
		Lead	963	mg/kg	12.0	mg/kg	Ref. 4, p. 131417
		Mercury	0.267	mg/kg	0.030	mg/kg	Ref. 4, p. 131417

Table 8 Analytical Results for Source 3 – Upland OU Data Gaps Report 2009 Equipment Laydown Area Soil Samples							
Sample ID	**Sample Depth (feet bgs)**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (Dry weight)**	**MRL**	**Units (Dry weight)**	**Reference**
(Cont.) LD-02 090320-LD2So-0-1	0.0 to 1.0	Zinc	456 JH (304)	mg/kg	2.4	mg/kg	Ref. 4, p. 131417; Ref. 5, pp. 8 and 18; Ref. 37, p. 11
		Di-n-butyltin	4.8	ug/kg	1.3	ug/kg	Ref. 4, p. 131689
		n-Butyltin	1.6	ug/kg	1.3	ug/kg	Ref. 4, p. 131689
		Tri-n-butyltin	1.8	ug/kg	1.3	ug/kg	Ref. 4, p. 131689
		Chlordane (gamma)	12	ug/kg	1.0	ug/kg	Ref. 4, p. 132271
		Endosulfan Sulfate	1.8	ug/kg	1.0	ug/kg	Ref. 4, p. 132271
		Methoxychlor	1.2	ug/kg	1.0	ug/kg	Ref. 4, p. 132271
		Bis(2-ethylhexyl)phthalate	9,200	ug/kg	1800	ug/kg	Ref. 4, p. 134385
		Anthracene	280	ug/kg	180	ug/kg	Ref. 4, p. 134385
		Phenanthrene	1,900	ug/kg	180	ug/kg	Ref. 4, p. 134385
		Benzo(a)anthracene	2,700	ug/kg	180	ug/kg	Ref. 4, p. 134385
		Benzo(a)pyrene	2,800	ug/kg	180	ug/kg	Ref. 4, p. 134385
		Benzo(b)fluoranthene	4,100	ug/kg	180	ug/kg	Ref. 4, p. 134385
		Benzo(k)fluoranthene	1,400	ug/kg	180	ug/kg	Ref. 4, p. 134385
		Chrysene	3,500	ug/kg	180	ug/kg	Ref. 4, p. 134385
		Dibenz(a,h)anthracene	640 JH (64)	ug/kg	180	ug/kg	Ref. 4, p. 134386; Ref. 5, pp. 8 and 14; Ref. 37, p. 11
		Fluoranthene	4,700	ug/kg	180	ug/kg	Ref. 4, p. 134385
		Indeno(1,2,3-cd)pyrene	2,200	ug/kg	180	ug/kg	Ref. 4, p. 134385
		Pyrene	4,400	ug/kg	180	ug/kg	Ref. 4, p. 134385
LD-02 090320-LD2So-1-3	1.0 to 3.0	Aroclor 1254	16	ug/kg	10	ug/kg	Ref. 4, p. 133434
		Aroclor 1260	18	ug/kg	10	ug/kg	Ref. 4, p. 133434
		Acenaphthene	9	ug/kg	6.8	ug/kg	Ref. 4, p. 134388
		Anthracene	14	ug/kg	6.8	ug/kg	Ref. 4, p. 134388
		Fluorene	9.7	ug/kg	6.8	ug/kg	Ref. 4, p. 134388
		Phenanthrene	71	ug/kg	6.8	ug/kg	Ref. 4, p. 134388
		Pyrene	76	ug/kg	6.8	ug/kg	Ref. 4, p. 134388
LD-03 090320-LD3So-0-1	0.0 to 1.0	Aroclor 1254	160	ug/kg	9.8	ug/kg	Ref. 4, p. 133435
		Aroclor 1260	160	ug/kg	9.8	ug/kg	Ref. 4, p. 133435
		Cadmium	1.310	mg/kg	0.035	mg/kg	Ref. 4, p. 131419
		Di-n-butyltin	2.5	ug/kg	1.2	ug/kg	Ref. 4, p. 131691
		Chlordane (gamma)	7.6	ug/kg	0.98	ug/kg	Ref. 4, p. 132273

Table 8 Analytical Results for Source 3 – Upland OU Data Gaps Report 2009 Equipment Laydown Area Soil Samples							
Sample ID	**Sample Depth (feet bgs)**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (Dry weight)**	**MRL**	**Units (Dry weight)**	**Reference**
(Cont.) LD-03 090320-LD3So-0-1	0.0 to 1.0	Endosulfan I	2.2	ug/kg	0.98	ug/kg	Ref. 4, p. 132273
		Methoxychlor	1.0	ug/kg	0.98	ug/kg	Ref. 4, p. 132273
		Bis(2-ethylhexyl)phthalate	3,500	ug/kg	1700	ug/kg	Ref. 4, p. 134391
		Dibenzofuran	220	ug/kg	170	ug/kg	Ref. 4, p. 134391
		Acenaphthene	430	ug/kg	170	ug/kg	Ref. 4, p. 134391
		Anthracene	780	ug/kg	170	ug/kg	Ref. 4, p. 134391
		Fluorene	380	ug/kg	170	ug/kg	Ref. 4, p. 134391
		Phenanthrene	4,000	ug/kg	170	ug/kg	Ref. 4, p. 134391
		Benzo(a)anthracene	2,100	ug/kg	170	ug/kg	Ref. 4, p. 134391
		Benzo(a)pyrene	1,900	ug/kg	170	ug/kg	Ref. 4, p. 134391
		Benzo(b)fluoranthene	2,600	ug/kg	170	ug/kg	Ref. 4, p. 134391
		Benzo(g,h,i)perylene	1,100	ug/kg	170	ug/kg	Ref. 4, p. 134392
		Benzo(k)fluoranthene	880	ug/kg	170	ug/kg	Ref. 4, p. 134391
		Chrysene	2,300	ug/kg	170	ug/kg	Ref. 4, p. 134391
		Dibenz(a,h)anthracene	350	ug/kg	170	ug/kg	Ref. 4, p. 134392
		Fluoranthene	5,000	ug/kg	170	ug/kg	Ref. 4, p. 134391
		Indeno(1,2,3-cd)pyrene	1,300	ug/kg	170	ug/kg	Ref. 4, p. 134391
		Pyrene	4,200	ug/kg	170	ug/kg	Ref. 4, p. 134391
LD-03 090320-LD3So-1-3	1.0 to 3.0	Aroclor 1254	11	ug/kg	10	ug/kg	Ref. 4, p. 133436
		Aroclor 1260	11	ug/kg	10	ug/kg	Ref. 4, p. 133436
		Anthracene	11	ug/kg	6.8	ug/kg	Ref. 4, p. 134394
		Phenanthrene	59	ug/kg	6.8	ug/kg	Ref. 4, p. 134394
		Fluoranthene	130	ug/kg	6.8	ug/kg	Ref. 4, p. 134394
		Pyrene	120	ug/kg	6.8	ug/kg	Ref. 4, p. 134394
LD-05 090320-LD5So-0-1	0.0 to 1.0	Aroclor 1254	1,500	ug/kg	49	ug/kg	Ref. 4, p. 133437
		Aroclor 1260	480	ug/kg	49	ug/kg	Ref. 4, p. 133437
		Cadmium	17.3	mg/kg	0.034	mg/kg	Ref. 4, p. 131421
		Mercury	0.723	mg/kg	0.037	mg/kg	Ref. 4, p. 131421
		4,4'-DDT	140	ug/kg	9.8	ug/kg	Ref. 4, p. 132275
		Chlordane (gamma)	86	ug/kg	4.9	ug/kg	Ref. 4, p. 132275
		Endrin	17	ug/kg	4.9	ug/kg	Ref. 4, p. 132275
		Endrin Aldehyde	16	ug/kg	4.9	ug/kg	Ref. 4, p. 132275

Table 8
Analytical Results for Source 3 – Upland OU Data Gaps Report 2009
Equipment Laydown Area Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MRL	Units (Dry weight)	Reference
(Cont.) LD-05 090320-LD5So-0-1	0.0 to 1.0	Bis(2-ethylhexyl)phthalate	980	ug/kg	670	ug/kg	Ref. 4, p. 134397
		Dibenzofuran	10	ug/kg	6.7	ug/kg	Ref. 4, p. 134397
		Di-n-butyl phthalate	46	ug/kg	6.7	ug/kg	Ref. 4, p. 134397
		Acenaphthene	30	ug/kg	6.7	ug/kg	Ref. 4, p. 134397
		Anthracene	90	ug/kg	6.7	ug/kg	Ref. 4, p. 134397
		Fluorene	29	ug/kg	6.7	ug/kg	Ref. 4, p. 134397
		Naphthalene	8.9	ug/kg	6.7	ug/kg	Ref. 4, p. 134396
		Phenanthrene	460	ug/kg	6.7	ug/kg	Ref. 4, p. 134397
		Benzo(a)anthracene	530	ug/kg	6.7	ug/kg	Ref. 4, p. 134397
		Benzo(a)pyrene	450	ug/kg	6.7	ug/kg	Ref. 4, p. 134397
		Benzo(b)fluoranthene	640	ug/kg	6.7	ug/kg	Ref. 4, p. 134397
		Benzo(g,h,i)perylene	280	ug/kg	6.7	ug/kg	Ref. 4, p. 134398
		Benzo(k)fluoranthene	220	ug/kg	6.7	ug/kg	Ref. 4, p. 134397
		Chrysene	620	ug/kg	6.7	ug/kg	Ref. 4, p. 134397
		Dibenz(a,h)anthracene	91	ug/kg	6.7	ug/kg	Ref. 4, p. 134398
		Fluoranthene	1,100	ug/kg	6.7	ug/kg	Ref. 4, p. 134397
		Indeno(1,2,3-cd)pyrene	320	ug/kg	6.7	ug/kg	Ref. 4, p. 134397
		Pyrene	950	ug/kg	6.7	ug/kg	Ref. 4, p. 134397
LD-05 090320-LD5So-1-3	1.0 to 3.0	Aroclor 1254	230	ug/kg	9.7	ug/kg	Ref. 4, p. 133438
		Aroclor 1260	130	ug/kg	9.7	ug/kg	Ref. 4, p. 133438
		Chlordane (gamma)	9.2	ug/kg	0.97	ug/kg	Ref. 4, p. 132276
		Endosulfan I	2.0	ug/kg	0.97	ug/kg	Ref. 4, p. 132276
		Endrin	2.1	ug/kg	0.97	ug/kg	Ref. 4, p. 132276
		Endrin Aldehyde	1.9	ug/kg	0.97	ug/kg	Ref. 4, p. 132276
		Bis(2-ethylhexyl)phthalate	320	ug/kg	64	ug/kg	Ref. 4, p. 134400
		Di-n-butyl phthalate	22	ug/kg	6.4	ug/kg	Ref. 4, p. 134400
		Anthracene	13	ug/kg	6.4	ug/kg	Ref. 4, p. 134400
		Phenanthrene	79	ug/kg	6.4	ug/kg	Ref. 4, p. 134400
		Benzo(a)anthracene	96	ug/kg	6.4	ug/kg	Ref. 4, p. 134400
		Chrysene	120	ug/kg	6.4	ug/kg	Ref. 4, p. 134400
		Fluoranthene	170	ug/kg	6.4	ug/kg	Ref. 4, p. 134400
		Pyrene	150	ug/kg	6.4	ug/kg	Ref. 4, p. 134400

Key:

() = Adjusted concentration as per Ref. 5, pp. 13 through 18.
bgs = below ground surface.

Table 8
Analytical Results for Source 3 – Upland OU Data Gaps Report 2009
Equipment Laydown Area Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MRL	Units (Dry weight)	Reference

H = High bias.
ID = Identification.
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample (Ref. 4, p. 138942).
MDL = Method detection limit.
mg/kg = milligrams per kilogram.
MRL = Method reporting limit.
ND = Not detected.
PQL = Practical quantitation limit.
Q = The sample result was between the MRL and the MDL (Ref. 4, pp. 131413, 132267, 134373, and 134376; Ref. 37, p. 3).
U = The analyte was analyzed for but was not detected above the reported sample quantitation limit (Ref. 4, p. 138942).
ug/kg = micrograms per kilogram.

Additionally, soil samples were collected from locations (SB-01, SB-02, and SB-03) in the Equipment Laydown Area of the Sandblast AOPC during the URS Upland OU Data Gaps Sampling event as presented in Table 9 below (Ref. 4, pp. 73 and 306 [Figure 5-2]). At each location, one sample was collected from 0 to 1 feet bgs and one sample was collected from 1 to 3 feet bgs (Ref. 4, p. 514 [Table 6-3d]). Each sample was sieved to obtain two size fractions (less than 250 micrometer and less than 2 millimeters) (Ref. 4, pp. 17, 73, and 514 [Table 6-3d)]). All samples underwent a quality assurance/quality control (QA/QC) review following the procedures specified in the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (Ref. 4, p. 138942). Samples for this investigation were collected following the guidance contained in related quality assurance project plans (Ref. 4, pp. 72, 290, and 291). Although not required by the HRS, background concentrations are provided to show the relative increase of contaminant levels in the source over background. Background soil samples (i.e., referred to as "Reference" samples) were collected from 14 locations (R1 through R14); however, these samples were not sieved (Ref. 4, p. 74). For this reason, the four soil samples collected from location SB-04 are used in this HRS Documentation Record to represent background lead concentrations since they were sieved and since these samples' have relatively low concentrations of lead. Background samples collected from the same sample depth and having the same size fraction as source soil samples were used for comparison in Table 9. All samples were received consistent with the accompanying COC forms (Ref. 4, pp. 135917 and 135920). The Upland OU Data Gaps Sampling soil sample locations are depicted on Figure 5-2 of Reference 4, p. 306 (Ref. 4, pp. 306 [Figure 5-2] and 514 [Table 6-3d]). The samples were analyzed for lead by EPA SW-846 Method 6010B (Ref. 4, pp. 135945 through 135956).

