

HRS DOCUMENTATION RECORD COVER SHEET

Name of Site: Upper Columbia River

Date Prepared: March 2024

Contact Persons

Site Investigation: Monica Tonel (206) 348-2692
U.S. Environmental Protection Agency
Seattle, WA

Region 10 START
Weston Solutions, Inc.
Seattle, WA

Documentation Record: Brandon Perkins (206) 553-6396
U.S. Environmental Protection Agency
Seattle, WA

Dennis J. Foerter
Weston Solutions, Inc.
Edison, NJ

Pathways, Components, or Threats Not Scored

- **Ground Water Migration Pathway** – The ground water migration pathway was not scored because its inclusion would not significantly affect the site score.
- **Surface Water Migration Pathway - Ground Water to Surface Water component** – The ground water to surface water component was not evaluated during the site inspection (SI) stage of the investigation because the surface water overland/flood migration component was scored.
- **Soil Exposure and Subsurface Intrusion Pathway – Subsurface Intrusion Component** – EPA sampling results indicate that inorganic substances are present in the surface soil (i.e., 0–2 feet below ground surface [ft bgs]). Sample locations within areas near occupied buildings consist only of inorganic contamination (i.e., arsenic and lead); however, EPA did not collect samples to fully evaluate the subsurface intrusion component. Based on these considerations, the subsurface intrusion component was not scored.
- **Air Migration Pathway** – Exposure to Site-related chemicals of potential concern (COPCs) in the air has been a public concern at the Site. During the Human Health Risk Assessment (HHRA) conducted by EPA, exposure to COPCs via the air pathway alone did not exceed risk benchmarks for lead, non-cancer effects from other chemicals, or cancer. The concentration of lead in UCR air was an order of magnitude lower than the default air lead concentration in the integrated exposure uptake biokinetic (IEUBK) model, which is a model commonly utilized in Superfund lead risk assessments. The last Site-specific air data were collected in 2009 at one location near Northport. However, emissions from the Trail, British Columbia (B.C.), Canada smelter (Cominco) as reported to the Canadian National Pollutant Release Inventory from 2002 to 2017 show that while individual metals may be emitted at varying rates, aerial emissions of arsenic and lead are generally lower than in years prior to 2009. Exposure to airborne contaminants from the Teck smelter does not pose a substantial risk to Site residents, recreators, or workers [Ref. 17, pp. 226]. Based on these considerations, the air migration pathway was not scored.

HRS DOCUMENTATION RECORD

Name of Site:	Upper Columbia River	Date Prepared: March 2024
EPA ID No.:	WASFN1002171	
EPA Region:	10	
Street Address of Site*:	Sediments of the Upper Columbia River north of the intersection of WA-25 and Marcus Campground Road	
County, State:	Upper Columbia River, Washington	
General Location in the State:	Northeastern Washington	
Topographic Map:	Marcus, WA	
Latitude*:	48.67204548°	
Longitude*:	-118.05324083°	
Site Reference Point:	Phase 3 Sediment Study contaminated sediment sample location EV001-SE-1-092619	
References:	[Figure 2-4 of this HRS documentation record; Ref. 63, p. 1]	

* The street address, coordinates, and contaminant locations presented in this Hazard Ranking System (HRS) documentation record identify the general area 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 National Priorities List (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 the Comprehensive Environmental Response, Compensation, and Liability Act (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	Not Scored
Surface Water Pathway	100.00
Soil Exposure and Subsurface Intrusion Pathway	21.66
Air Pathway	Not Scored
HRS SITE SCORE	51.15

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
UPPER COLUMBIA RIVER**

	<u>S</u>	<u>S²</u>
1. Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	Not Scored	
2a. Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	100.00	10,000
2b. Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	Not Scored	
2c. Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	100.00	10,000
3a. Soil Exposure Component Score (S_{se}) (from Table 5-1, line 22)	21.66	469.15
3b. Subsurface Intrusion Component Score (S_{ssi}) (from Table 5-11, line 12)	Not Scored	
3c. Soil Exposure and Subsurface Intrusion Pathway Score (S_{sessi}) (from Table 5-11, line 13)	21.66	469.15
4. Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	Not Scored	
5. Total of $S_{gw}^2 + S_{sw}^2 + S_{sessi}^2 + S_a^2$	10,469.15	
6. HRS Site Score Divide the value on line 5 by 4 and take the square root	51.15	

**HRS TABLE 4-1, SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET
UPPER COLUMBIA RIVER**

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	Not Scored
2b.	Runoff	25	Not Scored
2c.	Distance to Surface Water	25	Not Scored
2d.	Potential to Release by Overland Flow (lines 2a x [2b + 2c])	500	Not Scored
3.	Potential to Release by Flood:		
3a.	Containment (Flood)	10	Not Scored
3b.	Flood Frequency	50	Not Scored
3c.	Potential to Release by Flood (lines 3a x 3b)	500	Not Scored
4.	Potential to Release (lines 2d + 3c, subject to a maximum of 500)	500	Not Scored
5.	Likelihood of Release (higher of lines 1 and 4)	550	550
Waste Characteristics:			
6.	Toxicity/Persistence	(a)	Not Scored
7.	Hazardous Waste Quantity	(a)	Not Scored
8.	Waste Characteristics	100	Not Scored
Targets:			
9.	Nearest Intake	50	Not Scored
10.	Population:		Not Scored
10a.	Level I Concentrations	(b)	Not Scored
10b.	Level II Concentrations	(b)	Not Scored
10c.	Potential Contamination	(b)	Not Scored
10d.	Population (lines 10a + 10b + 10c)	(b)	Not Scored
11.	Resources	5	Not Scored
12.	Targets (lines 9 + 10d + 11)	(b)	Not Scored
Drinking Water Threat Score:			
13.	Drinking Water Threat Score ([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)	100	Not Scored
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 x 10 ⁸
16.	Hazardous Waste Quantity	(a)	1,000,000
17.	Waste Characteristics	1,000	1,000

Factor Categories and Factors		Maximum Value	Value Assigned
Targets:			
18.	Food Chain Individual	50	45
19.	Population:		
19a.	Level I Concentrations	(b)	0
19b.	Level II Concentrations	(b)	0.03
19c.	Potential Human Food Chain Contamination	(b)	Not Scored
19d.	Population (lines 19a + 19b + 19c)	(b)	0.03
20.	Targets (lines 18 + 19d)	(b)	45.03
21.	Human Food Chain Threat Score ([lines 14 x 17 x 20]/82,500, subject to a maximum of 100)	100	100
Environmental Threat			
Likelihood of Release:			
22.	Likelihood of Release (same value as line 5)	550	550
23.	Ecosystem Toxicity/Persistence/Bioaccumulation	(a)	5 x 10 ⁸
24.	Hazardous Waste Quantity	(a)	1,000,000
25.	Waste Characteristics	1,000	1,000
Targets:			
26.	Sensitive Environments:		
26a.	Level I Concentrations	(b)	0
26b.	Level II Concentrations	(b)	175
26c.	Potential Contamination	(b)	Not Scored
26d.	Sensitive Environments (lines 26a + 26b + 26c)	(b)	175
27.	Targets (value from 26d)	(b)	175
Environmental Threat Score:			
28.	Environmental Threat Score ([lines 22 x 25 x 27]/82,500, subject to a maximum of 60)	60	60.00
Surface Water Overland/Flood Migration Component Score For A Watershed			
29.	Watershed Score ^c (lines 13 + 21 + 28, subject to a maximum of 100)	100	100.00
Surface Water Overland/Flood Migration Component Score			
30.	Component Score (S _{of}) ^c , (highest score from line 29 for all watersheds evaluated, subject to a maximum of 100)	100	100.00

^aMaximum value applies to waste characteristics category.

^bMaximum value not applicable.

^cDo not round to nearest integer.

**HRS TABLE 5-1, SOIL EXPOSURE COMPONENT SCORESHEET
UPPER COLUMBIA RIVER**

Factor Categories and Factors	Maximum Value	Value Assigned
Resident Population Threat		
Likelihood of Exposure:		
1. Likelihood of Exposure	550	550
Waste Characteristics:		
2. Toxicity	(a)	10,000
3. Hazardous Waste Quantity	(a)	10
4. Waste Characteristics	100	18
Targets:		
5. Resident Individual	50	50
6. Resident Population:		
6a. Level I Concentrations	(b)	100.4
6b. Level II Concentrations	(b)	30.12
6c. Resident Population (lines 6a + 6b)	(b)	130.52
7. Workers	15	0
8. Resources	5	0
9. Terrestrial Sensitive Environments	(c)	0
10. Targets (lines 5 + 6c + 7 + 8 + 9)	(b)	180.52
Resident Population Threat Score:		
11. Resident Population Threat (lines 1 x 4 x 10)	(b)	1,787,148
Nearby Population Threat		
Likelihood of Exposure:		
12. Attractiveness/Accessibility	100	Not Scored
13. Area of Contamination	100	Not Scored
14. Likelihood of Exposure	500	Not Scored
Waste Characteristics:		
15. Toxicity	(a)	Not Scored
16. Hazardous Waste Quantity	(a)	Not Scored
17. Waste Characteristics	100	Not Scored
Targets:		
18. Nearby Individual	1	Not Scored
19. Population Within 1 Mile	(b)	Not Scored
20. Targets (lines 18 + 19)	(b)	Not Scored
Nearby Population Threat Score:		
21. Nearby Population Threat (lines 14 x 17 x 20)	(b)	Not Scored
Soil Exposure Component Score		
22. Soil Exposure Component Score ^d (S _{sc}), (lines [11 +21]/82,500, subject to a maximum of 100)	100	21.66

^aMaximum value applies to waste characteristics category.

^bMaximum value not applicable.

^cNo specific maximum value applies to factor. However, pathway score based solely on terrestrial sensitive environments is limited to maximum of 60.

^dDo not round to nearest integer.

FIGURES

Figure 1-1	Site/Source Location Map
Figure 1-2	Le Roi Smelter Source Map
Figure 2-1	Background Sediment Sample Location Map
Figure 2-2	Sediment Sample Location Map – Deadman’s Eddy
Figure 2-3	Sediment Sample Location Map – China Bend
Figure 2-4	Sediment Sample Location Map – Evans
Figure 3	Surface Water Zone of Contamination Map
Figure 4	Area of Observed Contamination Map
Figure 5	Potential Mine/Mill Sources, Stevens and Pend Oreille Counties, Washington
Figure 6	Scored Zone of Contamination Wetland Frontage Map, Stevens County, Washington

FIGURE REFERENCE SHEET

Figure 1-1: Site /Source Location Map

- Basemap: Esri World Topographic Map; used by EPA with Esri's permission.
- Map annotated by START to depict source locations and areas of concern and SO₂ Injury Area.
 - Ref. 4, p. 45
 - Ref. 33, pp. 361-364
 - Ref. 38, p. 332
 - Ref. 39, p. 22
 - Ref. 46, pp. 9-10, 13
 - Ref. 48, p. 1

Figure 1-2: Le Roi Smelter Source Map

- Basemap: ESRI World Topographic Map; used by EPA with ESRI's permission.
- MAP annotated by START to depict source locations.
 - Ref. 5, pp. 780-782
 - Ref. 37, p. 35
 - Ref. 38, p. 332
 - Ref. 46, p. 10
 - Ref. 48, p. 1

Figure 2-1: Background Sediment Sample Location Map

- Basemap: Esri World Topographic Map; used by EPA with Esri's permission.
- Map annotated by EPA START to depict background sediment locations from the 2019 Phase 3 Sediment Study and a slag sample collected adjacent to Cominco Smelter outfalls (2010).
 - Ref. 4, p. 45
 - Ref. 33, pp. 361, 365-367, 376
 - Ref. 18, p. 58

Figure 2-2: Sediment Sample Location Map – Deadman's Eddy

- Basemap: Esri World Topographic Map; used by EPA with Esri's permission.
- Map annotated by EPA START to depict sediment sample locations from the 2019 Phase 3 Sediment Study Deadman's Eddy Area of Interest.
 - Ref. 4, p. 45
 - Ref. 33, pp. 361, 364, 375
 - Ref. 49, p. 43

Figure 2-3: Sediment Sample Location Map – China Bend

- Basemap: Esri World Topographic Map; used by EPA with Esri's permission.
- Map annotated by EPA START to depict sediment sample locations from the 2019 Phase 3 Sediment Study China Bend Area of Interest
 - Ref. 33, pp. 361, 363, 374, 375

Figure 2-4: Sediment Sample Location Map – Evans

- Basemap: Esri World Topographic Map; used by EPA with Esri's permission.
- Map annotated by EPA START to depict sediment sample locations from the 2019 Phase 3 Sediment Study Evans Area of Interest.
 - Ref. 33, pp. 361-362, 373-374

FIGURE REFERENCE SHEET (continued)

Figure 3: Surface Water Zone of Contamination Map

- Basemap: Esri World Topographic Map; used by EPA with Esri's permission.
- Map annotated by EPA START to depict Zone of Contamination.
 - Ref. 4, p. 45
 - Ref. 33, pp. 361-362, 373
 - Ref. 35, pp. 211, 213
 - Ref. 46, p. 10
 - Ref. 48, p. 1

Figure 4: Area of Observed Contamination Map

- Basemap: Esri World Topographic Map; used by EPA with Esri's permission.
- Map annotated by EPA START to depict Soil Exposure Areas of Observed Contamination.
 - Ref. 38, pp. 266-267, 274-277, 280-281, 298-299, 302-311, 314-315, 320-321, 328-329, 338-341, 344-345, 348-351.
 - Ref. 48, p. 1

Figure 5: Potential Mine/Mill Sources, Stevens and Pend Oreille Counties, Washington

- Basemap: Esri World Topographic Map; used by EPA with Esri's permission.
 - Ref. 5, pp. 25, 30, 299, 305, 307, 313, 319, 327
 - Ref. 6, pp. 15, 126, 128
 - Ref. 7, pp. 8, 9
 - Ref. 58, p. 25
 - Ref. 59, pp. 5, 12

Figure 6: Scored Zone of Contamination Wetland Frontage Map, Stevens County, Washington

- Basemap: Esri World Topographic Map; used by EPA with Esri's permission.
- U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI).
- Map annotated by EPA START to depict wetland frontage within the zone of contamination.
 - Ref. 42, pp. 2-6

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6.	E & E. <u>Preliminary Assessments and Site Investigations Report, Lower Pend Oreille River Mines and Mills, Pend Oreille County, Washington</u> . March 2002. [533 pages]
7.	Herrera Environmental Consultants, Inc. <u>Site Inspection Report – Bonanza Mill Site, Stevens County, Washington</u> . October 3, 2002. [297 pages]
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16.	U.S. Department of Interior. <u>General Management Plan, Lake Roosevelt National Recreation Area.</u> January 18, 2000. [159 pages]
17.	SRC. <u>Final Site-Wide Human Health Risk Assessment: Upper Columbia River Site, (excluding Tables, Figures, and Appendices).</u> February 10, 2021. [249 pages]
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58.	TechLaw, Inc. <u>Removal Action Report (Revision 8), Hahnen Property, October 31 through November 3, 2012, Stevens County, Washington, DCN: TO-001-12-09-0011-DCN1578.</u> August 2014. [168 pages]
59.	TechLaw Inc. <u>Removal Assessment Trip Report, Young America Mine, Evans, Stevens County, Washington, DCN: - TO-001-11-06-0011-DCN1267.</u> March 2012. [189 pages]
60.	Parker, K (EPA). <u>POLREP #3 (Initial POLREP), Young America Mine, 10KN, Evans, Washington.</u> October 13, 2012. [3 pages]
61.	Zavela, A. and Parker, K (EPA). <u>POLREP #6 (Final POLREP), Young America Mine, 10KN, Evans, Washington.</u> October 31, 2012. [3 pages]
62.	Foerter, Dennis (WESTON). <u>Project Note to Upper Columbia River HRS Site File, Subject: Chains of Custody – 2001 Soil Samples collected at Le Roi/Northport Smelter.</u> January 31, 2024. [3 pages]
63.	Magee, Chloe (WESTON). <u>E-mail correspondence to Dennis Foerter (WESTON), Subject: Latitude/Longitude: Sample Location EV001-SE-1-092619.</u> January 31, 2024. [1 page]
64.	Foerter, Dennis (WESTON). <u>Project Note to Upper Columbia River HRS Site File, Subject: Sample Quantitation Limits – Soil Samples collected at Le Roi/Northport Smelter in September 2001.</u> February 9, 2024. [29 pages]
65.	Hart Crowser, Inc. <u>Upper Columbia River, Upland Soil Sampling Study, Stevens County, Washington, 17800-36.</u> May 6, 2013. [345 pages]
66.	Foerter, Dennis (WESTON). <u>Project Note to Upper Columbia River HRS File, Subject: Upper Columbia River Sediment Summary Maps for Phase 2 and Phase 3 Sediment Summary Reports submitted by Teck American Inc. – (Lead, Arsenic, Copper, and Zinc Map Summaries).</u> January 31, 2024. [162 pages]

SITE SUMMARY

The Upper Columbia River (UCR) site, located wholly within the state of Washington in the northeast portion of the state, includes for HRS scoring purposes the release of metals from two smelters to the UCR and to soil. The Upper Columbia River site includes three sources: slag historically discharged via outfalls from the Cominco smelter, currently owned by Teck Metals Ltd. (Teck; also referred to in references as Teck American Incorporated [TAI]), to the UCR approximately 10 river miles (RMs) upstream of the international border in Trail, British Columbia (B.C.); and two sources (i.e., contaminated soil and sluice box discharge) associated with the former Le Roi smelter located in Northport, Washington [see **Figure 1-1**; **Section 2.2** of this HRS documentation record]. As presented in the Source characterization section, these sources have been documented to contain metals, including antimony, arsenic, cadmium, chromium, copper, lead, nickel, silver, zinc, and mercury. Although previous investigations have documented metals contamination on the Columbia River as far down as the Grand Coulee Dam (150 RMs downstream of the U.S.-Canada border), the sediment contamination scored for HRS purposes includes the observed releases in contaminated sediments in the UCR between and downstream of the three sources spanning approximately 35 RMs of the Columbia River, extending from the U.S.-Canada border south and west to Marcus, Washington [Ref. 22, pp. 44, 49; see **Figures 1-1 and 3** of this HRS documentation record]. The Columbia River flows through Stevens, Ferry, Lincoln, Okanogan, and Grant Counties to the Grand Coulee Dam [Refs. 4, p. 163; 43, p. 507]. Contamination and targets are not scored for the portion of the UCR located in Canada (i.e., between the Cominco smelter and the U.S.-Canada border). Scored contamination and targets are evaluated for the U.S. portion of the zone of contamination, which encompasses a length of approximately 35 miles [**Figure 3** of this HRS documentation record]. Also scored is an area of observed contamination (AOC) in soil in Northport, Washington [**Figure 4** of this HRS documentation record]. This AOC is attributable to historical aerial deposition from both smelters. The releases from the smelters have become comingled in the UCR (at and downstream of the Le Roi smelter); the releases from both facilities have become comingled in the AOC soil contamination.

A Level II release to surface water targets (i.e., fishery, wetlands and a Federal-designated threatened species habitat) is documented [see **Section 4.1.4.3** of this HRS documentation record]. In addition, historical smelter smokestack emissions from both smelters have resulted in upland residential soil contamination; the presence of Level I and Level II Resident populations associated with the soil exposure component of the soil exposure and subsurface intrusion pathway have been documented [see **Section 5.1.1** of this HRS documentation record]. Source-specific scoresheets were also generated in the evaluation of this site. These source-specific scoresheets in Appendix A of this HRS documentation record show that even if the releases from the Cominco source and the release from the Le Roi sources were evaluated independently, they both score above 28.50 and qualify for the NPL.

In 2001, consultants for EPA conducted an expanded site inspection (ESI) of the UCR. As part of the investigation, sediment samples were collected from the UCR from RM 675 to RM 745 and from within tributaries to the river within this segment. Analytical results from this investigation indicated widespread contamination in lake and river sediments throughout the UCR between Inchelium, Washington and the U.S.-Canada border. Arsenic, cadmium, copper, lead, mercury, and zinc were detected in sediment samples downstream of sources at concentrations significantly above concentrations in the background sediment sample, which was collected from Lower Arrow Lake by the Washington State Department of Ecology [Ref. 4, pp. 66, 71-85]. During this investigation, several sediment samples collected from the UCR consisted of a visibly dark glassy sandy mixture characterized by EPA field personnel as slag [Ref. 4, p. 93]. The ESI sampling program also included the collection of sediment samples from the mouths of 110 tributaries located along the UCR to determine other potential sources of contamination. Analytical results from tributary samples did not indicate the presence of elevated contaminants of interest indicative of major watershed sources of contamination [Refs. 4, pp. 165-217, 226-227; 17, pp. 62-63].

In 2010, a consultant for the Confederated Tribes of the Colville Reservation (CCT) and the State of Washington conducted a study to assess the transport and fate of metallurgical slag material discharged into the UCR by Cominco smelter operations between 1930 and 1995 [Ref. 18, p. 4]. The results of the study indicate an estimated 12 million tons of slag were discharged into the UCR between 1929 and 1995. Slag discharged from the Cominco smelter was transported downstream as bed load and in suspension across the International Boundary. It is estimated that 10 percent of the total slag discharged to the UCR between 1930 and 1995 remains upstream of the International Boundary, and the remaining 90 percent has been transported downstream of the U.S.-Canada border down to the most downstream point of the study in Northport, WA. The study also determined that the remaining 10 percent in Canada is mobile and can be transported to the U.S. [Ref. 18, pp. 4, 5, 88, 90]. In addition, analytical results of a slag sample collected near the Cominco smelter indicated the presence of metals including antimony, arsenic, cadmium, chromium, copper, lead, nickel, zinc, and mercury [see **Section 2.2** of this HRS documentation record; Ref. 18, pp. 36, 58, 63, 74].

Analytical results of sediment samples collected during this investigation indicates that concentrations of these metals increased markedly downstream (compared to sediment samples collected upstream) of the Cominco smelter and remained at elevated levels at four U.S. sampling sites across the U.S. border; the most downstream sample being collected upstream of the Le Roi smelter. Background sediment samples were collected upstream of the Cominco smelter in Genelle and just downstream of the Keenleyside Dam 1 [Ref. 18, pp. 58, 72, 74].

In April 2011, an air quality and deposition analysis for the Upper Columbia River Basin was conducted by ICF International. This analysis was a model-based assessment of the impact of emissions from the Teck-Cominco facility on air quality and atmospheric deposition within the Upper Columbia River basin [Ref. 40, p. 1]. This evaluation included a study of historical literature, an analysis of local meteorological data, and a preliminary air quality modeling exercise using existing and modeling databases. Air quality modeling tools were used to examine the impacts of airborne sulfur dioxide (SO₂) and the deposition of airborne emissions of mercury and other metals to land and water surfaces [Ref. 40, p. 5]. This study determined that based on meteorological data collected at the surface and aloft at Northport, Washington for a period of one year (1929-1930), there was a consistent pattern of nighttime down-valley and daytime up-valley wind flow occurring all months of the year. The nighttime regime was characterized by a clearly defined 2,000-foot-thick southward flowing drainage layer capable of trapping emissions from the Trail facility and transporting them along the Columbia River Valley into Stevens County and beyond. Because of its persistence throughout the year, it was determined that this mechanism had the potential of causing pollutants to be transported from the Teck facility and likely has resulted in large quantities of mercury and other constituents (including lead, zinc, cadmium, and arsenic) being deposited into the Columbia River basin, Lake Roosevelt, and the Colville Reservation over an 85-year period [Ref. 40, pp. 33-35].

In September-October 2019, consultants for Teck American Incorporated (TAI) conducted a Phase 3 Sediment Study. This investigation was a follow up to a Phase 2 Sediment Study, which evaluated the entire 150-mile stretch of the UCR [Ref. 43, p. 295]. The Phase 3 Sediment Study focused on three areas of concern, including Deadman's Eddy, China Bend (also referred to as China Bar in some references), and Evans [see **Figure 1-1** of this HRS documentation record]. Analytical results from sediment samples collected from the UCR in these areas of concern indicated the presence of metals in sediment samples (collected downstream of sources) at concentrations significantly above concentrations detected in background sediment samples, which were collected upstream of the Cominco smelter in Trail, B.C. Metals detected at concentrations significantly above background concentrations during this investigation include antimony, arsenic, cadmium, copper, chromium, lead, zinc, and mercury [Figures, 2-1, 2-2, 2-3, 2-4; **Section 4.1.2.1.1** of this HRS documentation record]. During this investigation, slag was observed in sediment samples collected from all three areas of concern, with slag being observed in the most downstream sediment sample location (i.e., EV001), collected approximately 35 miles downstream of the U.S.-Canada border [Ref. 33, pp. 491, 362-364].

In 2019, a remedial investigation (RI) of the Northport Waterfront was conducted by a consultant of the Washington State Department of Ecology. This area included the shoreline of the UCR where slag wastes were previously discharged by the Le Roi smelter. This investigation was conducted because no cleanup actions were ever conducted (since the plant's closure) to address nearshore sediments contamination and the bank impacted by smelter waste and debris, including slags that were historically deposited along the shoreline or within the UCR. Previous response actions by EPA in 2004 addressed structures and contaminated soil on the Le Roi smelter property. In addition, BNSF performed additional excavation of contaminated soil adjacent to their right-of-way within the town park area. During this investigation, slag materials, (as both clinker and fine granulated particles) were noted to be widespread on the beach and the hillside leading to the UCR [Ref. 37, pp. 6, 7, 36-38]. During the RI, sediment/slag samples were collected from test pits advanced along the UCR waterfront [Ref. 37, pp. 8, 9, 35]. The samples were collected from locations along the southern shoreline of the UCR [Ref. 37, p. 35]. Analytical results from these samples indicated the presence of high concentrations of several metals [see **Section 2.2.2** for Source 3 of this HRS documentation record].

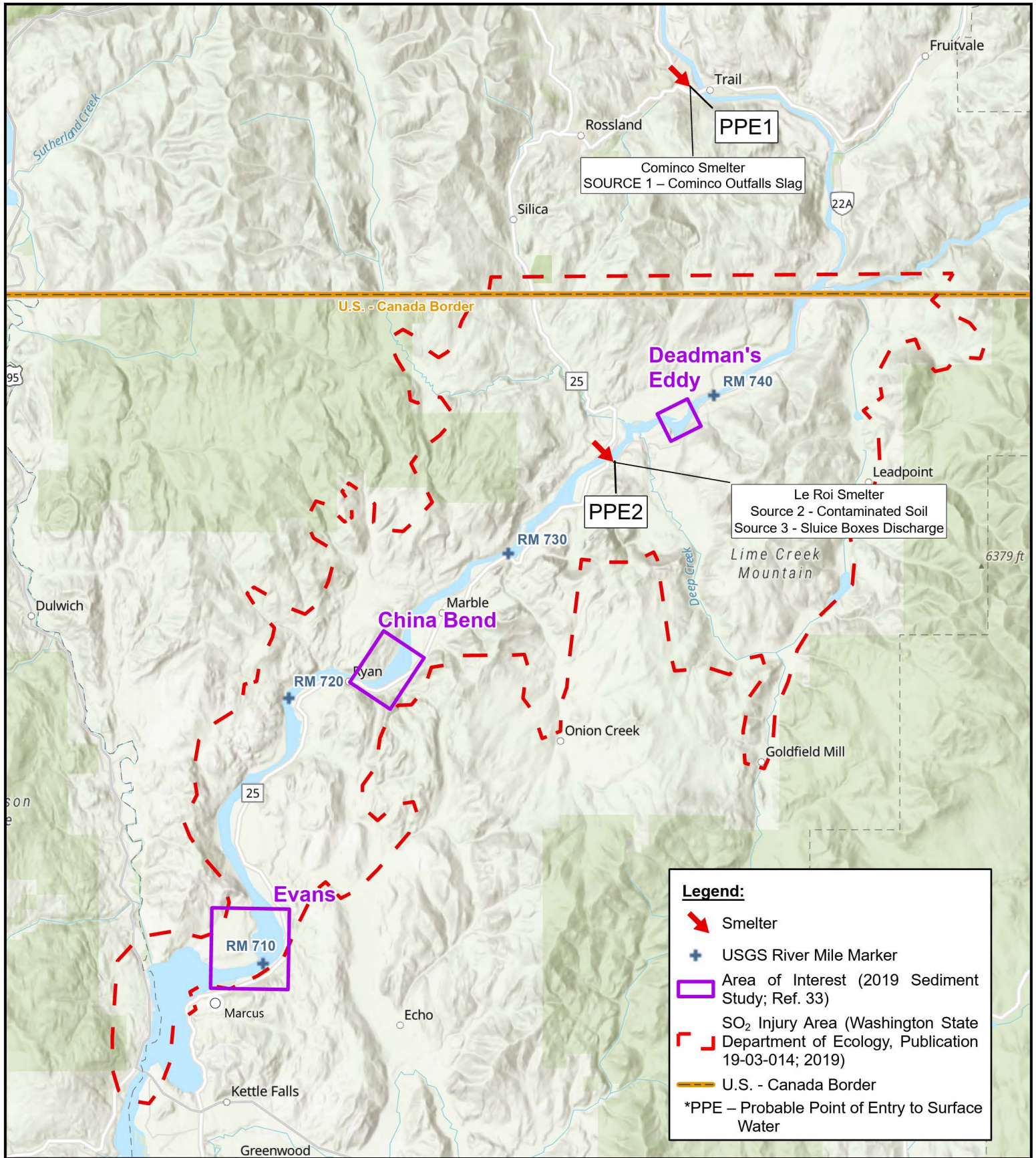
In February 2021, EPA released a Human Health Risk Assessment (HHRA) for the UCR site. The HHRA was conducted as part of an ongoing remedial investigation and feasibility study (RI/FS). Data and information from numerous investigations conducted at the UCR site was used in the HHRA. Due to cessation of granulated slag discharges from the Trail facility to the UCR in mid-1995, a new smelter installation in 1997, and operational improvements which led to a significant reduction in stack emissions, a cutoff date of 2002 was utilized for all environmental datasets evaluated for use in the HHRA (i.e., no data collected prior to 2002 were used) [Ref. 17, p. 66]. The HHRA was performed under a Settlement Agreement signed by Teck Cominco Metals Ltd., Teck American Incorporated (TAI), the U.S. Department of Justice, and the U.S. Environmental

Protection Agency in 2006 [Ref. 17, pp. 37, 52-53]. The HHRA concluded that the main chemical contributing to risk in sediment was lead. The main chemical contributors to risk in soil were lead and arsenic, which were detected in many Decision Units (DUs) and Aerial Deposition Areas (ADAs) at concentrations exceeding estimated background concentrations. Based on emissions from the Trail, B.C. Canada smelter as reported to the Canadian National Pollutant Release Inventory from 2002 to 2017, aerial emissions of lead and arsenic are generally lower than in years prior to 2009. It was concluded that current exposure to airborne contaminants from the Teck smelter does not pose a substantial risk to Site residents, recreators, or workers [Ref. 17, pp. 225-226].

Since 2003, numerous EPA Removal activities have occurred in the Northport, Washington area, including several removal site evaluations (RSEs). Activities included the sampling of residential and commercial properties in and around the Northport community, sampling of public areas, and collecting drinking water samples from a municipal well near the former Le Roi smelter area. In 2003 and 2004, Northport residential and commercial properties with lead concentrations in soil greater than the removal action limit (i.e., 1,000 milligrams per kilogram [mg/kg]) were identified for a time-critical removal action (TCRA). In 2004, a removal action was conducted at the former Le Roi smelter and residential areas with contaminated soils being consolidated at an 11-acre area of the smelter site. Contaminated soils were covered with a polyethylene sheet and clean soil, and vegetated [Refs. 17, p. 65; 49, p. 16]. During removal activities, EPA also discovered underground waterways (i.e., sluice boxes) which Le Roi smelter used to discharge waste slag directly to the UCR [see **Section 2.2 (Source 3)** of this HRS documentation record; Ref. 46, p. 4]. Historical photographs from 1901 confirm that large piles of slag were being deposited directly into the UCR [Ref. 44, p. 10]. While in operation, this smelter was one of the largest smelters on the West Coast, processing 500 tons of ore per day [Refs. 5, p. 105; 50, p. 11].

In 2014 and 2016, Teck sampled residential properties and a CCT allotment. For these sampling events, a removal action level of 700 mg/kg for lead in soil was evaluated. Based on analytical results from residential soil sampling, TCRAs were conducted in 2015, 2017, and 2018. In 2019, given the lower removal action level for lead in soil (i.e., from 1,000 mg/kg to 700 mg/kg), EPA conducted an RSE of properties within the town of Northport that were sampled in 2003 and 2004 as described above and found to have lead in soil at concentrations near or above 700 mg/kg. The RSE identified 16 additional properties that met the criteria for a TCRA. Soil cleanup activities were conducted in 2020 [Ref. 17, pp. 65-66; 38, p. 11]. EPA conducted a subsequent RSE in the residential area of Northport in 2021 and TCRAs were conducted at 15 properties [Ref. 57, p. 1].

Analytical results from soil samples collected from residential properties by EPA in 2021 as part of an RSE has documented an area of observed contamination (AOC) in the residential/commercial area of Northport, west of the former Le Roi smelter, delineated by sampling locations exhibiting contamination within the top 2 feet of soil [see **Figure 4**; see **Section 5.0** of this HRS documentation record]. The portion of the AOC on private residential properties is within 200 feet of occupied residences [see **Section 5.1.1.1** of this HRS documentation record].



Coordinate System:
WGS 1984 Web Mercator Auxiliary Sphere
Source:
Background: ESRI World Topographic Map
*The source of this map image is ESRI, used by EPA with ESRI's permission.
Task Order No.:
68HE0722F0087-01

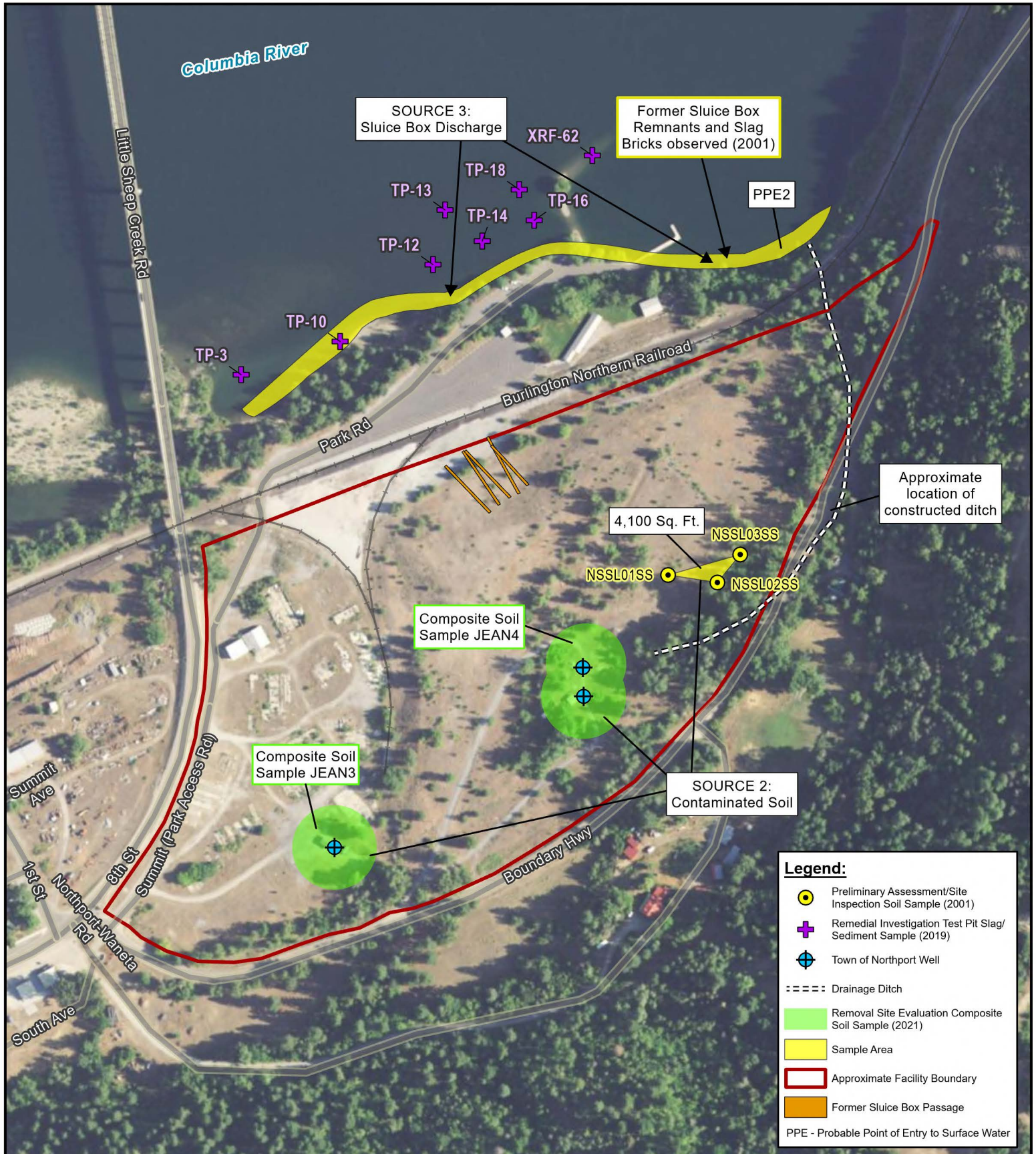
0 3 6 Miles

EPA Region 10

Weston Solutions Inc.
START V

**FIGURE 1-1
SITE/SOURCE
LOCATION MAP
UPPER COLUMBIA RIVER**

February 2024



Coordinate System:
WGS 1984 Web Mercator Auxiliary Sphere

Source:
Background: ESRI World Imagery
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Task Order No.:
68HE0722F0087-01



EPA Region 10



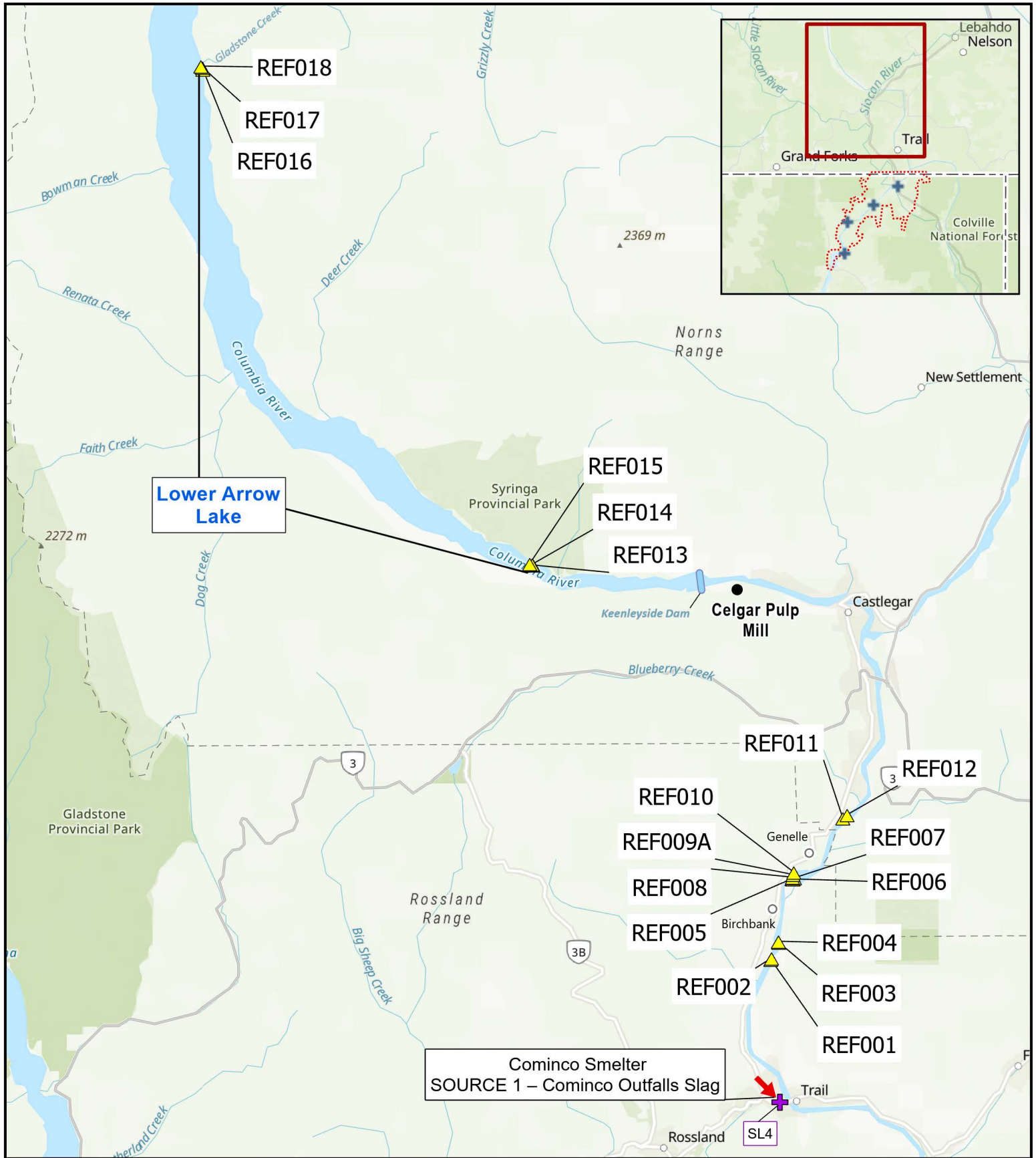
Weston Solutions Inc.
START V

FIGURE 1-2
LE ROI SMELTER SOURCE MAP
UPPER COLUMBIA RIVER

February 2024



0 255 510 1,020 Feet



Coordinate System:
WGS 1984 Web Mercator Auxiliary Sphere

Source:
Background: ESRI World Topographic Map
*The source of this map image is ESRI, used by EPA with ESRI's permission.

Task Order No.:
68HE0722F0087-01

Legend:

- Sediment Sample
- Smelter
- Slag Sample (April 2010)

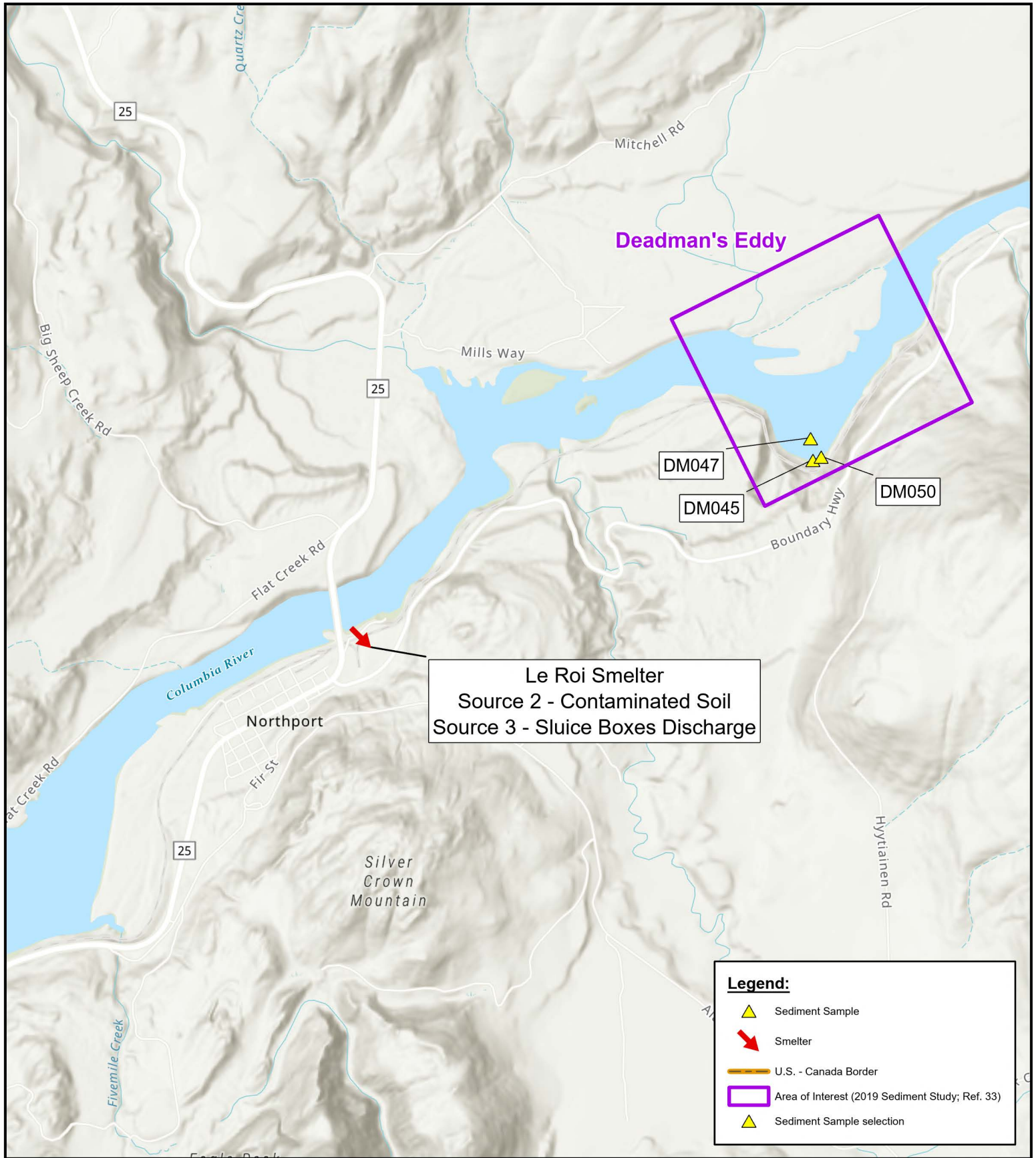
0 2.5 5 10 Miles

EPA Region 10

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FIGURE 2-1
SOURCE 1 – BACKGROUND
SEDIMENT SAMPLE LOCATION MAP
UPPER COLUMBIA RIVER

FEBRUARY 2024



Coordinate System:
WGS 1984 Web Mercator Auxiliary Sphere

Source:
Background: ESRI World Topographic Map
Wetland: NWI - U.S. Fish Wildlife Service
*The source of this map image is ESRI, used by EPA with ESRI's permission.

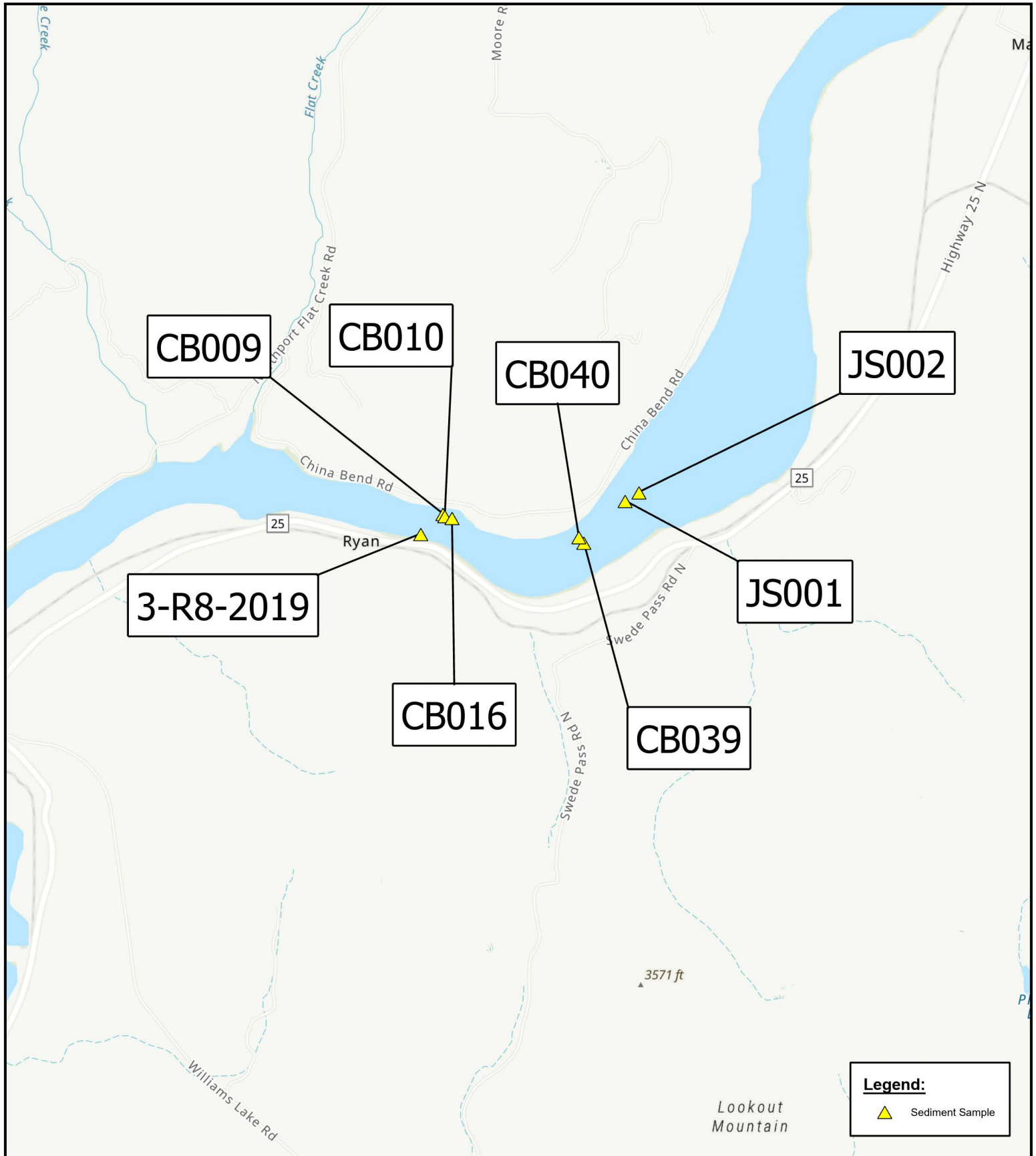
Task Order No.:
68HE0722F0087-01

0 0.5 1 2 Miles



FIGURE 2-2
SEDIMENT SAMPLE
LOCATION MAP - DEADMAN'S EDDY
UPPER COLUMBIA RIVER

February 2024



Coordinate System:
WGS 1984 Web Mercator Auxiliary Sphere

Source:
Background: ESRI World Topographic Map

Wetland: NWI - U.S. Fish Wildlife Service

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68HE0722F0087-01



EPA Region 10



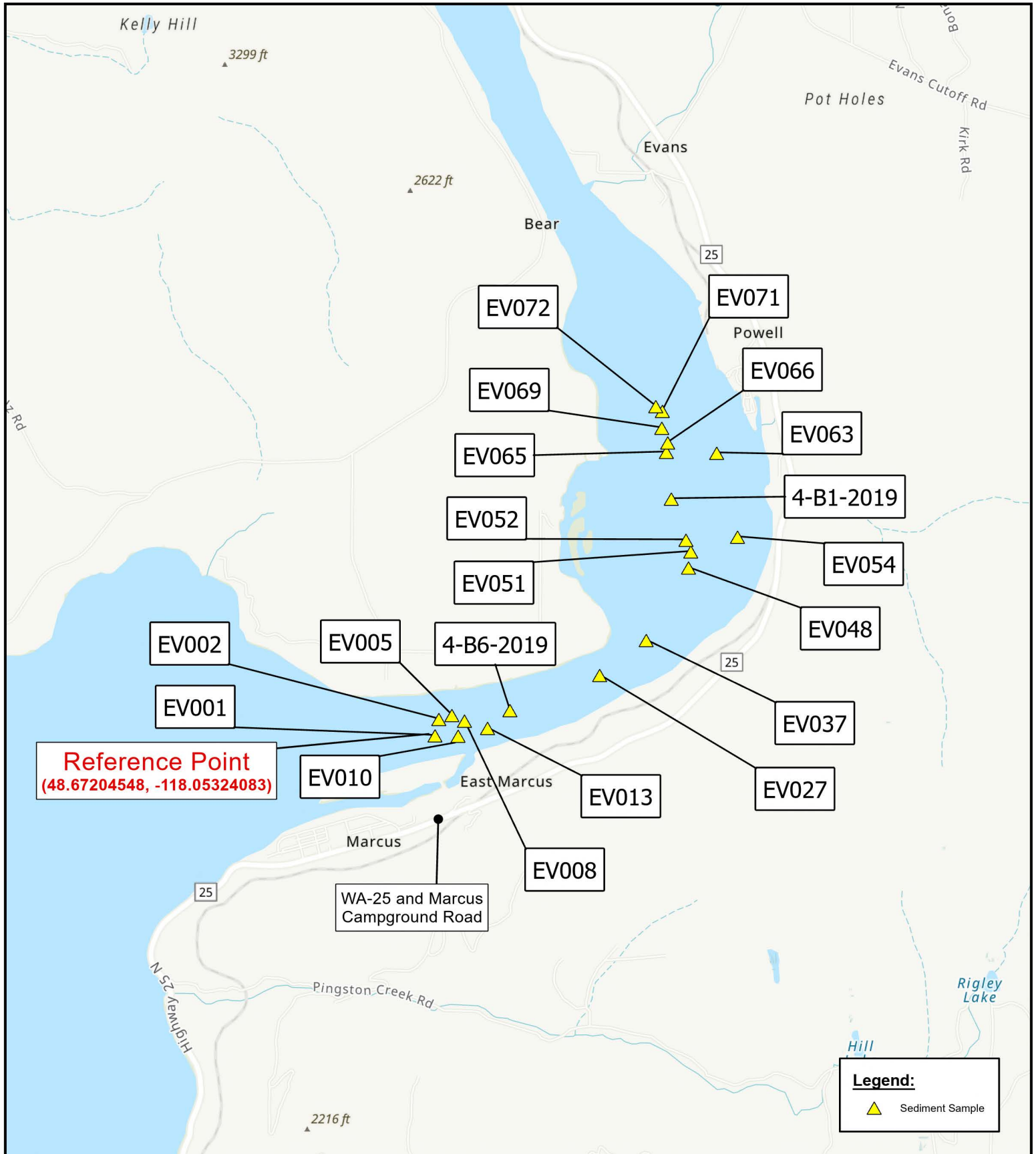
Weston Solutions Inc.
START V

FIGURE 2-3
SEDIMENT SAMPLE
LOCATION MAP - CHINA BEND
UPPER COLUMBIA RIVER

February 2024



0 0.5 1 2 Miles



Coordinate System:
WGS 1984 Web Mercator Auxiliary Sphere

Source:
Background: ESRI World Topographic Map
Wetland: NWI - U.S. Fish Wildlife Service
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FIGURE 2-4
SEDIMENT SAMPLE
LOCATION MAP - EVANS
UPPER COLUMBIA RIVER

February 2024



0 0.5 1 2 Miles

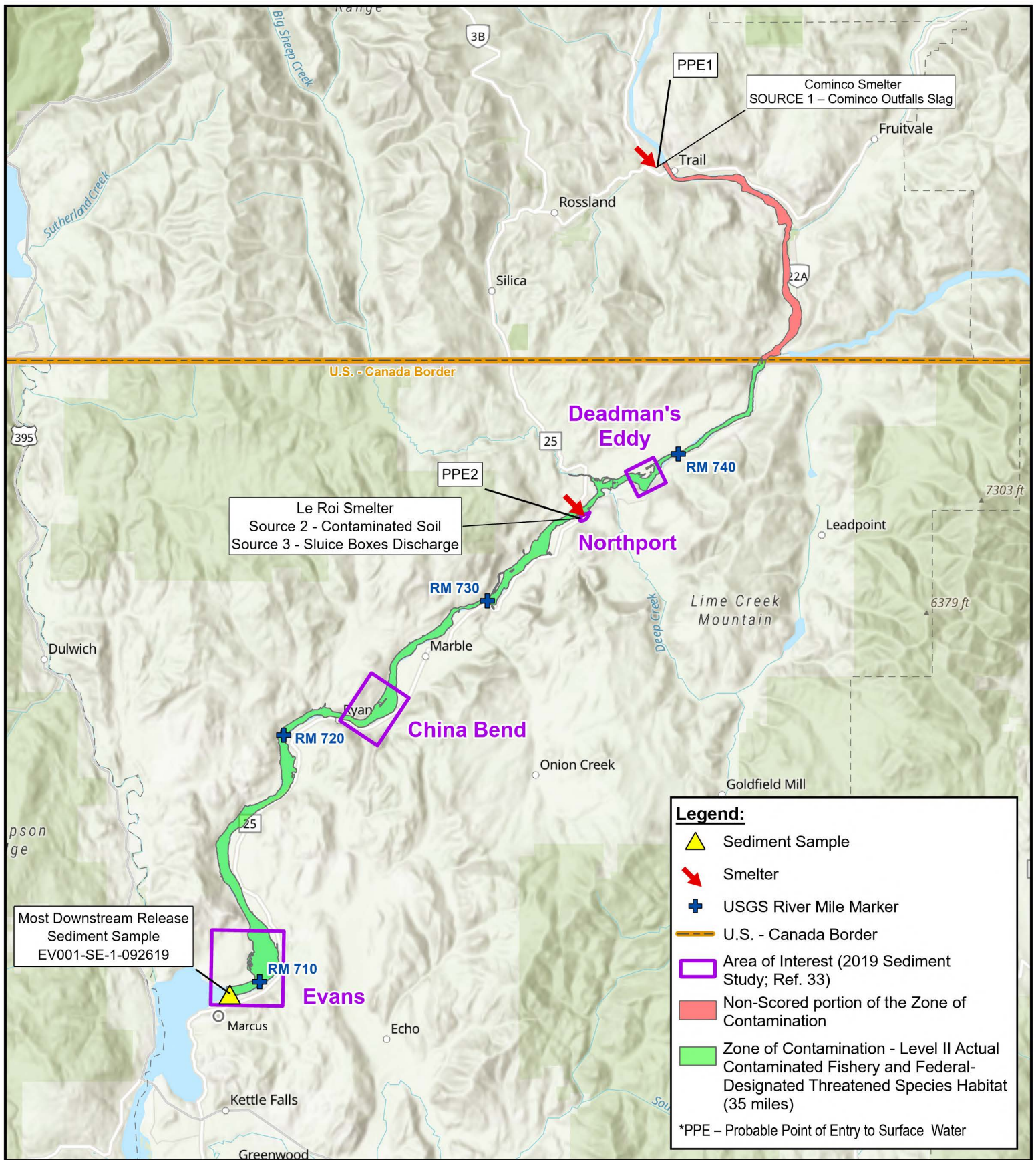
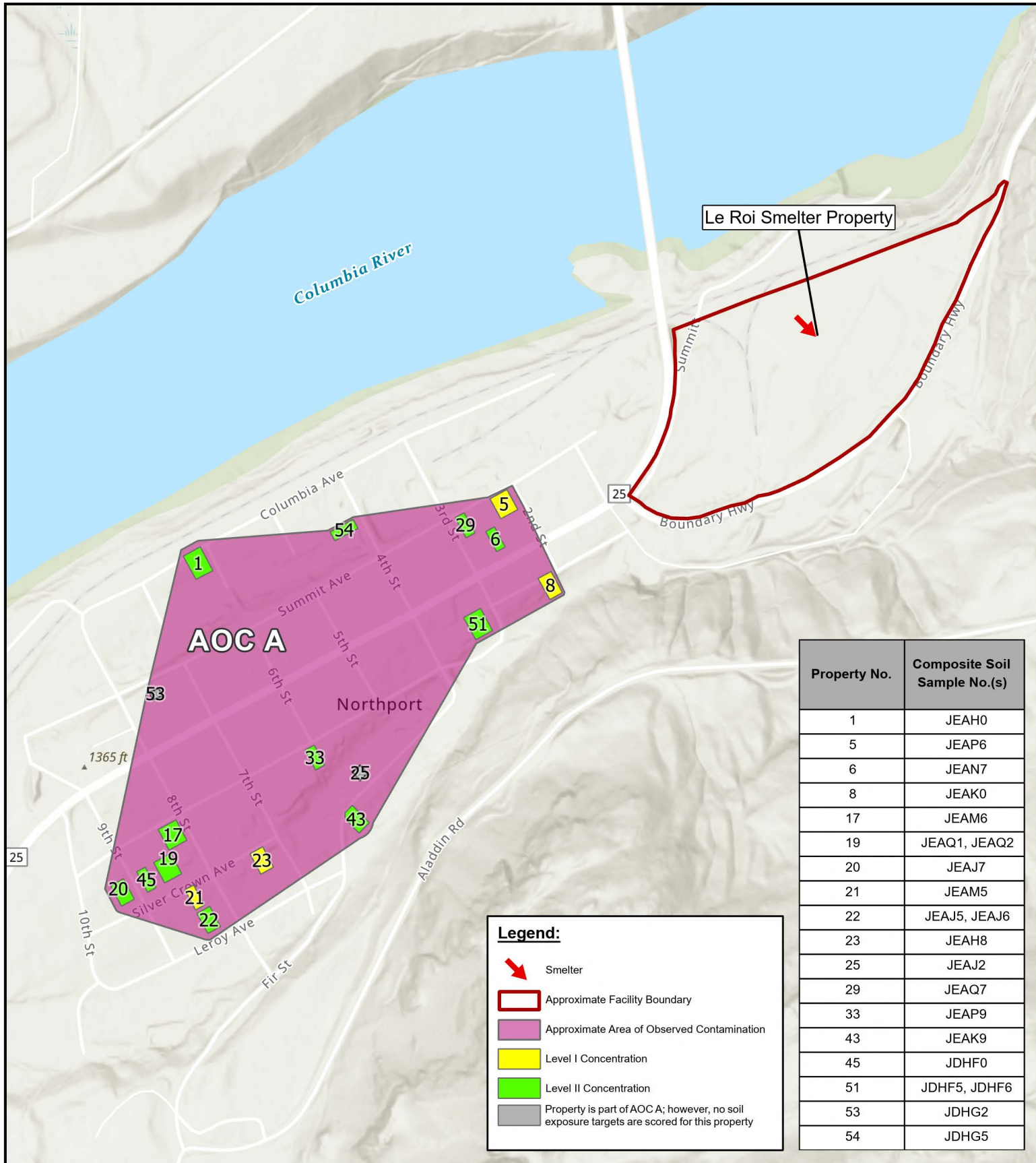


FIGURE 3
SURFACE WATER ZONE
OF CONTAMINATION MAP
UPPER COLUMBIA RIVER

February 2024



Coordinate System:
WGS 1984 Web Mercator Auxiliary Sphere

Source:
Background: ESRI World Topographic Map
*The source of this map image is ESRI, used by EPA with ESRI's permission.