Table 9 Analytical Results for Source 3 – URS Upland OU Data Gaps Report 2009 Laydown Area Soil Samples							
Sample ID	**Sample Depth (feet bgs)**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (Dry weight)**	**MRL**	**Units (Dry weight)**	**Reference**
Background Soil Sample (<250 um from 0.0 to 1.0 feet bgs)							
SB-04 <250 um 090127-SB-SB4-0-1So	0.0 to 1.0	Lead	90.8	mg/kg	10.0	mg/kg	Ref. 4, pp. 514 and 135938
Equipment Laydown Area Contaminated Soil Samples (<250 um from 0.0 to 1.0 feet bgs)							
SB-01 <250 um 090127-SB-SB1-0-1So	0.0 to 1.0	Lead	398	mg/kg	9.9	mg/kg	Ref. 4, pp. 514 and 135926
SB-03 <250 um 090127-SB-SB3-0-1So	0.0 to 1.0	Lead	921	mg/kg	10.0	mg/kg	Ref. 4, pp. 514 and 135934
Background Soil Sample (<2 mm from 0.0 to 1.0 feet bgs)							
SB-04 <2 mm 090127-SB-SB4-0-1So	0.0 to 1.0	Lead	52.7	mg/kg	9.8	mg/kg	Ref. 4, pp. 514 and 135937
Equipment Laydown Area Contaminated Soil Samples (<2 mm from 0.0 to 1.0 feet bgs)							
SB-01 <2 mm 090127-SB-SB1-0-1So	0.0 to 1.0	Lead	258	mg/kg	10.0	mg/kg	Ref. 4, pp. 514 and 135925
SB-02 <2 mm 090127-SB-SB2-0-1So	0.0 to 1.0	Lead	176	mg/kg	9.9	mg/kg	Ref. 4, pp. 514 and 135929
SB-03 <2 mm 090127-SB-SB3-0-1So	0.0 to 1.0	Lead	768	mg/kg	10.0	mg/kg	Ref. 4, pp. 514 and 135933
Background Soil Sample (<250 um from 1.0 to 3.0 feet bgs)							
SB-04 <250 um 090127-SB-SB4-1-3S	1.0 to 3.0	Lead	9.5 JQ	mg/kg	9.8	mg/kg	Ref. 4, pp. 514 and 135940; Ref. 37, p. 11

Table 9
Analytical Results for Source 3 – URS Upland OU Data Gaps Report 2009
Laydown Area Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MRL	Units (Dry weight)	Reference
Equipment Laydown Area Contaminated Soil Samples (<250 um from 1.0 to 3.0 feet bgs)							
SB-01 <250 um 090127-SB-SB1-1-3So	1.0 to 3.0	Lead	16.2	mg/kg	10.0	mg/kg	Ref. 4, p. 135928
SB-02 <250 um 090127-SB-SB2-1-3So	1.0 to 3.0	Lead	12.0	mg/kg	9.3	mg/kg	Ref. 4, p. 135932
SB-03 <250 um 090127-SB-SB3-1-3So	1.0 to 3.0	Lead	44.8	mg/kg	9.8	mg/kg	Ref. 4, p. 135936
Background Soil Sample (<2 mm from 1.0 to 3.0 feet bgs)							
SB-04 <2 mm 090127-SB-SB4-1-3So	1.0 to 3.0	Lead	6.90 JQ	mg/kg	8.2	mg/kg	Ref. 4, p. 135939; Ref. 37, p. 11
Equipment Laydown Area Contaminated Soil Samples (<2 mm from 1.0 to 3.0 feet bgs)							
SB-01 <2 mm 090127-SB-SB1-1-3So	1.0 to 3.0	Lead	13.9	mg/kg	10.0	mg/kg	Ref. 4, p. 135927
SB-03 <2 mm 090127-SB-SB3-1-3So	1.0 to 3.0	Lead	25.2	mg/kg	10.0	mg/kg	Ref. 4, p. 135935

Key:

bgs = below ground surface.
ID = Identification.
J = The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL (Ref. 4, p. 135914).
MDL = Method detection limit.
mg/kg = milligrams per kilogram.
mm = millimeters.
MRL = Method reporting limit.
PQL = Practical quantitation limit.
Q = The sample result was between the MRL and the MDL (Ref. 4, pp. 135939 and 135940; Ref. 37, p. 4).
um = micrometers.

List of Hazardous Substances Associated with Source

PCBs (Aroclor 1254 and Aroclor 1260), metals (cadmium, lead, mercury, and zinc), pesticides (4,4'-DDT, chlordane (gamma), endosulfan I, endosulfan sulfate, endrin, endrin aldehyde, and methoxychlor), SVOCs (acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dibenz(a,h)anthracene, dibenzofuran, di-n-butyl phthalate, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene), and butyltins (di-n-butyltin, n-butyltin, and tri-n-butyltin).

Butyltins are pollutants/contaminants found at this site (see Table 8 of this HRS documentation record). Butyltins are a class of compounds that bioaccumulate in sediment and fish tissue and are known to have effects on human health and wildlife (Ref. 35, p. 63). One study found that rats whose mothers were exposed to tributyltin during pregnancy showed altered performance in some neurological tests conducted when they were young adults (Ref. 36, p. 27). Another study, also with tributyltin, found that exposure during gestation, lactation, and post-lactation affected some developmental landmarks in female rats (Ref. 36, p. 27). Dibutyltin, and tributyltin, when administered during pregnancy, have induced developmental and reproductive effects in rodents (Ref. 36, p. 33).

The EPA has developed risk-based residential soil RSLs for dibutyltin compounds (i.e., 19 mg/kg) and for tri-n-butyltin (i.e., 23 mg/kg) (Ref. 33, pp. 2, 7, and 15). The RSET has determined that tributyltin is a bioaccumulative chemical of concern in Oregon, including the Columbia River where it borders Oregon and Washington (Ref. 34, p. 142). RSET has proposed freshwater benthic screening levels for dibutyltin, monobutyltin, and tributyltin (Ref. 34, p. 190) and water quality-based screening levels for tributyltin (Ref. 34, p. 195).

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The hazardous constituent quantity for Source No. 3 could not be adequately determined according to the HRS requirements; that is, the total mass of all Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances in the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). There are insufficient historical and current data (Manifests, PRP records, State records, Permits, Waste concentration data, etc.) available to adequately calculate the total mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source No. 3 with reasonable confidence.

Hazardous Constituent Quantity Value (S): NS

2.4.2.1.2 Hazardous Wastestream Quantity

The hazardous wastestream quantity for Source No. 3 could not be adequately determined according to the HRS requirements; that is, the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants in the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). There are insufficient historical and current data (Manifests, PRP records, State records, permits, etc.) available to adequately calculate the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous wastestream quantity for Source No. 3 with reasonable confidence.

Hazardous Wastestream Quantity (W): NS

2.4.2.1.3 Volume

Available data are insufficient to document a volume measure (Ref. 1, Section 2.4.2.1.3).

Volume Assigned Value (V): NS

2.4.2.1.4 Area

The area measure of the source is not known. As a conservative estimate, an area of greater than 0 is assigned (Ref. 1, Section 2.4.2.1.4).

Area Assigned Value (A): >0

Source Hazardous Waste Quantity Factor Value (Ref. 1, Section 2.4.2.1.5): >0

SOURCE DESCRIPTION

2.2 SOURCE CHARACTERIZATION

Number of the Source: 4

Name and description of the source: Bulb Slope AOPC (Contaminated Soil)

The Bulb Slope AOPC was identified during the removal of equipment offshore of Bradford Island in February and March of 2002 (Ref. 4, p. 52). The Bulb Slope AOPC consists of a fan-shaped accumulation of glass and electrical light bulb debris that extends over approximately 1,900 square feet of a steep slope between the Columbia River and the Landfill access road (Ref. 4, p. 52). The debris is concentrated in the center of the slope and the types of glass observed included internal/external light bulbs, fluorescent light bulbs, automobile light bulbs, 1- to 1.5-inch-diameter glass tubes, clear window pane glass, white-colored molded glass (possibly lamppost light covers), and miscellaneous glass beverage containers (Ref. 4, p. 52). Potential surface water runoff routes from upland portions of this source area are to the north toward the Columbia River (Ref. 4, p. 303 [Figure 4-1]). The base of the Bulb Slope AOPC is at an elevation of approximately 75 feet above mean sea level (amsl) (Ref. 4, p. 52). The normal operating range for the Bonneville pool is between 71.5 feet amsl elevation and 76.6 feet amsl as measured at the dam (Ref. 4, p. 52). Based on this information, the base of the Bulb Slope AOPC may be partially submerged during some periods (Ref. 4, p. 52).

In November 2002, a reconnaissance investigation of the Bulb Slope Area was conducted by URS (Ref. 4, pp. 69 and 290). During this investigation, soil samples were collected from eight locations (Ref. 4, pp. 69 and 308 [Figure 5-4]). These were locations Area A04, Area A05, Area B06, Area B07, Area C01, Area C02, Area C08, and Area C09 (Ref. 4, pp. 308 [Figure 5-4] and 483 [Table 5-7]). All samples were collected from 0.17 to 0.33 feet bgs, with the exception of sample Area C01 which was collected from 0.08 to 0.25 feet bgs (Ref. 4, p. 483 [Table 5-7]). The samples revealed the presence of PCBs and metals (Ref. 4, p. 483 [Table 5-7]) (see Table 10 of this HRS Documentation Record).

Location of the source, with reference to a map:
The Bulb Slope AOPC is located on the eastern side of Bradford Island, Oregon (see Figure 5 of this HRS Documentation Record; Ref. 4, p. 297).

Containment
Release to Surface Water via Overland Migration and/or Flood: A surface water containment factor value of 10 (Ref. 1, Table 4-2) is assigned because the Bulb Slope AOPC is vegetated or covered with organic debris (i.e., the source has no maintained engineered cover, or functioning and maintained run-on control system and runoff management system) (Ref. 4, p. 41).

Containment Factor Value: 10

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

The RI report documents the investigation activities that have taken place over the past 10 years since the report was written (i.e., approximately the period from 2002 to 2012) (Ref. 4, p. 20); including new sampling work conducted during the RI in 2007 and 2009 to fill identified data gaps (Ref. 4, p. 72). The RI states that due to the relatively static physical environment of the Upland OU, environmental data collected over the past decade prior to the RI can be considered representative of current conditions (Ref. 4, p. 59). The RI report included laboratory data forms from these investigations as Appendix E. For this reason, the primary reference for information contained in tables within this section are taken from this appendix.

URS Bulb Slope Reconnaissance Investigation 2002

- Bulb Slope Area AOPC Source Samples: Soil samples were collected from eight locations (Area A04, Area A05, Area B06, Area B07, Area C01, Area C02, Area C08, and Area C09 in the Bulb Slope AOPC during the URS Bulb Slope Reconnaissance Investigation sampling event as presented in Table 10 below (Ref. 4, pp. 308 [Figure 5-4] and 483 [Table 5-7]). All samples were collected from 0.17 to 0.33 feet bgs, with the exception of sample Area C01 which was collected from 0.08 to 0.25 feet bgs (Ref. 4, p. 483 [Table 5-7]). All samples underwent a quality assurance/quality control (QA/QC) review following the procedures specified in the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review and Inorganic Data Review (Ref. 4, p. 138823). Samples for this investigation were collected in accordance with a sampling and analysis plan (Ref. 4, p. 138823). The samples were analyzed for PCBs by EPA SW-846 Method 8082, total lead by EPA SW-846 6010, and total mercury by EPA SW-846 7471A (Ref. 4, p. 138823). The samples were received consistent with the accompanying COC forms (Ref. 4, pp. 5101 and 138824). Soil sample Area C09 is used in this HRS Documentation Record to represent background concentrations since the sample was collected within the same area as other Bulb Slope AOPC samples and due to the sample's relatively low concentrations of contaminants (Ref. 4, p. 308 [Figure 5-4] and p. 483 [Table 5-7]). Although not required by the HRS, background concentrations are provided to show the relative increase of contaminant levels in the source over background. The URS Bulb Slope Reconnaissance Investigation soil sample locations are depicted on Figure 5-4 of Reference 4, p. 308.

Table 10
Analytical Results for Source 4 – Bulb Slope Reconnaissance Investigation 2002
Bulb Slope AOPC Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MDL/ RL	Units (Dry weight)	Reference
Background Soil Samples							
Area C09 021120BSC 09SS	0.17 to 0.33	Aroclor 1260	20 U	ug/kg	NR	ug/kg	Ref. 4, pp. 483 and 5120
		Lead	25	mg/kg	3	mg/kg	Ref. 4, p. 5142
		Mercury	0.13	mg/kg	0.06	mg/kg	Ref. 4, p. 5142

Table 10
Analytical Results for Source 4 – Bulb Slope Reconnaissance Investigation 2002
Bulb Slope AOPC Soil Samples

Sample ID	Sample Depth (feet bgs)	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MDL/ RL	Units (Dry weight)	Reference
Bulb Slope AOPC Contaminated Soil Samples							
Area A04 021120BSA 04SS	0.17 to 0.33	Aroclor 1260	78	ug/kg	NR	ug/kg	Ref. 4, pp. 483 and 5115
		Lead	234	mg/kg	2	mg/kg	Ref. 4, p. 5137
Area A05 021120BSA 05SS	0.17 to 0.33	Aroclor 1260	37	ug/kg	NR	ug/kg	Ref. 4, pp. 483 and 5116
		Lead	202	mg/kg	3	mg/kg	Ref. 4, p. 5138
		Mercury	0.74	mg/kg	0.06	mg/kg	Ref. 4, p. 5138
Area B06 021120BSB 06SS	0.17 to 0.33	Aroclor 1260	160	ug/kg	NR	ug/kg	Ref. 4, pp. 483 and 5117
		Lead	444	mg/kg	2	mg/kg	Ref. 4, p. 5139
		Mercury	0.50	mg/kg	0.06	mg/kg	Ref. 4, p. 5139
Area B07 021120BSB 07SS	0.17 to 0.33	Aroclor 1260	35	ug/kg	NR	ug/kg	Ref. 4, pp. 483 and 5118
		Lead	170	mg/kg	6	mg/kg	Ref. 4, p. 5140
Area C01 021120BSC 01SS	0.17 to 0.33	Aroclor 1260	27	ug/kg	NR	ug/kg	Ref. 4, pp. 483 and 5110
Area C08 021120BSC 08SS	0.17 to 0.33	Aroclor 1260	51	ug/kg	NR	ug/kg	Ref. 4, pp. 483 and 5119
		Lead	142	mg/kg	2	mg/kg	Ref. 4, p. 5141

Key:
bgs = below ground surface.
ID = Identification.
MDL = Method detection limit.
mg/kg = milligrams per kilogram.
NR = Not reported. Neither the MDL nor the RL are reported on the laboratory data forms, however, in Table 5-7 of Reference 4 on page 483, bolded results are indicated in the Notes at the end of the table as being "…detected above the MDL".
RL = Reporting limit.
U = The analyte was not detected at or above the MDL (Ref. 4, p. 80).
ug/kg = micrograms per kilogram.