Task Order No.:
68HE0722F0087-01



0 500 1,000 2,000 Feet



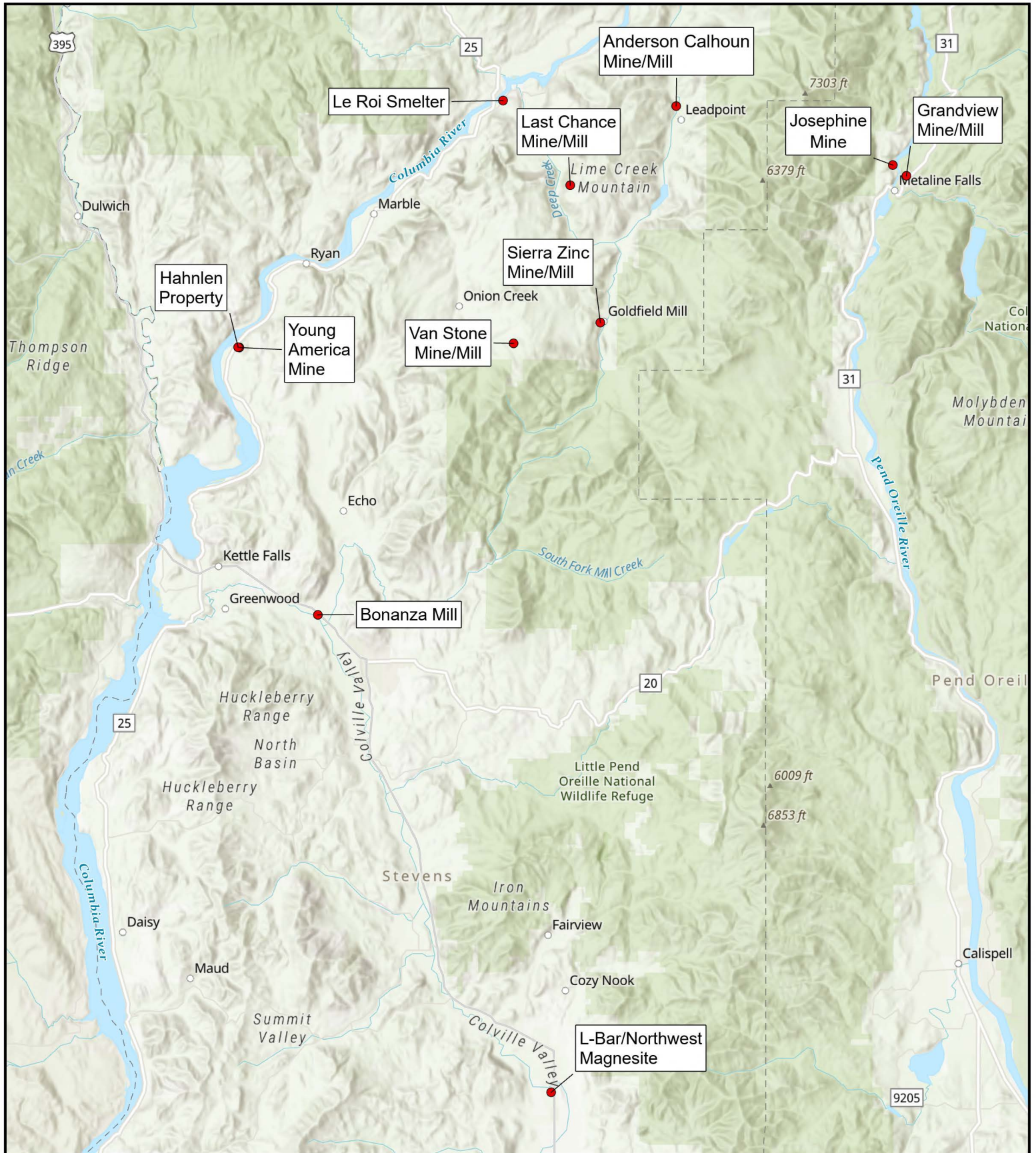
EPA Region 10



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FIGURE 4
AREA OF OBSERVED
CONTAMINATION MAP
UPPER COLUMBIA RIVER

FEBRUARY 2024



Coordinate System:
WGS 1984 Web Mercator Auxiliary Sphere

Source:
Background: ESRI World Topographic Map
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Task Order No.:
68HE0722F0087-01

Legend:

● Mine/Mill Sites



EPA Region 10



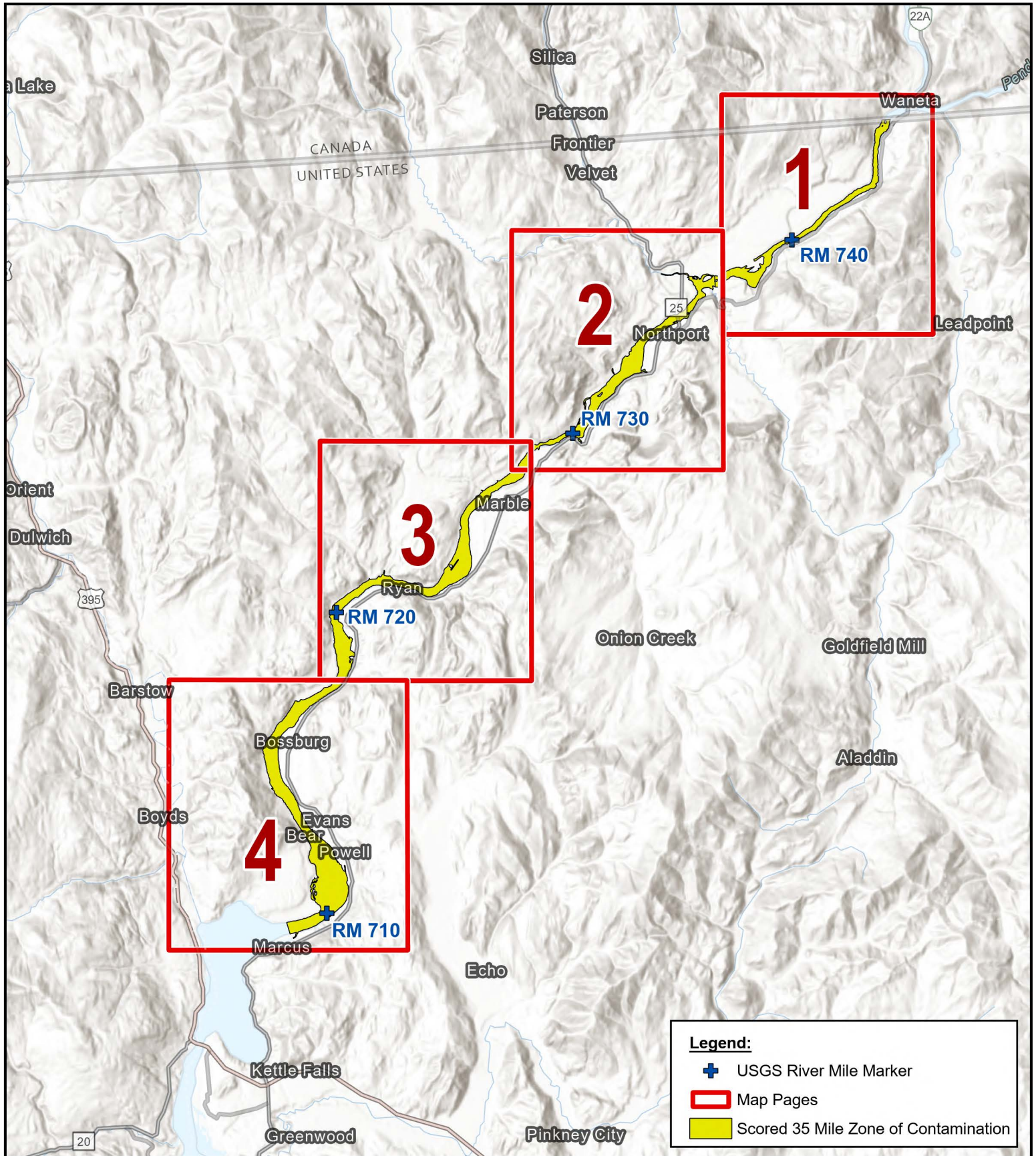
Weston Solutions Inc.
START V

FIGURE 5
POTENTIAL MINE/MILL SOURCES
STEVENS AND PEND OREILLE COUNTIES,
WASHINGTON
UPPER COLUMBIA RIVER

February 2024



0 3.25 6.5 13
Miles



EPA Region 10

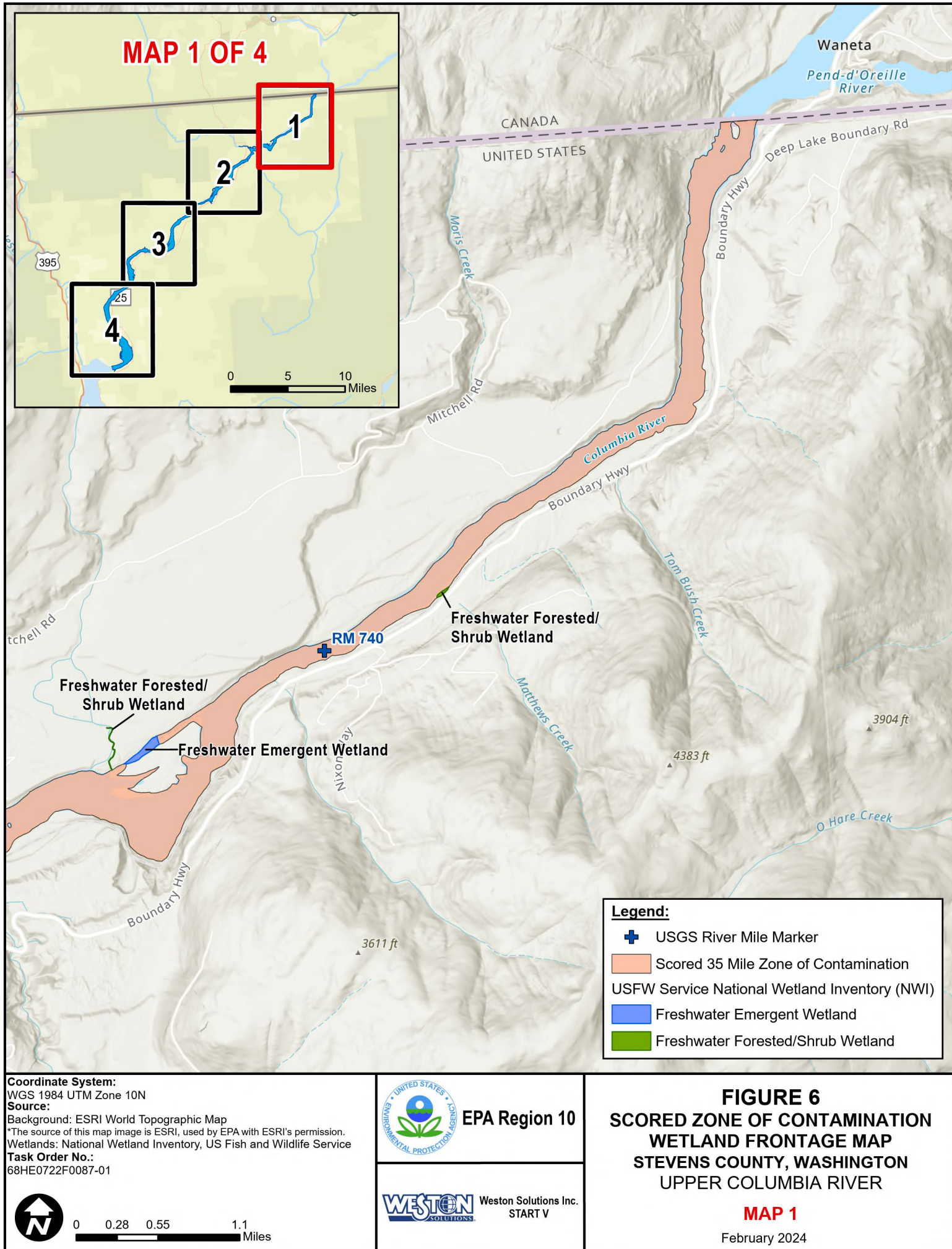


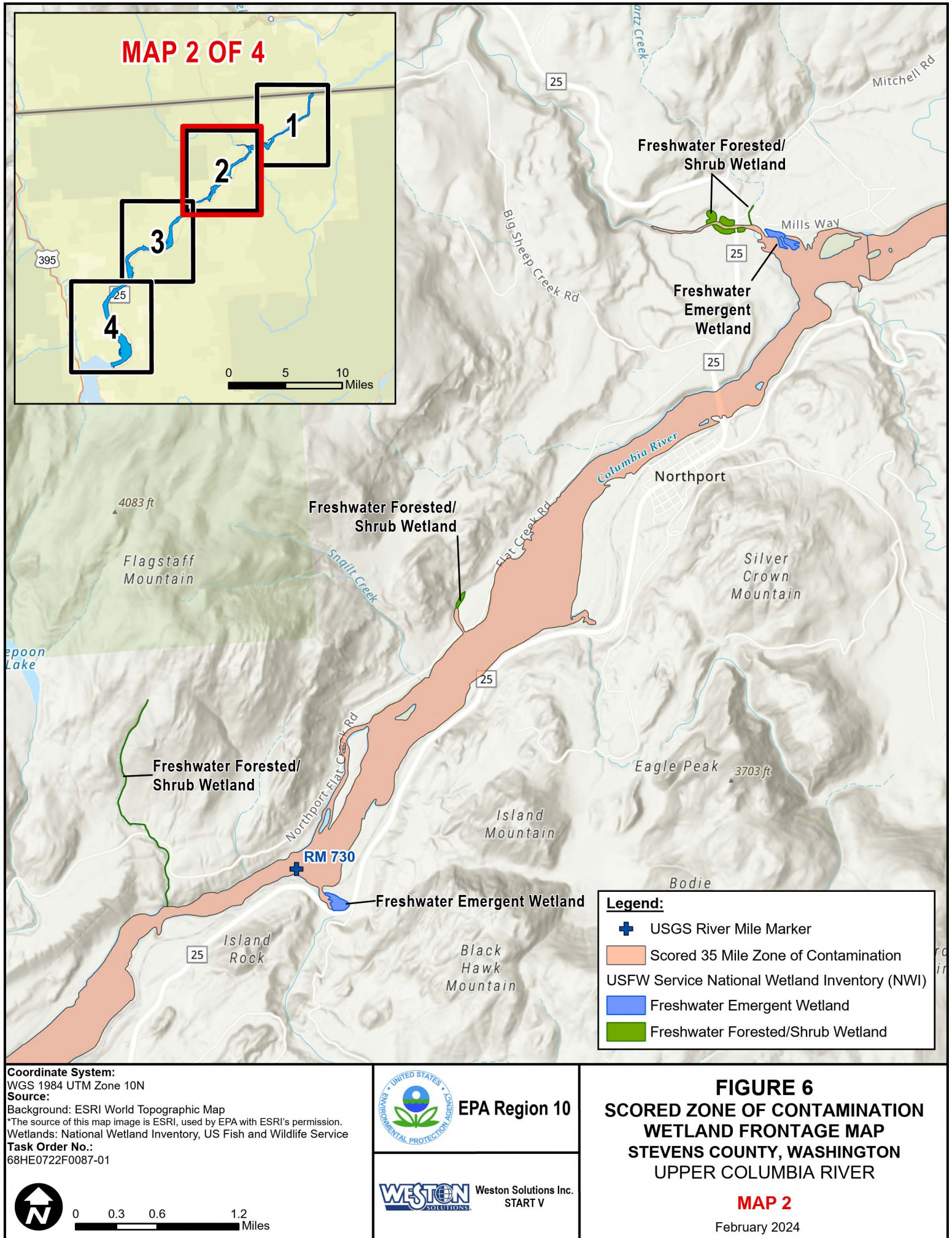
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FIGURE 6
SCORED ZONE OF CONTAMINATION
WETLAND FRONTAGE MAP
STEVENS COUNTY, WASHINGTON
UPPER COLUMBIA RIVER

MAP OVERVIEW

February 2024





MAP 2 OF 4

Freshwater Forested/
Shrub Wetland

Freshwater
Emergent
Wetland

Freshwater Forested/
Shrub Wetland


Freshwater Forested/
Shrub Wetland

Freshwater Emergent Wetland


Legend:

- USGS River Mile Marker
- Scored 35 Mile Zone of Contamination
- USFW Service National Wetland Inventory (NWI)
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland

Coordinate System:
WGS 1984 UTM Zone 10N
Source:
Background: ESRI World Topographic Map
*The source of this map image is ESRI, used by EPA with ESRI's permission.
Wetlands: National Wetland Inventory, US Fish and Wildlife Service
Task Order No.:
68HE0722F0087-01



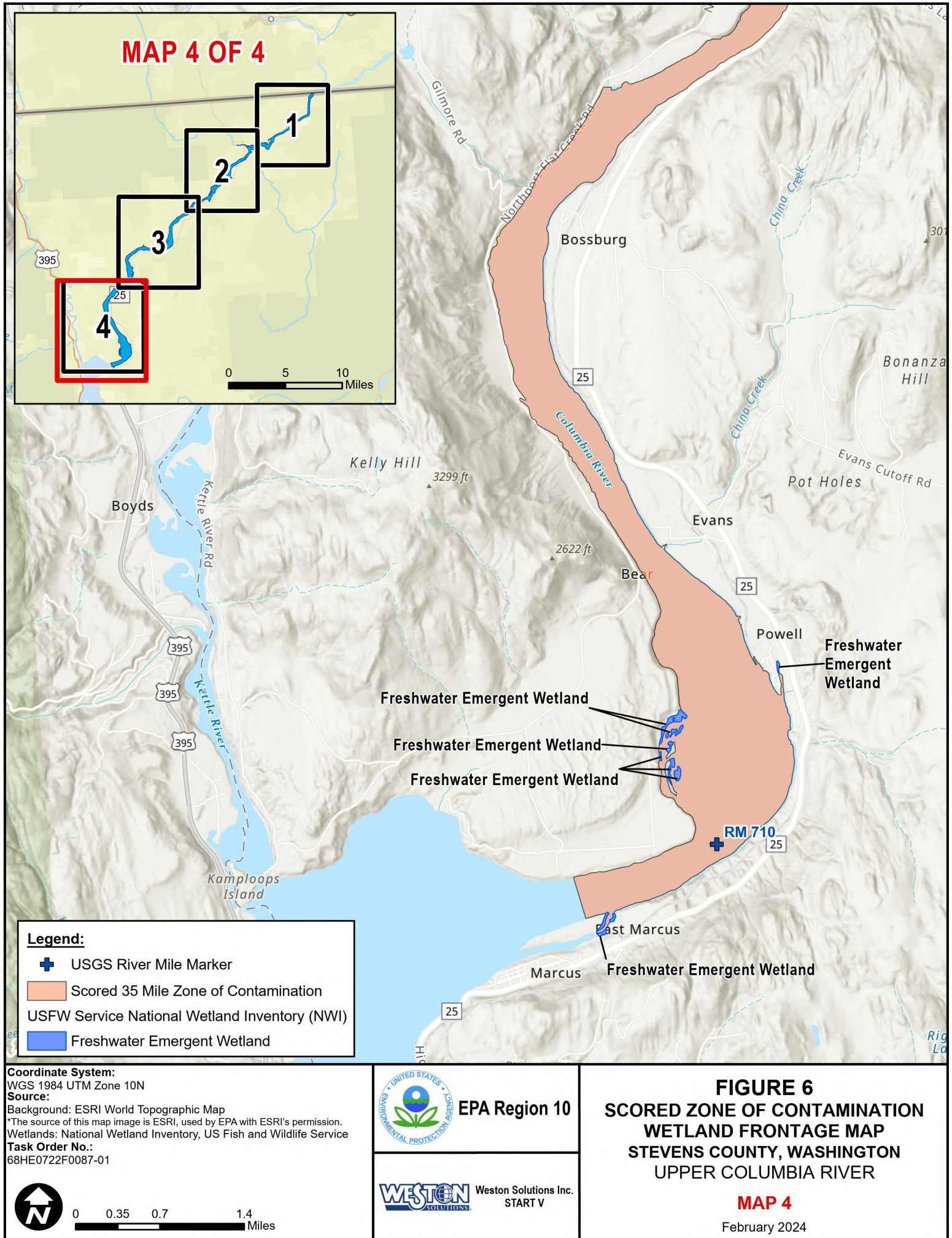
EPA Region 10



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FIGURE 6
SCORED ZONE OF CONTAMINATION
WETLAND FRONTAGE MAP
STEVENS COUNTY, WASHINGTON
UPPER COLUMBIA RIVER

MAP 2
February 2024



SOURCE DESCRIPTION

2.2 SOURCE CHARACTERIZATION

2.2.1 Source Identification

Number of the source: Source No. 1

Name of source: Cominco Outfalls Slag

Source Type: Other

A significant contributor of hazardous substance contamination to the UCR sediments is a source located in Canada. Source 1 consists of effluent from outfalls from a lead, silver, and zinc smelter and fertilizer production operation owned by Consolidated Mining and Smelting Company of Canada, Ltd. (Cominco) [Ref. 4, p. 26]. The Cominco smelter is in Canada on the UCR, approximately 10 RMs upstream of the international boundary [Figure 1-1 of this HRS documentation record]. Smelting operations began in Trail, British Columbia (B.C.) in 1894. Canadian Smelting Works operated the facility from 1894 to 1906; Cominco began operations of the smelter and refinery in 1906 [Refs. 13, p. 36; 3, pp. 1, 3-4]. The facility primarily produced lead and silver during the first decade of operation, with zinc production being initiated in 1916. Fertilizer plants were built at the Trail smelter in 1930, facilitating the production of both nitrogen- and phosphorous-based fertilizers. While the Trail smelter was originally built to process materials from local mines, ore concentrates were obtained from mining operations located throughout the world [Refs. 3, p. 3; 13, p. 36].

Effluent from four outfalls that discharged to the UCR is scored as Source 1 [Ref. 4, p. 26]. Three of the outfalls (i.e., Sewer II, Sewer III, Sewer 07) were for the metallurgical plants which generated slag as a by-product; one outfall (i.e., Sewer I) was for the tail slag launder system. A fifth outfall (i.e., Sewer IV) was used for the fertilizer operation; however, effluent discharges from this outfall are not scored in this HRS documentation record [see Other Possible Sources Not Scored] [Refs. 4, p. 26; 8, pp. 19, 20; 12, p. 17].

Slag, historically discharged via smelter outfalls to the Columbia River, is a black, glassy material which contains copper, lead, and zinc in addition to other metals [Refs. 4, p. 25; 10, p. 7]. The majority of this material has the size and texture of sand; however, approximately 1% by weight consists of fines which have a broken egg-shell or needle-like morphology [Refs. 4, p. 25; 10, p. 7]. During a boat trip conducted in September 1991 by representatives from the B.C. Ministry of Environment, Lands, and Parks and Cominco, slag was documented to be present from Trail, B.C. to China Bend in Washington State at approximately RM 724 [Ref. 8, p. 24]. The largest slag deposits were observed in back eddies and quiet areas north of the border on the west side of the river [Ref. 8, p. 24]. The largest deposit of what appeared to be predominantly slag in Washington State was on the southwest side of a large sand/gravel bar located just north of Northport, Washington known as Deadman's Eddy [Ref. 8, p. 24].

This slag has been demonstrated to contain concentrations of copper ranging from 0.01% to 2.99%, lead ranging from 0.1% to 3.68%, and zinc ranging from 2.5% to 15.6% [Refs. 4, p. 26; 10, p. 7; 11, p. 1]. The B.C. Ministry of Environment, Lands, and Parks required the elimination of slag to the Columbia River by December 1996; however, since this time, Cominco has had several releases of slag to the river during upset conditions [Ref. 4, p. 28]. Cominco's operations have been characterized by frequent accidental releases of contaminants into the river [Ref. 4, p. 28]. On 86 days between September 1987 and May 2001, Cominco reported spills of pollutants into the Columbia River [Section 4.1.2.1 of this HRS documentation record; Refs. 13, pp. 152-154; 14, p. 2].

In 2010, a consultant for the CCT and the State of Washington conducted a study to assess the transport and fate of metallurgical slag material discharged into the UCR by Cominco smelter operations between 1930 and 1995. The results of the study indicate slag discharged from the Cominco smelter was transported downstream as bed load and in suspension across the International Boundary. It is estimated that 10 percent of the total slag discharged to the UCR between 1930 and 1995 remains upstream of the International Boundary, and the remaining 90 percent has been transported downstream of the U.S.-Canada border down to the most downstream point of the study in Northport,

WA. The study also determined that the remaining 10 percent in Canada is mobile and can be transported to the U.S. [Ref. 18, pp. 5, 88, 90].

Location of the source, with reference to a map of the site:

The outfalls are located along the banks of the Columbia River in Trail, B.C., approximately 10 RMs upstream of the U.S.–Canada border [Figure 1-1 of this HRS documentation record; Refs. 9, p. 24; 13, p. 203].

Containment

Release to surface water via overland migration:

The source consists of outfalls that discharged effluent and slag directly to the Columbia River [Ref. 4, p. 26]. A surface water containment value of 10 is assigned based on evidence of hazardous substance migration from the source to the UCR [Ref. 1, Table 4-2].

Release to surface water via flood:

The containment factor value for release to surface water via flood is not evaluated because it does not affect the listing decision.

2.2.2 Hazardous Substances Associated with the Source

Table 1 below lists hazardous substances present in Cominco outfall effluent. Cominco effluent was not sampled by consultants for EPA. For this reason, hazardous substances listed to be present in outfall effluent are documented by Cominco reports and from outfall releases reported to the B.C. Ministry of Environment, Lands, and Parks by Cominco.

TABLE 1 – Cominco Smelter – Outfalls HAZARDOUS SUBSTANCES	
Analyte	Reference
Arsenic	Refs. 12, p. 17; 13, pp. 138-139
Cadmium	Refs. 12, p. 17; 13, pp. 138-139
Copper	Refs. 11; 13, p. 138
Lead	Refs. 11; 12, p. 17; 13, p. 140
Mercury	Refs. 12, p. 17; 13, pp. 139-140
Zinc	Refs. 11; 12, p. 17; 13, pp. 139-140

In April 2010, a consultant for CCT collected a slag sample (SL4) from the UCR riverbed adjacent to the Cominco smelter [see **Figure 2-1** of this HRS documentation record]. This sample was analyzed for Target Analyte List metals using EPA Method 6020, except for mercury, which was analyzed under EPA Method 7471. The slag sample was identified as 100 percent slag [Ref. 18, pp. 58, 61, 62, 63, 72, 74, 77]. Table 2 below lists hazardous substances detected in slag (in various grain sizes), based on analytical results of the slag sample collected by a consultant for CCT in April 2010.

TABLE 2 – APRIL 2010 SLAG SAMPLE RESULTS (mg/kg)*						
Slag Sample SL4	<0.063 mm	0.1777-0.25 mm	0.71-1 mm	1.41-2 mm	2.83-4 mm	Bagged Sample
Antimony	93	17	17	7.9	7.2	7.8
Arsenic	580	170	160	110	64	86
Cadmium	140	73	73	3	2	33
Chromium	41	34	54	59	58	49
Copper	4,200	1,500	1,700	1,500	1,400	1,300
Lead	25,000	8,800	7,900	3,700	1,200	3,600
Mercury	8.4	0.39	0.086	0.075	0.041	0.088
Nickel	40	16	18	22	16	16
Silver	39	11	8.2	5.7	2.6	4.7
Zinc	30,000	36,000	36,000	18,000	2,800	16,000

mm = millimeter

mg/kg = milligrams per kilogram

*Ref. 18, p. 74

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Tier A – Hazardous Constituent Quantity

The hazardous constituent quantity for Source 1 could not be adequately determined according to the HRS requirements; that is, the total mass of all CERCLA hazardous substances in the source and releases from 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, potentially responsible party (PRP) records, State records, permits, waste concentration data, etc.] available to adequately calculate the total or partial 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 1 with reasonable confidence. As a result, the evaluation of hazardous waste quantity proceeds to the evaluation of *Tier B*, Hazardous Wastestream Quantity [Ref. 1, Section 2.4.2.1.1].

Hazardous Constituent Quantity (C) Value: NS

2.4.2.1.2 Tier B – Hazardous Wastestream Quantity

Reports that accurately document the yearly and daily amounts of tail slag released to the UCR from the Cominco smelter have not been located. Reports prepared by consultants to Cominco state that prior to 1995, slag was discharged to the UCR at an average yearly rate of 145,000 tonnes or 159,836 tons (i.e., 145,000 tonnes / 0.90718 tonnes per 1 ton = 159,836 tons) and an average daily rate of 360 tonnes or 397 tons (i.e., 360 tonnes / 0.90718 tonnes per 1 ton = 397 tons) [Ref. 13, p. 37; Ref. 53, p. 2]. The quantity of slag produced for each year of smelter operation can more accurately be calculated from lead production values. Cominco has reported that the amount of lead is directly related to the amount of slag produced using the following information [Ref. 15, p. 2].

Lead production x 140% = amount of blast furnace slag produced.

Amount of blast furnace slag produced x 85% = Amount of slag produced. For example:

- 151,492 tons of lead produced in 1930 x 140% = 212,088.8 tons of blast furnace slag
- 212,088.8 tons of blast furnace slag x 85% = 180,275.48 tons of slag produced in 1930

Lead production values were obtained from Cominco annual reports [Ref. 3, pp. 3-20]. Using this information, it is estimated that 11,980,922.52 tons or 23,961,845,040 pounds (11,980,922.52 x 2,000 pounds per 1 ton) of tail slag were produced from the Cominco smelter and released to the UCR over the course of operations from 1930 to 1994 as demonstrated in Table 3 below.

TABLE 3* – Tons of Tail Slag Produced by The Cominco Smelter 1930 to 1994			
Year	Lead (tons)*	Blast Furnace Slag (tons)	Tail Slag (tons)
1930	151,492	212,088.80	180,275.48
1931	138,843	194,380.20	165,223.17
1932	126,619	177,266.60	150,676.61
1933	127,319	178,246.60	151,509.61

TABLE 3* – Tons of Tail Slag Produced by The Cominco Smelter 1930 to 1994			
Year	Lead (tons)*	Blast Furnace Slag (tons)	Tail Slag (tons)
1934	157,674	220,743.60	187,632.06
1935	164,329	230,060.60	195,551.51
1936	182,541	255,557.40	217,223.79
1937	206,579	289,210.60	245,829.01
1938	201,574	282,203.60	239,873.06
1939	191,439	268,014.60	227,812.41
1940	220,602	308,842.80	262,516.38
1941	229,203	320,884.20	272,751.57
1942	245,800	344,120.00	292,502.00
1943	224,845	314,783.00	267,565.55
1944	144,267	201,973.80	171,677.73
1945	163,266	228,572.40	194,286.54
1946	165,849	232,188.60	197,360.31
1947	162,155	227,017.00	192,964.45
1948	160,107	224,149.80	190,527.33
1949	146,176	204,646.40	173,949.44
1950	170,364	238,509.60	202,733.16
1951	162,712	227,796.80	193,627.28
1952	183,389	256,744.60	218,232.91
1953	166,356	232,898.40	197,963.64
1954	166,379	232,930.60	197,991.01
1955	149,795	209,713.00	178,256.05

TABLE 3* – Tons of Tail Slag Produced by The Cominco Smelter 1930 to 1994			
Year	Lead (tons)*	Blast Furnace Slag (tons)	Tail Slag (tons)
1956	149,262	208,966.80	177,621.78
1957	144,017	201,623.80	171,380.23
1958	134,827	188,757.80	160,444.13
1959	140,881	197,233.40	167,648.39
1960	160,079	224,110.60	190,494.01
1961	171,833	240,566.20	204,481.27
1962	152,217	213,103.80	181,138.23
1963	155,001	217,001.40	184,451.19
1964	151,372	211,920.80	180,132.68
1965	186,484	261,077.60	221,915.96
1966	184,871	258,819.40	219,996.49
1967	187,567	262,593.80	223,204.73
1968	199,258	278,961.20	237,117.02
1969	195,822	274,150.80	233,028.18
1970	219,396	307,154.40	261,081.24
1971	163,000	228,200.00	193,970.00
1972	170,000	238,000.00	202,300.00
1973	172,000	240,800.00	204,680.00
1974	95,000	133,000.00	113,050.00
1975	138,000	193,200.00	164,220.00
1976	142,000	198,800.00	168,980.00
1977	150,000	210,000.00	178,500.00

TABLE 3* – Tons of Tail Slag Produced by The Cominco Smelter 1930 to 1994			
Year	Lead (tons)*	Blast Furnace Slag (tons)	Tail Slag (tons)
1978	147,000	205,800.00	174,930.00
1979	140,000	196,000.00	166,600.00
1980	130,000	182,000.00	154,700.00
1981	131,500	184,100.00	156,485.00
1982	126,600	177,240.00	150,654.00
1983	132,300	185,220.00	157,437.00
1984	129,700	181,580.00	154,343.00
1985	132,300	185,220.00	157,437.00
1986	122,300	171,220.00	145,537.00
1987	87,700	122,780.00	104,363.00
1988	132,400	185,360.00	157,556.00
1989	114,100	159,740.00	135,779.00
1990	71,800	100,520.00	85,442.00
1991	96,000	134,400.00	114,240.00
1992	100,900	141,260.00	120,071.00
1993	96,121.54	134,570.16	114,384.64
1994	104,719.57	146,607.40	124,616.29
TOTAL	10,068,002.12	14,095,202.96	11,980,922.52

* Ref. 3, pp. 3-20; 15, pp. 1-2; 54, pp. 1-6

Note: All values were calculated without truncation; only the final tabulated values here were truncated for presentation purposes

Based on the report conducted by a consultant for CCT, it is estimated that 90 percent of the slag discharged to the UCR (between 1930 and 1994) was transported into the U.S. [Ref. 18, p. 5, 87, 89, 90]. The value assigned to hazardous wastestream quantity is calculated as follows:

$$\begin{aligned} 23,961,845,040 \text{ pounds} \times 0.9 &= 21,565,660,536 \text{ pounds} \\ 21,565,660,536 \text{ pounds} / 5,000 &= 4,313,132.10 \end{aligned}$$

Hazardous Wastestream Quantity (W) Value: 4,313,132.10
[Ref. 1, Section 2.4.2.1.2, Table 2-5]

2.4.2.1.3 Tier C – Volume

The volume of tail slag produced between 1930 and 1994 is estimated to be 23,961,845,040 pounds as shown in **Section 2.4.2.1.2** above. The value assigned to the volume measure is calculated as follows:

$$\begin{aligned} 23,961,845,040 \text{ pounds} \times 0.9 &= 21,565,660,536 \\ 21,565,660,536 \text{ pounds} / 2,000 \text{ pounds per cubic yard} &= 10,782,830.268 \text{ cubic yards} \\ 10,782,830.268 \text{ Cubic yards} / 2.5 &= 4,313,132.10 \end{aligned}$$

Volume (V) Assigned Value = 4,313,132.10
[Ref. 1, Section 2.4.2.1.3, Table 2-5]

2.4.2.1.4 Tier D – Area

Because the volume was scored, a value of 0 for area measure is assigned for this source [Ref. 1, Section 2.4.2.1.4].

Dimensions of source = N/A
Area (A) Assigned Value: 0

2.4.2.1.5 Source Hazardous Waste Quantity Value

Per the HRS, the highest of the values assigned to the source for hazardous constituent quantity (Tier A), hazardous wastestream quantity (Tier B), Volume (Tier C), and Area (Tier D) should be assigned as the source hazardous waste quantity value [Ref. 1, Section 2.4.2.1.5]. The source hazardous waste quantity value for Source 1 is 4,313,132.10 for Tier B – Hazardous Wastestream Quantity [Ref. 1, Section 2.4.2].

Source Hazardous Waste Quantity Value: 4,313,132.10

SOURCE DESCRIPTION

2.2 SOURCE CHARACTERIZATION

2.2.1 Source Identification

Number of the source: Source No. 2

Name and description of the source: Contaminated Soil (Le Roi Smelter)

Source Type: Contaminated Soil

Source 2 consists of metals-contaminated soil on the former Le Roi smelter facility located in Northport, Washington. The Le Roi smelter is located on approximately 32 acres of land near the Columbia River [Ref. 50, p. 9]. In 1897, the smelter began refining copper, lead, and silver ores from mines in northeast Washington, as well as copper ore from British Columbia, Canada [Ref. 5, p. 104]. By 1908, this smelter was one of the largest smelters on the West Coast, processing 500 tons of ore per day [Ref. 5, p. 105; 50, p. 11]. The smelter was closed and dismantled in 1922, after 24 years of sporadic operation [Ref. 5, p. 105]. In 2004, a removal action was conducted at the former Le Roi smelter with contaminated soil being consolidated at an 11-acre area of the smelter site. Contaminated soils were covered with a polyethylene sheet and clean soil, and vegetated [Ref. 17, p. 65; 49, p. 16]. It was reported that the 4,100 ft² contaminated soil area was not removed during the 2004 Removal Action by EPA due to its proximity to the Town of Northport wells [Ref. 57, p. 2]. In 2021, EPA conducted composite soil sampling on the Le Roi smelter property in the area of the Town of Northport wells as part of an RSE. Analytical results from these samples indicated the presence of lead and arsenic above screening levels [Ref. 38, pp. 332-333].

Location of the source, with reference to a map of the site:

Source 2 (contaminated soil) is located in the eastern area of the site, near the Town of Northport wells [Figure 1-2 of this HRS documentation record; 38, p. 332, 333].

Containment

Release to surface water via overland migration: The source consists of exposed contaminated soil which does not have a maintained engineered cover or a functioning and maintained run-on control system and runoff management system [Refs. 5, p. 791-792; 38, pp. 68-69, 94; 57, p. 2]. A surface water containment factor value of 10 is assigned [Ref. 1, Table 4-2].

Release to surface water via flood:

The containment factor value for release to surface water via flood is not evaluated because it does not affect the listing decision.

2.2.2 Hazardous Substances Associated with the Source

EPA PA/SI Sampling 2001

In June and September 2001, consultants for the EPA visited the Le Roi smelter property and collected surface soil samples as a part of a preliminary assessment/site inspection (PA/SI) [Ref. 5, p. 34]. Three surface soil samples (NSSL01SS, NSSL02SS, and NSSL03SS) were collected west of the former tailings area underneath the slag bricks [Refs. 5, p. 108; 25, pp. 472, 473, 480; 48, p. 1]. A background surface soil sample (NSBK02SS) was collected south of the Le Roi smelter [Ref. 5, pp. 64]. All surface soil samples including the background sample were collected from 0 to 6 inches below ground surface [Ref. 5, pp. 40, 45 (Table 3-1)]. These three surface soil samples contained some slag material and demonstrate the types of contaminants associated with slag from the Le Roi smelter [Ref. 5, pp. 108, 109]. The samples appeared to consist of very fine to medium grained sand with sandy reddish slag and yellowish stain [Ref. 5, p. 108]. Samples were analyzed for TAL metals following CLP SOW ILM04.1 [Ref. 5, p. 56, 1,116]. Validation of this data was conducted based on criteria outlined in the National Functional Guidelines for Inorganic Data Review (02/94) [Ref. 5, p. 1,120]. As shown below in **Table 4**, analytical results from soil samples indicated the presence of several metals at concentrations significantly above concentrations detected in a background sample.

TABLE 4 – LE ROI SMELTER PA/SI SOIL SAMPLE RESULTS (2001)								
Sample No.: CLP Sample No.:	NSBK02SS MJ0KK6		NSSL01SS MJ0KK0		NSSL02SS MJ0KK1		NSSL03SS MJ0KK2	
Date:	9/13/01		9/13/01		9/13/01		9/13/01	
Depth Interval (in. bgs)	0 to 6		0 to 6		0 to 6		0 to 6	
Comments:	Background							
Metals (mg/kg)	Result	CRDL	Result	CRDL	Result	CRDL	Result	CRDL
Antimony	1.5 JB	15.07	11.8 JB	12.6	21.4 JL	13.43	60.6 JL	13.23
Arsenic	2.6	2.51	294 JL	2.10	297 JL	2.23	209 JL	2.20
Cadmium	1.3	1.25	2	1.05	26.9	1.11	105	1.10
Copper	17.3	6.28	2,430	5.25	14,700	5.59	4,480	5.51
Lead	57.0	0.75	2,600	0.63	7,980	0.67	10,500	0.66
Nickel	8.0 JB	10.05	12.0	8.40	25.3	8.95	16.5	8.82
Silver	0.57 JB	2.51	13.1	2.10	21.3	2.23	26.7	2.20
Zinc	60.9	5.02	120	4.20	978	4.47	5,420	4.41
Mercury	0.06 U	0.12	0.28	0.10	0.34	0.11	0.40	0.11
Reference(s)	Refs. 5, pp. 45, 169, 1,115-1,121, 1,132; 62, p. 3; 64, pp. 1-2		Figure 1-2 ; Refs. 5, pp. 40, 169, 791, 1,115-1,121, 1,126; 62, p. 2; 64, pp. 1-2		Figure 1-2 , Refs. 5, pp. 40, 169, 791, 1,115-1,121, 1,127; 62, p. 2; 64, pp. 1-2		Figure 1-2 ; Refs. 5, pp. 40, 169, 792, 1,115-1,121, 1,128, 62, p. 2; 64, pp. 1-2	

Bold = concentration detected significantly (three times or more) above background.

in. bgs = inches below ground surface.

mg/kg = milligrams per kilogram.

CRDL = Contract Required Detection Limit [Ref. 64, pp. 1-2]

U = The analyte was not detected above the level of the associated value. The associated value is either the contract required detection limit or the sample detection limit [Ref. 5, p. 169, 1,121].

B = The reported concentration is between the instrument detection limit and the contract required detection limit [Ref. 5, p. 169].

J = The analyte was positively identified. The associated numerical value is an estimate [Ref. 5, p. 1,121].

L = Low bias [Ref. 5, p. 1,121].

For the above JB-qualified results, these results are qualified solely due to detection between the detection limit and CRDL [Ref. 5, pp. 1,115-1,121]. These results are not considered biased per the EPA Quick Reference Fact Sheet Using Qualified Data to Document an Observed Release and Observed Contamination, and therefore were not adjusted [Ref. 19, p. 6]. For the above JL-qualified results, these low biased contaminated results are not adjusted

per EPA Quick Reference Fact Sheet Using Qualified Data to Document an Observed Release and Observed Contamination [Ref. 19, p. 8].

An estimated quantity of 4,100 ft² of contaminated soil was calculated for the area encompassing these three contaminated soil samples collected during the PA/SI [Ref. 48, p. 1]. It was reported that the 4,100 ft² contaminated soil area was not removed during the 2004 Removal Action by EPA due to its proximity to the municipal wells [Ref. 57, p. 2].

2021 EPA Removal Site Evaluation (RSE)

In September 2021, EPA collected two 30-point composite surface soil samples from the Le Roi smelter property. These samples were collected as part of a Removal Site Evaluation conducted on properties in Northport, WA [Ref. 38, pp. 12, 14, 332-333]. Sample analysis was limited to lead and arsenic using Superfund Analytical Methods (SFAM) 01.0 or EPA 3050B+6010D/Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES) on the <150 micrometers (µm) fraction. Data validation was performed by EPA following EPA's Stage 4 Data Validation Electronic/Manual Process (S4VEM) and in accordance with the EPA CLP Statement of Work for Inorganic Superfund Methods (EPA, 2020a), EPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (2009), and National Functional Guidelines for Inorganic Superfund Data Review (EPA, 2020b), where applicable to the analyses performed [Ref. 38, p. 17]. It should be noted that the samples collected during the 2021 RSE are similar to soil samples used to determine background soil concentrations in the region [see background results shown Table 6]. Soil samples collected during the 2021 RSE were sieved to <150 µm; for the published background sample study, 96 percent of the samples analyzed were composed of a prepared size of <150 µm [Refs. 38, p. 17; 39, p. 19].

Sample analytical results for surface soil samples with concentrations significantly above published background levels (i.e., three times the published background concentration) are presented in **Table 5** below:

TABLE 5 – LE ROI SMELTER RSE SOIL SAMPLE RESULTS (2001)					
Sample No.:	JEAN3		JEAN4		3x Maximum Published Background Concentration*
Date:	9/24/21		9/24/21		
Depth Interval (in. bgs)	0 to 1		0 to 1		
Comments:	Composite		Composite		
Metals (mg/kg)	Result	CRQL	Result	CRQL	
Arsenic	26	1	170	1	33
Lead	620	1	14,000	1	297
Reference(s)	Figure 1-2; Ref. 38, pp. 94, 228-230, 237, 332-333, 2,229 2,466		Figure 1-2; Ref. 38, pp. 94, 228-230, 238, 332-333, 2,230, 2,466		Ref. 39, pp. 51-52

Bold = Concentration significantly above background

mg/kg = milligrams per kilogram

in. bgs = inches below ground surface

CRQL = Contract Required Quantitation Limit [Ref. 38, p. 543]

* = See the below Background Soil Concentration Discussion – Use of Published Data

* Background Soil Concentration Discussion - Use of Published Data

No background soil samples were collected during the 2021 RSE investigation. Although background soil samples are not required in HRS evaluations to identify contaminated soil as a source, background levels are discussed here to demonstrate the relative increase in contamination over background.

Since the Columbia River Valley has been impacted by historical metals pollution from smelter emissions from the Cominco smelter in Trail B.C., and the Le Roi smelter, published data for northeast Washington was used to evaluate background soil concentrations [Ref. 39, p. 11]. The Washington State Department of Ecology Publication 19-03-014 (i.e., Upland Regional Soil Background Characterization for Select Metals in Northeast Washington Watersheds), included as Reference 39 of this HRS documentation record, was used to evaluate background soil concentrations. The analyses within this publication established natural background metals values that represent upper-percentile thresholds in soils in 11 state-defined watersheds (Water Resource Inventory Areas [WRIAs]) [Ref. 39, p. 7]. This publication noted that historic metals pollution from smelter emissions in the Upper Columbia River Valley occurred in the study area for much of the 20th century. This pollution was due to emissions from the smelter complex in Trail, British Columbia (i.e., Teck) and emissions from a smelter that operated intermittently in Northport, Washington (i.e., Le Roi smelter) [Ref. 39, p. 11]. It is important to note that values used to determine background metals concentrations were from WRIA 61, which is specific to Upper Lake Roosevelt (not the entire Northeastern Washington study area). In addition, soil data for samples collected within WRIA 61 were collected as part of investigations of upland soil conditions in the Upper Columbia River. These studies focused on areas of northern Stevens County [Ref. 39, pp. 16, 39]. The values used in this publication represent conservative upper percentile thresholds (90th percentile) within WRIA 61 [Ref. 39, pp. 13, 51-53]. The study concluded that concentrations of certain metals (cadmium, lead, zinc) in upland soil surfaces (within the smelter-impacted WRIA 61 watershed) represent definitive metal enrichment resulting from historical anthropogenic activity, primarily as the result of smelting operation emissions [Ref. 39, p. 29].

Based on a review of the above considerations, the background soil concentration data from this publication shown in **Table 6** is considered appropriate for comparison of samples collected during the RSE.

TABLE 6 – Published Background Soil Concentrations (Northeast Washington)		
Hazardous Substance	Background Concentration (mg/kg) WRIA 61	3x Background Concentration
Antimony	1.7	5.1
Arsenic	11	33
Cadmium	2.9	8.7
Copper	32	96
Lead	99	297
Nickel	37	111
Zinc	252	756
Mercury	0.09	0.27

Ref. 39, pp. 51-53

mg/kg = milligrams per kilogram

WRIA 61 = Water Resource Inventory Area – Upper Lake Roosevelt [Ref. 39, p. 13].

It should be noted that the background soil concentrations from the 2001 PA/SI conducted on the Le Roi smelter were lower (for arsenic and lead) than the above published concentrations. An HRS conservative approach for the 2021 RSE samples was taken and the published data for arsenic and lead [see **Table 6** of this HRS documentation record] were used to demonstrate the relative increase in metals concentrations above background [see **Table 5** of this HRS documentation record]; however, the RSE soil concentrations for lead and arsenic would demonstrate an increase in metals concentrations even if they were compared to 2001 background sample NSBK02SS [see **Table 4** of this HRS documentation record].

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Tier A – Hazardous Constituent Quantity

The hazardous constituent quantity for Source 2 could not be adequately determined according to the HRS requirements; that is, the total mass of all CERCLA hazardous substances in the source and releases from 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, potentially responsible party (PRP) records, State records, permits, waste concentration data, etc.] available to adequately calculate the total or partial 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 2 with reasonable confidence. As a result, the evaluation of hazardous waste quantity proceeds to the evaluation of *Tier B*, Hazardous Wastestream Quantity [Ref 1, Section 2.4.2.1.1].

Hazardous Constituent Quantity (C) Value: NS

2.4.2.1.2 Tier B – Hazardous Wastestream Quantity

The hazardous wastestream quantity for Source 2 could not be adequately determined according to the HRS requirements; that is, the total mass of all hazardous wastestreams plus the mass of any additional CERCLA pollutants and contaminants in the source and releases from 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, waste concentration data, etc.) available to adequately calculate the total mass or partial mass of the hazardous wastestreams plus the mass of all 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 2 with reasonable confidence. Scoring proceeds to the evaluation of *Tier C*, Volume [Ref. 1, Section 2.4.2.1.2].

Hazardous Wastestream Quantity (W) Value: NS

2.4.2.1.3 Tier C – Volume

Available data are insufficient to document a volume measure.

Volume (V) Assigned Value = NS

2.4.2.1.4 Tier D – Area

Sampling and analytical results show that soil at the former Le Roi smelter is contaminated with metals [see **Sections 2.2.1** and **2.2.2** of this HRS documentation record]. The conservative area of contaminated soil as documented according to HRS criteria is approximately 4,100 ft² [Ref. 48, p. 1]. The source type is “Contaminated Soil”, so the area value is divided by 34,000 to obtain the assigned value shown below [Ref. 1, Section 2.4.2.1.4].

Dimensions of source = 4,100 ft²
Area (A) Assigned Value: $4,100/34,000 = 0.12$
[Ref. 1, Section 2.4.2.1.4, Table 2-5]

SD-Hazardous Waste Quantity
Source No.: 2

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source hazardous waste quantity value for Source 2 is 0.12 for Tier D – Area [Ref. 1, Section 2.4.2].

Source Hazardous Waste Quantity Value: 0.12

SOURCE DESCRIPTION

2.2 SOURCE CHARACTERIZATION

2.2.1 Source Identification

Number of the source: Source No. 3

Name and description of the source: Sluice Boxes Discharge

Source Type: Other

Source 3 consists of former sluice boxes associated with the former Le Roi smelter facility located in Northport, Washington. In 1897, the smelter began refining copper, lead, and silver ores from mines in northeast Washington, as well as copper ore from British Columbia, Canada [Ref. 5, p. 104]. By 1908, this smelter was one of the largest smelters on the West Coast, processing 500 tons of ore per day [Ref. 5, p. 105]. Slag was discharged from the furnaces at the Le Roi smelter directly into the Columbia River via underground waterways, also referred to as sluice boxes [Refs. 4, p. 22-24; 46, p. 9]. Historical photographs from 1901 show that piles of slag discharged along the banks of the UCR [Ref. 44, p. 10]. Facility maps from 1901 and 1908 depict five underground waterways (sluice boxes, grouped as three passage areas) transporting slag from furnaces to discharge points on the Columbia River [Refs. 4, p. 24; 46, pp. 9-10]. In June 2001, remnants of the sluice boxes and slag were observed by EPA along the banks of the UCR and adjacent to the UCR near the boat launch area of the park [Ref. 5, pp. 780-782]. In September 2004, EPA located three of these underground waterways/sluice boxes [Ref. 46, pp. 4, 13]. The sluice boxes were constructed of wood [Ref. 46, pp. 4, 17-22]. A fine black powder material, presumed to be slag, was observed at the top of one of the passages. This material was analyzed on site for lead using a portable XRF unit. XRF results detected concentrations of lead at 32,300 parts per million (ppm). An additional sample was collected on product inside the passage and XRF screening indicated lead at a concentration of 10,400 ppm [Ref. 46, pp. 4, 28].

In 2019, a remedial investigation (RI) of the Northport Waterfront was conducted by a consultant of the Washington State Department of Ecology. This area included the shoreline of the UCR where slag wastes were previously discharged by the Le Roi smelter. This investigation was conducted because no cleanup actions were ever conducted to address nearshore sediments contamination and the bank impacted by smelter waste and debris, including slags that were historically deposited along the shoreline or within the UCR. Previous response actions by EPA in 2004 addressed structures and contaminated soil on the Le Roi smelter property. In addition, BNSF performed additional excavation of contaminated soil adjacent to their right-of-way within the town park area. During this investigation, slag materials, (as both clinker and fine granulated particles) were noted to be widespread on the beach and the hillside leading to the UCR [Ref. 37, pp. 6, 7, 36-38]. During the RI, sediment/slag samples were collected from test pits advanced along the UCR waterfront [Ref. 37, pp. 8, 9, 35]. The samples were collected from locations along the southern shoreline of the UCR [Ref. 37, p. 35]. Analytical results from these samples indicated the presence of high concentrations of several metals [see **Section 2.2.2** of this HRS documentation record].

Location of the source, with reference to a map of the site:

Source 3 (i.e., sluice boxes discharge) is located in the northern portion of the former Le Roi smelter facility along the south bank of the UCR [**Figure 1-2** of this HRS documentation record; Refs. 5, pp. 780-782; 46, pp. 9-10].

Containment

Release to surface water via overland migration: The source consists of sluice boxes which discharged slag directly to the UCR. This source does not have a maintained engineered cover or a functioning and maintained run-on control system and runoff management system [Refs. 4, pp. 22-24; 5, pp. 780-782; 46, pp. 9-10]. During RI activities

conducted by a contractor of the Washington State Department of Ecology in 2019, slag was observed in 101 of 138 samples sampled along the UCR waterfront. Most of the observed slag was either granular or mixed granular and clinker [Ref. 37, pp. 10, 36-38]. Based on this information and the direct discharge to the UCR (evidence of hazardous substance migration from the source to the UCR), a surface water containment factor value of 10 is assigned [Ref. 1, Table 4-2].

Release to surface water via flood:

The containment factor value for release to surface water via flood is not evaluated because it does not affect the listing decision.

2.2.2 Hazardous Substances Associated with the Source

Remedial Investigation Slag Sampling (2019)

As part of a remedial investigation conducted by a consultant of the Washington State Department of Ecology, sediment/slag samples were collected from test pits advanced along the UCR waterfront [Ref. 37, pp. 8, 9, 35]. The samples were collected from locations along the southern shoreline of the UCR [Ref. 37, p. 35]. Samples were analyzed by Eurofins TestAmerica, Spokane using TAL metals (EPA Method 6010C) and mercury (EPA Method 7471B) [Ref. 37, p. 11]. Validation was completed consistent with EPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (EPA 2017) [Ref. 37, pp. 13, 121-126]. Test Pit logs from these samples indicated that these samples were classified as slag. [Ref. 37, pp. 63, 70, 72-74, 76, 78]. Analytical results from samples characterized as slag are presented below in **Table 7**.

TABLE 7 – 2019 REMEDIAL INVESTIGATION SLAG SAMPLES								
Sample ID: Date: Depth Interval (ft. bgs) Comments:	TP-10 (0.5-1.0)		TP-12 (0.0-0.5)		TP-14 (0.0-0.5)		TP-16 (3.0-3.5)	
	3/26/19		3/25/19		3/25/19		3/25/19	
	0.5 to 1		0 to 0.5		0 to 0.5		3 to 3.5	
	Slag		Slag		Slag		Slag	
Metals (mg/kg)	Result	RL	Result	RL	Result	RL	Result	RL
Antimony	ND	22	ND	84	ND	91	ND	9.9
Arsenic	41	11	ND	42	ND	46	31	4.9
Cadmium	ND	8.9	ND	34	ND	36	ND	3.9
Chromium	19	11	ND	42	52	46	43	4.9
Copper	1,300	36	400	130	1,200	150	1,400	16
Lead	5,600	27	11,000	100	3,900	110	1,400	12
Zinc	12,000	45	46,000	170	19,000	180	2,000	20
Mercury (ug/kg)*	ND	50	ND	50	ND	49	ND	48
Reference(s)	Figure 1-2; Ref. 37, pp. 30, 36, 70, 145-146, 215		Figure 1-2; Ref. 37, pp. 30, 36, 72, 148, 295		Figure 1-2; Ref. 37, pp. 30, 36, 74, 150, 296		Figure 1-2; Ref. 37, pp. 31, 36, 76, 153-154, 298	
Sample ID: Date: Depth Interval (ft. bgs) Comments:	TP-18 (0.0-0.5)		XRF-63		TP-13 (0.0-0.5)		TP-3 (0.0-0.5)	
	3/26/19		3/27/19		3/25/19		3/26/19	
	0 to 0.5		0 to 0.5		0 to 0.5		0 to 0.5	
	Slag		Granular Slag present		Slag		Visual Slag at surface	
INORGANICS (mg/kg)	Result	RL	Result	RL	Result	RL	Result	RL
Antimony	32	21	27 J	22	32	21	27 J	22
Arsenic	17	10	31	11	17	10	31	11
Cadmium	ND	8.4	ND	8.7	ND	8.4	ND	8.7
Chromium	91	10	130	11	91	10	130	11
Copper	1,500	33	2,400	35	1,500	33	2,400	35
Lead	260	25	510	26	260	25	510	26
Zinc	10,000	42	18,000	44	10,000	42	18,000	44
Mercury (ug/kg)*	ND	50	ND	49	ND	50	ND	49
References	Figure 1-2; Ref. 37, pp. 31, 36, 78, 154, 299		Figure 1-2; Ref. 37, pp. 31, 38, 169, 232		Figure 1-2; Ref. 37, pp. 30, 36, 73, 149-150, 217		Figure 1-2; Ref. 37, pp. 30, 36, 63, 134-135, 210	

mg/kg = milligrams per kilogram

* = Mercury measured in micrograms per kilogram (ug/kg)

ft. bgs = feet below ground surface

RL = Reporting Limit [Ref. 37, p. 132]

J = estimated due to matrix spike/matrix spike duplicate recovery and precision [Ref. 37, p. 124, 126]

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Tier A – Hazardous Constituent Quantity

The hazardous constituent quantity for Source 3 could not be adequately determined according to the HRS requirements; that is, the total mass of all CERCLA hazardous substances in the source and releases from 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, potentially responsible party (PRP) records, State records, permits, waste concentration data, etc.] available to adequately calculate the total or partial 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 3 with reasonable confidence. As a result, the evaluation of hazardous waste quantity proceeds to the evaluation of *Tier B*, Hazardous Wastestream Quantity [Ref 1, Section 2.4.2.1.1].