List of Hazardous Substances Associated with Source

PCBs (Aroclor 1260), lead, and mercury.

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The hazardous constituent quantity for Source No. 4 could not be adequately determined according to the HRS requirements; that is, the total mass of all Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances in the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). There are insufficient historical and current data (Manifests, PRP records, State records, Permits, Waste concentration data, etc.) available to adequately calculate the total mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source No. 4 with reasonable confidence.

Hazardous Constituent Quantity Value (S): NS

2.4.2.1.2 Hazardous Wastestream Quantity

The hazardous wastestream quantity for Source No. 4 could not be adequately determined according to the HRS requirements; that is, the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants in the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). There are insufficient historical and current data (Manifests, PRP records, State records, permits, etc.) available to adequately calculate the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous wastestream quantity for Source No. 4 with reasonable confidence.

Hazardous Wastestream Quantity (W): NS

2.4.2.1.3 Volume

In November 2002, an investigation concluded that PCBs as Aroclor 1260, lead, and mercury were present in soils within the area of visually observed glass debris at the Bulb Slope AOPC (Ref. 4, pp. 69 and 70). At this time, it was estimated that approximately 95 to 125 cy of debris and impacted soil was present at the Bulb Slope AOPC on top of a bedrock base (Ref. 4, p. 70).

Using the lower estimated volume of 95 cy, the volume measure of the source is conservatively calculated to be 0.038 (i.e., 95 cy / 2,500 for contaminated soil) (Ref. 1, Section 2.4.2.1.3).

Volume Assigned Value (V): 0.038

2.4.2.1.4 Area

An area measure of 0 is assigned since the volume of the source could be estimated (Ref. 1, Section 2.4.2.1.4).

Area Assigned Value (A): 0

Source Hazardous Waste Quantity Factor Value (Ref. 1, Section 2.4.2.1.5): 0.038

SOURCE DESCRIPTION

2.2 SOURCE CHARACTERIZATION

Number of the Source: 5

Name and description of the source: River OU Former Debris Piles (other)

In October and November 2000, underwater dive surveys were conducted along the north shore of Bradford Island and numerous pieces of electrical equipment and other solid waste in three distinct piles (designated as Former Debris Piles #1, #2, and #3) were discovered in the Columbia River adjacent to the Landfill AOPC (Ref. 4, pp. 29, 53, and 70). The electrical equipment debris in piles #1 and #2 included PCB-containing light ballasts, lightning arresters, and electrical capacitors (Ref. 6, pp. 3 and 13 [Table 4-1]). Photographs of the types of electrical equipment recovered are included as Appendix B of Reference 6 (Ref. 6, pp. 25 through 36). PCB containing items were not recovered from Pile #3 (Ref. 6, p. 8). Since Piles #1 and #2 are the same source type, contain the same types of electrical equipment, are both within the Columbia River, and effect the same targets, they have been aggregated into one source for the purposes of this HRS Documentation Record.

The electrical debris contaminated the surrounding sediment with PCBs, PAHs, and metals (Ref. 4, p. 53; Ref. 6, pp. 3 and 15 [Table 5-2]). The removal of equipment and debris from the Columbia River along the north shore of Bradford Island took place in December 2000 and in February and March 2002 (Ref. 6, pp. 3 and 11). Approximately 32 tons of solid waste was removed and disposed of off-site including four 55-gallon drums of PCB-containing electrical debris (Ref. 4, p. 11). Prior to removing items, the type of item was identified and assessed as to whether the item could contain liquids (e.g., inerteen capacitors) or contained solid PCBs (e.g., lighting ballasts), and whether the item was damaged (Ref. 6, p. 6). Samples of recovered equipment were collected to determine disposal options and these samples contained Aroclor 1248, Aroclor 1254, and Aroclor 1268 (Ref. 6, pp. 10 and 16 [Table 5-3]) (See Table 11 of this HRS Documentation Record). Figure 2-2 on page 19 of Reference 6 depicts the historic in-water locations of three former debris piles. Sediments adjacent to damaged items were removed using a small hydraulic pump fitted to a hose (Ref. 6, p. 6). Sediment samples collected from drums of sediment recovered within Debris Pile #1 contained between 116,000 to 1,440,000 ug/kg Aroclor 1254 (Ref. 6, pp. 10 and 15 [Table 5-2]). Sediment samples collected from drums of sediment recovered within Debris Pile #2 contained 149 and 286 ug/kg Aroclor 1254 (Ref. 6, pp. 10 and 15 [Table 5-2]).

Following the removal of electrical equipment debris from the Columbia River, investigations were completed in 2002 and 2003 to assess the extent of sediment-related impacts from the waste-related items (Ref. 4, p. 70). Aroclor 1254 was found to be present in 77 sediment samples (S1-29 through S1-42, S1-44 through S1-52, S2-53 through S2-78, and TR-1 through TR-28; see Reference 14, Figure 6-1 on page 92 and Reference 7, Figure 5-1B on page 212 for sample locations) collected near the former debris piles at concentrations ranging from 1 to 690,000 ug/kg (Ref. 14, pp. 42, 77 [Table 6-6], and 240 [Table B-1). Aroclor 1254 was not detected above method detection limits (i.e., ranging from <0.05 to <1.16 ug/kg) in 20 sediment samples (RF-91 through RF-100; see Reference 14, Figure 6-2 on page 93 for sample locations) collected from upstream, reference locations (Ref. 14, pp. 42, 79 [Table 6-8], and 241 [Table B-1]). These results indicated that the source of PCBs to Forebay sediments was the former debris found in the waste piles (Pile #1, #2, and #3) (Ref. 14, p. 8). Some of the PCB-contaminated sediment associated with the former debris piles was removed in 2007 (Ref. 4, p. 53). See Section 4.1.2.1.1, Observed Release, of this HRS Documentation Record for documentation of residual Forebay sediment contamination based on sampling events conducted after sediment removal activities.

Location of the source, with reference to a map:
The River OU Former Debris Piles were located on the northern shore of Bradford Island and within the Columbia River (see Figure 5 of this HRS Documentation Record; Ref. 6, p. 19 [Figure 2-2]).

Containment
Release to Surface Water via Overland Migration and/or Flood: A surface water containment factor value of 10 (Ref. 1, Table 4-2) is assigned because former Debris Piles #1 and #2 were present within the Columbia River and have caused sediment contamination (Ref. 6, p. 11).

Containment Factor Value: 10

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

URS In-Water Removal Work 2002

- River OU Former Debris Pile Source Samples: Samples of material contained in electrical equipment removed from Debris Piles #1 and #2 were collected during the 2000 and 2002 URS In-Water Removal Work in order to determine disposal options (Ref. 6, pp. 10 and 16 [Table 5-3]). The concentrations of several PCB Aroclors that were detected in this recovered equipment are provided in Table 11.

Table 11
Analytical Results for Source 5 – URS In-Water Removal Work 2002 and 2000
River OU Former Debris Pile Electrical Equipment Samples

Equipment Type	Hazardous Substance	Hazardous Substance Concentration	Units	MDL	Units	Reference
2002 Results						
Oil Filled Switches	Aroclor 1268	0.15	mg/L	NK	mg/L	Ref. 6, p. 16
Long Black Rectangle Ballast	Aroclor 1254	1,900	mg/kg	NK	mg/kg	Ref. 6, p. 16
Jefferson Mercury Light Ballast	Aroclor 1254	1.0	mg/kg	NK	mg/kg	Ref. 6, p. 16
Grey Dome Ballast	Aroclor 1248	330	mg/kg	NK	mg/kg	Ref. 6, p. 16
Coupling Capacitor	Aroclor 1254	980	mg/kg	NK	mg/kg	Ref. 6, p. 16
Silver Finned Ballast	Aroclor 1254	340	mg/kg	NK	mg/kg	Ref. 6, p. 16
2000 Results						
Inerteen Capacitor	Aroclor 1254	20	percent	NK	percent	Ref. 6, p. 16
Coupling Capacitor	Aroclor 1254	1.99	mg/kg	NK	mg/kg	Ref. 6, p. 16
Lighting Ballast	Aroclor 1254	258	mg/kg	NK	mg/kg	Ref. 6, p. 16
Lightening Arrestor (felt)	Aroclor 1254	6.35	mg/kg	NK	mg/kg	Ref. 6, p. 16

Key:

MDL = Method detection limit.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.
NK = Not known.

List of Hazardous Substances Associated with Source

PCBs (Aroclor 1248, Aroclor 1254, and Aroclor 1268).

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The hazardous constituent quantity for Source No. 5 could not be adequately determined according to the HRS requirements; that is, the total mass of all Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances in the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). There are insufficient historical and current data (Manifests, PRP records, State records, Permits, Waste concentration data, etc.) available to adequately calculate the total mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source No. 5 with reasonable confidence.

Hazardous Constituent Quantity Value (S): NS

2.4.2.1.2 Hazardous Wastestream Quantity

The hazardous wastestream quantity for Source No. 5 could not be adequately determined according to the HRS requirements; that is, the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants in the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). There are insufficient historical and current data (Manifests, PRP records, State records, permits, etc.) available to adequately calculate the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous wastestream quantity for Source No. 5 with reasonable confidence.

Hazardous Wastestream Quantity (W): NS

2.4.2.1.3 Volume

Four 55-gallon drums of PCB-containing electrical debris were removed from the Columbia River (Ref. 6, p. 11). The volume measure of the source is not known. As a conservative estimate, a volume of greater than 0 is assigned (Ref. 1, Section 2.4.2.1.3).

Volume Assigned Value (V): >0

2.4.2.1.4 Area

An area measure of 0 is assigned since the volume of the source could be determined (Ref. 1, Sections 2.4.2.1.3 and 2.4.2.1.4).

Area Assigned Value (A): 0

Source Hazardous Waste Quantity Factor Value (Ref. 1, Section 2.4.2.1.5): >0

Table 12 Summary of Source Descriptions			
Source Number	**Source Hazardous Waste Quantity Value [a]**	**Source Hazardous Constituent Quantity Complete? (Y/N)**	**Containment Value for Surface Water [b]**
1. Landfill AOPC	3	N	10
2. Spent Sandblast Grit Disposal Area	0.296	N	10
3. Equipment Laydown Area	>0	N	10
4. Bulb Slope Area	0.038	N	10
5. River OU Former Debris Piles	>0	N	10
[a] - See Section 2.4.2 of this document. [b] - See Section 2.2 of this document; Ref. 1, Section 4.1.2.1.2.1.1, and Table 4-2.			

Description of Other Possible Sources: The Pistol Range AOPC is located on the south side of Bradford Island and was used for small arms target practice from approximately 1950 through 1970 (Ref. 4, p. 21) (see Figure 4 of this HRS Documentation Record). Surface soils became contaminated with lead at concentrations ranging from 7.5 to 1,110 mg/kg and zinc at concentrations ranging from 74 to 199 mg/kg (Ref. 4, pp. 21 and 482 [Table 5-6]). The topography of the area consists of a sequence of vegetated slopes and flat areas (Ref. 4, p. 21). Erosion and transport of soil from the Pistol Range AOPC to the river is currently unlikely (Ref. 4, p. 21). However, when the Pistol Range AOPC was in use as a firing range, the ground surface may have been less vegetated and there may have been historical runoff to the Columbia River (Ref. 4, p. 21).

4.1 OVERLAND/FLOOD MIGRATION COMPONENT

4.1.1 GENERAL CONSIDERATIONS

4.1.1.1 Definition of Hazardous Substance Migration Path for Overland/Flood Component

Bradford Island site is located on Bradford Island within the Columbia River (Ref. 4, p. 20). Probable points of entry (PPEs) for surface water runoff from each source area to the Columbia River are as follows:

Source 1 – Landfill AOPC: The land surface slopes to the north and east; toward the Columbia River and this source includes shoreline portions of the river, and an area of mass wasting adjacent to the river (i.e., PPE 1 on Figure 5 of this HRS Documentation Record). Ref. 4, pp. 21, 300 [Figure 3-3], and 303 [Figure 4-1]). The distance from this source to PPE 1 in the Columbia River is 0 (see Figure 5 of this HRS Documentation Record).

Source 2 – Spent Sandblast Grit Disposal Area: This source is within the Sandblast Area AOPC (Ref. 4, p. 49). A portion of stormwater runoff from impervious surfaces (asphalt) within this AOPC drains to four catch basins (designated as #1, #2, #3, and #4) (Ref. 4, pp. 49 and 50). These catch basins discharge to the Columbia River via two outfalls (designated as Outfalls #1 [PPE 2] and #2 [PPE 6]) (Ref. 4, pp. 49 and 50, and pp. 301 [Figure 3-4] and 303 [Figure 4-1]; Ref. 15, p. 6 [Figure 3]). Catch basin #4 is immediately adjacent to the Spent Sandblast Grit Disposal Area and is the furthest of the four catch basins from the Columbia River (Ref. 4, p. 301 [Figure 3-4]). The overland distance from this catch basin to its discharge point at Outfall #1 (PPE 2) on the Columbia River is approximately 225 feet (Ref. 4, p. 301 [Figure 3-4]; and see Figure 5 of this HRS Documentation Record). The disposal of spent sandblast grit in the area immediately east of the former sandblast building (i.e., the Spent Sandblast Girt Disposal Area) has resulted in the release of metallic and organometallic constituents into the surface and subsurface soil (Ref. 4, p. 50). This material has subsequently been transported across the site by surface water runoff into the stormwater drainage features (Ref. 4, p. 50 and p. 301 [Figure 3-4]), and ultimately to the Columbia River (Ref. 4, p. 301 [Figure 3-4]; Ref. 15, p. 6 [Figure 3]). Although in October 2001, the USACE cleaned the sediment from the stormwater system, replaced the filter fabric socks that line each catch basin, and has replaced the socks on a periodic basis, these liners would not prevent hazardous substances from migrating to the Columbia River (Ref. 4, p. 50).