Hazardous Constituent Quantity (C) Value: NS

2.4.2.1.2 Tier B – Hazardous Wastestream Quantity

The hazardous wastestream quantity for Source 3 could not be adequately determined according to the HRS requirements; that is, the total mass of all hazardous wastestreams plus the mass of any additional CERCLA pollutants and contaminants in the source and releases from 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, waste concentration data, etc.) available to adequately calculate the total mass or partial mass of the hazardous wastestreams plus the mass of all 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 3 with reasonable confidence. Scoring proceeds to the evaluation of *Tier C*, Volume [Ref. 1, Section 2.4.2.1.2].

Hazardous Wastestream Quantity (W) Value: NS

2.4.2.1.3 Tier C – Volume

Source 3 consists of Sluice Box Discharge of slag to the UCR. Based on analytical results from samples containing slag along the shoreline of the UCR during the 2019 RI, it is apparent that contamination is present at depth; however, a volume is not known at this time. A Tier C volume value of >0 is assigned [Ref. 1, Section 2.4.2.1.3].

Dimension of source (yd³): >0 yd³
Volume (V) Assigned Value (>0)/2.5 = >0
[Ref. 1, Section 2.4.2.1.3, Table 2-5]

2.4.2.1.4 Tier D – Area

A Tier D measure of 0 is assigned since the volume of the source could be estimated [Ref. 1, Section 2.4.2.1.4].

Area (A) Assigned Value: 0

SD-Hazardous Waste Quantity
Source No.: 3

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source hazardous waste quantity value for Source 3 is >0 for Tier C – Volume [Ref. 1, Section 2.4.2].

Source Hazardous Waste Quantity Value: >0

SITE SUMMARY OF SOURCE DESCRIPTIONS

Source Number	Source Hazardous Waste Quantity Value	Containment			
		Ground Water	Surface Water	Air	
				Gas	Particulate
1	4,313,132.10	NS	10	NS	NS
2	0.12	NS	10	NS	NS
3	>0	NS	10	NS	NS

NS = Not Scored

Other Possible Sources Not Scored

Cominco Smelter – Fertilizer Outfall Effluent Discharge - Fertilizer plants were built at the Trail smelter in 1930, facilitating the production of both nitrogen- and phosphorous-based fertilizers. One of the five outfalls associated with the Cominco smelter (i.e., Sewer IV) was used for the fertilizer operation, which discharged effluent to the UCR. A trend graph of metals in effluents from the metallurgical operation from 1980 to 1996 demonstrates that fertilizer plant operation contributed to an average effluent discharge up to 4 kg/d of total mercury and 350 kg/d of dissolved zinc [Refs. 4, pp. 25, 26; 9, pp. 6, 24; 12, p. 18]. The outfall discharge associated with the fertilizer operation was not scored in this HRS documentation record because the current surface water migration pathway score has a maximum pathway score of 100.

4.1 OVERLAND/FLOOD MIGRATION COMPONENT

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

The Columbia River flows from northern B.C., Canada, generally south through eastern Washington, and then west, forming part of the border between Washington and Oregon, and eventually emptying into the Pacific Ocean. A reservoir, Franklin D. Roosevelt Lake (commonly known as Lake Roosevelt), was formed on the Columbia River by the construction of the Grand Coulee Dam [Ref. 28, p. 10-12]. Lake Roosevelt extends about 135 miles upstream from the dam, reaching to within 15 miles of the international boundary with Canada [Ref. 28, p. 10]. The Columbia River is the principal inflow to Lake Roosevelt and contributes about 90% of the flow from a large drainage area in Canada and the U.S. [Ref. 28, p. 10]. In addition to the Columbia River, four other major rivers flow directly into Lake Roosevelt: the Kettle, Colville, Spokane, and Sanpoil rivers [Ref. 28, pp. 10, 11]. The Pend Oreille River flows into the main stem of the Columbia River just north of the U.S.-Canada border [Ref. 28, pp. 10, 11]. The sampling used in this HRS documentation record demonstrates the presence of contaminated sediments throughout the Upper Columbia River from the U.S.-Canada border to Marcus, Washington, approximately 35 miles downstream [Figure 3; see Section 4.1.2.1 of this HRS documentation record].

The construction of Grand Coulee Dam, a federal reclamation project, took place between 1933 and 1941 [Ref. 29, p. 1]. Purposes and benefits of this dam include flood control and river regulation, water storage and delivery (including irrigation), power generation, recreation, and fish and wildlife. [Ref. 29, p. 1]. Lake Roosevelt, behind the dam, has over 5,000,000 acre feet of active storage [Ref. 29, p. 2].

From January through June, Lake Roosevelt is drawn down in preparation for spring runoff [Ref. 28, p. 18]. The normal operating range on the lake is between 1,290 feet above mean sea level (AMSL; full pool) to 1,208 feet AMSL, resulting in seasonal lake level fluctuations in excess of 80 feet [Refs. 16, p. 64; 29, p. 2]. During draw down, floodplains and steeply eroded banks of Lake Roosevelt that may contain sediments contaminated with hazardous substances are exposed [Ref. 16, p. 64].

Water quality conditions, including the dispersion of hazardous substances, can be affected by dams and reservoirs [Ref. 32, p. 3]. Coarser sediments entering a reservoir typically deposit at the head of pools [Ref. 32, p. 8]. The finer sediments, such as silt and clay, are deposited near or transported past the dams [Ref. 32, p. 8]. Pollutants entering the mainstem can adsorb to sediments, mostly to silt and clay, and be transported and accumulate with them [Ref. 32, p. 8]. When lake levels are lowered significantly, the accumulated contaminated sediments can be scoured and transported downstream [Ref. 32, p. 8]. During these times, pollutants adsorbed to sediments can become dissolved in the water column [Ref. 32, p. 4].

In-Water Segment

Cominco operates outfalls that have historically discharged slag and effluent directly to the UCR [Ref. 4, p. 26]. Three outfalls are for the metallurgical plants which generate slag as a by-product; one is for a slag launder system [Ref. 4, p. 26]. Although the effects of these releases to sediments in Canada are not included in this HRS documentation record, these releases have contributed significantly to hazardous substance sediment contamination downstream of the U.S.-Canada border and for this reason, are included in this HRS documentation record. The in-water segment for Source 1 begins at the probable point of entry (PPE) to surface water, which is the UCR at the discharge point of the Cominco Smelter Slag outfalls (designated as PPE1). From PPE1, the target distance limit continues downstream along the UCR approximately 10 miles to the U.S.-Canada border. The TDL continues from the border approximately 9.5 miles downstream along the UCR until it reaches the PPE associated with Sources 2 and 3 for the Le Roi smelter (designated as PPE2). PPE2 consists of approximately 1,500 feet of shoreline along the south bank of the UCR adjacent to the northern portion of the former Le Roi smelter facility. This area of shoreline received runoff from a constructed ditch which originated adjacent to the former slag brick pile and contaminated soil area located in the southern portion of the property (Source 2) [Refs. 5, p. 264; 48, p. 1]. The ditch was constructed to cease flooding at the property and direct runoff to the UCR [Ref. 25, p. 404]. PPE2 also received slag which was discharged to the UCR via underground waterways (Source 3) which were utilized to convey slag from smelter furnaces directly to the

shoreline of the UCR [Ref. 46, pp. 4, 9, 28]. There is no overland segment to surface water associated with the underground waterways (Source 3), as slag was discharged directly to the UCR. From PPE2, the surface water pathway continues south and west along the UCR [**Figures 1-1, 1-2, and 3** of this HRS documentation record; Ref. 44, p. 10].

4.1.2.1 Likelihood of Release

4.1.2.1.1 Observed Release

Observed Release by Direct Observation

Basis for Direct Observation: Cominco Smelter

Cominco operated four outfalls that have historically discharged slag and effluent directly to the Columbia River [Ref. 4, p. 26]. Three of the outfalls are for the metallurgical plants which generate slag as a by-product, one is for a slag launder system [Ref. 4, p. 26]. The slag is a black, glassy material which contains copper, lead, and zinc in addition to other metals [Ref. 4s, p. 26; 10, p. 7]. The majority of this material has the size and texture of sand; however, approximately 1% by weight consists of fines which have a broken egg-shell or needle-like morphology [Refs. 4, p. 261; 10, p. 7]. This slag has been demonstrated to contain concentrations of copper ranging from 0.01% to 2.99%, lead ranging from 0.1% to 3.68%, and zinc ranging from 2.5% to 15.6% [Refs. 4, p. 26; 10, p. 7; 11, p. 1]. The B.C. Ministry of Environment, Lands, and Parks required the elimination of slag to the Columbia River by December 1996; however, since this time, Cominco has had several releases of slag to the river during upset conditions [Ref. 4, p. 28]. Further, the presence of slag along the shores of the Columbia River has been documented from Trail B.C., the location of the Cominco smelter, to China Bar at RM 724 in Washington State indicating Cominco as a source for this contamination [see Source 1 discussion **Section 2.2** of this HRS documentation record]. Further investigation by Teck in 2013 has documented the presence of slag as far down as RM 673 [Ref. 43, p. 447].

A trend graph of metals in effluents from the metallurgical operation from 1980 to 1996 demonstrates that the average discharges for dissolved metals were as high as 18 kilogram per day (kg/d) of arsenic, 62 kg/d of cadmium, 200 kg/d of lead, and 7,400 kg/d of zinc [Ref. 4, p. 26; 12, p. 17].

Cominco's operations have been characterized by frequent accidental releases of contaminants into the UCR. On 86 occasions between September 1987 and May 2001, Cominco reported spills of pollutants into the UCR; although not all would necessarily involve hazardous substances, these spills are listed in **Table 8** below [Refs. 13, pp. 152-154; 14, pp. 1, 2].

TABLE 8 – REPORTED SPILLS FROM THE COMINCO SMELTER TO THE UPPER COLUMBIA RIVER 1987 TO 2001 ADAPTED FROM ENVIRONMENT CANADA SPILLTRACKER DATABASE			
Year	Date	Contaminant	Reported Quantity
1987	September 2	Sulphuric Acid (50%)	15 metric tons
1988	November 25	Zinc Solution (150 grams per liter)	5 metric tons
1989	May 1	Neutral Thickener	60,000 liters
	July 16	Gypsum and Phosphoric acid	Unknown
	July 17	Arsenic	Unknown
	August 18	Yellow Substance	305 meters long
1990	January 20	Sulphuric acid (93%)	Unknown
	March 6	Mercury	14 kilograms
	June 11	Sulphuric Acid	909 liters
	August 24	Sulphuric Acid	16,000 liters
	September 4	Zinc Electrolyte	Unknown
1991	January 30	Zinc	576 kilograms
	February 5	Copper Sulphate solution	3,000 liters
	February 7	Phosphoric acid	0.9 to 1.8 metric tons
	February 11	Sulfide residue (zinc)	4,456 liters
	March 16	Sulphuric acid	4.54 metric tons

**TABLE 8 –
REPORTED SPILLS FROM THE COMINCO SMELTER TO THE UPPER COLUMBIA RIVER
1987 TO 2001
ADAPTED FROM ENVIRONMENT CANADA SPILLTRACKER DATABASE**

Year	Date	Contaminant	Reported Quantity
	April 2	Phosphoric acid	15 metric tons
	April 6	Phosphoric acid	1.36 metric tons
	April 13	Sulphuric acid (15%)	1,000 liters
		Sulphuric acid (160 grams per liter)	Unknown
	April 21	Zinc return acid (160 grams per liter)	220 liters
	May 13	Zinc slurry	22.7 liters
		Ammonia	90.9 liters
	June 15	Phosphoric acid (weak)	2 metric tons
	June 21	Phosphoric acid	Unknown
		Phosphates	6.7 metric tons
	June 24	Phosphoric acid (27%)	2.72 to 3.63 metric tons
	August 1	Coal dust / water	220 liters
	September 9	Furnace oil	50 metric tons
	September 16	Sodium bisulphate (20 liters per minute)	Unknown
		Sulphuric acid	132-176 liters
	December 7	Zinc electrolyte	881 liters
	December 20	Zinc pressure leach slurry	2,273 liters
1992	March 11	Phosphate	Unknown
	April 2	Phosphate	Unknown
	April 20	Zinc electrolyte solution	25,000 liters
	April 22	Sulfide leach residue	Unknown
	May 23	Zinc electrolyte solution	350 liters
	May 26	Phosphoric acid (21%)	5 metric tons
	July 11	Phosphoric acid	Unknown
	July 23	Compressor oil	25 liters
	August 3	Sulphuric acid	Unknown
	September 30	Mercury	15 kilograms
	November 3	Sulphuric acid	434 kilograms
	December 8	Ammonium sulphate	12.3 metric tons
	December 11	Ammonium sulphate	12 metric tons
	December 16	Sulphuric acid (93%)	25 to 30 metric tons
1993	January 5	Mercury	Up to 7 kilograms
	January 7	Sulphuric acid (50 grams per liter)	13,000 metric tons
		Zinc sulphate (150 grams per liter)	600 kilograms
	March 14	Ammonia	Unknown
	June 10	Mercury	18 kilograms
	July 30	Sulphuric acid	10 metric tons
	September 4	Arsenic (dissolved)	60 to 65 kilograms
	November 3	Cadmium oxide	Unknown
	December 9	Arsenic (dissolved)	22 kilograms
1994	February 9	Arsenic	20 kilograms
	February 10	Mercury	1.3 kilograms
	March 5	Chlorine	< 1 kilogram
	June 1	Ammonium sulphate	2 cubic meters
	June 13	Ammonium Sulphate	Unknown
	July 4	Mercury	< 1 kilogram
	October 5	Ammonia	3,500 kilograms
	October 24	Zinc oxide	Unknown

TABLE 8 – REPORTED SPILLS FROM THE COMINCO SMELTER TO THE UPPER COLUMBIA RIVER 1987 TO 2001 ADAPTED FROM ENVIRONMENT CANADA SPILLTRACKER DATABASE			
Year	Date	Contaminant	Reported Quantity
1995	March 10	Dissolved Cadmium	70 kilograms
	March 22	Coal dust suspected	Unknown
	June 13	Zinc	960 kilograms
	June 25	Sulphuric acid	Approx. 1,000 liters
1996	January 17	Sulphuric acid and zinc	40,000 liters
	February 26	Fume lead slurry	3 cubic meters
	February 27	Sodium carbonate	3 cubic meters
		Zinc	0.5 kilogram
		Lead	0.3 kilogram
		Cadmium	0.01 kilogram
	April 7	White solution and foam	Unknown
	May 23	White discoloration	Unknown
	May 10	Slag	25 metric tons
	November 8	Barren Slag	35 metric tons
	December 31	White oxide dust	Unknown
1997	March 13	Dissolved cadmium and mercury	3,000 kilograms
	March 25	Dissolved cadmium	22 kilograms
	May 20	Acidic solution	Unknown
	July 23	Zinc slurry	500 kilograms
	December 17	Zinc and mercury	700 liters
1998	March 6	Slurry with arsenic	5 cubic meters
	April 7	Barren Slag	1 metric ton
	May 3	Cadmium solution	15 kilograms
	June 2	Total arsenic	20.36 kilograms
	August 20	Slag, lead, zinc, water	Approx. 25,000 liters
	October 24	Granulated Slag	15 minutes duration
	November 24	Arsenic	20 kilograms
	December 25	Zinc	87 kilograms
		Cadmium	3 kilograms
2000	February 18	Zinc	350 kilograms
		Cadmium compound	10.5 kilograms
2001	May 27	Oil	10 liters

Ref. 13, pp. 152-154; 14, p. 1, 2

In April 2010, a consultant for CCT collected a slag sample from the river bed of the UCR adjacent to the Cominco smelter outfalls. This sample was analyzed for Target Analyte List metals using EPA Method 6020, except for mercury, which was analyzed under EPA Method 7471. The slag sample was identified as 100 percent slag. Hazardous substances detected in this slag sample included antimony, arsenic, cadmium, chromium, copper, lead, nickel, zinc, and mercury [See **Section 2.2** (Source 1); **Table 2** of this HRS documentation record; Ref. 18, pp. 58, 61, 63, 72, 74, 77].

Given the historical discharges (i.e., hazardous substance spills into the UCR) from the Cominco facility, and the presence of slag in the UCR, it is evident that hazardous substances have entered the UCR by direct deposition; therefore, an observed release by direct observation is established.

Basis for Direct Observation: Le Roi Smelter

Slag was discharged from the furnaces at the Le Roi smelter directly into the UCR via underground waterways, also referred to as sluice boxes [see **Section 2.2 (Source 3)** of this HRS documentation record; Ref. 4, p. 24]. While in operation, the Le Roi smelter was one of the largest smelters on the West Coast, processing 500 tons of ore per day [Ref. 5, pp. 104, 105]. Historical photographs from 1901 show that piles of slag were being discharged along the banks of the UCR [Ref. 44, p. 10]. Facility maps from 1901 and 1908 depict five underground waterways (sluice boxes) transporting slag from five furnaces to discharge points on the UCR [Ref. 46, pp. 9-10]. In September 2004, EPA located three of these underground waterways/sluice boxes [Ref. 46, pp. 4, 13]. The sluice boxes were constructed of wood [Ref. 46, pp. 4, 17-22]. At least one contained a fine black powder material, presumed to be slag. Two grab samples of this material were analyzed on site for lead using a portable XRF unit [Ref. 46, pp. 4, 28]. XRF results detected concentrations of lead at 32,300 ppm and 10,400 ppm in these samples [Ref. 46, p. 4].

During the Remedial Investigation conducted by a consultant for the Washington State Department of Ecology in 2019, slag was observed in 101 of the 138 locations sampled along the UCR waterfront. Slag was usually visible as a distinct layer within the sediment or soil columns and it appeared as either black granulated material (similar to a coarse sand) or as clinkers. Most of the observed slag was either granular or mixed granular and clinker [Ref. 37, p. 10, 36-38]. Analytical results of sediment/slag samples collected from test pits on the southern shoreline of the UCR indicated the presence of hazardous substances [see **Table 7** of this HRS documentation record].

Given the fact that slag was discharged from the furnaces at the Le Roi smelter directly into the UCR via underground waterways (sluice boxes), and analytical results from sediment/slag samples, it is evident that hazardous substances have entered the UCR by direct deposition; therefore, an observed release by direct observation is established [Ref. 37, pp. 36-50].

Observed Release by Chemical Analysis

Sediment samples collected by consultants of Teck in 2019 from the UCR document the presence of metals at concentrations that meet the criteria for observed release by chemical analysis [Tables 11 and 13 of this HRS documentation record; Ref. 1, Section 4.1.2.1.1].

Notes on Sample Similarity:

Background sediment samples were collected from 18 locations of the UCR; all locations were located in Canada and upstream of the Cominco smelter facility [see Figure 2-1 of this HRS documentation record]. The background and release samples were handled the same procedurally and were similar physically, as follows:

- **Sampling Methods:** The background and release sediment samples were collected in September-October 2019 by consultants of Teck. Sample collection and analyses were conducted in accordance with an EPA-approved quality assurance project plan (QAPP) [Refs. 33, pp. 15; 34, pp. 63-87]. Depending on target strata at a sediment sampling location, one of three sampling devices was used to collect sediment samples (Van Veen power grab, Modified Hamon Grab, or freeze grab sampler). In areas too shallow for use of vessel-operated samplers, sediment samples were collected using stainless steel hand tools [Ref. 33, p. 31].
- **Analytical Procedures:** Sediment samples were analyzed by ALS Environmental for total metals (EPA Method 6020A) and total mercury (EPA Method 7471B) [Ref. 33, p. 381]. Data was validated in accordance with the Guidance for Labeling Externally Validated Laboratory Data for Superfund Use (EPA 540-R-08-005; 2009) and EPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Methods Data Review (EPA 540-R-2017-001; 2017) [Refs. 33, p. 55; 35, pp. 4, 25-33; 36, pp. 4, 13-21]. TOC and grain size analyses were performed via American Society for Testing and Materials (ASTM) Method D4129-05 and ASTM Method D422, respectively [Ref. 33, p. 381].
- **Physical Setting:** Twelve background sediment samples (i.e., REF001 through REF012) and all release samples were collected from free-flowing portions of the UCR. Six background sediment samples i.e., REF013 through REF018) were collected further upstream in a lacustrine zone of Lake Arrow Lake, which is upstream of the Keenleyside Dam [Ref. 33, p. 25].
- **Sampling Depth:** Background and release sediment samples were collected from a surface depth of 0 to 6 inches below sediment surface (bss) [Ref. 33, pp. 21, 24].
- **Percent Solids:** The percent solids in the background samples ranged from 41.2% to 92.7%, while the percent solids in the release samples ranged from 38.5% to 94.3% [see Tables 9 and 10 of this HRS documentation record].
- **Grain size:** Total fines (silt and clay) in background samples ranged from 0.07% to 56.1%, while total fines in release samples ranged from 0.08% to 88.1%. Total fines were higher in the background samples collected from the lacustrine zone of Lower Arrow Lake (i.e., Samples REF013 through REF018). The majority of release samples exhibit total fines within the background samples range of total fines [see Tables 9 and 10 of this HRS documentation record].
- **Total Organic Carbon (TOC):** TOC in background samples ranged from 0.046% to 7.07%, while TOC in release samples ranged from 0.065% to 2.94. As with grain size, TOC levels were higher in the background samples collected from the lacustrine zone of Lower Arrow Lake (i.e., REF013 through REF018) [see Tables 9 and 10 of this HRS documentation record].

Due to the similarities (i.e., same time frame, same sampling and analytical methods, same laboratories, similar physical setting and sampling depths, generally overlapping ranges of percent solids, grain size and TOC), background samples REF001 through REF012 and all release analytical results are comparable. Although total fines and TOC are elevated in Lower Arrow Lake background sediment samples REF013 through REF018 (compared to background samples REF001 through REF012), there are many similarities between Lower Arrow Lake background sediment samples and release samples (i.e., same timeframe, same sampling and analytical methods, same laboratories, and same sampling depths). Background and release sample physical characteristics are presented in Table 9 and Table 10. Maximum reported background concentrations for each hazardous substance is presented in Table 12. Background analytical results and release analytical results are presented in Table 11 and Table 13.

TABLE 9 – BACKGROUND SAMPLE PHYSICAL CHARACTERISTICS								
Field Sample ID	Lab ID No.	Sample Date	Depth below top of sediment (inches)	Solids (%)	TOC (%)	Total Fines (Silt and Clay) (%)	Sample Location/Rationale	References
REF013-SE-1-092419	K1908958-019	9/24/19	0–6	72.9	0.489	6.04	UCR at Lower Arrow Lake; upstream of Cominco Trail facility	Figure 2-1 ; 33, pp. 21, 367; 34, pp. 438, 513; 35, pp. 150, 201
REF014-SE-1-092619	K1909230-006	9/26/19	0–6	66.7	0.785	17.16	UCR at Lower Arrow Lake; upstream of Cominco Trail facility	Figure 2-1 ; 33, pp. 21, 367; 34, pp. 444, 520; 35, pp. 299, 344
REF015-SE-1-092619	K1909230-009	9/26/19	0-6	48.6	2.92	36.07	UCR at Lower Arrow Lake; upstream of Cominco Trail facility	Figure 2-1 ; 33, pp. 21, 367; 34, pp. 444, 519; 35, pp. 319, 346
REF016-SE-1-092519	K1908958-025	9/25/19	0–6	58.5	1.0	20.29	UCR at Lower Arrow Lake; upstream of Cominco Trail facility	Figure 2-1 ; 33, pp. 21, 367; 34, pp. 439, 517; 35, pp. 155, 202
REF017-SE-1-092519	K1908958-026	9/25/19	0-6	50.9	1.39	33.5	UCR at Lower Arrow Lake; upstream of Cominco Trail facility	Figure 2-1 ; 33, pp. 21, 367; 34, pp. 439, 517; 35, pp. 160, 203
REF018-SE-1-092519	K1908958-027	9/25/19	0-6	41.2	7.07	56.12	UCR at Lower Arrow Lake; upstream of Cominco Trail facility	Figure 2-1 ; 33, pp. 21, 367; 34 pp. 439, 516; 35, pp. 165, 204
REF001-SE-1092819	K1909230-18	9/28/19	0-6	87.1	0.046 J	0.09	UCR at Birchbank, BC; upstream of Cominco Trail facility	Figure 2-1 ; 33, pp. 21, 366; 34, pp. 445, 525; 35, pp. 234, 332
REF002-SE-092819	K1909230-017	9/28/19	0-6	92.7	0.061	0.1	UCR at Birchbank, BC; upstream of Cominco Trail facility	Figure 2-1 ; 33, pp. 21, 366; 34, pp. 445, 525; 35, pp. 239, 333
REF003-SE-1-092719	K1909230-011	9/27/19	0-6	72.9	0.073	0.77	UCR at Birchbank, BC; upstream of Cominco Trail facility	Figure 2-1 ; 33, pp. 21, 366; 34, pp. 444, 522; 35, pp. 244, 334
REF004-SE-1-092719	K1909230-012	9/27/19	0-6	84.7	0.166	1.49	UCR at Birchbank, BC; upstream of Cominco Trail facility	Figure 2-1 ; 33, pp. 21, 366; 34, pp. 444, 523; 35, pp. 249; 335
REF005-SE-1-100319	K1909500-003	10/3/19	0-6	85.0	0.062	0.2	UCR at Genelle, BC; upstream of Cominco Trail facility	Figure 2-1 ; 33, pp. 21, 365; 34, pp. 455, 538; 35, pp. 377, 404

TABLE 9 – BACKGROUND SAMPLE PHYSICAL CHARACTERISTICS								
Field Sample ID	Lab ID No.	Sample Date	Depth below top of sediment (inches)	Solids (%)	TOC (%)	Total Fines (Silt and Clay) (%)	Sample Location/Rationale	References
REF006-SE-1-100219	K1909230-027	10/2/19	0-6	80.3	0.225	0.92	UCR at Genelle, BC; upstream of Cominco Trail facility	Figure 2-1; 33, pp. 21, 365; 34, pp. 446, 535; 35, pp. 254, 336
REF007-SE-1-093019	K1909230-019	9/30/19	0-6	81.8	0.161	1.25	UCR at Genelle, BC; upstream of Cominco Trail facility	Figure 2-1; 33, pp. 21, 365; 34, pp. 445, 527; 35, pp. 259, 338
REF008-SE-1-093019	K1909230-020	9/30/19	0-6	91.3	0.069	0.38	UCR at Genelle, BC; upstream of Cominco Trail facility	Figure 2-1; 33, pp. 21, 365; 34, pp. 445, 528; 35, pp. 269, 339
REF009A-SE-1-100219	K1909230-028	10/2/19	0-6	74.5	0.058	0.35	UCR at Genelle, BC; upstream of Cominco Trail facility	Figure 2-1; 33, pp. 21, 365; 34, pp. 446, 533; 35, pp. 274, 340
REF010-SE-1-100319	K1909500-004	10/3/19	0-6	80.9	0.076	0.07	UCR at Genelle, BC; upstream of Cominco Trail facility	Figure 2-1; 33, pp. 21, 365, 34, pp. 455, 539; 35, pp. 382, 405
REF011-SE-1-100119	K1909230-022	10/1/19	0-6	72.7	0.062	0.62	UCR upstream of Genelle, BC; upstream of Cominco Trail facility	Figure 2-1; 33, pp. 21, 365; 34, pp. 445, 530; 35, pp. 279, 342
REF012-SE-1-100419	K1909500-005	10/4/19	0-6	71.8	0.231	7.44	UCR upstream of Genelle, BC; upstream of Cominco Trail facility	Figure 2-1; 33, pp. 21, 365; 34, pp. 455, 542; 35, pp. 387, 406

J = Quantitation is approximate due to limitations identified during the QA Review [Ref. 35 p. 36].

TABLE 10 – RELEASE SAMPLE PHYSICAL CHARACTERISTICS								
Field Sample ID	Lab ID No.	Sample Date	Depth below top of sediment (inches)	Solids (%)	TOC (%)	Total Fines (Silt and Clay) (%)	Sample Location/Rationale	References
DM045-SE-1-091919	K1908958-001	9/19/19	0-6	73.9	0.316	33.7	UCR – Deadman’s Eddy; Observed Release	Figure 2-2; 33, pp. 21, 24, 364; 34, pp. 437, 504; 35, pp. 96, 98, 179
DM050-SE-1-092019	K19089858-004	9/20/19	0-6	69.2	0.487	36.29	UCR – Deadman’s Eddy; Observed Release	Figure 2-2; 33, pp. 21, 24, 364; 34, pp. 437, 506; 35, pp. 102-103, 181
DM047-SE-1-101819	K1909828-006	10/18/19	0-6	78.3	0.208	1.7	UCR – Deadman’s Eddy; Observed Release	Figure 2-2; 33, pp. 21, 24, 364; 34, pp. 472, 567; 36, pp. 133-134
CB009-SE-1-101219	K1909753-011	10/12/19	0-6	73.9	0.415 J	4.34	UCR – China Bend; Observed Release	Figure 2-3; 33, pp. 21, 24, 363; 34, pp. 464, 628; 36, pp. 25-26
CB010-SE-1-101219	K1909753-012	10/12/19	0-6	73	0.404 J	5.49	UCR – China Bend; Observed Release	Figure 2-3; 33, pp. 21, 24, 363; 34, pp. 464, 629; 36, pp. 27-28
CB016-SE-1-101119	K1909753-008	10/11/19	0-6	74.2	0.275 J	1.52	UCR – China Bend; Observed Release	Figure 2-3; 33, pp. 21, 24, 363; 34, pp. 464, 626; 36, pp. 30-31
CB039-SE-1-101119	K1989753-010	10/11/19	0-6	81.7	0.103 J	0.13	UCR – China Bend; Observed Release	Figure 2-3; 33, pp. 21, 24, 363; 34, pp. 464, 624; 36, pp. 36, 38
JS001-SE-1-101019	K1909753-002	10/10/19	0-6	75.7	0.364 J	1.62	UCR – China Bend; Observed Release	Figure 2-3; 33, pp. 21, 24, 363; 34, pp. 464, 622; 36, pp. 66-67
JS002-SE-1-101019	K1909753-001	10/10/19	0-6	78.2	0.175 J	1.57	UCR – China Bend; Observed Release	Figure 2-3; 33, pp. 21, 24, 363; 34, pp. 464, 622; 36, pp. 68, 70
3-R8-2019-SE-1-101619	K1909754-014	10/16/19	0-6	84.5	0.132 J	0.25	UCR – China Bend; Observed Release	Figure 2-3; 33, pp. 21, 24, 363; 34, pp. 469, 634; 36, pp. 81-82
CB040-SE-1-101819	K1909828-004	10/18/19	0-6	58.4	0.180	1.65	UCR – China Bend; Observed Release	Figure 2-3; 33, pp. 21, 24, 363; 34, pp. 472, 638; 36, pp. 118-119
4-B1-2019-SE-1-092619	K1909230-013	9/26/19	0-6	91.6	0.084	1.31	UCR – Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 445, 585; 35, pp. 207-208, 324

TABLE 10 – RELEASE SAMPLE PHYSICAL CHARACTERISTICS								
Field Sample ID	Lab ID No.	Sample Date	Depth below top of sediment (inches)	Solids (%)	TOC (%)	Total Fines (Silt and Clay) (%)	Sample Location/Rationale	References
4-B6-2019-SE-1-092619	K1909230-014	9/26/19	0-6	93.4	0.065	0.29	UCR – Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 445, 585; 35, pp. 209-210, 325
EV001-SE-1-092619	K1909230-001	9/26/19	0-6	92.8	0.11	0.49	UCR at Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 444, 585; 35, pp. 211, 213, 326
EV005-SE-1-091119	K1908714-002	9/11/19	0-6	90	0.142	1.93	UCR at Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 427, 484; 35, pp. 46-47, 76
EV010-SE-1-091219	K1908714-007	9/12/19	0-6	81.5	0.163	0.99	UCR at Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 427, 487; 35, pp. 48-49, 77
EV013-SE-1-091319	K1908714-009	9/13/19	0-6	79.3	0.102	0.82	UCR at Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 427, 489; 35, pp. 52-53, 79
EV054-SE-1-091119	K1908714-004	9/11/19	0-6	40.05	2.79	75.68	UCR at Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 427, 484; 35, pp. 58-59, 81
EV063-SE-1-091019	K1908714-003	9/10/19	0-6	38.5	2.94	88.11	UCR at Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 427, 482; 35, pp. 62-63, 83
EV002-SE-1-092419	K1908958-015	9/24/19	0-6	92.9	0.075	0.12	UCR at Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 438, 579; 35, pp. 104, 106, 182
EV008-SE-1-092319	K1908958-012	9/23/19	0-6	90.3	0.081	1.32	UCR at Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 437, 577; 35, pp. 110-111, 185
EV027-SE-1-092119	K1908958-010	9/21/19	0-6	80	0.147	0.08	UCR at Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 437, 575; 35, pp. 114, 116, 187
EV037-SE-1-092319	K1908958-013	9/23/19	0-6	94.3	0.087	0.88	UCR at Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 438, 577; 35, pp. 118-119, 189
EV048-SE-1-092419	K1908958-017	9/24/19	0-6	91	0.099	0.79	UCR at Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 438, 580; 35, pp. 128-129, 192

TABLE 10 – RELEASE SAMPLE PHYSICAL CHARACTERISTICS								
Field Sample ID	Lab ID No.	Sample Date	Depth below top of sediment (inches)	Solids (%)	TOC (%)	Total Fines (Silt and Clay) (%)	Sample Location/Rationale	References
EV051-SE-1-092419	K1908958-015	9/24/19	0-6	88.1	0.195	0.77	UCR at Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 438, 580; 35, pp. 130-131, 193
EV065-SE-1-092519	K1908958-020	9/25/19	0-6	90.7	0.081	0.45	UCR at Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 438, 582; 35, pp. 136-138, 195
EV066-SE-1-092519	K1908958-022	9/25/19	0-6	87.8	0.125	1.98	UCR at Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 438, 582; 35, pp. 144-145, 198
EV069-SE-1-092519	K1908958-023	9/25/19	0-6	90.8	0.067	1.63	UCR at Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 438, 582; 35, pp. 146-147, 199
EV071-SE-1-092519	K1908958-024	9/25/29	0-6	88.6	0.139	0.5	UCR at Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 468, 583; 35, pp. 148-149, 200
EV072-SE-1-092619	K1909230-004	9/26/19	0-6	80.2	0.105	2.63	UCR at Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 444, 587; 35, pp. 230-231, 330
EV052-SE-1-092616	K1909230-003	9/26/19	0-6	89.0	0.253	1.57	UCR at Evans; Observed Release	Figure 2-4; 33, pp. 21, 24, 362; 34, pp. 444, 586; 35, pp. 226-227, 329

J = Quantitation is approximate due to limitations identified during the QA Review [Ref. 36, p. 24].

TABLE 11 – BACKGROUND SEDIMENT SAMPLE CONCENTRATIONS

Station Location	Hazardous Substance	Concentration (mg/kg)	RL	Reference
REF013-SE-1-092419	Antimony	0.054 J (0.106)	0.098	Figure 2-1; 35, p. 150; 19, pp. 8, 20
	Arsenic	0.89	0.49	Figure 2-1; 35, p. 150
	Cadmium	0.133	0.020	Figure 2-1; 35, p. 150
	Chromium	11.6	0.20	Figure 2-1; 35, p. 150
	Copper	3.89	0.2	Figure 2-1; 35, p. 150
	Lead	8.4	0.049	Figure 2-1; 35, p. 150
	Zinc	28.6	2.0	Figure 2-1; 35, p. 151
	Mercury	0.002 U	0.024	Figure 2-1; 35, p. 151
REF014-SE-1-092619	Antimony	0.131 J (0.259)	0.095	Figure 2-1; 35, p. 299; 19, pp. 8, 20
	Arsenic	1.26 J (2.192)	0.95	Figure 2-1; 35, p. 299; 19, pp. 8, 20
	Cadmium	0.256 J (0.360)	0.038	Figure 2-1; 35, p. 299; 19, pp. 8, 20
	Chromium	14.4	0.38	Figure 2-1; 35, p. 299
	Copper	6.03 J (7.356)	0.38	Figure 2-1; 35, p. 299; 19, pp. 8, 20
	Lead	12.9	0.095	Figure 2-1; 35, p. 299
	Zinc	37.4	1.9	Figure 2-1; 35, p. 300
	Mercury	0.010 U*	0.024	Figure 2-1; 35, p. 300
REF015-SE-1-092619	Antimony	0.5 J (0.990)	0.14	Figure 2-1; 35, p. 319; 19, pp. 8, 20
	Arsenic	4.7 J (8.178)	1.4	Figure 2-1; 35, p. 319; 19, pp. 8, 20
	Cadmium	1.1 J (1.551)	0.055	Figure 2-1; 35, p. 319; 19, pp. 8, 20
	Chromium	40.4	0.55	Figure 2-1; 35, p. 319
	Copper	21.5 J (26.230)	0.55	Figure 2-1; 35, p. 319; 19, pp. 8, 20
	Lead	59.1	0.14	Figure 2-1; 35, p. 319
	Zinc	90.8	2.7	Figure 2-1; 35, p. 320
	Mercury	0.030 U*	0.037	Figure 2-1; 35, p. 320
REF016-SE-1-	Antimony	0.04 U*	0.10	Figure 2-1; 35, p. 155

TABLE 11 – BACKGROUND SEDIMENT SAMPLE CONCENTRATIONS				
Station Location	Hazardous Substance	Concentration (mg/kg)	RL	Reference
092519	Arsenic	9.5	1.0	Figure 2-1; 35, p. 155
	Cadmium	0.229	0.04	Figure 2-1; 35, p. 155
	Chromium	20.4	0.4	Figure 2-1; 35, p. 155
	Copper	16.3	0.4	Figure 2-1; 35, p. 155
	Lead	10	0.1	Figure 2-1; 35, p. 155
	Zinc	47.2	2.0	Figure 2-1; 35, p. 156
	Mercury	0.013 J*	0.031	Figure 2-1; 35, pp. 25-32, 156; 19, pp. 6, 8, 20
REF017-SE-1-092519	Antimony	0.05 J (0.0990)	0.11	Figure 2-1; 35, p. 160; 19, pp. 8, 20
	Arsenic	4.6	1.1	Figure 2-1; 35, p. 160
	Cadmium	0.219	0.043	Figure 2-1; 35, p. 160
	Chromium	19.4	0.43	Figure 2-1; 35, p. 160
	Copper	19.2	0.43	Figure 2-1; 35, p. 160
	Lead	11.6	0.11	Figure 2-1; 35, p. 160
	Zinc	47.0	2.1	Figure 2-1; 35, p. 161
	Mercury	0.014 J*	0.035	Figure 2-1; 35, pp. 25-32, 161; 19, pp. 6, 8, 20
REF018-SE-1-092519	Antimony	0.28 J (0.554)	0.13	Figure 2-1; 35, p. 165; 19, pp. 8, 20
	Arsenic	3.2	1.3	Figure 2-1; 35, p. 165
	Cadmium	0.631	0.053	Figure 2-1; 35, p. 165
	Chromium	19.2	0.53	Figure 2-1; 35, p. 165
	Copper	19.9	0.53	Figure 2-1; 35, p. 165
	Lead	26.7	0.13	Figure 2-1; 35, p. 165
	Zinc	58.8	2.7	Figure 2-1; 35, p. 167
	Mercury	0.030 J*	0.046	Figure 2-1; 35, pp. 25-32, 167; 19, pp. 6, 8, 20
REF001-SE-1-092819	Antimony	0.04 UJ	0.11	Figure 2-1; 35, p. 234
	Arsenic	1.3 J (2.262)	1.1	Figure 2-1; 35, p. 234; 19, pp. 8, 20
	Cadmium	0.14 J (0.197)	0.044	Figure 2-1; 35, p. 234; 19, pp. 8, 20
	Chromium	4.95	0.44	Figure 2-1; 35, p. 234

TABLE 11 – BACKGROUND SEDIMENT SAMPLE CONCENTRATIONS				
Station Location	Hazardous Substance	Concentration (mg/kg)	RL	Reference
	Copper	4.89 J (5.965)	0.44	Figure 2-1; 35, p. 234; 19, pp. 8, 20
	Lead	6.80	0.11	Figure 2-1; 35, p. 234
	Zinc	27.8	2.2	Figure 2-1; 35, p. 235
	Mercury	0.002 U*	0.018	Figure 2-1; 35, p. 235
REF002-SE-1-092819	Antimony	0.033 UJ	0.083	Figure 2-1; 35, p. 239
	Arsenic	0.83 J (1.444)	0.83	Figure 2-1; 35, p. 239; 19, pp. 8, 20
	Cadmium	0.089 J (0.125)	0.033	Figure 2-1; 35, p. 239; 19, pp. 8, 20
	Chromium	5.88	0.33	Figure 2-1; 35, p. 239
	Copper	3.36 J (4.099)	0.33	Figure 2-1; 35, p. 239; 19, pp. 8, 20
	Lead	3.50	0.083	Figure 2-1; 35, p. 239
	Zinc	23.1	1.7	Figure 2-1; 35, p. 240
	Mercury	0.002 U	0.016	Figure 2-1; 35, p. 240
REF003-SE-1-092719	Antimony	0.005 UJ	0.13	Figure 2-1; 35, p. 244
	Arsenic	0.7 J (1.218)	1.3	Figure 2-1; 35, p. 244; 19, pp. 8, 20
	Cadmium	0.093 J (0.131)	0.051	Figure 2-1; 35, p. 244; 19, pp. 8, 20
	Chromium	9.09	0.51	Figure 2-1; 35, p. 244
	Copper	3.39 J (4.135)	0.51	Figure 2-1; 35, p. 244; 19, pp. 8, 20
	Lead	4.57	0.13	Figure 2-1; 35, p. 244
	Zinc	26.5	2.6	Figure 2-1; 35, p. 245
	Mercury	0.002 U	0.002	Figure 2-1; 35, p. 245
REF004-SE-1-092719	Antimony	0.204 J (0.403)	0.066	Figure 2-1; 35, p. 249; 19, pp. 8, 20
	Arsenic	1.94 J (3.375)	0.66	Figure 2-1; 35, p. 249; 19, pp. 8, 20
	Cadmium	0.196 J (0.276)	0.027	Figure 2-1; 35, p. 249; 19, pp. 8, 20
	Chromium	13.0	0.27	Figure 2-1; 35, p. 249
	Copper	4.98 J (6.075)	0.27	Figure 2-1; 35, p. 249; 19, pp. 8, 20
	Lead	24.2	0.066	Figure 2-1; 35, p. 249
	Zinc	62.5	1.3	Figure 2-1; 35, p. 250

TABLE 11 – BACKGROUND SEDIMENT SAMPLE CONCENTRATIONS				
Station Location	Hazardous Substance	Concentration (mg/kg)	RL	Reference
	Mercury	0.003 U*	0.015	Figure 2-1; 35, p. 250
REF005-SE-1-100319	Antimony	0.039 UJ	0.098	Figure 2-1; 35, p. 377
	Arsenic	0.85 J (1.479)	0.98	Figure 2-1; 35, p. 377; 19, pp. 8, 20
	Cadmium	0.091	0.039	Figure 2-1; 35, p. 377
	Chromium	7.87	0.39	Figure 2-1; 35, p. 377
	Copper	4.95 J (6.039)	0.2	Figure 2-1; 35, p. 377; 19, pp. 8, 20
	Lead	3.61 J (5.198)	0.098	Figure 2-1; 35, p. 377; 19, pp. 8, 20
	Zinc	22.9 J (34.350)	0.98	Figure 2-1; 35, p. 378; 19, pp. 8, 20
	Mercury	0.002 U	0.023	Figure 2-1; 35, p. 378
REF006-SE-1-100219	Antimony	0.034 UJ	0.085	Figure 2-1; 35, p. 254
	Arsenic	0.96	0.85	Figure 2-1; 35, p. 254
	Cadmium	0.203	0.034	Figure 2-1; 35, p. 254
	Chromium	9.48	0.34	Figure 2-1; 35, p. 254
	Copper	3.77	0.17	Figure 2-1; 35, p. 254
	Lead	5.64	0.085	Figure 2-1; 35, p. 254
	Zinc	36.1	0.85	Figure 2-1; 35, p. 255
	Mercury	0.002 U	0.018	Figure 2-1; 35, p. 255
REF007-SE-1-093019	Antimony	0.031 UJ	0.077	Figure 2-1; 35, pp. 259, 260
	Arsenic	1.49 J (2.592)	0.77	Figure 2-1; 35, p. 259; 19, pp. 8, 20
	Cadmium	0.104 J (0.146)	0.031	Figure 2-1; 35, p. 259; 19, pp. 8, 20
	Chromium	7.21	0.31	Figure 2-1; 35, p. 259
	Copper	4.41 J (5.380)	0.31	Figure 2-1; 35, p. 259; 19, pp. 8, 20
	Lead	5.18	0.077	Figure 2-1; 35, p. 259
	Zinc	33.9	1.5	Figure 2-1; 35, p. 261
	Mercury	0.002 U*	0.017	Figure 2-1; 35, p. 261
REF008-SE-1-	Antimony	0.034 UJ	0.084	Figure 2-1; 35, p. 269

TABLE 11 – BACKGROUND SEDIMENT SAMPLE CONCENTRATIONS				
Station Location	Hazardous Substance	Concentration (mg/kg)	RL	Reference
093019	Arsenic	0.95 J (1.653)	0.84	Figure 2-1; 35, p. 269; 19, pp. 8, 20
	Cadmium	0.093 J (0.131)	0.034	Figure 2-1; 35, p. 269; 19, pp. 8, 20
	Chromium	7.21	0.34	Figure 2-1; 35, p. 269
	Copper	3.97 J (4.843)	0.34	Figure 2-1; 35, p. 269; 19, pp. 8, 20
	Lead	4.18	0.084	Figure 2-1; 35, p. 269
	Zinc	29.7	1.7	Figure 2-1; 35, p. 270
	Mercury	0.002 U*	0.017	Figure 2-1; 35, p. 270
REF009A-SE-1-100219	Antimony	0.027 UJ	0.068	Figure 2-1; 35, p. 274
	Arsenic	0.66 J*	0.68	Figure 2-1; 35, pp. 25-32, 274; 19, pp. 6, 8, 20
	Cadmium	0.095	0.027	Figure 2-1; 35, p. 274
	Chromium	7.47	0.27	Figure 2-1; 35, p. 274
	Copper	3.75	0.14	Figure 2-1; 35, p. 274
	Lead	3.55	0.068	Figure 2-1; 35, p. 274
	Zinc	25.3	0.68	Figure 2-1; 35, p. 275
	Mercury	0.002 U	0.017	Figure 2-1; 35, p. 275
REF010-SE-1-100319	Antimony	0.035 UJ	0.088	Figure 2-1; 35, p. 382
	Arsenic	1.19	0.88	Figure 2-1; 35, p. 382
	Cadmium	0.106	0.035	Figure 2-1; 35, p. 382
	Chromium	7.12	0.35	Figure 2-1; 35, p. 382
	Copper	3.76 J (4.587)	0.18	Figure 2-1; 35, p. 382; 19, pp. 8, 20
	Lead	4.41 J (6.350)	0.088	Figure 2-1; 35, p. 382; 19, pp. 8, 20
	Zinc	24.5 J (36.750)	0.88	Figure 2-1; 35, p. 383; 19, pp. 8, 20
	Mercury	0.002 U	0.017	Figure 2-1; 35, p. 383
REF011-SE-1-100119	Antimony	0.04 UJ	0.11	Figure 2-1; 35, p. 279
	Arsenic	0.9 J*	1.1	Figure 2-1; 35, pp. 25-32, 279; 19, pp. 6, 8, 20
	Cadmium	0.11	0.042	Figure 2-1; 35, pp. 279
	Chromium	8.86	0.42	Figure 2-1; 35, pp. 279

TABLE 11 – BACKGROUND SEDIMENT SAMPLE CONCENTRATIONS				
Station Location	Hazardous Substance	Concentration (mg/kg)	RL	Reference
	Copper	3.34	0.21	Figure 2-1; 35, pp. 279
	Lead	5.12	0.11	Figure 2-1; 35, pp. 279
	Zinc	38.8	1.1	Figure 2-1; 35, p. 281
	Mercury	0.002 U	0.021	Figure 2-1; 35, p. 281
REF012-SE-1-100419	Antimony	0.04 UJ	0.11	Figure 4; 35, p. 387
	Arsenic	1.0 J (1.740)	1.1	Figure 2-1; 35, p. 387; 19, pp. 8, 20
	Cadmium	0.209	0.042	Figure 2-1; 35, p. 387
	Chromium	8.57	0.42	Figure 2-1; 35, p. 387
	Copper	3.72 J (4.538)	0.21	Figure 2-1; 35, p. 387; 19, pp. 8, 20
	Lead	9.72 J (13.996)	0.11	Figure 2-1; 35, p. 387; 19, pp. 8, 20
	Zinc	44.7 J (67.050)	1.1	Figure 2-1; 35, p. 388; 19, pp. 8, 20
	Mercury	0.002 U	0.018	Figure 2-1; 35, p. 388

mg/kg = milligrams per kilogram

J = Quantitation approximate due to limited restrictions identified during the QA review [Ref. 35, p. 36]

RL = Reporting limit; considered equivalent to the sample quantitation limit defined in the HRS Rule [Refs. 1, Sections 1.1 and 2.3; 35, p. 1].

U = The analyte was not detected at or above the associated detection limit [Ref. 35, p. 36]

U* = The analyte should be considered “not-detected” because it was detected in an associated blank at a similar level [Ref. 35, p. 36].

UJ = The analyte was not detected and the detection limit may be higher due to a low bias identified during the QA review [Refs. 35, p. 36; 36, p. 24]

Note – The J-qualified estimated results have been adjusted up to account for unknown bias per EPA Quick Reference Fact Sheet Using Qualified Data to Document an Observed Release and Observed Contamination. The adjustment factors are provided in the fact sheet and the adjusted results are in parentheses. Although J-qualified results are estimated, the presence of the analytes are not in question and the result is usable [Ref. 19, pp. 8, 20].

J* = Sample was qualified solely due to detection between the detection limit and the RL. These results are not considered biased per EPA Quick Reference Fact Sheet Using Qualified Data to Document an Observed Release and Observed Contamination; therefore, results were not adjusted [Ref. 19, p. 6].

Based on an evaluation of the above background concentrations, release samples will be compared to the highest background concentrations for each contaminant, as shown below:

TABLE 12 – OBSERVED RELEASE CRITERIA			
Matrix	Hazardous Substance	Maximum Background Concentration (mg/kg)	Observed Release Criteria RL or 3 x Background (mg/kg)
Sediment	Antimony	0.99*	2.97
	Arsenic	9.5	28.5
	Cadmium	1.55*	4.65
	Chromium	40.4	121.2
	Copper	26.23*	78.69
	Lead	59.1	177.3
	Zinc	90.8	272.4
	Mercury	0.030	0.09

Notes:

mg/kg – milligrams per kilogram (mg/kg) used for metal analytes.

* Adjusted concentration (in accordance with Reference 19, pp. 8, 20)

TABLE 13 – RELEASE SEDIMENT SAMPLE CONCENTRATIONS					
Sample ID No.	Hazardous Substance	Concentration (mg/kg)	RL (mg/kg)	Observed Release Criteria (mg/kg)	Reference
DM045-SE-1-091919	Antimony	7.11 J-	0.053	2.97	Figure 2-2; 35. P. 96; 19, p. 8
	Cadmium	7.12	0.021	4.65	Figure 2-2; 35. P. 96
	Copper	139	0.21	78.69	Figure 2-2; 35. P. 96
	Lead	440	0.053	177.3	Figure 2-2; 35. P. 96
	Zinc	2,780	110	272.4	Figure 2-2; 35, p. 98
	Mercury	1.94	0.12	0.09	Figure 2-2; 35, p. 98
DM050-SE-1-092019	Antimony	5.33 J-	0.045	2.97	Figure 2-2; 35, p. 102; 19, p. 8
	Cadmium	12.7	0.018	4.65	Figure 2-2; 35, p. 102
	Copper	142	0.18	78.69	Figure 2-2; 35, p. 102
	Lead	698	0.045	177.3	Figure 2-2; 35, p. 102
	Zinc	3,590	91	272.4	Figure 2-2; 35, p. 103
	Mercury	1.57	0.13	0.09	Figure 2-2; 35, p. 103
DM047-SE-1-101819	Antimony	10.4 J (5.25)	0.097	2.97	Figure 2-2; 36, p. 133; 19, pp. 8, 20
	Copper	514 J (421.31)	3.9	78.69	Figure 2-2; 36, p. 134; 19, pp. 8, 20
	Lead	1,170 J (812.5)	0.097	177.3	Figure 2-2; 36, p. 134; 19, pp. 8, 20
	Zinc	9,220 J (6,146.66)	19	272.4	Figure 2-2; 36, p. 134; 19, pp. 8, 20
CB009-SE-1-101219	Antimony	17.7 J (8.93)	0.086	2.97	Figure 2-3; 36, p. 25; 19, pp. 8, 20
	Copper	1,090	3.4	78.69	Figure 2-3; 36, p. 26
	Lead	772	0.086	177.3	Figure 2-3; 36, p. 26
	Zinc	14,100	17	272.4	Figure 2-3; 36, p. 26
CB010-SE-1-101219	Antimony	7.28 J (3.67)	0.11	2.97	Figure 2-3; 36, p. 27; 19, pp. 8, 20
	Copper	354	4.3	78.69	Figure 2-3; 36, p. 28
	Lead	390	0.11	177.3	Figure 2-3; 36, p. 28
	Zinc	5,570	21	272.4	Figure 2-3; 36, p. 28
	Mercury	0.305 J (0.166)	0.025	0.09	Figure 2-3; 36, p. 28; 19, pp. 8, 20
CB016-SE-1-101119	Antimony	9.54 J (4.81)	0.12	2.97	Figure 2-3; 36, p. 30; 19, pp. 8, 20
	Copper	549	4.7	78.69	Figure 2-3; 36, p. 31
	Lead	430	0.12	177.3	Figure 2-3; 36, p. 31
	Zinc	9,210	23	272.4	Figure 2-3; 36, p. 31
CB039-SE-1-101119	Antimony	49.5 J (25)	0.088	2.97	Figure 2-3; 36, p. 37; 19, pp. 8, 20
	Arsenic	30.7	0.88	28.5	Figure 2-3; 36, p. 37
	Chromium	125	0.35	121.2	Figure 2-3; 36, p. 38

TABLE 13 – RELEASE SEDIMENT SAMPLE CONCENTRATIONS					
Sample ID No.	Hazardous Substance	Concentration (mg/kg)	RL (mg/kg)	Observed Release Criteria (mg/kg)	Reference
	Copper	2,240	3.5	78.69	Figure 2-3; 36, p. 38
	Lead	461	0.088	177.3	Figure 2-3; 36, p. 38
	Zinc	18,500	18	272.4	Figure 2-3; 36, p. 38
JS001-SE-1-101019	Antimony	10.7 J (5.4)	0.12	2.97	Figure 2-3; 36, p. 66; 19, pp. 8, 20
	Copper	803	4.8	78.69	Figure 2-3; 36, p. 67
	Lead	534	0.12	177.3	Figure 2-3; 36, p. 67
	Zinc	11,100	24	272.4	Figure 2-3; 36, p. 67
JS002-SE-1-101019	Antimony	8.29 J (4.186)	0.11	2.97	Figure 2-3; 36, p. 68; 19, pp. 8, 20
	Copper	872	4.5	78.69	Figure 2-3; 36, p. 70
	Lead	671	0.11	177.3	Figure 2-3; 36, p. 70
	Zinc	15,200	23	272.4	Figure 2-3; 36, p. 70
3-R8-2019-SE-1-101619	Antimony	16.4 J (8.28)	0.077	2.97	Figure 2-3; 36, p. 81; 19, pp. 8, 20
	Arsenic	80.5	0.77	28.5	Figure 2-3; 36, p. 81
	Cadmium	5.01	0.031	4.65	Figure 2-3; 36, p. 82
	Copper	1,540	3.1	78.69	Figure 2-3; 36, p. 82
	Lead	5,520 J (3,833.33)	7.7	177.3	Figure 2-3; 36, p. 82; 19, pp. 8, 20
	Zinc	29,300	15	272.4	Figure 2-3; 36, p. 82
CB040-SE-1-101819	Antimony	21.2 J (10.70)	0.093	2.97	Figure 2-3; 36, p. 118; 19, pp. 8, 20
	Copper	1,170 J (959.01)	3.7	78.69	Figure 2-3; 36, p. 119; 19, pp. 8, 20
	Lead	648 J (450)	0.093	177.3	Figure 2-3; 36, p. 119; 19, pp. 8, 20
	Zinc	14,700 J (9,800)	19	272.4	Figure 2-3; 36, p. 119; 19, pp. 8, 20
4-B1-2019-SE-1-092619	Antimony	34.2 J (17.27)	0.094	2.97	Figure 2-4; 35, p. 207; 19, pp. 8, 20
	Chromium	123	0.38	121.2	Figure 2-4; 35, p. 207
	Copper	2,130 J (1,745.9)	0.38	78.69	Figure 2-4; 35, p. 207; 19, pp. 8, 20
	Lead	383	0.094	177.3	Figure 2-4; 35, p. 207
	Zinc	18,800	94	272.4	Figure 2-4; 35, p. 208
4-B6-2019-SE-1-092619	Antimony	26.8 J (13.53)	0.077	2.97	Figure 2-4; 35, p. 209; 19, pp. 8, 20
	Copper	1,830 J (1,500)	0.31	78.69	Figure 2-4; 35, p. 209; 19, pp. 8, 20
	Lead	503	0.077	177.3	Figure 2-4; 35, p. 209
	Zinc	18,900	77	272.4	Figure 2-4; 35, p. 210