Source 3 – Equipment Laydown Area: This source is within the Sandblast Area AOPC (Ref. 4, p. 49). In 2009, evidence of runoff was observed along the Landfill access road and the adjacent Equipment Laydown Area (Ref. 4, p. 50). Portions of the Equipment Laydown Area are adjacent to the Columbia River (Ref. 4, p. 301 [Figure 3-4]). Other portions of the Equipment Laydown Area drain to catch basin #1 which is connected to Outfall #1 (PPE 2) which discharges to the Columbia River (Ref. 4, pp. 301 [Figure 3-4] and 303 [Figure 4-1]; Ref. 15, p. 6 [Figure 3]). The overland distance from this catch basin to the Columbia River is less than 200 feet (Ref. 4, p. 301 [Figure 3-4]; and Figure 5 of this HRS Documentation Record). Although in October 2001, the USACE cleaned the sediment from the stormwater system, replaced the filter fabric socks that line each catch basin, and has replaced the socks on a periodic basis, these liners would not prevent hazardous substances from migrating to the Columbia River (Ref. 4, p. 50).

Source 4 – Bulb Slope AOPC: The vegetated Bulb Slope AOPC disposal area slopes steeply from the Landfill access road (approximate elevation of 95 to 100 feet amsl) down to the Columbia River (approximate elevation of 75 feet amsl) (Ref. 4, p. 52). Potential surface water runoff routes from upland portions of this source area are to the north toward the Columbia River (Ref. 4, pp. 53, 303 [Figure 4-1]). The slope angle is near vertical at the base of the slope for a height of approximately 4 feet above the river level (Ref. 4, p. 52). The normal operating range for the Bonneville pool is between 71.5 feet amsl elevation and 76.6 feet amsl as measured at the dam (Ref. 4, p. 52). Based on this information, the base of the Bulb Slope AOPC may be partially submerged during some periods (Ref. 4, p. 52). At the base of the slope, wave erosion has resulted in mass wasting (small slope failures) of material into the river (Ref. 4, p. 53). Mass wasting into the river appears to be the only potential mechanism for transport of debris and/or contaminated soil into the Columbia River (i.e., PPE 3 on Figure 5 of this HRS Documentation Record) (Ref. 4, p. 53). The distance from this source to the Columbia River is 0 (see Figure 5 of this HRS Documentation Record).

Source 5 – River OU Debris Piles: Two piles of PCB-contaminated electrical equipment (i.e., Piles #1 and #2) were once located within the Columbia River (i.e., PPEs 4 and 5 on Figure 5 of this HRS Documentation Record) (Ref. 4, pp. 53 and 302 [Figure 3-5]). The distance from this source to the Columbia River is 0 (see Figure 5 of this HRS Documentation Record).

4.1.1.2 Target Distance Limit

The total annual precipitation for Cascade Locks, Oregon in 2019 was 48.09 inches (Ref. 8, p. 4). From the various PPEs described in section 4.1.1.1 of this HRS documentation record, The 15-mile Target Distance Limit (TDL) begins at Source 5, Debris Pile #1, continues downstream approximately 2.5 miles to Outfall #2, then extends from Outfall #2 for 15 miles downstream within the Columbia River (see Figure 6 of this HRS Documentation Record). The nearest United States Geological Survey stream gaging stations to Bradford Island is present below the Bonneville Dam, however, stream flow data is not maintained for this station (Ref. 9, p. 2). Other nearby USGS gaging stations are station 14105700 at the Dalles, Oregon located upstream and station 14144700 at Vancouver, Washington located downstream (Ref. 10, p. 2; Ref. 11, p. 2). Both of these stations had average annual stream flows in excess of 100,000 cubic feet per second (cfs), with Dalles, Oregon station having 199,100 cfs and the Vancouver, Washington station having 204,400 cfs (Ref. 12, p. 1; Ref. 13, p. 1).

4.1.2.1 LIKELIHOOD OF RELEASE

4.1.2.1.1 Observed Release

Direct Observation

Basis for Direct Observation:
In October and November 2000, underwater dive surveys were conducted along the north shore of Bradford Island and numerous pieces of electrical equipment and other solid waste in three distinct piles (Piles #1, #2, and #3) were discovered in the Columbia River adjacent to the Landfill AOPC (Ref. 4, pp. 29, 53, and 70). The electrical equipment debris included PCB-containing light ballasts, electrical insulators, lighting arresters, electrical switches, rocker switches, a breaker box, and electrical capacitors (Ref. 4, pp. 48 and 53). The electrical debris contaminated the surrounding sediment with PCBs, PAHs, and metals (Ref. 4, p. 53). The removal of equipment and debris from the Columbia River along the north shore of Bradford Island took place in December 2000 and in February and March 2002 (Ref. 4, p. 29). Approximately 32 tons of solid waste was removed and disposed of off-site (Ref. 4, p. 29). Figure 3-5 on page 302 of Reference 4 depicts the historic in-water locations of three former debris piles. Photographs of the types of electrical equipment recovered are included as Appendix B of Reference 6 (Ref. 6, pp. 25 through 36). The concentrations of several PCBs (Aroclor 1248, 1254 and 1268) detected in recovered equipment are provided in Table 11 of this HRS documentation record.

Investigations were completed in 2002 and 2003 to assess the extent of sediment-related impacts from the waste-related items (Ref. 4, p. 70). A sediment investigation in 2004 revealed that the PCB Aroclor 1254 was detected at high levels along certain parts of the river bottom (Ref. 16, p. 6). Some of the associated PCB-contaminated sediment was removed in 2007 (Ref. 4, p. 53). Contaminated sediment removal was conducted by dredging near the former debris pile areas (Ref. 4, pp. 76 and 77). These sediment removal areas were designated as removal areas RA1, RA2, and RA3 (Ref. 16, pp. 6 and 145 [Sheet Number C-1]). The total dredged area was approximately one acre (Ref. 4, p. 76). Dredged sediments were dewatered and transported in trucks to a properly permitted disposal facility (Ref. 16, p. 7). Residual contamination in the sediment includes PCBs, PAHs, and selected metals (Ref. 4, p. 53). See the "Chemical Analysis" section below of this HRS Documentation Record for presentations of contaminated sediment data.

Chemical Analysis:

Basis for Chemical Analysis:
Samples collected by the EPA from within the surface water migration pathway TDL during two sampling events will be used to document an observed release by chemical analysis as presented below.

USACE 2012 RI (Ref. 4) and USACE 2013 Pre-Feasibility Study (Ref. 15).

In 2008, post-removal sediment and co-located clam tissue (*Corbicula fluminea*; also known as Asian clam) samples were collected in the Forebay Area and in a Reference (background) locations as a component of the USACE 2012 RI (Ref. 4, pp. 77, 238, and 311). A total of 19 Forebay sediment samples and 19 co-located Forebay clam tissue samples were collected (samples P04 through P11, P13 through P18, P21, P65, P67, P88, and P89) (Ref. 4, pp. 536, 537, and 538 [Table 6-8a]; 542, 543, and 544 [Table 6-9a]; and 311 [Figure 6-3]). A total of 18 Reference sediment samples and 18 co-located Reference clam tissue samples were collected (P22, P24, P26 through P29, P34 through P42, P85, P86, and P87) (Ref. 4, pp. 539, 540, and 541 [Table 6-8b]; 545, 546, and 547 [Table 6-9b]; and 312 [Figure 6-4]). All samples were collected according to the project QAPP (Ref. 4, pp. 139001 and 139018). Samples were analyzed for PCBs using

EPA SW-846 Method 8082, SVOCs using EPA SW-846 Method 8270, and grain size using PSEP (sediment only), among other analyses (Ref. 4, pp. 139001 and 139002). Data results were reviewed in accordance with EPA's *Contract Laboratory Program National Functional Guidelines for Organic Data Review* (Ref. 4, pp. 139002, 139012, 139019, and 139030). All samples were maintained under proper COC (Ref. 4, pp. 79461, 79462, 90272, 90274, 90276, 91618, 91619, 91620, 139003, 139012, and 139020).

Analytical results from the 2008 RI indicate the presence of Aroclor-1254 and bis(2-ethylhexyl)phthalate at elevated concentrations in sediment samples collected from the Forebay Area with respect to background concentrations based on the highest concentrations of these analytes in the background sediment samples; regardless of grain size (see Table 13 for reference citations). Additionally, analytical results indicate the presence of Aroclor-1254 at elevated concentrations in the clam tissue samples collected from the Forebay Area with respect to background concentrations based on the highest concentration of this analyte in the background clam tissue samples (see Table 14 for reference citations). Many of the Forebay Area clam tissue samples contained the SVOCs benzo(a)pyrene, benzo(b)fluoranthene, and pyrene at concentrations that may be elevated with respect to background concentrations; however, since the MRLs associated with the background clam tissue samples were generally about five times higher than the MRLs associated the Forebay Area clam tissue samples, observed releases for these analytes could not be confirmed (see Reference 4 sample numbers in Table 6-7b [page 535] and Table 6-9a [pages 542, 543, and 544] and corresponding laboratory data sheets for background and Forebay Area clam tissue samples on pages 78537, 78538, 78540, 78541, 78542, 78545, 78546, 78547, 81077 through 81083, 81085 through 81092, 81094, 81790, 81791, 83672, and 83675).

In 2011, URS collected sediment, clam (*Corbicula fluminea;* also known as Asian clam) tissue, and smallmouth bass (*Micropterus dolomieu*) tissue samples from the Forebay Area and smallmouth bass from the Reference Area in support of a 2013 pre-feasibility study on behalf the USACE (Ref. 15, pp. 1, 80 through 86). In total seven sediment samples (P112 through P118) were collected and co-located clam tissue samples were collected and analyzed at locations P112 through P115 and at location P118 (Ref. 15, pp. 6 [Figure 3], 12 [Table 3], and 13 [Table 4]; Ref. 7, p. 212 [Figure 1-5B]). Regarding smallmouth bass, nineteen locations were sampled in the Forebay Area (62 through 65, 67 through 74, 76, 78, 79, and 81 through 84) and 19 locations were sampled in the Reference Area (39, 41 through 50, 52, and 55 through 61) (Ref. 15, pp. 4 [Figure 1], 5 [Figure 2], 8 and 9 [Table 1], and 10 and 11 [Table 2]). All samples were collected in accordance with a QAPP (Ref. 15, p. 29). Samples were analyzed for PCBs using EPA SW-846 Method 8082, metals using EPA SW-846 6000/7000 series, total mercury using EPA SW-846 7471A, SVOCs using EPA SW-846 8270C/8270D-SIM, pesticides using EPA SW-846 Method 8081, butyltins using CAS SOP, and grain size (sediments only) using PSEP, among other analyses (Ref. 15, pp. 30 and 43 through 46). Data results were reviewed in accordance with EPA's *Contract Laboratory Program National Functional Guidelines for Organic Data Review* and EPA's *National Functional Guidelines for Inorganic Superfund Data Review* (Ref. 15, pp. 30 and 31). All samples were maintained under proper COC (Ref. 15, pp. 31). Since reference sediment and clam tissue samples were not collected during this investigation, the reference samples from the 2008 RI sampling are used for comparison to the 2011 pre-feasibility study results and these sample results have been included in Tables 13 and 14 below.

Analytical results from the 2011 pre-feasibility sampling event indicate the presence of Aroclor-1254 at elevated concentrations in sediment samples collected from the Forebay Area with respect to background concentrations based on the highest concentrations of these analytes in the background sediment samples; regardless of grain size (see Table 13 for reference citations). Additionally, analytical results indicate the presence of Aroclor-1254 at elevated concentrations in the clam tissue samples collected from the Forebay Area with respect to background concentrations based on the highest concentration of this analyte in the background clam tissue samples (see Table 14 for reference citations).

Table 13
Analytical Results – USACE RI 2008 Sampling Event and USACE Pre-Feasibility Study 2011 Sampling Event
Columbia River Sediment Samples

Sample ID and Date Collected	% Silt	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MDL or MRL	Units (Dry weight)	Reference
Reference (Background) Sediment Samples – USACE RI 2008 Sampling Event							
P22 08030522SD 3/5/2008	50.1%	Aroclor 1254	ND U	ug/kg	10	ug/kg	Ref. 4, pp. 539, 91654, 92382, and 92925
		Bis(2-ethylhexyl)phthalate	6.6 J	ug/kg	200	ug/kg	
P24 08030524SD 3/5/2008	51.0%	Aroclor 1254	ND U	ug/kg	10	ug/kg	Ref. 4, pp. 539, 91655, 92383, and 92927
		Bis(2-ethylhexyl)phthalate	4.9 J	ug/kg	200	ug/kg	
P26 08030426SD 3/4/2008	38.5%	Aroclor 1254	ND U	ug/kg	10	ug/kg	Ref. 4, pp. 539, 91650, 92378, and 92917
		Bis(2-ethylhexyl)phthalate	29 J	ug/kg	200	ug/kg	
P27 08030427SD 3/4/2008	51.7%	Aroclor 1254	ND U	ug/kg	9.6	ug/kg	Ref. 4, pp. 539, 91651, 92379, and 92919
		Bis(2-ethylhexyl)phthalate	6.7 J	ug/kg	190	ug/kg	
P28 08030428SD 3/4/2008	64.9%	Aroclor 1254	ND U	ug/kg	**11**	ug/kg	Ref. 4, pp. 539, 91652, 92380, and 92921
		Bis(2-ethylhexyl)phthalate	11 J	ug/kg	**210**	ug/kg	

Table 13
Analytical Results – USACE RI 2008 Sampling Event and USACE Pre-Feasibility Study 2011 Sampling Event
Columbia River Sediment Samples