TABLE 13 – RELEASE SEDIMENT SAMPLE CONCENTRATIONS					
Sample ID No.	Hazardous Substance	Concentration (mg/kg)	RL (mg/kg)	Observed Release Criteria (mg/kg)	Reference
EV001-SE-1-092619	Antimony	24.5 J (12.37)	0.078	2.97	Figure 2-4; 35, p. 211; 19, pp. 8, 20
	Copper	1,770 J (1,450.819)	0.31	78.69	Figure 2-4; 35, p. 211; 19, pp. 8, 20
	Lead	555	0.078	177.3	Figure 2-4; 35, p. 211
	Zinc	19,800	78	272.4	Figure 2-4; 35, p. 213
EV005-SE-1-091119	Antimony	29 J-	0.086	2.97	Figure 2-4; 35, p. 46; 19, p. 8
	Copper	1,900	17	78.69	Figure 2-4; 35, p. 46
	Lead	487	0.043	177.3	Figure 2-4; 35, p. 46
	Zinc	18,400	220	272.4	Figure 2-4; 35, p. 47
EV010-SE-1-091219	Antimony	26.7 J (13.484)	0.060	2.97	Figure 2-4; 35, p. 48; 19, pp. 8,
	Copper	1,340	0.24	78.69	Figure 2-4; 35, p. 48
	Lead	371	0.060	177.3	Figure 2-4; 35, p. 48
	Zinc	13,100	300	272.4	Figure 2-4; 35, p. 49
EV013-SE-1-091319	Antimony	26.8 J-	0.053	2.97	Figure 2-4; 35, p. 52; 19, p. 8
	Copper	1,540	0.21	78.69	Figure 2-4; 35, p. 52
	Lead	593	0.053	177.3	Figure 2-4; 35, p. 52
	Zinc	15,900	270	272.4	Figure 2-4; 35, p. 53
EV054-SE-1-091119	Cadmium	7.76	0.039	4.65	Figure 2-4; 35, p. 58
	Copper	139	0.39	78.69	Figure 2-4; 35, p. 58
	Lead	393	0.098	177.3	Figure 2-4; 35, p. 58
	Zinc	1,190	4.9	272.4	Figure 2-4; 35, p. 59
	Mercury	1.53	0.033	0.09	Figure 2-4; 35, p. 59
EV063-SE-1-091019	Cadmium	10.2	0.045	4.65	Figure 2-4; 35, p. 62
	Copper	172	0.45	78.69	Figure 2-4; 35, p. 62
	Lead	462	0.11	177.3	Figure 2-4; 35, p. 62
	Zinc	1,290	5.7	272.4	Figure 2-4; 35, p. 63
	Mercury	1.28	0.047	0.09	Figure 2-4; 35, p. 63
EV002-SE-1-092419	Antimony	25.9 J-	0.089	2.97	Figure 2-4; 35, p. 104; 19, p. 8
	Copper	1,870	8.9	78.69	Figure 2-4; 35, p. 104
	Lead	382	0.044	177.3	Figure 2-4; 35, p. 104
	Zinc	17,200	89	272.4	Figure 2-4; 35, p. 106
EV008-SE-1-092319	Antimony	26.8 J-	0.080	2.97	Figure 2-4; 35, p. 110; 19, p. 8
	Copper	1,970	8	78.69	Figure 2-4; 35, p. 110
	Lead	541	0.04	177.3	Figure 2-4; 35, p. 110
	Zinc	19,300	80	272.4	Figure 2-4; 35, p. 111
EV027-SE-1-092119	Antimony	24.1 J-	0.083	2.97	Figure 2-4; 35, p. 114; 19, p. 8
	Copper	1,530	8.3	78.69	Figure 2-4; 35, p. 114
	Lead	429	0.042	177.3	Figure 2-4; 35, p. 114
	Zinc	14,400	83	272.4	Figure 2-4; 35, p. 116
EV037-SE-1-092319	Antimony	21.5 J-	0.069	2.97	Figure 2-4; 35, p. 118; 19, p. 8
	Copper	1,790	6.9	78.69	Figure 2-4; 35, p. 118

TABLE 13 – RELEASE SEDIMENT SAMPLE CONCENTRATIONS					
Sample ID No.	Hazardous Substance	Concentration (mg/kg)	RL (mg/kg)	Observed Release Criteria (mg/kg)	Reference
	Lead	369	0.035	177.3	Figure 2-4; 35, p. 118
	Zinc	17,400	69	272.4	Figure 2-4; 35, p. 119
EV048-SE-1-092419	Antimony	30.7 J-	0.093	2.97	Figure 2-4; 35, p. 128; 19, p. 8
	Copper	1,950	9.3	78.69	Figure 2-4; 35, p. 128
	Lead	403	0.047	177.3	Figure 2-4; 35, p. 128
	Zinc	16,400	93	272.4	Figure 2-4; 35, p. 129
EV051-SE-1-092419	Antimony	33.9 J-	0.098	2.97	Figure 2-4; 35, p. 130; 19, p. 8
	Copper	2,180	9.8	78.69	Figure 2-4; 35, p. 130
	Lead	480	0.049	177.3	Figure 2-4; 35, p. 130
	Zinc	18,500	98	272.4	Figure 2-4; 35, p. 131
EV065-SE-1-092519	Antimony	32.8 J-	0.086	2.97	Figure 2-4; 35, p. 136; 19, p. 8
	Copper	2,260	8.6	78.69	Figure 2-4; 35, p. 136
	Lead	464	0.043	177.3	Figure 2-4; 35, p. 136
	Zinc	19,600	86	272.4	Figure 2-4; 35, p. 138
EV066-SE-1-092519	Antimony	30.6 J-	0.086	2.97	Figure 2-4; 35, p. 144; 19, p. 8
	Chromium	124	0.17	121.2	Figure 2-4; 35, p. 144
	Copper	2,300	8.6	78.69	Figure 2-4; 35, p. 144
	Lead	373	0.043	177.3	Figure 2-4; 35, p. 144
	Zinc	19,700	86	272.4	Figure 2-4; 35, p. 145
EV069-SE-1-092519	Antimony	33 J-	0.093	2.97	Figure 2-4; 35, p. 146; 19, p. 8
	Copper	2,410	9.3	78.69	Figure 2-4; 35, p. 146
	Lead	448	0.047	177.3	Figure 2-4; 35, p. 146
	Zinc	20,900	93	272.4	Figure 2-4; 35, p. 147
EV071-SE-1-092519	Antimony	34.3 J-	0.086	2.97	Figure 2-4; 35, p. 148; 19, p. 8
	Chromium	126	0.17	121.2	Figure 2-4; 35, p. 148
	Copper	2,460	8.6	78.69	Figure 2-4; 35, p. 148
	Lead	465	0.043	177.3	Figure 2-4; 35, p. 148
	Zinc	20,500	86	272.4	Figure 2-4; 35, p. 149
EV072-SE-1-092619	Antimony	46.8 J (23.636)	0.086	2.97	Figure 2-4; 35, p. 230; 19, pp. 8, 20
	Chromium	133	0.34	121.2	Figure 2-4; 35, p. 230
	Copper	2,310 J (1,893.443)	0.34	78.69	Figure 2-4; 35, p. 230; 19, pp. 8, 20
	Lead	457	0.086	177.3	Figure 2-4; 35, p. 230
	Zinc	20,600	86	272.4	Figure 2-4; 35, p. 231
EV052-SE-1-092619	Antimony	32.6 J (16.464)	0.089	2.97	Figure 2-4; 35, p. 226; 19, pp. 8, 20
	Copper	1,700	0.36	78.69	Figure 2-4; 35, p. 226
	Lead	435	0.089	177.3	Figure 2-4; 35, p. 226
	Zinc	16,700	89	272.4	Figure 2-4; 35, p. 227

mg/kg = milligrams per kilogram

J = Quantitation approximate due to limited restrictions identified during the QA review [Refs. 35, p. 36; 36, p. 24].

J- = Quantitation approximate, but the result may be biased low. [Refs. 35, p. 36; 36, p. 24].

RL = Reporting limit; considered equivalent to the sample quantitation limit defined in the HRS Rule [Refs. 1, Sections 1.1 and 2.3; 35, p. 1].

U = The analyte was not detected at or above the associated detection limit [Refs. 35, p. 36; 36, p. 24].

UJ = The analyte was not detected, and the detection limit may be higher due to a low bias identified during the QA review [Refs. 35, p. 36; 36, p. 24].

Note – The J-qualified estimated results have been adjusted up to account for unknown bias per EPA Quick Reference Fact Sheet Using Qualified Data to Document an Observed Release and Observed Contamination. The adjustment factors are provided in the fact sheet and the adjusted results are in parentheses. Although J-qualified results are estimated, the presence of the analytes are not in question and the result is usable [Ref. 19, pp. 8, 20].

Additional Sediment samples confirming an Observed Release by Chemical Analysis:

It should be noted that there are additional sediment samples from the 2019 Teck Phase 3 Sediment Study which meet the criteria for an observed release to surface water; however, they were not included due to the sheer volume of data. These samples were not included because they were collected near sediment samples already included in documenting an observed release to surface water. In addition, the current samples and associated data used resulted in a maximized score of the surface water migration pathway. These sediment samples and associated data are included in References 35 and 36.

Attribution

Analytical results from sediment samples collected in September and October 2019 by consultants of Teck as part of a Phase 3 sediment study document an observed release by chemical analysis to the UCR. The UCR is contaminated with heavy metals from the U.S.-Canada border to RM 708 near Marcus, Washington, an approximate 35-mile stretch of river [see **Section 4.1.2.1.1** of this HRS documentation record]. Although sediment samples were collected from three areas of concern which are several miles apart, contamination does exist between these areas. A Phase 2 Sediment study was previously conducted by a consultant of Teck and when this sediment data is combined with the Phase 3 data, the 35-mile stretch encompassing the zone of contamination exhibits nearly continuous contamination [Ref. 66, pp. 3-162]. Sources associated with each smelter included in this HRS documentation record [see **Section 2.2** of this HRS documentation record] have contributed to commingling of metals contamination in the UCR [see **Section 4.1.2.1.1** of this HRS documentation record] and impact the targets on the UCR including fisheries, wetlands, and a Federal-designated threatened species habitat [Sections 4.1.3.3.1, 4.1.3.3.2.2, and 4.1.4.3.1.2 of this HRS documentation record].

Previous sediment investigations within the UCR have also documented contamination to the UCR from sources associated with both smelters. In 2001, consultants for EPA conducted an expanded site inspection (ESI) of the UCR. As part of the investigation, sediment samples were collected from the UCR from RM 675 (approximately 35 RMs downstream of the Evan's area) to RM 745 (approximately at the U.S.-Canada border) and from within tributaries to the river within this segment. Analytical results from this investigation indicated widespread contamination in lake and river sediments throughout the UCR between Inchelium, Washington and the U.S.-Canada border. Arsenic, cadmium, copper, lead, mercury, and zinc were detected at concentrations significantly above background sample concentrations, which were collected from Lower Arrow Lake by the Washington State Department of Ecology [Ref. 4, pp. 66, 71-85]. During this investigation, several sediment samples collected from the UCR consisted of a visibly dark glassy sandy mixture characterized by EPA field personnel as slag [Ref. 4, p. 93]. The ESI sampling program also included the collection of sediment samples from the mouths of 110 tributaries located along the UCR to determine other potential sources of contamination. Analytical results from tributary samples did not indicate the presence of elevated contaminants of interest indicative of major watershed sources of contamination [Refs. 4, pp. 165-217, 226-227; 17, pp. 62-63].

Source 1 (i.e., Cominco Outfalls Slag) is located approximately 10 RMs upstream of the U.S.-Canada border and was scored based on an observed release by direct observation from outfalls that discharge effluent and slag contaminated with metals directly to the UCR [see Source 1 discussion **Section 2.2** of this HRS documentation record]. Although the most upstream scored observed release sample is located at Deadman's Eddy, approximately 17 RMs downstream of the Cominco outfalls, contamination of the UCR does exist between the Cominco facility and the most upstream scored observed release sample located in Deadman's Eddy [see **Figure 3** of this HRS documentation record]. In 2010, a consultant for CCT collected sediment samples from the UCR at locations both upstream and downstream of the Cominco outfalls. Analytical results of sediment samples collected during this investigation indicates that concentrations of these metals increased markedly downstream (compared to sediment samples collected upstream) of the Cominco smelter and remained at elevated levels at four U.S. sampling sites across the U.S. border; the most downstream sample being collected upstream of the Le Roi smelter. Background sediment samples were collected upstream of the Cominco smelter in Genelle and just downstream of the Keenleyside Dam [Ref. 18, pp. 58, 72, 74]. In addition, analytical results of a slag sample collected near the Cominco smelter indicated the presence of metals including antimony, arsenic, cadmium, chromium, copper, lead, nickel, zinc, and mercury [see **Section 2.2** of this HRS documentation record; Ref. 18, pp. 36, 58, 63, 74].

From the Cominco smelter outfalls, metals contamination extends downstream along the UCR where it commingles with releases associated with the Le Roi smelter. In 1897, the Le Roi smelter began refining copper, lead, and silver ores from mines in northeast Washington, as well as copper ore from British Columbia, Canada [Ref. 5, p. 104]. By 1908, this smelter was one of the largest smelters on the West Coast, processing 500 tons of ore per day [Ref. 5, p. 105]. The smelter was closed and dismantled in 1922, after 24 years of sporadic operation [Ref. 5, p. 105]. During its operation, slag was discharged from the furnaces at the Le Roi smelter directly into the UCR via underground waterways, also referred to as sluice boxes (i.e., Source 3) [see **Section 2.2** of this HRS documentation record; Ref.

4, p. 22-24]. Historical photographs from 1901 show that piles of slag were being discharged along the banks of the UCR [Ref. 44, p. 10]. Facility maps from 1901 and 1908 depict five underground waterways (sluice boxes, grouped as three passage areas) transporting slag from furnaces to discharge points on the UCR [Refs. 4, p. 24; 46, pp. 9-10].

In 2019, an RI of the Northport Waterfront was conducted by a consultant of the Washington State Department of Ecology. This area included the shoreline of the UCR where slag wastes were previously discharged directly to the UCR by the Le Roi smelter. This investigation was conducted because no cleanup actions were ever conducted to address nearshore sediments contamination and the bank impacted by smelter waste and debris, including slags that were historically deposited along the shoreline or within the UCR. During this investigation, slag materials, (as both clinker and fine granulated particles) were noted to be widespread on the beach, the hillside leading to the UCR as well as in the UCR [Ref. 37, pp. 6, 7, 36-38]. During the RI, sediment/slag samples were collected from test pits advanced along the UCR waterfront [Ref. 37, pp. 8, 9, 35]. The samples were collected from locations along the southern shoreline of the UCR [Ref. 37, p. 35]. Analytical results from these samples indicated the presence of high concentrations of several metals [see **Section 2.2.2; Table 7** of this HRS documentation record].

The presence of slag along the shores of the UCR has been documented from Trail B.C., the location of the Cominco smelter, to RM 708 in Washington State indicating Cominco and Le Roi smelters as the sources for this contamination [see **Section 2.2** of this HRS documentation record].

Metals associated with Cominco smelter and the Le Roi smelter sources were detected at concentrations significantly above those concentrations detected in background sediment samples; therefore, at least some portion of the significant increase of these metals in observed release samples in the UCR is attributable to a release from sources associated with both smelters [**Table 11; Table 13** of this HRS documentation record; Ref. 1, Section 4.1.2.1.1].

Other Possible Sites

In addition to contamination from sources (associated with the two smelters) scored in this HRS evaluation, other potential sources of hazardous substances that may have contributed to contamination include mining and milling operations and pulp and paper production [see **Figures 2-1 and 5** of this HRS documentation record]. These contaminant sources are summarized in the following paragraphs.

Celgar Pulp Mill - The Celgar Pulp Company (Celgar) bleach kraft pulp mill is an additional source of hazardous substance contamination to the Columbia River, however, it is not included as a source in this HRS documentation record since this document has been limited to sources of inorganic contamination and the Celgar mill is instead a source of dioxin/furan contamination. The Celgar mill is in Castlegar, B.C., approximately 30 RMs upstream from the U.S.-Canada border [**Figure 2-1** of this HRS documentation record; Ref. 22, p. 20]. From 1961 until mid-1993, the mill primarily used chlorine in its bleaching process [Ref. 4, p. 31]. The pulp mill discharged effluent containing chlorinated organic compounds, including dioxins and furans, into the Columbia River [Ref. 4, p. 31].

Bonanza Mill - The Bonanza Mill is located approximately 3 miles northwest of Colville, Washington, on the Colville River, a tributary of the Columbia River. The site is a former lead and zinc mill that operated from 1885 to 1952 [Ref. 7, p. 8, 9]. The facility contained a 100-ton flotation mill that processed ore using amalgamation, leaching, and/or flocculation, each of which utilized inorganic elements including mercury [Ref. 7, p. 8]. As a result of milling activities, approximately 17,500 cubic yards of tailings and waste rock were spread across the facility [Ref. 7, p. 11]. Analytical results of tailings/waste rock samples indicate the presence of significant concentrations of arsenic, barium, cadmium, cobalt, copper, lead, manganese, mercury, silver, and zinc [Ref. 7, pp. 30-31 (Table 6-1)]. Further, analytical results of sediment samples collected from the Colville River indicate the presence of lead at an elevated concentration and analytical results of sediment samples collected from on-site ditches draining to the Colville River indicate the presence of elevated concentrations of arsenic, barium, copper, lead, manganese, mercury, silver, and zinc [Ref. 7, pp. 19, 89, 91-92, 94, and 95]. After these sampling efforts, consultants for the EPA conducted a removal action at the facility which included placing 12 to 18 inches of either rock or clay barrier over exposed contaminated mine wastes [Ref. 47, pp. 3, 4]. The Bonanza Mill is not believed to be a source of the zone of contamination as scored in this HRS documentation record, as the Colville River discharges to the UCR downstream of the zone of contamination [Ref. 7, pp. 34, 36].

Young America Mine/Mill – The Young America Mine is located approximately 3.6 miles northwest of Evans and is accessible from Highway 25 via Hutson Jones Way [Ref. 59, p. 5]. The site consists of two areas. The mine portion is located on the eastern side of Highway 25 and is located on land managed by the U.S. Bureau of Land Management (BLM). The mill and tailings impoundment portion of the site is located on four privately-owned parcels west of Highway 25 near the UCR. The mine operated between 1897 and 1953, mining zinc, lead, silver, and gold. The flotation mill was built (by Gregor Mines, Inc.) in the late 1940s and operated from 1948 to 1954. Tailings resulting from the mining operations were discharged downhill towards the west into an impoundment area located in the mill portion of the site. The estimated volume of tailings in the impoundment area is 9,500 cubic yards [Ref. 59, p. 7]. XRF screening in July 2011 indicated the presence of lead above screening levels in the following areas: the berm material surrounding the impoundment; soil beneath the cover in the impoundment; soil along the roadway on site; soil within 50 feet outside the berm perimeter, and material on the hill below the mine portion of the site [Ref. 59, p. 9]. XRF screening for lead west of the impoundment area between the impoundment and the UCR did not indicate lead levels above screening levels (i.e., 250 mg/kg) [Ref. 59, p. 14]. Laboratory analyses from soil samples collected from the mine and mill portions of the site indicated the presence of lead, arsenic, cadmium, and manganese above EPA Regional Screening Levels (RSLs) [Ref. 59, p. 9]. In 2012, EPA conducted a TCRA to consolidate and cap contaminated soil and tailings in the area around and below the mill buildings. Mill buildings were crushed in place, the existing cap was removed on the impoundment and the tailings and contaminated soil were capped with a liner and local material. The TCRA was completed on November 3, 2012 [Refs. 60, p. 2; 61, p. 2]. In the 2021 HHRA conducted by EPA, it was determined that there was no evidence that contamination moved down-river from the Young America Mine mill impoundment [Ref. 17, p. 62].

Hahnlen Property – The Hahnlen Property is located approximately 3.6 miles northeast of Evans, WA on the east side of Highway 25. The UCR shoreline is located approximately 800 feet west of the property. The Young America Mine is located to the east of the Hahnlen Property and a flotation mill associated with the Young America Mine was built on the western side of Highway 25. An aerial tram was used to transport ore from the mine to the mill from 1948 to 1954. The Hahnlen Property is believed to have become contaminated when mine ore was transported through it to the mill across Highway 25 [Ref. 58, p. 7]. Between October 31, 2012 and November 3, 2012, EPA performed a removal action which consisted of the identification and covering of soil contaminated with lead above the site-specific action level of 250 mg/kg of lead [Ref. 58, p. 6]. XRF measurements were collected on site and lead was detected at elevated concentrations ranging from 494 to 4,868 mg/kg [Ref. 58, p. 8]. Contaminated soil within the delineated boundaries were covered with native soils [Ref. 58, p. 6]. Approximately 31,568 square feet of lead-contaminated soil was covered with a liner; clean soil from a nearby source was placed on the liner [Ref. 58, p. 14].

Mines and Mills – Stevens County, Washington

In 2001, EPA conducted PA/SI investigations at 39 mines and mills in Stevens County, Washington. In addition to the Le Roi smelter, four sites were recommended for further action under CERCLA; an additional site (Sierra Zinc Mine/Mill) was later recommended for further action under CERCLA [Ref. 30, p. 1]. These sites are summarized below:

Anderson Calhoun Mine/Mill

The Anderson Calhoun Mine/Mill is located 1 mile north of Leadpoint, Washington, on the west side of Deep Creek, a tributary of the Columbia River [5, pp. 136-137]. The mine/mill is a former lead and zinc mine/mill that is reported to have been in operation from 1948 to 1952 [Ref. 5, p. 136]. The mine/mill contains a tailings pile measuring 555 feet by 500 feet by an unknown depth, a waste rock pile measuring 120 feet by 80 feet by 20 feet deep, an evaporation pond measuring 105 feet by 50 feet, and a mine pit measuring 100 feet by 50 feet [Ref. 5, pp. 6-136, 139]. Analytical results documented significant concentrations of copper and mercury in the tailings pile. Lead and zinc were detected in water from the mine pit [Ref. 5, p. 140]. EPA removal action activities occurred at the site in 2010 [Ref. 17, p. 68]. The Anderson Calhoun Mine/Mill is not believed to be a source of contamination to the UCR, as analytical results from a tributary sample (TS105) collected from Deep Creek at its confluence with the UCR during the 2001 ESI did not exhibit significant concentrations of metals [Ref. 4, pp. 215-216, 227, 451].

Last Chance Mine/Mill

The Last Chance Mine/Mill is located approximately 5 miles southeast of Northport, Washington, near Deep Creek, a tributary of the UCR. The facility is a former lead, silver, and zinc mine/mill that produced 5,937,708 pounds of lead; 18,567 pounds of silver and 110,110 pounds of zinc between 1904-1954 [Ref. 5, pp. 30, 114]. The facility was developed by four adits and more than 1,000 feet in open cuts and trenches [Ref. 5, p. 114]. Ore processing was conducted in a 60-ton gravity-flotation mill [Ref. 5, p. 115]. Two waste rock piles are present at the facility: one measuring 1,320 feet by 75 feet by 2 feet deep and the other measuring 75 feet by 45 feet by an unknown depth [Ref. 5, p. 115]. Analytical results of waste rock samples indicate the presence of significant concentrations of cadmium, lead, mercury, thallium, and zinc [Ref. 5, pp. 175 (Table 6-13), 176, 235 (Figure 6-24)]. A tailings pile is also present at the facility [Ref. 5, p. 115]. This tailings pile is irregularly shaped and at its longest length and width measures 600 feet by 105 feet with a depth of approximately 3 feet [Ref. 5, p. 115, 235 (Figure 6-24)]. Analytical results of tailings samples indicate the presence of significant concentrations of cadmium, lead, mercury, and zinc [Ref. 5, p. 175 (Table 6-13), 176, 235 (Figure 6-24)]. Further, an unnamed intermittent creek passes through one of the waste rock piles and the tailings pile as it flows toward Deep Creek [Ref. 5, p. 235 (Figure 6-24)]. The Last Chance Mine/Mill is not believed to be a source of contamination to the UCR, as analytical results from a tributary sample (TS105) collected from Deep Creek at its confluence with the UCR during the 2001 ESI did not exhibit significant concentrations of metals [Ref. 4, pp. 215-216, 227, 451].

L-Bar/Northwest Magnesite

L-Bar/Northwest Magnesite facility is located approximately two miles south of Chewelah, Washington, on the south bank of the Colville River, a tributary of the UCR. The facility is a former magnesite plant that opened in 1916 and closed in 1968. In the mid-1970s, the facility was converted to recover magnesium from a magnesium processing byproduct commonly referred to as flux bar. The magnesium recovery facility was closed in 1991 [Ref. 5, p. 78]. It has been demonstrated that flux bar and flux bar residue materials are sources of ammonia and chloride [Ref. 5, p. 79]. Ammonia and chloride have been detected in shallow groundwater, soils, and in surface water in two on-site ditches, at least one of which drains to the Colville River [Ref. 5, p. 79]. River sampling demonstrated a slight increase in ammonia and chloride [Ref. 5, p. 79]. A Cleanup Action Plan prepared by Ecology and finalized in June 2000 contains cleanup actions including source removal, monitoring, and institutional controls [Ref. 5, p. 79]. The L-Bar/Northwest Magnesite site is not believed to be a source of the zone of contamination as scored in this HRS documentation record, as the Colville River discharges to the UCR downstream of the zone of contamination [Ref. 5, pp. 258, 299].

Van Stone Mine/Mill

The Van Stone Mine/Mill is located approximately 11 miles south of Northport, Washington, on Onion Creek, a tributary of the Columbia River. The facility is a former cadmium, lead, and zinc mine/mill that contains two tailings piles, a waste rock storage area, an open pit, a seepage pond, and stained soil areas [Ref. 5, pp. 94, 96]. Tailings from ore processing were slurried via a wooden flume to pile locations [Ref. 5, p. 95]. Waste rock was hauled and dumped into storage areas [Ref. 5, p. 96]. The dimensions on the tailings piles and waste rock pile were not determined, however, at least one of the tailings piles stands up to 50 feet above ground surface [Ref. 5, p. 95]. Analytical results of tailings samples indicate the presence of significant concentrations of lead, manganese, mercury, and zinc [Ref. 5, pp. 160-165 (Table 6-6), 166]. Analytical results of waste rock samples indicate the presence of significant concentrations of cadmium, lead, mercury, and zinc [Ref. 5, pp. 158-160 (Table 6-6), 166]. Several unnamed creeks flow through the facility grounds to Onion Creek [Ref. 5, pp. 221 (Figure 6-13), 223 (Figure 6-14), and 262]. Surface water runoff from the tailings piles and the waste rock area drains to these unnamed creeks [Ref. 5, pp. 221 (Figure 6-13), 262, 223 (Figure 6-14)]. Analytical results of a sediment sample collected at the probable point of entry from one of the tailings piles to an adjacent unnamed creek indicate the presence of elevated concentrations of lead and zinc [Ref. 5, pp. 167 (Table 6-7), 168 and 223 (Figure 6-14)]. The Van Stone Mine/Mill underwent a removal action in 2017 [Ref. 17, p. 68]. The Van Stone Mine/Mill is not believed to be a source of contamination to the UCR, as analytical results from a tributary sample (TS099) collected from Onion Creek at its confluence with the UCR during the 2001 ESI did not exhibit significant concentrations of metals [Ref. 4, pp. 213-214, 227, 450].

Sierra Zinc Mine/Mill

The Sierra Zinc Mine/Mill is located approximately 17 miles south of Northport, Washington, on the west side of Deep Creek, a tributary of the Columbia River. The mine/mill is a former gold, lead, silver, and zinc mine/mill that operated sporadically from 1909 to 1952 [Ref. 5, pp. 30, 124]. The mine/mill contains a tailings pile measuring 1,000 feet by 2,100 feet by approximately 20 feet deep and a waste rock pile measuring 100 feet by 50 feet by 5 feet deep [Ref. 5, pp. 124-125]. Analytical results document significant concentrations of cadmium, copper, lead, mercury, and zinc in both the tailings pile and the waste rock pile [Ref. 5, p. 126]. The Sierra Zinc Mine/Mill underwent removal actions in 2001 and 2002 [Ref. 17, pp. 67-68]. The Sierra Zinc Mine/Mill also underwent a removal action in 2017 [Ref. 17, p. 68]. The Sierra Zinc Mine/Mill is not believed to be a source of contamination to the UCR, as analytical results from a tributary sample (TS105) collected from Deep Creek at its confluence with the UCR during the 2001 ESI did not exhibit significant concentrations of metals [Ref. 4, pp. 215-216, 227, 451].

Mines and Mills – Pend Oreille County, Washington

In 2001-2002, EPA conducted PA/SI investigations at 21 mines and mills in Pend Oreille County, Washington. During this investigation, a total of five sites were recommended for further action under CERCLA. Three of the sites have since had their status changed to no further remedial action planned (NFRAP) [Ref. 31, p. 1]. The remaining sites are summarized below:

Josephine Mine

The Josephine Mine is a former zinc, lead, silver, and cadmium mine located in the Metaline mining district. The mine area consisted of a shaft, a waste rock pile, a small building, and collapsing wood structure. The mine is located directly across the Pend Oreille River from the Pend Oreille Mine/Mill. Analytical results of a sediment sample at the probable point of entry of a waste rock pile to the Pend Oreille River documented significant concentrations of cadmium, lead, mercury, silver, and zinc [Ref. 6, pp. 50-53, 133]. The Josephine Mine underwent a removal action; the site was deemed to have localized contaminant concentrations that met EPA requirements for a removal action; however, the Josephine Mine was not identified as a source of contamination to the UCR site [Ref. 17, p. 62].

Grandview Mine/Mill

The Grandview Mine/Mill is located in the lower Pend Oreille River Valley, approximately 0.75 mile from the east bank of the Pend Oreille River, approximately 2 miles northeast of Metaline Falls, Washington. Source areas identified on site included a tailings pile, waste rock piles, and an abandoned container and drum area. Analytical results from sampling events conducted in 2000 and 2001 indicated that the Grandview Mine/Mill is a source of hazardous substance contamination to groundwater drinking water wells, an unnamed spring, a former wastewater ditch, and the Pend Oreille River. Contaminants detected at elevated concentrations in a sediment sample collected from the Pend Oreille River included cadmium, copper, lead, and zinc [Ref. 6, pp. 52-53, 134-135]. The Grandview Mine/Mill underwent a removal action; the site was deemed to have localized contaminant concentrations that met EPA requirements for a removal action; however, the Grandview Mine/Mill was not identified as a source of contamination to the UCR site [Ref. 17, p. 62].