Sample ID and Date Collected	% Silt	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MDL or MRL	Units (Dry weight)	Reference
P29 08022229SD 2/22/2008	54.8%	Aroclor 1254	ND U	ug/kg	10	ug/kg	Ref. 4, pp. 539, 91658, 92386, and 92933
		Bis(2-ethylhexyl)phthalate	15 J	ug/kg	200	ug/kg	
P34 08022534SD 2/25/2008	43.9%	Aroclor 1254	ND U	ug/kg	10	ug/kg	Ref. 4, pp. 540, 91661, 92389, and 92939
		Bis(2-ethylhexyl)phthalate	7.5 J	ug/kg	200	ug/kg	
P35 08022535SD 2/25/2008	31.6%	Aroclor 1254	ND U	ug/kg	10	ug/kg	Ref. 4, pp. 540, 91660, 92388, and 92937
		Bis(2-ethylhexyl)phthalate	11 J	ug/kg	200	ug/kg	
P36 08022536SD 2/25/2008	29.1%	Aroclor 1254	ND U	ug/kg	10	ug/kg	Ref. 4, pp. 540, 91659, 92387, and 92935
		Bis(2-ethylhexyl)phthalate	11 J	ug/kg	200	ug/kg	
P37 08022637SD 2/26/2008	30.6%	Aroclor 1254	ND U	ug/kg	10	ug/kg	Ref. 4, pp. 540, 91662, 92390, and 92941
		Bis(2-ethylhexyl)phthalate	5.5 J	ug/kg	200	ug/kg	
P38 08022738SD 2/27/2008	30.1%	Aroclor 1254	ND U	ug/kg	10	ug/kg	Ref. 4, pp. 540, 91663, 92391, and 92943

Table 13
Analytical Results – USACE RI 2008 Sampling Event and USACE Pre-Feasibility Study 2011 Sampling Event
Columbia River Sediment Samples

Sample ID and Date Collected	% Silt	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MDL or MRL	Units (Dry weight)	Reference
(Cont.) P38 08022738SD 2/27/2008	30.1%	Bis(2-ethylhexyl)phthalate	5.9 J	ug/kg	200	ug/kg	Ref. 4, pp. 540, 91663, 92391, and 92943
P39 08022739SD 2/27/2008	25.7%	Aroclor 1254	ND U	ug/kg	9.9	ug/kg	Ref. 4, pp. 540, 91664, 92392, and 92945
		Bis(2-ethylhexyl)phthalate	6.8 J	ug/kg	200	ug/kg	
P40 08022740SD 2/27/2008	22.3%	Aroclor 1254	ND U	ug/kg	10	ug/kg	Ref. 4, pp. 541, 91665, 92393, and 92947
		Bis(2-ethylhexyl)phthalate	7.5 J	ug/kg	200	ug/kg	
P41 08022741SD 2/27/2008	16.3%	Aroclor 1254	ND U	ug/kg	10	ug/kg	Ref. 4, pp. 541, 91666, 92394, and 92949
		Bis(2-ethylhexyl)phthalate	6.8 J	ug/kg	200	ug/kg	
P42 08022742SD 2/27/2008	7.31%	Aroclor 1254	ND U	ug/kg	10	ug/kg	Ref. 4, pp. 541, 91667, 92395, and 92951
		Bis(2-ethylhexyl)phthalate	5.7 J	ug/kg	200	ug/kg	
P85 08030685SD 3/6/2008	36.2%	Aroclor 1254	ND U	ug/kg	10	ug/kg	Ref. 4, pp. 541, 91656, 92384, and 92929

Table 13

Analytical Results – USACE RI 2008 Sampling Event and USACE Pre-Feasibility Study 2011 Sampling Event

Columbia River Sediment Samples

Sample ID and Date Collected	% Silt	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MDL or MRL	Units (Dry weight)	Reference
(Cont.) P85 08030685SD 3/6/2008	36.2%	Bis(2-ethylhexyl)phthalate	110 J	ug/kg	200	ug/kg	Ref. 4, pp. 541, 91656, 92384, and 92929
P86 08030686SD 3/6/2008	43.1%	Aroclor 1254	ND U	ug/kg	10	ug/kg	Ref. 4, pp. 541, 91653, 92381, and 92923
		Bis(2-ethylhexyl)phthalate	5.8 J	ug/kg	200	ug/kg	
P87 08030687SD 3/6/2008	60.6%	Aroclor 1254	ND U	ug/kg	10	ug/kg	Ref. 4, pp. 541, 91657, 92385, and 92931
		Bis(2-ethylhexyl)phthalate	15 J	ug/kg	200	ug/kg	
Columbia River Contaminated Forebay Sediment Samples – USACE RI 2008 Sampling Event							
P04 08022604SD 2/26/2008	40.4%	Aroclor 1254	27	ug/kg	10	ug/kg	Ref. 4, pp. 536, 90305, 90744, and 91203
		Bis(2-ethylhexyl)phthalate	340	ug/kg	200	ug/kg	
Columbia River Contaminated Forebay Sediment Samples – USACE Pre-Feasibility Study 2011 Sampling Event							
P112 111019P112SD 10/19/2011	3.4%	Aroclor 1254	670	ug/kg	NK	NA	Ref. 15, p. 13
P113 111019P113SD 10/19/2011	3.64%	Aroclor 1254	1,900 J[1] (190)	ug/kg	NK	NA	Ref. 15, p. 13

Table 13

Analytical Results – USACE RI 2008 Sampling Event and USACE Pre-Feasibility Study 2011 Sampling Event

Columbia River Sediment Samples

Sample ID and Date Collected	% Silt	Hazardous Substance	Hazardous Substance Concentration	Units (Dry weight)	MDL or MRL	Units (Dry weight)	Reference
P114 111019P114 SD 10/19/2011	3.96%	Aroclor 1254	320	ug/kg	NK	NA	Ref. 15, p. 13
P115 111018P115 SD 10/18/2011	4.87%	Aroclor 1254	11	ug/kg	NK	NA	Ref. 15, p. 13
P116 111018P116 SD 10/18/2011	12.6%	Aroclor 1254	11	ug/kg	NK	NA	Ref. 15, p. 13
P117 111018P117 SD 10/18/2011	3.99%	Aroclor 1254	86	ug/kg	NK	NA	Ref. 15, p. 13

Notes:
Bold font indicates the result is the highest of all background samples.

Key:

() = Adjusted concentration as per Ref. 5, p. 16.
ID = Identification.
J = The result is an estimated concentration that is less than the MRL, but greater than or equal to the MDL (Ref. 4, pp. 90258, 91610, 91611, and 139002). Bis(2-ethylhexyl)phthalate results for quality assurance matrix spike/matrix spike duplicate were outside of the relative percent difference (RPD) control limit of 30% (Ref. 4, p. 139008). Since this analyte had already been qualified as an estimate and flagged with a 'J' due to the concentration being between the MDL and the MRL, further qualification of the data based on the RPD was not required (Ref. 4, p. 139008). No other data quality assurance or quality control issues were noted with regard to bis(2-ethylhexyl)phthalate (Ref. 4, pp. 138999 through 139010).
J^1 = The reported value is an estimate and the bias is not known (Ref. 15, p. 13).
MDL = Method detection limit.
MRL = Method reporting limit.
NA = Not applicable.
ND = Not detected.
NK = Not known – The associated laboratory data sheet is not available, however, since the result does not have a U qualifier which would indicate the analyte was not detected above the reported sample

Table 13 Analytical Results – USACE RI 2008 Sampling Event and USACE Pre-Feasibility Study 2011 Sampling Event Columbia River Sediment Samples							
Sample ID and Date Collected	**% Silt**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (Dry weight)**	**MDL or MRL**	**Units (Dry weight)**	**Reference**
		quantitation limit (Ref. 15, pp. 13 and 31), it can be inferred that the result is above the reported sample quantitation limit.					
U =		The compound was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL (Ref. 4, pp. 90258, 91610, and 91611).					
ug/kg =		micrograms per kilogram.					

Table 14 Analytical Results – USACE RI 2008 Sampling Event and USACE Pre-Feasibility Study 2011 Sampling Event Columbia River Clam Tissue Samples						
Sample ID and Date Collected	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (wet weight)**	**MDL or MRL**	**Units (wet weight)**	**Reference**
Reference (Background) Clam Tissue Samples – USACE RI 2008 Sampling Event						
P22 08030522TC 3/5/2008	Aroclor 1254	36	ug/kg	10	ug/kg	Ref. 4, pp. 545 and 82076
P24 08030524TC 3/5/2008	Aroclor 1254	30	ug/kg	9.7	ug/kg	Ref. 4, pp. 545 and 82075
P26 08030426TC 3/4/2008	Aroclor 1254	35	ug/kg	9.9	ug/kg	Ref. 4, pp. 545 and 82081
P27 08030427TC 3/4/2008	Aroclor 1254	37	ug/kg	9.9	ug/kg	Ref. 4, pp. 545 and 82082
P28 08030428TC 3/4/2008	Aroclor 1254	33	ug/kg	9.8	ug/kg	Ref. 4, pp. 545 and 82077

Table 14
Analytical Results – USACE RI 2008 Sampling Event and USACE Pre-Feasibility Study 2011 Sampling Event
Columbia River Clam Tissue Samples

Sample ID and Date Collected	Hazardous Substance	Hazardous Substance Concentration	Units (wet weight)	MDL or MRL	Units (wet weight)	Reference
P29 08022229TC 2/22/2008	Aroclor 1254	32	ug/kg	9.8	ug/kg	Ref. 4, pp. 545 and 82083
P34 08022534TC 2/25/2008	Aroclor 1254	32	ug/kg	9.9	ug/kg	Ref. 4, pp. 546 and 82084
P35 08022535TC 2/25/2008	Aroclor 1254	37	ug/kg	9.9	ug/kg	Ref. 4, pp. 546 and 82067
P36 08022536TC 2/25/2008	Aroclor 1254	38	ug/kg	9.9	ug/kg	Ref. 4, pp. 546 and 82968
P37 08022637TC 2/26/2008	Aroclor 1254	35	ug/kg	9.9	ug/kg	Ref. 4, pp. 546 and 82069
P38 08022738TC 2/27/2008	Aroclor 1254	37	ug/kg	9.9	ug/kg	Ref. 4, pp. 546 and 82070
P39 08022739TC 2/27/2008	Aroclor 1254	38	ug/kg	9.6	ug/kg	Ref. 4, pp. 546 and 82071
P40 08022740TC 2/27/2008	Aroclor 1254	37	ug/kg	10	ug/kg	Ref. 4, pp. 547 and 82072
P41 08022741TC 2/27/2008	Aroclor 1254	**39**	ug/kg	9.8	ug/kg	Ref. 4, pp. 547 and 82073

Table 14 Analytical Results – USACE RI 2008 Sampling Event and USACE Pre-Feasibility Study 2011 Sampling Event Columbia River Clam Tissue Samples						
Sample ID and Date Collected	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (wet weight)**	**MDL or MRL**	**Units (wet weight)**	**Reference**
P42 08022742TC 2/27/2008	Aroclor 1254	35	ug/kg	10	ug/kg	Ref. 4, pp. 547 and 82074
P85 08030685TC 3/6/2008	Aroclor 1254	34	ug/kg	9.9	ug/kg	Ref. 4, pp. 547 and 82078
P86 08030686TC 3/6/2008	Aroclor 1254	31	ug/kg	9.9	ug/kg	Ref. 4, pp. 547 and 82079
P87 08030687TC 3/6/2008	Aroclor 1254	33	ug/kg	10	ug/kg	Ref. 4, pp. 547 and 82080
Columbia River Contaminated Forebay Clam Tissue Samples – USACE RI 2008 Sampling Event						
P04 08022604TC 2/26/2008	Aroclor 1254	120 P	ug/kg	9.8	ug/kg	Ref. 4, pp. 542 and 78064
Columbia River Contaminated Forebay Clam Tissue Samples – USACE Pre-Feasibility Study 2011 Sampling Event						
P112 111019P112TC 10/19/2011	Aroclor 1254	800	ug/kg	NK	NA	Ref. 15, p. 12
P113 111019P113TC 10/19/2011	Aroclor 1254	1200	ug/kg	NK	NA	Ref. 15, p. 12
P114 111019P114TC 10/19/2011	Aroclor 1254	620	ug/kg	NK	NA	Ref. 15, p. 12

Table 14
Analytical Results – USACE RI 2008 Sampling Event and USACE Pre-Feasibility Study 2011 Sampling Event
Columbia River Clam Tissue Samples

Sample ID and Date Collected	Hazardous Substance	Hazardous Substance Concentration	Units (wet weight)	MDL or MRL	Units (wet weight)	Reference
P115 111018P115TC 10/18/2011	Aroclor 1254	370	ug/kg	NK	NA	Ref. 15, p. 12

Notes:
Bold font indicates the concentration is the highest of all background samples.

Key:

CAS	=	Columbia Analytical Services.
CLP	=	Contract Laboratory Program.
ID	=	Identification.
MDL	=	Method detection limit.
MRL	=	Method reporting limit.
ND	=	Not detected.
NK	=	Not known - The associated laboratory data sheet is not available, however, since the result does not have a U qualifier which would indicate the analyte was not detected above the reported sample quantitation limit (Ref. 15, pp. 12 and 31), it can be inferred that the result is above the reported sample quantitation limit.
P	=	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results (25% for CLP Pesticides) (Ref. 4, pp. 77721 and 77722). During the second column confirmation performed by CAS on Method 8082, the sample results for the associated sample number exceeded the confirmation column agreement criterion of RPD <40% for Aroclor 1254 and were flagged "P" by the laboratory (Ref. 4, pp. 78064 and 139026). The lower of the results from the analyses on the two columns was selected for reporting due to the apparent interferences observed in the chromatogram for the column with the higher concentration (Ref. 4, p. 139026). For this reason, the bias on the qualifier is considered to be low for the purposes of this HRS Documentation Record.
RPD	=	Relative percent difference.
ug/kg	=	micrograms per kilogram.

Attribution:

Sediment, clam tissue, and smallmouth bass tissue samples contain elevated concentrations of Aroclor 1254 with respect to background concentrations (see Sections 4.1.2.1.1 and 4.1.3.3.1). Sediment and clam tissue samples also contain elevated concentrations of bis(2-ethylhexyl)phthalate with respect to background concentrations (see Section 4.1.2.1.1). Of these hazardous substances, Aroclor 1254 was detected in Sources 1, 3, and 5; and bis(2-ethylhexyl)phthalate was detected in Sources 1 and 3 (see Section 2.2). Each of these sources are not fully contained (see Section 2.2 of this HRS Documentation Record for each of these sources) and have overland routes for surface water runoff from them to the Columbia River (see Section 4.1.1.1 of this HRS Documentation Record).

Source 1, the Landfill AOPC, is a former waste disposal site at the tip of Bradford Island that was used from the early 1940s until the early 1980s (Ref. 4, p. 20). Waste disposed of in the Landfill included:

household waste, project-related wastes (grease, light bulbs, sandblast grit), electrical debris, up to 50 ballasts, broken glass, rubber tires, metal debris, wood debris, metal cables, asbestos-containing building materials, burned debris, ceramic insulators, and mercury vapor lamps (Ref. 4, p. 20). In general, the investigations found that for approximately 40 years, the USACE managed, stored, and disposed of waste materials at the landfill in excavated pits or existing depressions on the eastern end of Bradford Island (Ref. 4, p, 48). Some additional wastes were disposed of over the northern and eastern edges of the island (Ref. 4, p. 48). Soil samples collected from within the Landfill AOPC revealed the presence of PCBs including Aroclor 1254), metals, herbicides, pesticides, VOCs, and SVOCs including bis(2-ethylhexyl)phthalate (see Section 2.2 of this HRS Documentation Record). The land surface slopes to the north and east; toward the Columbia River, and closer to the river, an area of mass wasting is present (Ref. 4, pp. 300 [Figure 3-3] and 303 [Figure 4-1]). By 1982, the surface of the Landfill AOPC had been capped with soil, and another layer of soil was added in 1989 (Ref. 4, p. 20). Given that the RI describes that precipitation that falls on the Landfill AOPC footprint percolates to groundwater, it is evident that this source does not have a liner (Ref. 4, p. 37).

Source 2, the Sandblast Grit Disposal Area, is an area adjacent to the former sandblast building were spent sandblast grit was historically spread on the ground over an unknown period prior to 1994 (Ref. 4, p. 50). The disposal of spent sandblast grit in the area immediately east of the former sandblast building has resulted in the release of metallic and organometallic constituents, which were used in historical painting operations, into the surface and subsurface soil (Ref. 4, p. 50). This material has subsequently been transported across the site by surface water runoff into the stormwater drainage features (Ref. 4, p. 50 and p. 301 [Figure 3-4]), and ultimately to the Columbia River (Ref. 4, p. 301 [Figure 3-4]; Ref. 15, p. 6 [Figure 3]). Although available sample results do not indicate the presence of significant concentrations of bis(2-ethylhexyl)phthalate or Aroclor 1254 with respect to background concentrations in this source, the samples did reveal the presence of Aroclor 1260, several metals, and several organotins at significant concentrations with respect to background concentrations (see Table 6 of this HRS Documentation Record) and these analytes have the potential to impact the Columbia River.

Source 3, the Equipment Laydown Area, is used by the USACE to store industrial equipment and materials (Ref. 4, p. 52). Soil samples from this area revealed the presence of PCBs including Aroclor 1254, metals, butyltins, pesticides, and SVOCs including bis(2-ethylhexyl)phthalate (Ref. 4, pp. 508 [Table 6-3a] and 512 [Table 6-3c]). The Equipment Laydown Area is a herbaceously vegetated area (See Figure 5 of this HRS documentation record; Ref. 4, p. 40). Portions of the Equipment Laydown Area are immediately adjacent to the Columbia River (Ref. 4, p. 301 [Figure 3-4]). Other portions of the Equipment Laydown Area drain to catch basin #1 which is connected to Outfall #1 which discharges to the Columbia River (Ref. 4, pp. 301 [Figure 3-4] and 303 [Figure 4-1]; Ref. 15, p. 6 [Figure 3]).

Source 4, the Bulb Slope AOPC, consists of a fan-shaped accumulation of glass and electrical light bulb debris that extends over approximately 1,900 square feet of a steep slope between the Columbia River and the Landfill access road (Ref. 4, p. 52). The debris is concentrated in the center of the slope and the types of glass observed included internal/external light bulbs, fluorescent light bulbs, automobile light bulbs, 1- to 1.5-inch-diameter glass tubes, clear window pane glass, white-colored molded glass (possibly lamppost light covers), and miscellaneous glass beverage containers (Ref. 4, pp. 52 and 53). The majority of the Bulb Slope AOPC is herbaceously vegetated and/or covered with organic debris (Ref. 4, p. 41). The base of the Bulb Slope AOPC may be partially submerged in the Columbia River during some periods (Ref. 4, p. 52). At the base of the slope, wave erosion has resulted in mass wasting (small slope failures) of material into the river (Ref. 4, p. 53). Although available sample results do not indicate the presence of significant concentrations of bis(2-ethylhexyl)phthalate or Aroclor 1254 with respect to background concentrations in this source, the samples did reveal the presence of Aroclor 1260, lead, and mercury at significant concentrations with respect to background concentrations (see Table 10 of this HRS Documentation Record) and these analytes have the potential to impact the Columbia River.

Source 5, the River OU Former Debris Piles, consisted of piles within the Columbia River of electrical equipment debris including PCB-containing light ballasts, lightning arresters, and electrical capacitors (Ref. 4, pp. 29, 53, and 70; Ref. 6, pp. 3 and 13 [Table 4-1]). The removal of equipment and debris from the Columbia River along the north shore of Bradford Island took place in December 2000 and in February and March 2002 (Ref. 6, pp. 3 and 11). Samples of recovered equipment were collected to determine disposal options and these samples contained Aroclor 1248, Aroclor 1254, and Aroclor 1268 (Ref. 6, pp. 10 and 16 [Table 5-3]) (See Table 11 of this HRS Documentation Record). The documentation of these PCB containing debris piles in direct contact with the Columbia River forms the basis for documenting an observed release from the site by direct observation (see section 4.1.2.1.1 of this HRS Documentation Record).

Hazardous Substances Released
Aroclor 1248, Aroclor 1254, Aroclor 1268, and bis(2-ethylhexyl)phthalate.

Observed Release Factor Value: 550

4.1.3.2 WASTE CHARACTERISTICS

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

Table 15 below provides Human Food Chain Threat Waste Characteristics Factor Values for those hazardous substances present in the sources at the Bradford Island (see Section 2.2).

Table 15
Human Food Chain Threat Waste Characteristics Factor Values

Hazardous Substance	Source	Toxicity Factor Value [a]	Persis-tence Factor Value [b]	Bioaccumul-ation Factor Value [c]	Toxicity/Per-sistence/Bioaccu-mulation Value (Ref. 1, Table 4-16)	Reference
Aroclor-1248[c]	5	10,000	1	50,000	5×10^8	Ref. 2, p. 41
Aroclor-1254[c]	1, 3, 5	10,000	1	50,000	5×10^8	Ref. 2, p. 41
Aroclor-1260[c]	1, 2, 3, 4	10,000	1	50,000	5×10^8	Ref. 2, p. 41
Aroclor-1268[c]	5	10,000	1	50,000	5×10^8	Ref. 2, p. 41
Antimony	1, 2	10,000	1	5	50,000	Ref. 2, p. 5
Arsenic	1, 2	10,000	1	5	50,000	Ref. 2, p. 6
Cadmium	1, 2, 3	10,000	1	50,000	5×10^8	Ref. 2, p. 14
Chromium	1, 2	10,000	1	5	50,000	Ref. 2, p. 17
Copper	1, 2	100	1	50,000	5×10^6	Ref. 2, p. 19
Lead	1, 2, 3, 4	10,000	1	5,000	5×10^7	Ref. 2, p. 34
Mercury	1, 3, 4	10,000	1	50,000	5×10^8	Ref. 2, p. 35
Nickel	1, 2	10,000	1	5	50,000	Ref. 2, p. 38
Thallium	1	10,000	1	500	5×10^7	Ref. 2, p. 44
Zinc	1, 2, 3	10	1	500	5,000	Ref. 2, p. 48
2,4,5-T	1	100	1	500	50,000	Ref. 2, p. 47
4,4'-DDT	3	1,000	1	50,000	5×10^7	Ref. 2, p. 20
BHC (alpha) (aka Hexachlorocyclohexane, alpha-)	1	10,000	1	5,000	5×10^7	Ref. 2, p. 31
BHC (beta) (aka Hexachlorocyclohexane, beta-)	1	1,000	1	500	500,000	Ref. 2, p. 32
Chlordane	1	1,000	1	5,000	5×10^6	Ref. 2, p. 15

Table 15 Human Food Chain Threat Waste Characteristics Factor Values						
Hazardous Substance	**Source**	**Toxicity Factor Value [a]**	**Persis-tence Factor Value [b]**	**Bioaccumul-ation Factor Value [c]**	**Toxicity/Per-sistence/Bioaccu-mulation Value (Ref. 1, Table 4-16)**	**Reference**
Chlordane (gamma)	3	1,000	1	50,000	5×10^7	Ref. 2, p. 16
Endosulfan I	3	100	1	500	50,000	Ref. 2, p. 25
Endosulfan sulfate	3	NA	NA	NA	NA	NA
Endrin	3	10,000	1	5,000	5×10^7	Ref. 2, p. 26
Endrin aldehyde	3	0	1	5,000	0	Ref. 2, p. 27
Heptachlor	1	10,000	1	500	5×10^6	Ref. 2, p. 29
Heptachlor epoxide	1	10,000	1	5,000	5×10^7	Ref. 2, p. 30
Methoxychlor	3	100	1	500	50,000	Ref. 2, p. 36
Tetrachloroethylene	1	100	0.07	50	350	Ref. 2, p. 43
Toluene	1	10	0.07	50	35	Ref. 2, p. 45
Acenaphthene	1, 3	10	0.4	500	2,000	Ref. 2, p. 2
Acenaphthylene	1	1	0.4	500	200	Ref. 2, p. 3
Anthracene	1, 3	10	0.4	50,000	2×10^5	Ref. 2, p. 4
Benz(a)anthracene	1, 3	100	1	50,000	5×10^6	Ref. 2, p. 7
Benzo(a)pyrene	1, 3	10,000	1	50,000	5×10^8	Ref. 2, p. 8
Benzo(b)fluoranthene	1, 3	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	1, 3	0	1	50,000	0	Ref. 2, p. 9
Benzo(k)fluoranthene	1, 3	10	1	50,000	500,000	Ref. 2, p. 11
Bis(2-ethylhexyl)phthalate	1, 3	100	1	50,000	5×10^6	Ref. 2, p. 12
Butyl benzyl phthalate	1	10	1	500	5,000	Ref. 2, p. 13
Chrysene	1, 3	10	1	5	50	Ref. 2, p. 18
Dibenz(a,h)anthracene	1, 3	10,000	1	50,000	5×10^8	Ref. 2, p. 22
Dibenzofuran	1, 3	1,000	0.4	500	200,000	Ref. 2, p. 23
Di-n-butylphthalate	3	10	1	5,000	50,000	Ref. 2, p. 21
Fluoranthene	1, 3	100	1	5,000	500,000	Ref. 2, p. 10

Table 15 Human Food Chain Threat Waste Characteristics Factor Values						
Hazardous Substance	**Source**	**Toxicity Factor Value [a]**	**Persis-tence Factor Value [b]**	**Bioaccumul-ation Factor Value [c]**	**Toxicity/Per-sistence/Bioaccu-mulation Value (Ref. 1, Table 4-16)**	**Reference**
Fluorene	1, 3	100	1	500	50,000	Ref. 2, p. 28
Indeno(1,2,3-cd)pyrene	1, 3	100	1	50,000	5×10^6	Ref. 2, p. 33
Naphthalene	1, 3	1,000	0.07	50,000	3.5×10^6	Ref. 2, p. 37
Pentachlorophenol	1	100	1	50,000	5×10^6	Ref. 2, p. 39
Phenanthrene	1, 3	1	0.4	5,000	2,000	Ref. 2, p. 40
Pyrene	1, 3	100	1	50,000	5×10^6	Ref. 2, p. 42
Dibutyltin (di-n-butyltin)	1, 2, 3	10,000	0.07	5	3,500	Ref. 2, p. 24
Monobutyltin	1, 2	NA	NA	NA	NA	NA
n-Butyltin	3	NA	NA	NA	NA	NA
Tributyltin (tri-n-butyltin)	1, 2, 3	10,000	0.4	50,000	2×10^8	Ref. 2, p. 46

a. Fresh water values (Ref. 1, Section 4.1.3.2.1; Ref. 2).
b. River persistence values (Ref. 2).
c. Fresh water values (Ref. 1, Section 4.1.3.2.1.3; Ref. 2).

Key:
NA = None available.

The hazardous substances having the highest Toxicity/Persistence/Bioaccumulation Value of 5×10^8 are PCBs (Aroclor 1248, Aroclor 1254, Aroclor 1260, and Aroclor-1268), cadmium, mercury, benzo(a)pyrene, and dibenz(a,h)anthracene.

Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8

4.1.3.2.2 Hazardous Waste Quantity

Table 16 Hazardous Waste Quantity		
Source No.	**Source Type**	**Source Hazardous Waste Quantity**
1. Landfill AOPC	Landfill	3
2. Spent Sandblast Grit Disposal Area	Contaminated Soil	0.296
3. Equipment Laydown Area	Contaminated Soil	>0
4. Bulb Slope Area	Contaminated Soil	0.038
5. River OU Former Debris Piles	Other	>0

Targets within the surface water migration pathway are subject to Level I concentrations (see Section 4.1.3.3.2.2 below) and source hazardous constituent quantity is not complete (see Section 2.4.2.1.1). A Hazardous Waste Quantity Factor Value of 100 is assigned (Ref. 1, Sections 2.4.2 and 2.4.2.2).

Hazardous Waste Quantity Factor Value (Ref. 1, Table 2-6): 100

4.1.3.2.3 Waste Characteristics Factor Category Value

Toxicity/Persistence Factor Value: 10,000
Hazardous Waste Quantity Factor Value: 100

Toxicity/Persistence Factor Value x Hazardous Waste Quantity Factor Value: 1×10^6

(Toxicity/Persistence Factor Value x Hazardous Waste Quantity Factor Value) x Bioaccumulation Factor Value: 5×10^{10} subject to a maximum value of 1×10^{12} (Ref. 1, Section 4.1.3.2.3)

Waste Characteristics Factor Category Value (Ref. 1, Table 2-7): 320

4.1.3.3 HUMAN FOOD CHAIN TARGETS

4.1.3.3.1 Food Chain Individual

Level I Concentrations -
Hydraulic modeling of the waters near Bradford Island was conducted by the USACE (Ref. 4, p. 41). This modeling indicates that a large eddy forms behind the dam and creates a reverse current flow next to Bradford Island (Ref. 4, p. 41). This reverse flow appears to attract adult salmonids exiting the fish ladder on their way upstream and may result in the fish being swept back over the dam (Ref. 4, p. 41). Introduced fish species may be present in the Dam's Forebay for prolonged periods throughout the year and are popular recreational species with a recognized societal value (Ref. 4, p. 41).

Consumption of shellfish from the Bonneville Dam Forebay Area is not known to occur, particularly for subsistence fishers (Ref. 4, p. 187). Smallmouth bass is a resident species that is known to occur in the River OU (Ref. 7, p. 26). It has a small home range and high fidelity to its range and, therefore, has the potential to spend its entire lifetime in the River OU (Ref. 7, p. 26). It is a trophic level 3/4 species feeding on smaller fish such as sculpin, peamouth, and juvenile fish, as well as crayfish and insect larvae (Ref. 7, p. 26). All these characteristics make it likely that the smallmouth bass is a fish species that may represent reasonable maximum exposure to contaminants of potential concern (Ref. 7, p. 26). It is also extremely popular with sport fishers, nontribal high consumption anglers, and also, to some extent, tribal fishermen (Ref. 7, p. 26; Ref. 17, pp. 1, 2, and 9).

In 2011, URS collected smallmouth bass (*Micropterus dolomieu*) tissue samples from the Forebay Area and smallmouth bass from a Reference Area in support of a 2013 pre-feasibility study on behalf the USACE (Ref. 15, pp. 1, and 8 through 11). Smallmouth bass were collected from 19 locations in the Forebay Area (62 through 65, 67 through 74, 76, 78, 79, and 81 through 84) and from 19 locations in the Reference Area (39 through 52, and 55 through 61) (Ref. 15, pp. 4 [Figure 1], 5 [Figure 2], 8 and 9 [Table 1], and 10 and 11 [Table 2]). All samples were collected in accordance with a QAPP with the exception of a few deviations that were documented in a Work Plan Memorandum (Ref. 15, p. 29). Samples were analyzed for PCBs using EPA SW-846 Method 8082, metals using EPA SW-846 6000/7000 series, total mercury using EPA SW-846 7471A, SVOCs using EPA SW-846 8270, pesticides using EPA SW-846 Method 8081, butyltins using CAS SOP, and percent lipids using NOAA (Ref. 15, p. 30). Data results were reviewed in accordance with EPA's *Contract Laboratory Program National Functional Guidelines for Organic Data Review* and EPA's *National Functional Guidelines for Inorganic Superfund Data Review* (Ref. 15, pp. 30 and 31). All samples were maintained under proper COC (Ref. 15, pp. 31).

Table 17 provides tissue sample results for three smallmouth bass samples obtained from the Zone of Actual Contamination demonstrating the presence of Aroclor-1254 in these samples (see Figure 6 of this HRS Documentation Record). Notably, the concentrations of Aroclor-1254 in these samples (i.e., ranging from 13,000 ug/kg to 65,000 ug/kg) were more than 59 times the highest concentration of Aroclor-1254 detected in the smallmouth bass tissue samples collected from the reference locations (i.e., ranging from not detected at 9.80 ug/kg to detected at 220 ug/kg) (Ref. 15, pp. 8 and 9; Ref. 29, p. 3).

Table 17 Analytical Results –USACE Pre-Feasibility Study 2011 Sampling Event Columbia River Smallmouth Bass Tissue Samples							
Sample ID and Date Collected	**Hazardous Substance**	**Hazardous Substance Concentration**	**Units (wet weight)**	**MRL[a]**	**Units (wet weight)**	**Benchmark Cancer Risk**	**Reference**
Columbia River Contaminated Tissue Samples							
62 R09032011SB62 9/3/2011	Aroclor 1254	13,000	ug/kg	NK	NA	2.08 ug/kg	Ref. 15, p. 10; Ref. 29, p. 3
63 R09032011SB63 9/3/2011	Aroclor 1254	29,000	ug/kg	NK	NA	2.08 ug/kg	Ref. 15, p. 10; Ref. 29, p. 3
68 R09032011SB68 9/3/2011	Aroclor 1254	65,000	ug/kg	NK	NA	2.08 ug/kg	Ref. 15, p. 10; Ref. 29, p. 3

Key:
ID = Identification.
MDL = Method detection limit.
NA = Not applicable.
NK = Not known.
ug/kg = micrograms per kilogram.

The Bradford Island area is within the homelands of the Confederated Tribes and Bands of the Yakama Nation (Yakama Nation) (Ref. 17, p. 1). This Island and this vicinity remain as an important usual and accustomed (U&A) area for cultural, subsistence, and commercial fishing (Ref. 17, p. 1). Yakamas historically consumed multiple migratory and resident fish species, as well as shellfish, from Bradford Island (Ref. 17, p. 1). Today, within the areas of impacted sediments and resident fish, Tribal fish consumption rates by fish/shellfish species are difficult to quantify (Ref. 17, p. 1). Yakamas have always and will continue to fish from the Bonneville Pool (Ref. 17, p. 1). Because smallmouth bass is not formally managed by any tribes in this area (it is a non-native, non-treaty game fish managed by the state agencies) and is not Endangered Species Act (ESA)-listed, the tribal commercial or subsistence catch is not recorded or accounted for through the *U.S. v. Oregon* Management Agreement (Ref. 17, p. 2). Some fishers have stated that they previously sold sturgeon from the Bonneville Pool but no longer do because of concerns about Bradford Island contamination (Ref. 17, p. 2).

In 2013, both the Oregon Health Authority and the Washington Department of Health issued fish consumption advisories for resident fish species in the Columbia River above Bonneville Dam due to elevated levels of mercury and PCBs (Ref. 17, p. 2; Ref. 18, p. 1). In 2008 and 2009 the Oregon Department of Environmental Quality conducted an ecological assessment in the lower middle Columbia River to address data gaps on the extent and concentrations of chemical contaminants (Ref. 18, p. 1). During this effort, smallmouth bass and largescale sucker fish tissue samples were collected; and based on these data the Oregon Health Authority found two human health concerns in resident fish: mercury and PCBs (Ref. 18, p. 1). The fish consumption advisory applies to the Middle Columbia River from the

Bonneville Dam to the McNary Dam (see "Middle Columbia River Fish Advisory" map in Reference 18, p. 1).

A food chain individual factor value of 50 is assigned because a fishery is subject to Level I concentrations.

Level II Concentrations –
Not scored.

Potential Contamination –
Not scored.

Food Chain Individual Factor Value: 50
Ref. 1, Section 4.1.3.3.1

4.1.3.3.2 Population

4.1.3.3.2.1 Level I Concentrations

Smallmouth bass tissue samples obtained from the Zone of Actual Contamination contain PCBs at concentrations that exceed the human food chain cancer risk benchmark (see Table 17 and Figure 6 of this HRS Documentation Record). Smallmouth bass is a resident species (Ref. 7, p. 26). It has a small home range and high fidelity to its range and, therefore, has the potential to spend its entire lifetime in the River OU (Ref. 7, p. 26). The Zone of Actual Contamination is within the Yakama Nation's U&A fishing grounds (Ref. 17, p. 1). Although a U&A treaty fishing area, enrolled Yakama members are currently prohibited (by tribal regulation) from building fishing platforms on Bradford Island (Ref. 17, p. 2). This decision to issue tribal regulations prohibiting fishing platforms on Bradford Island is a direct result of contamination issues and safety concerns (Ref. 17, p. 2). Some fishers have stated that they previously sold sturgeon from the Bonneville Pool but no longer do because of concerns about Bradford Island contamination (Ref. 17, p. 2).

The lower Bonneville pool tribal treaty harvests are continuing despite fish advisory warnings, and that includes smallmouth bass being harvested as non-target by-catch in tribal commercial, ceremonial, and subsistence fisheries at Fort Rains Treaty Fishing Access Site and other nearby sites (Ref. 17, pp. 1 and 2). Because smallmouth bass is not formally managed by any tribes in this area (it is a non-native, non-treaty game fish managed by the state agencies) and is not Endangered Species Act-listed, the tribal commercial or subsistence catch is not recorded or accounted for through the *U.S. v. Oregon* Management Agreement (Ref. 17, p. 2). The amount of harvest is unknown but greater than zero pounds per year (Ref. 17, p. 2).

A Level I concentrations value of 0.3 is calculated (i.e., a human food chain value of 0.03 x 10 for Level I concentrations) (Ref. 1, Section 4.1.3.3.2.1 [Table 4-18]). A value of 0.3 is assigned to Level I concentrations.

Level I Concentrations Factor Value: 0.3

4.1.3.3.2.2 Level II Concentrations

Not scored.

Level II Concentrations Human Food Chain Factor Value: Not scored
Ref. 1, Section 4.1.3.3.2.2 and Table 4-18

4.1.3.3.2.3 Potential Human Food Chain Contamination

The Bradford Island area is within the homelands of the Yakama Nation (Ref. 17, p. 1). This Island and this vicinity remain as an important U&A area for cultural, subsistence, and commercial fishing (Ref. 17, p. 1). Yakamas historically consumed multiple migratory and resident fish species, as well as shellfish, from Bradford Island (Ref. 17, p. 1). Yakamas have always and will continue to fish from the Bonneville Pool (Ref. 17, p. 1). Because smallmouth bass is not formally managed by any tribes in this area (it is a non-native, non-treaty game fish managed by the state agencies) and is not Endangered Species Act (ESA)-listed, the tribal commercial or subsistence catch is not recorded or accounted for through the *U.S. v. Oregon* Management Agreement (Ref. 17, p. 2). Some Yakama Nation fishers have stated that they previously sold sturgeon from the Bonneville Pool but no longer do because of concerns about Bradford Island contamination (Ref. 17, p. 2). Three other tribes are allowed to fish at U&A locations within the Columbia River (Ref. 7, p. 23). These are the Confederated Tribes of the Warm Springs Reservation, the Nez Perce Tribe, and the Confederated Tribes of the Umatilla Indian Reservation (Ref. 7, p. 23). Bradford Island is a historic customary fishing location for these tribes (Ref. 7, p. 23). Subsistence activity is expected to occur year-round (Ref. 7, p. 24). Fish catch numbers are not available.

Sport fishing is known to occur within the 15-mile TDL. The latest sport fish catch data from the Oregon Department of Fish and Wildlife is for 2018 (Ref. 19; Ref. 20; Ref. 21; Ref. 22; and Ref. 23). The 15-mile TDL is within the approximate 39-mile catch area reported for the portion of the Columbia River from the Bonneville Dam to the Interstate 5 (I-5) bridge (Ref. 19, p. 6; Ref. 20, p. 7; Ref. 21, p. 7; Ref. 22, p. 7; Ref. 23, p. 7; Ref. 24, p. 1; Ref. 28, p. 50). The 15-mile TDL represents approximately 38 percent of this 39-mile catch area (i.e., [15 miles / 39 miles] x 100; rounded to the nearest integer) (Ref. 24, p. 1).

The latest sport fish catch report from the Washington State Department of Fish and Wildlife is for 2017 (Ref. 26, p. 1). The 15-mile TDL is within the approximate 118-mile salmon catch area reported for the portion of the Columbia River from the Bonneville Dam to a line drawn between Tongue Point, Oregon and Rocky Point, Washington (Ref. 27, p. 1; Ref. 28, p. 53). The 15-mile TDL represents approximately 13 percent of this 118-mile catch area (i.e., [15 miles / 118 miles] x 100; rounded to the nearest integer) (Ref. 27, p. 1). The 15-mile TDL is also within the approximate 39-mile steelhead catch area reported for the portion of the Columbia River from the Bonneville Dam to the Interstate 5 (I-5) bridge (Ref. 24, p. 1; Ref. 28, p. 53). The 15-mile TDL represents approximately 38 percent of this 39-mile catch area (i.e., [15 miles / 39 miles] x 100; rounded to the nearest integer) (Ref. 24, p. 1).

Estimated potential human food chain fish harvest numbers for catch within the 15-mile TDL is provided in Table 18 below.

Table 18 Fish Harvest						
Species	**Total Fish Catch (a)**	**Percent within TDL (b)**	**Total Catch within TDL (c = a x b)[1]**	**Average Weight of Fish (d)**	**Pounds Harvested within the TDL (c x d)[1]**	**Reference**
Oregon						
Sport Catch Spring Chinook Salmon	869	38%	330	22	7,260	Ref. 19, pp. 1 and 6; Ref. 25, pp. 19 and 20
Sport Catch Fall Chinook Salmon	2,666	38%	1,013	22	22,286	Ref. 20, pp. 1 and 7; Ref 25, p. 20
Sport Catch Summer Steelhead	576	38%	219	7.5[a]	1,643	Ref. 21, pp. 1 and 7; Ref. 25, p. 11
Sport Catch Winter Steelhead	13	38%	5	7.5[a]	38	Ref. 22, pp. 1 and 7; Ref. 25, p. 11
Sport Catch Coho Salmon	84	38%	32	10[b]	320	Ref. 23, pp. 1 and 7; Ref. 25, p. 7
				Total Harvest for Oregon	**31,547**	
Washington						
Sport Catch Chinook Salmon	21,081	13%	2,741	22	60,302	Ref. 25, pp. 19 and 20; Ref. 26, p. 39
Sport Catch Coho	1,370	13%	178	10[b]	1,780	Ref. 25, p. 7; Ref. 26, p. 39
Sport Catch Sockeye	139	13%	18	5.75[c]	104	Ref. 25, p. 16; Ref. 26, p. 39
Sport Catch Jackchin	1,107	13%	144	NK	>0	Ref. 26, p. 39
Sport Catch Jackcoho	38	13%	5	NK	>0	Ref. 26, p. 39
Sport Catch Steelhead	148	38%	56	7.5[a]	420	Ref. 25, p. 11; Ref. 26, p. 65
				Total Harvest for Washington	**>62,606**	

Notes:

1 – Result rounded to the nearest integer.

a – Steelhead weight between 5 and 10 pounds (Ref. 25, p. 11). An average of 7.5 pounds was used to estimate fish weight.
b – Coho weigh between 8 and 12 pounds (Ref. 25, p. 7). An average of 10 pounds was used to estimate fish weight.
c – Sockeye weigh between 3.5 and 8 pounds (Ref. 25, p. 16). An average of 5.75 pounds was used to estimate fish weight.

Key:

NK = Not known.

Table 19 below indicates the calculation for Potential Human Food Chain Contamination Factor Value.

Table 19
Potential Human Food Chain Contamination Factor Value Calculation

Pounds Harvested	Human Food Chain Population Value	Dilution Weight	Dilution Weighted Target Value	Reference
>94,153	31	0.00001	0.00031	Ref. 1, Table 4-13 and Table 4-18; Ref. 12, p. 1; Ref. 13, p. 1. For Pounds Harvested see Table 18.
Total dilution weighted target value			0.00031/ 10 = 0.000031	

Potential Human Food Chain Contamination Factor Value: 0.000031
Ref. 1, Section 4.1.3.3.2.3

4.1.4.2 WASTE CHARACTERISTICS

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

Table 20 below provides Environmental Threat Waste Characteristics Factor Values for those hazardous substances present in the sources at the Bradford Island (see Section 2.2).

Table 20
Environmental Threat Waste Characteristics Factor Values

Hazardous Substance	Source	Ecosystem Toxicity Factor Value [a]	Persistence Factor Value [b]	Environmental Bioaccumulation Factor Value [c]	Ecosystem Toxicity/Persistence/Environmental Bioaccumulation Value (Ref. 1, Table 4-16)	Reference
Aroclor-1248[c]	5	10,000	1	50,000	5×10^8	Ref. 2, p. 41
Aroclor-1254[c]	1, 3, 5	10,000	1	50,000	5×10^8	Ref. 2, p. 41
Aroclor-1260[c]	1, 2, 3, 4	10,000	1	50,000	5×10^8	Ref. 2, p. 41
Aroclor-1268[c]	5	10,000	1	50,000	5×10^8	Ref. 2, p. 41
Antimony	1, 2	1	1	5	5	Ref. 2, p. 5
Arsenic	1, 2	10	1	50,000	500,000	Ref. 2, p. 6
Cadmium	1, 2, 3	10,000	1	50,000	5×10^8	Ref. 2, p. 14
Chromium	1, 2	10,000	1	500	5×10^6	Ref. 2, p. 17
Copper	1, 2	1,000	1	50,000	5×10^7	Ref. 2, p. 19
Lead	1, 2, 3, 4	1,000	1	50,000	5×10^7	Ref. 2, p. 34
Mercury	1, 3, 4	10,000	1	50,000	5×10^8	Ref. 2, p. 35
Nickel	1, 2	100	1	50,000	5×10^6	Ref. 2, p. 38
Thallium	1	100	1	500	50,000	Ref. 2, p. 44
Zinc	1, 2, 3	10	1	50,000	500,000	Ref. 2, p. 48
2,4,5-T	1	10,000	1	500	5×10^6	Ref. 2, p. 47
4,4'-DDT	3	10,000	1	50,000	5×10^8	Ref. 2, p. 20
BHC (alpha) (aka Hexachlorocyclohexane, alpha-)	1	1,000	1	5,000	5×10^6	Ref. 2, p. 31
BHC (beta) (aka Hexachlorocyclohexane, beta-)	1	1,000	1	5,000	5×10^6	Ref. 2, p. 32

Table 20 Environmental Threat Waste Characteristics Factor Values						
Hazardous Substance	**Source**	**Ecosystem Toxicity Factor Value [a]**	**Persis-tence Factor Value [b]**	**Environmental Bioaccumul-ation Factor Value [c]**	**Ecosystem Toxicity/Per-sistence/Environ-mental Bioaccu-mulation Value (Ref. 1, Table 4-16)**	**Reference**
Chlordane	1	10,000	1	50,000	5×10^8	Ref. 2, p. 15
Chlordane (gamma)	3	10,000	1	5,000	5×10^7	Ref. 2, p. 16
Endosulfan I	3	10,000	1	50,000	5×10^8	Ref. 2, p. 25
Endosulfan sulfate	3	NA	NA	NA	NA	NA
Endrin	3	10,000	1	50,000	5×10^8	Ref. 2, p. 26
Endrin aldehyde	3	0	1	5,000	0	Ref. 2, p. 27
Heptachlor	1	10,000	1	50,000	5×10^8	Ref. 2, p. 29
Heptachlor epoxide	1	10,000	1	50,000	5×10^8	Ref. 2, p. 30
Methoxychlor	3	10,000	1	5,000	5×10^7	Ref. 2, p. 36
Tetrachloroethylene	1	100	0.07	50	350	Ref. 2, p. 43
Toluene	1	100	0.07	5,000	35,000	Ref. 2, p. 45
Acenaphthene	1, 3	10,000	0.4	500	2×10^6	Ref. 2, p. 2
Acenaphthylene	1	0	0.4	500	0	Ref. 2, p. 3
Anthracene	1, 3	10,000	0.4	50,000	2×10^8	Ref. 2, p. 4
Benz(a)anthracene	1, 3	10,000	1	50,000	5×10^8	Ref. 2, p. 7
Benzo(a)pyrene	1, 3	10,000	1	50,000	5×10^8	Ref. 2, p. 8
Benzo(b)fluoranthene	1, 3	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	1, 3	0	1	50,000	0	Ref. 2, p. 9
Benzo(k)fluoranthene	1, 3	0	1	50,000	0	Ref. 2, p. 11
Bis(2-ethylhexyl)phthalate	1, 3	1,000	1	50,000	5×10^7	Ref. 2, p. 12
Butyl benzyl phthalate	1	1,000	1	500	500,000	Ref. 2, p. 13
Chrysene	1, 3	1,000	1	5,000	5×10^6	Ref. 2, p. 18
Dibenz(a,h)anthracene	1, 3	0	1	50,000	0	Ref. 2, p. 22
Dibenzofuran	1, 3	1,000	0.4	500	200,000	Ref. 2, p. 23

Table 20 Environmental Threat Waste Characteristics Factor Values						
Hazardous Substance	**Source**	**Ecosystem Toxicity Factor Value [a]**	**Persistence Factor Value [b]**	**Environmental Bioaccumulation Factor Value [c]**	**Ecosystem Toxicity/Persistence/Environmental Bioaccumulation Value (Ref. 1, Table 4-16)**	**Reference**
Di-n-butylphthalate	3	1,000	1	50,000	5×10^7	Ref. 2, p. 21
Fluoranthene	1, 3	10,000	1	5,000	5×10^7	Ref. 2, p. 10
Fluorene	1, 3	1,000	1	5,000	5×10^6	Ref. 2, p. 28
Indeno(1,2,3-cd)pyrene	1, 3	0	1	50,000	0	Ref. 2, p. 33
Naphthalene	1, 3	1,000	0.07	50,000	3.5×10^6	Ref. 2, p. 37
Pentachlorophenol	1	100	1	50,000	5×10^6	Ref. 2, p. 39
Phenanthrene	1, 3	10,000	0.4	50,000	2×10^8	Ref. 2, p. 40
Pyrene	1, 3	10,000	1	50,000	5×10^8	Ref. 2, p. 42
Dibutyltin (di-n-butyltin)	1, 2, 3	0	0.07	5	0	Ref. 2, p. 24
Monobutyltin	1, 2	NA	NA	NA	NA	NA
n-Butyltin	3	NA	NA	NA	NA	NA
Tributyltin (tri-n-butyltin)	1, 2, 3	10,000	0.4	50,000	2×10^8	Ref. 2, p. 46

a. Fresh water values (Ref. 1, Section 4.1.4.2.1.1; Ref. 2).
b. River persistence values (Ref. 2).
c. Fresh water values (Ref. 1, Section 4.1.4.2.1.3; Ref. 2).

Key:
NA = None available.

The hazardous substance having the highest Ecosystem Toxicity/Persistence/Environmental Bioaccumulation Factor value of 5×10^8 are PCBs (Aroclor 1248, Aroclor 1254, Aroclor 1260, and Aroclor-1268), cadmium, mercury, 4,4'-DDT, chlordane, endosulfan I, endrin, heptachlor, heptachlor epoxide, benzo(a)anthracene, benzo(a)pyrene, and pyrene.

Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8

4.1.4.2.2 Hazardous Waste Quantity

Table 21 Hazardous Waste Quantity		
Source No.	**Source Type**	**Source Hazardous Waste Quantity**
1. Landfill AOPC	Landfill	3
2. Spent Sandblast Grit Disposal Area	Contaminated Soil	0.296
3. Equipment Laydown Area	Contaminated Soil	>0
4. Bulb Slope Area	Contaminated Soil	0.038
5. River OU Former Debris Piles	Other	>0

Targets within the surface water migration pathway are subject to Level II concentrations (see Section 4.1.4.3.1.2 below) and source hazardous constituent quantity is not complete (see Section 2.4.2.1.1). A Hazardous Waste Quantity Factor Value of 100 is assigned (Ref. 1, Section 2.4.2.2).

Hazardous Waste Quantity Factor Value (Ref. 1, Section 2.4.2.2, Table 2-6): 100

4.1.4.2.3 Waste Characteristics Factor Category Value

Ecosystem Toxicity/Persistence Factor Value: 10,000
Hazardous Waste Quantity Factor Value: 100

Ecosystem Toxicity/Persistence Factor Value x Hazardous Waste Quantity Factor Value: 1×10^{6}

(Ecosystem Toxicity/Persistence Factor Value x Hazardous Waste Quantity Factor Value) x Environmental Bioaccumulation Factor Value: 5×10^{10} subject to a maximum value of 1×10^{12}

Waste Characteristics Factor Category Value (Ref. 1, Section 2.4.3, Table 2-7): 320

Waste Characteristics Factor Category Value: 320
Ref. 1, Section 2.4.3, Table 2-7

4.1.4.3 ENVIRONMENTAL THREAT – TARGETS

Level I concentrations for the Environmental Threat is not being scored.

4.1.4.3.1 Sensitive Environments

4.1.4.3.1.1 Level I Concentrations

Sensitive Environments

Not scored.

Wetlands

Not scored.

Level I Concentrations Factor Value: Not Scored

4.1.4.3.1.2 Level II Concentrations

Sensitive Environments

Based on historic photographs and USACE hydroacoustic sounding data, a submerged shelf appears to be adjacent to the north side of Bradford Island at a depth of about 30 feet below pool level (Ref. 4, p. 41). This shelf appears to be about 50 feet wide, parallel to the north shore of the island (Ref. 4, p. 41). The shelf could be critical habitat for ESA-listed salmonids (Ref. 4, p. 41). Shallow water (20 feet deep or less) also occupies a band approximately 50 feet wide along the south shoreline of Bradford Island (Ref. 4, p. 41).

The Yakama Nation has stated that anadromous and resident fish species use the Bradford Island area of the Columbia River for foraging, migration, rearing, spawning, and overwintering habitat (Ref. 17, p. 3). All fish species, adult and juvenile, would be expected to swim in, adjacent to or near the Zone of Actual Contamination (Ref. 17, p. 3). They also stated that several ESA-listed species are found in the waters surrounding Bradford Island, including their designated critical habitat and essential fish habitat (Ref. 17, p. 3).

A Zone of Actual Contamination subject to Level II concentrations is present along the north shore of Bradford Island (see section 4.1.2.1.1 and Figure 5). This Zone of Actual Contamination contains critical habitat for a several federal threatened species, as well as other sensitive environments as indicated in Table 22. A critical migratory pathway for Bull trout, Sockeye salmon, summer Chinook, and fall Chum is expected to exist within the Zone of Actual Contamination as these species migrate to and/or from critical spawning habitats (Ref. 30, p. 1).

Table 22
Sensitive Environments Subject to Level II Concentrations

Sensitive Environment	Distance from Nearest PPE to Sensitive Environment	Sensitive Environment Value (Ref. 1, Table 4-23)	References
Critical Habitat for the Federal Threatened Chinook salmon (*Oncorhynchus tshawytscha*) – Lower Columbia River ESU	0 feet	100	Ref. 30, p. 3; Ref. 31, pp. 27, 28, 32 and 33
Critical Habitat for the Federal Threatened Chum salmon *(Oncorhynchus keta)* – Columbia River ESU	0 feet	100	Figure 5 of this HRS Documentation Record; Ref. 3, p. 1; Ref. 30, p. 2; Ref. 31, pp. 70, 71, 73, and 74
Critical Habitat for the Federal Threatened Steelhead salmon (*Oncorhynchus mykiss*) – Lower Columbia River ESU	0 feet	100	Ref. 30, p. 2; Ref. 31, pp. 160, 167, 176, 177, 185, and 186
Critical Habitat for the Federal Threatened Bull trout (*Salvelinus confluentus*) – Lower Columbia River Basin	0 feet	100	Ref. 30, pp. 2, 58, and 59; Ref. 38, pp. 45 and 75; Ref. 39, pp. 4, 5, and 6

Table 22 Sensitive Environments Subject to Level II Concentrations			
Sensitive Environment	**Distance from Nearest PPE to Sensitive Environment**	**Sensitive Environment Value (Ref. 1, Table 4-23)**	**References**
Federal Threatened and State Endangered Coho salmon *(Oncorhynchus kisutch)* – Lower Columbia River ESU	0 feet	75	Ref. 30, p. 2; Ref. 31, p. 2
Sum of Values			**475**

Wetlands

Not scored.

Sum of Level II Sensitive Environments Value + Wetlands Value: 475 + 0 (not scored) = 475

Level II Concentrations Factor Value: 475
Ref. 1, Section 4.1.4.3.1.2

4.1.4.3.1.3 Potential Contamination

Potential Sensitive Environment Targets

Not Scored.

Potential Wetland Frontages

Not scored.

Potential Contamination Factor Value: Not Scored