Hazardous Substances Released:

Antimony
Arsenic
Cadmium
Chromium
Copper
Lead
Zinc
Mercury

Observed Release Factor Value: 550

4.1.3.2 Human Food Chain Threat - Waste Characteristics

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

TABLE 14 - TOXICITY/PERSISTENCE/BIOACCUMULATION							
Hazardous Substance	Source Number	Present in OR	Toxicity Factor Value	Persistence Factor Value*	Fresh Water Food Chain Bioaccumulation Factor Value**	Toxicity/Persistence/Bioaccumulation Factor Value (HRS Table 4-16)	Ref. 2 Page
Antimony	1, 2, 3	X	10,000	1	5	5×10^4	2
Arsenic	1, 2, 3	X	10,000	1	5	5×10^4	7
Cadmium	1, 2, 3	X	10,000	1	50,000	5×10^8	12
Chromium	1, 3	X	10,000	1	5	5×10^4	17
Copper	1, 2, 3	X	100	1	50,000	5×10^6	22
Lead	1, 2, 3	X	10,000	1	5,000	5×10^7	27
Mercury	1, 2, 3	X	10,000	1	50,000	5×10^8	32
Nickel	1, 2		10,000	1	5	5×10^4	37
Silver	1, 2		100	1	50	5×10^3	42
Zinc	1, 2, 3	X	10	1	500	5×10^3	47

OR = Observed Release

* Persistence factor value for rivers [Ref. 1, Sections 4.1.2.2.1.2 and 4.1.3.2.1.2]

** Bioaccumulation potential factor value for freshwater [Ref. 1, Section 4.1.3.2.1.3]

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

4.1.3.2.2 Hazardous Waste Quantity

TABLE 15 - HAZARDOUS WASTE QUANTITY		
Source Number	Source Hazardous Waste Quantity (HWQ) Value (HRS Section 2.4.2.1.5)	Is source hazardous constituent quantity data complete? (yes/no)
1	4,313,132.10	No
2	0.12	No
3	>0	No
Sum of Values:	4,313,132	
Hazardous Waste Quantity Factor Value	1,000,000	

The sum corresponds to a hazardous waste quantity factor value of 1,000,000 in HRS Table 2-6 [Ref. 1, Section 2.4.2.2]. However, the HRS states that if any target is subject to Level I or Level II concentrations, assign either the value for Table 2-6 or a value of 100, whichever is greater, as the hazardous waste quantity factor value for that pathway [Ref. 1, Section 2.4.2.2]. Therefore, a hazardous waste quantity factor value of 1,000,000 is assigned for the surface water migration pathway.

Hazardous Waste Quantity Factor Value: 1,000,000
[Ref. 1, Table 2-6]

4.1.3.2.3 Waste Characteristics Factor Category Value

Mercury and cadmium are documented in observed releases and associated with Sources 1, 2, and 3, which have a surface water pathway containment factor value greater than 0 for the watershed and correspond to a toxicity/persistence factor value of 10,000 and bioaccumulation potential factor value of 50,000, as shown above [Ref. 1, Section 4.1.3.2.1.4; 2, pp. 12, 32].

$$\begin{aligned} &(\text{Toxicity/Persistence Factor Value}) \times (\text{Hazardous Waste Quantity Factor Value}) = \\ &10,000 \times 1,000,000 = 1 \times 10^{10} \\ &(\text{Subject to a maximum of } 1 \times 10^8) \\ &[\text{Ref. 1, Section 4.1.3.2.3}] \end{aligned}$$

$$\begin{aligned} &(\text{Toxicity/Persistence Factor Value} \times \text{Hazardous Waste Quantity Factor Value}) \times \\ &(\text{Bioaccumulation Potential Factor Value}) = (1 \times 10^8) \times (50,000) = 5 \times 10^{12} \\ &(\text{Subject to a maximum of } 1 \times 10^{12}) \\ &[\text{Ref. 1, Section 4.1.3.2.3}] \end{aligned}$$

The resulting waste characteristics product of 1×10^{12} corresponds to a Waste Characteristics Factor Category Value of 1,000 in Table 2-7 of the HRS [Ref. 1, Section 2.4.3.1].

Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8
Hazardous Waste Quantity Factor Value: 1,000,000
Waste Characteristics Factor Category Value: 1,000

4.1.3.3 Human Food Chain Threat - Targets

The zone of actual contamination is the area of the UCR between the most upstream PPE (PPE1) and farthest downstream observed release sample (EV001-SED-1-092619). As stated previously, contamination and targets are not scored for the portion of the UCR located in Canada (i.e., between PPE1 and the U.S.-Canada border). Scored contamination and targets are evaluated for the U.S. portion of the zone of contamination, which encompasses a length of approximately 35 miles [Figure 3 of this HRS documentation record].

There is an observed release of metals contaminants to the UCR [see Section 4.1.2.1.1 of this HRS documentation record], which is used for consumption fishing. Species caught for consumption in the UCR from the U.S.-Canada border to Marcus Washington (and within the scored zone of actual contamination) include walleye, sturgeon, rainbow trout, kokanee, and northern pike [Refs. 24, p. 1; 56, p. 1]. The original north boundary of the Colville Indian Reservation was the Canadian border; this former “North Half” of the Colville Indian Reservation continues to be an important homeland to the CCT. The CCT exercises certain management and regulatory authority in this area from the northern boundary of the current reservation north to the Canadian border, bounded by the Okanogan and Columbia rivers. CCT-owned land and individual tribal members reside on the North Half and use the lands, waters, and natural resources for cultural and subsistence uses as they do on the reservation [Refs. 17, p. 61; 20, pp. 1-2; 21, pp. 1-2, 4].

The Washington State Department of Health (WSDH) has a fish advisory in place for the consumption of various fish due to mercury and polychlorinated biphenyl (PCB) concerns. The advisory covers the portion of the UCR from the U.S.-Canada border to the Grand Coulee Dam. Guidelines are in place for the consumption of species within the UCR including kokanee, lake whitefish, rainbow trout, white sturgeon, northern pike, burbot, longnose sucker, mountain whitefish, smallmouth bass, walleye, largescale sucker, and largemouth bass. A do-not-eat advisory is in place for northern pikeminnow [Ref. 23, p. 1]. A WSDH fish consumption advisory Technical Summary (dated July 2012) identifies the Teck smelter as a primary source of metals and other chemical contaminants in the UCR [Ref. 52, p. 1].

4.1.3.3.1 Food Chain Individual

As noted in **Sections 4.1.2.1.1 and 4.1.3.2.1**, an observed release of hazardous substances associated with Sources 1, 2, and 3 and having a bioaccumulation potential factor value of 500 or greater has been documented in the UCR. There is Level II contamination of a fishery [see **Sections 4.1.2.1.1, 4.1.3.2.1, and 4.1.3.3** of this HRS documentation record]. Therefore, a food chain individual factor value of 45 is assigned [Ref. 1, Section 4.1.3.3.1].

Sample IDs: DM045-SE-1-091919 (and others)
Hazardous Substance(s): Mercury, Cadmium, Copper
Bioaccumulation Potential: 50,000
References: Ref. 1, Sections 4.1.2.1.1; 2, pp. 12, 17, 32; 24, p. 1; **Table 13** of this HRS documentation record

Food Chain Individual Factor Value: 45

SWOF/Food Chain-Level I/Level II Concentrations/Potential Contamination

4.1.3.3.2 Population

4.1.3.3.2.1 Level I Concentrations

The Level I concentrations factor value is 0 because there are no fisheries subject to Level I concentrations [Ref. 1, Section 4.1.3.3.2.1].

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Level I Concentrations Factor Value: 0

4.1.3.3.2.2 Level II Concentrations

The zone of actual contamination is the area of the UCR between the most upstream PPE (PPE1) and farthest downstream observed release sample (EV001-SED-1-092619). As stated previously, contamination and targets are not scored for the portion of the UCR located in Canada (i.e., between PPE1 and the U.S.-Canada border). Scored contamination and targets are evaluated for the U.S. portion of the zone of contamination, which encompasses a length of approximately 35 miles [Figure 3 of this HRS documentation record]. The scored zone of actual contamination in the UCR is used for consumption fishing [Refs. 24, p. 1; 56, p. 1]. Species caught for consumption in the scored zone of actual contamination include walleye, sturgeon, rainbow trout, kokanee and northern pike [Refs. 24, p. 1, 56, p. 1].

The food chain production for the fishery is not documented, so based on the aforementioned information, the fishery is assigned to the category “Greater than 0 to 100 pounds per year,” which corresponds to the assigned human food chain population value of 0.03 in Table 4-18 of the HRS [Ref. 1, Section 4.1.3.3.2.2]. The available documentation demonstrates that fishing for human consumption occurs within the scored zone of actual contamination delineated by metals detected in sediment samples at concentrations meeting observed release criteria (i.e., significantly above background and attributable to the site); therefore, the target fishery is evaluated for Level II actual contamination [Figure 3 of this HRS documentation record; Ref. 1, Section 4.1.3.3; 24, p. 1].

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Level II Concentrations Factor Value: 0.03

4.1.3.3.2.3 Potential Human Food Chain Contamination

The potential human food chain contamination value is not scored because the site already receives a listing-eligible site score based on other factors.

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Potential Human Food Chain Contamination Factor Value: NS

4.1.4.2 Environmental Threat - Waste Characteristics

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation**TABLE 16 - ECOTOXICITY/PERSISTENCE/BIOACCUMULATION**

Hazardous Substance	Source Number	Present in OR	Fresh Water Ecotoxicity Factor Value	Persistence Factor Value*	Fresh Water Ecosystem Bioaccumulation Factor Value**	Ecotoxicity/Persistence/Bioaccumulation Factor Value (HRS Table 4-21)	Ref. 2 Page
Antimony	1, 2, 3	X	1	1	5	5	2
Arsenic	1, 2, 3	X	10	1	50,000	5×10^5	7
Cadmium	1, 2, 3	X	10,000	1	50,000	5×10^8	12
Chromium	1, 3	X	10,000	1	500	5×10^6	17
Copper	1, 2, 3	X	1,000	1	50,000	5×10^7	22
Lead	1, 2, 3	X	1,000	1	50,000	5×10^7	27
Mercury	1, 2, 3	X	10,000	1	50,000	5×10^8	32
Nickel	1, 2		100	1	50,000	5×10^6	37
Silver	1, 2		10,000	1	50	5×10^5	42
Zinc	1, 2, 3	X	10	1	50,000	5×10^5	47

OR = Observed Release

* Persistence factor value for rivers [Ref. 1, Sections 4.1.2.2.1.2 and 4.1.4.2.1.2]

** Ecosystem bioaccumulation potential factor value for freshwater [Ref. 1, Section 4.1.4.2.1.3]

Ecosystem Toxicity/Persistence/Environmental Bioaccumulation Factor Value: 5×10^8 4.1.4.2.2 Hazardous Waste Quantity

TABLE 17 - HAZARDOUS WASTE QUANTITY		
Source Number	Source Hazardous Waste Quantity (HWQ) Value (HRS Section 2.4.2.1.5)	Is source hazardous constituent quantity data complete? (yes/no)
1	4,313,132.10	No
2	0.12	No
3	>0	No
Sum of Values:	4,313,132	

The sum corresponds to a hazardous waste quantity factor value of 1,000,000 in HRS Table 2-6 [Ref. 1, Section 2.4.2.2]. The HRS states that if any target is subject to Level I or Level II concentrations, assign either the value for Table 2-6 or a value of 100, whichever is greater, as the hazardous waste quantity factor value for that pathway [Ref. 1, Section 2.4.2.2]. Therefore, a hazardous waste quantity factor value of 1,000,000 is assigned for the surface water migration pathway.

Hazardous Waste Quantity Factor Value:
1,000,000 [Ref. 1, Table 2-6]

4.1.4.2.3 Waste Characteristics Factor Category Value

Cadmium and mercury are documented in observed releases and associated with Sources 1, 2, and 3, which have a surface water pathway containment factor value greater than 0 for the watershed, correspond to an ecotoxicity/persistence factor value of 10,000 and bioaccumulation potential factor value of 50,000, as shown above [Refs. 1, Section 4.1.4.2.1.4; 2, pp. 12, 32]

$$\begin{aligned} &(\text{Ecotoxicity/persistence factor value}) \times (\text{hazardous waste quantity factor value}) = \\ &10,000 \times 1,000,000 = 1 \times 10^{10} \\ &(\text{Subject to a maximum of } 1 \times 10^8) \\ &[\text{Ref. 1, Section 4.1.4.2.3}] \end{aligned}$$

$$\begin{aligned} &(\text{Ecotoxicity/persistence factor value} \times \text{hazardous waste quantity factor value}) \times \\ &(\text{bioaccumulation potential factor value}) = (1 \times 10^8) \times (50,000) = 5 \times 10^{12} \\ &(\text{Subject to a maximum of } 1 \times 10^{12}) \\ &[\text{Ref. 1, Section 4.1.4.2.3}] \end{aligned}$$

The value of 1×10^{12} corresponds to a waste characteristics factor category value of 1,000 in Table 2-7 of the HRS [Ref. 1, Section 2.4.3.1].

Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value:	5×10^8
Hazardous Waste Quantity Factor Value:	1,000,000
Waste Characteristics Factor Category Value:	1,000

4.1.4.3 Environmental Threat - Targets

The zone of actual contamination is the area of the UCR between the most upstream PPE (PPE1) and farthest downstream observed release sample (EV001-SED-1-092619). As stated previously, contamination and targets are not scored for the portion of the zone of contamination located in Canada (i.e., between PPE1 and the U.S.-Canada border). Scored contamination and targets are evaluated for the U.S. portion of the zone of contamination, which encompasses a length of approximately 35 miles [Figure 3 of this HRS documentation record]. There is one Federal-designated threatened species and 3.7 miles of HRS-eligible wetland frontage in the scored zone of contamination [Figure 6; Refs. 24, p. 1; 26, p. 1, 27, p. 1; 42, pp. 1-6; 56, p. 1]. There are no media-specific benchmarks for sediment, so the target sensitive environment is subject to Level II concentrations [Ref. 1, Sections 2.5 and 4.1.4.3].

4.1.4.3.1 Sensitive Environments4.1.4.3.1.1 Level I Concentrations

The Level I concentrations factor value is 0 because there are no sensitive environments subject to Level I concentrations [Ref. 1, Section 4.1.4.3.1.1].

Level I Concentrations Factor Value: 0

4.1.4.3.1.2 Level II Concentrations

There are no media-specific benchmarks for sediment; therefore, the target sensitive environment located within the zone of actual contamination is subject to Level II concentrations [Ref. 1, Sections 2.5 and 4.1.4.3].

Sensitive Environments

Habitat known to be used by the Bull Trout (*Salvelinus confluentus*), a Federal-designated threatened species, is subject to Level II concentrations [Refs. 1, Section 4.1.4.3; 24, p. 1, 26, p. 1; 27, p. 1; 56, p. 1]. USFWS indicates that the range for Bull Trout includes the portion of the UCR which encompasses the zone of contamination (i.e., from the U.S.-Canada border to Marcus, WA) [Figure 3 of this HRS documentation record; Ref. 51, p. 1-2, the range is denoted by the green line].

TABLE 18 - LEVEL II CONCENTRATIONS – SENSITIVE ENVIRONMENTS			
Sensitive Environment	Distance from PPE to Nearest Point of Sensitive Environment	Sensitive Environment Value (HRS Table 4-23)	Reference
Habitat known to be used by Federal-designated Threatened species - Bull Trout (<i>Salvelinus confluentus</i>)	0 miles	75	Refs. 24, p.1; 26, p. 1; 27, p. 1; 51, pp. 1-2; 56, p. 1

Wetlands

TABLE 19 - LEVEL II CONCENTRATIONS – WETLANDS			
Sensitive Environment	Wetland Frontage subject to Level II Contamination	Sensitive Environment Value (HRS Table 4-24)	Reference
Palustrine Wetlands	3.7 miles	100	Ref. 42, p. 1; Figure 6

Wetland Value: 100

Sensitive Environments Value: 75

Sum of Sensitive Environments Value + Wetland Value: 175

Level II Concentrations Factor Value: 175

4.1.4.3.1.3 Potential Contamination

The potential contamination factor value is not scored because the site already receives a listing-eligible site score based on other factors.

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Potential Contamination Factor Value: NS

5.0 SOIL EXPOSURE AND SUBSURFACE INTRUSION PATHWAY

5.1 SOIL EXPOSURE COMPONENT

5.1.0 GENERAL CONSIDERATIONS

Based on the 2021 EPA RSE sampling results, the entirety of AOC A covers a residential area to the southwest of the former Le Roi smelter. From September 18 through September 28, 2021, EPA collected 30-point composite soil samples from residential properties in Northport, WA [Ref. 38, pp. 12, 14; **Figure 4** of this HRS documentation record]. Analytical results show the presence of arsenic and lead in residential surface soils at concentrations significantly above published background levels [see **Tables 6 and 20** of this HRS documentation record]. All samples were collected from the top 2 feet of soil (i.e., 0 to 2 feet bgs) and the areas of the properties encompassing the 30-point composite soil samples were located within 200 feet of the on-property residences [Ref. 38, pp. 266, 274, 276, 280, 298, 302, 304, 306, 308, 310, 320, 328, 338, 340, 344, 348, 350]. Contaminated soil within this residential area is associated with historical aerial deposition from the Cominco smelter as well as emissions from the Le Roi smelter (when operations occurred in the early 1900s).

It should be noted that based on results from the 2021 RSE, EPA conducted TCRAs at properties with lead concentrations above 630 ppm [Ref. 57, p. 1]. Resident populations associated with these properties are not scored.

Letter by which this area is to be identified: A

Name and description of the area: Residential Contaminated Soil

Area of Observed Contamination Type: Contaminated Soil

AOC A is defined by a polygon bounded by soil contamination meeting HRS observed contamination criteria (i.e., locations showing lead and arsenic at concentrations significantly above published background levels and collected from the top 2 feet of soil) [see **Figure 4**; **Table 20** of this HRS documentation record; Ref. 38, pp. 266, 274, 276, 280, 298, 302, 304, 306, 308, 310, 314, 320, 328, 338, 340, 344, 348, 350; 39, pp. 51-52]. Typically, all soil within the AOC between sample locations documenting observed contamination, excluding areas covered by impervious surfaces, is inferred as contaminated soil. However, since EPA has conducted removal activities at many properties in the Northport area dating back to 2003 [see **Site Summary** section of this HRS documentation record], not all properties were included within the AOC polygon; for the purpose of determining the hazardous waste quantity area and resident population for the AOC, a conservative approach was taken and only contaminated properties from the 2021 RSE sampling event, that did not have soil removals, were included in the calculation. In addition, regarding calculating the size of the AOC, an HRS conservative approach was taken and an area measure of >0 is assigned.

EPA has identified 16 properties with dwellings that are affected by the AOC. Four of these properties are subject to Level I contamination of arsenic (based on sample results greater than the cancer risk screening concentration benchmark of 0.772 mg/kg); 12 properties are subject to Level II contamination of lead (no benchmark established) [**Figure 4**; **Tables 21 and 22** of this HRS documentation record; Ref. 2, pp. 10, 30].

Location of the area, with reference to a map of the site:

The AOC is in a residential area to the southwest of the former Le Roi smelter property [**Figure 4** of this HRS documentation record].

Chemical Analysis showing the observed contamination:

From September 18 through September 28, 2021, EPA collected surface soil samples from a residential area of Northport, WA located southwest of the former Le Roi smelter. Samples were analyzed for arsenic and lead using Superfund Analytical Methods (SFAM) 01.0 or EPA 3050B+6010D/Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES) on the <150 µm fraction. Data validation was performed by EPA following EPA's Stage 4

Data Validation Electronic/Manual Process (S4VEM) and in accordance with the EPA CLP Statement of Work for Inorganic Superfund Methods (EPA, 2020a), EPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (2009), and National Functional Guidelines for Inorganic Superfund Data Review (EPA, 2020b), where applicable to the analyses performed [Ref. 38, pp. 12, 17].

Upon completion of a property owner/representative interview, EPA determined decision units (DUs) and EPA assigned DU types to areas of the property. The sampling depth was based on the soil depth interval that people are most likely to come in contact with. The sampling depth for yards, driveways, and play areas were typically at 0 to 1 inch bgs; gardens and other landscaped areas were at tilling depth, the depth to which a given garden was excavated before adding organic fill (generally 0 to 12 inches). In addition, any sampling that occurred at tilling depth required hand tools to carefully remove the top material prior to sampling [Ref. 38, p. 12-14].

Each DU dimension was measured and recorded by Global Positioning System (GPS), and thirty-point composite sample aliquot locations were flagged at approximately equally spaced increments within each DU. Sample aliquot locations were adjusted to account for impedances to equal spacing that included irregular DU area shape, vehicles, abandoned equipment, permanent yard fixtures, debris, vegetation, and terrain. A soil sample was composited from the thirty aliquots within each DU [Ref. 38, p. 14].

Each DU was sampled at pre-determined depths using a Multi-Incremental Sampling Tool (MIST) and a 2.5-inch diameter barrel sampler. For a given DU, a 30-point composite sample was typically collected at the 0 to 1 inch bgs or tilling depth interval. For the purposes of this evaluation, bgs is synonymous with below the organic layer of soil. In DUs that were filled with non-native fill material (i.e., gardens filled with gardening soil or mulch, playgrounds filled with mulch, or driveways filled with gravel) 1-inch sample aliquots were collected from anywhere between 0 and 12 inches below perceived fill material. For example, the 6 to 7 inches bgs tilling depth interval aliquots collected from each of the thirty aliquot locations were placed in a 1-gallon plastic sample bag, composited into a single sample, and then stored in a sample cooler [Ref. 38, p. 14-15].

Sample analytical results for surface soil samples with concentrations meeting the criteria for observed contamination (i.e., three times the published background concentration) are presented in **Table 20** below. See **Table 6** for published background concentrations used in evaluating and reference citations.

Background Soil Concentration Discussion - Use of Published Data

No background soil samples were collected during the 2021 RSE investigation.

Since the Columbia River Valley has been impacted by historical metals pollution from emissions from smelters in in Trail B.C. and Northport, Washington, published data for northeast Washington was used to evaluate background soil concentrations [Ref. 39, p. 11]. The Washington State Department of Ecology Publication 19-03-014 (i.e., Upland Regional Soil Background Characterization for Select Metals in Northeast Washington Watersheds), included as Reference 39 of this HRS documentation record, was used to evaluate background soil concentrations. The analyses within this publication established natural background metals values that represent upper-percentile thresholds in soils in 11 state-defined watersheds (Water Resource Inventory Areas [WRIAs]) [Ref. 39, p. 7]. This publication noted that historic metals pollution from smelter emissions in the Upper Columbia River Valley occurred in the study area for much of the 20th century. This pollution was due to emissions from the smelters in Trail B.C. and Northport, Washington [Ref. 39, p. 11]. It is important to note that values used to determine background metals concentrations were from WRIA 61, which is specific to Upper Lake Roosevelt (not the entire Northeastern Washington study area). In addition, soil data for samples collected within WRIA 61 were collected as part of investigations of upland soil conditions in the Upper Columbia River. These studies focused on areas of northern Stevens County [Ref. 39, pp. 16, 39]. The values used in this publication represent conservative upper percentile thresholds (90th percentile) within WRIA 61 [Ref. 39, pp. 13, 51-52]. The study concluded that concentrations of certain metals (cadmium, lead, zinc) in upland soil surfaces (within the smelter-impacted WRIA 61 watershed) represent definitive metal enrichment resulting from historical anthropogenic activity, primarily as the result of smelting operation emissions [Ref. 39, p. 29].

It should be noted that the soil concentrations for lead and arsenic detected in background soil sample NSBK02SS (collected during the 2001 PA/SI at the Le Roi smelter) were lower than published concentrations. PA/SI background sample NSBK02SS had a lead concentration of 57 mg/kg; the published data concentration for lead was 99 mg/kg. For arsenic, PA/SI background sample NSBK02SS had an arsenic concentration of 2.7 mg/kg; the published data concentration for lead was 11 mg/kg. An HRS conservative approach for the 2021 RSE samples was taken and the published data for arsenic and lead [see **Table 6** of this HRS documentation record] were used to determine observed contamination.

Based on a review of the above considerations, the background soil concentration data from this publication is considered appropriate for comparison of samples collected during the RSE to establish observed contamination.

TABLE 20 - AREA OF OBSERVED CONTAMINATION SAMPLE ANALYTICAL RESULTS (AOC A)

Hazardous Substance	Sample ID	Property ID	Depth (in. bgs)	Sample Date	3x Maximum Background, or Highest Reporting Detection Limit (0–2 ft. bgs)	Result mg/kg	CRQL mg/kg	References
Arsenic	JEAP6	5	11-12	9/26/21	33	40	1	38, pp. 228-230, 249, 274-275, 353, 2,207, 2,241; 39, p. 51
	JEAK0	08	0-1	9/21/21		33	1	38, pp. 90-91, 177-179, 198, 280-281, 356, 986, 1,026; 39, p. 51
	JEAM5	21	0-1	9/24/21		33	1	38, pp. 94, 200-202, 204, 306-307, 354, 1,618, 1,636; 39, p. 51
	JEAH8	23	6-7	9/20/21		60	1	38, pp. 88-89, 177-179, 187, 310-311, 355, 983, 1,015; 39, p. 51
	JDHG2	53	0-1	9/27/21		38	1	38, pp. 96, 205-207, 220, 348-349, 357, 1,903, 1,931; 39, p. 51
Lead	JEAH0	01	0-1	9/19/21	297	530	1	38, pp. 87, 177-179, 182, 266-267, 353, 983, 1,010; 39, p. 52
	JEAN7	6	0-1	9/26/21		380	1	38, pp. 95, 228-230, 240, 276-277, 353, 2,206, 2,232; 39, p. 52
	JEAM6	17	0-1	9/24/21		310	1	38, pp. 94, 228-231, 298-299, 354, 2,206, 2,223; 39, p. 52
	JEAQ2	19	6-7	9/26/21		600	1	38, pp. 95, 251-253, 258, 302-303, 354, 2,477, 2,529; 39, p. 52
	JEAQ1	19	0-1	9/26/21		370	1	38, pp. 95, 251-253, 257, 302-303, 354, 2,477, 2,528; 39, p. 52
	JEAJ7	20	0-1	9/21/21		580	1	38, pp. 90-91, 177-179, 195, 304-305, 354, 986, 1,023; 39, p. 52
	JEAJ6	22	6-7	9/21/21		540	1	38, pp. 90-91, 177-179, 194, 308-309, 355, 986, 1,022; 39, p. 52
	JEAJ5	22	0-1	9/21/21		420	1	38, pp. 90-91, 177-179, 193, 308-309, 355, 986, 1,021; 39, p. 52
	JEAJ2	25	0-1	9/20/21		570	1	38, pp. 89, 177-179, 191, 314-315, 355, 986, 1,019; 39, p. 52
	JEAQ7	29	0-1	9/27/21		520	1	38, pp. 96, 251-253, 262, 320-321, 355, 2,477, 2,533; 39, p. 52
	JEAP9	33	0-1	9/26/21		320	1	38, pp. 95, 251-253, 255, 328-329, 356, 2,477, 2,526; 39, p. 52
	JEAK9	43	0-1	9/22/21		460	1	38, pp. 91-92, 131-133, 140, 338-339, 356, 1,305, 1,330; 39, p. 52
	JDHF0	45	6-7	9/27/21		490	1	38, pp. 96, 205-208, 340-341, 356, 1,902, 1,919; 39, p. 52
	JDHF6	51	0-1	9/27/21		610	1	38, pp. 96, 205-207, 214, 344-345, 356, 1,902, 1,925; 39, p. 52
	JDHF5	51	0-1	9/27/21		340	1	38, pp. 205-207, 213, 344-345, 357, 1,902, 1,924; 39, p. 52
	JDHG5	54	0-1	9/28/21		370	1	38, pp. 97-98, 205-207, 222, 350-351, 357, 1,903, 1,933; 39, p. 52

mg/kg = milligram per kilogram

in. bgs = inches below ground surface

CRQL – Contract Required Quantitation Limit [Ref. 38, p. 543]

Attribution:

From September 18 through September 28, 2021, EPA collected surface soil samples from a residential area of Northport, WA located west of the former Le Roi smelter. Validated soil analytical data document an area of observed contamination as shown by lead and arsenic being detected at levels significantly above published background levels on residential properties in Northport [see **Figure 4; Table 20** of this HRS documentation record].

In April 2011, an air quality and deposition analysis for the Upper Columbia River Basin was conducted by ICF International. This analysis was a model-based assessment of the impact of emissions from the Teck-Cominco facility on air quality and atmospheric deposition within the upper Columbia River basin [Ref. 40, p. 1]. The study included a study of historical literature, an analysis of local meteorological data, and a preliminary air quality modeling exercise using existing and modeling databases. Air quality modeling tools were used to examine the impacts of airborne sulfur dioxide (SO₂) and the deposition of airborne emissions of mercury and other metals to land and water surfaces [Ref. 40, p. 5]. This study determined that based on meteorological data collected at the surface and aloft at Northport, Washington for a period of one year (1929-1930), there was a consistent pattern of nighttime down-valley and daytime up-valley wind flow occurring all months of the year. The nighttime regime was characterized by a clearly defined 2,000-foot-thick southward flowing drainage layer capable of trapping emissions from the Trail facility and transporting them along the Columbia River Valley into Stevens County and beyond. Because of its persistence throughout the year, this mechanism has the potential of causing pollutants to be transported from the Teck facility and likely has resulted in large quantities of mercury and other constituents (including lead, zinc, cadmium, and arsenic) being deposited into the Columbia River basin, Lake Roosevelt, and the Colville Reservation over an 85-year period [Ref. 40, p. 33-35].

In 1897, the Le Roi smelter began refining copper, lead, and silver ores from mines in northeast Washington, as well as copper ore from British Columbia, Canada [Ref. 5, p. 104]. By 1908, this smelter was one of the largest smelters on the West Coast, processing 500 tons of ore per day [Ref. 5, p. 105]. Copper and gold were processed by heap roasting, which involved the open burning of raw ore prior to placing it in a furnace. The heap roasting process produced a disagreeable sulfur odor. Local farmers believed that the heap roasting process was poisoning nearby soils [Ref. 55, p. 13]. Operations were suspended in 1909. In 1914, the smelter reopened to process lead ore to meet the government demand for World War I. Lead smelting operations during this period produced up to 30 tons per day of airborne sulfur emissions. The smelter was closed and dismantled in 1922, after 24 years of sporadic operation [Refs. 5, p. 105; 55, p. 14, 15].

In 2011, a Washington State Department of Ecology-sponsored study of upland lakes in northeast Washington reported the likely presence of smelter impacts to lakes located within the Upper Columbia River Valley. It was determined that elevated metals concentrations were present in upland lake sediment at levels that may adversely inhabit these upland water bodies. The 2011 Ecology study also indicated a localized metal enrichment around the Le Roi smelter [Ref. 65, p. 15].

Previous Removal Activities

Since 2003, several EPA Removal activities (including TCRAs) have occurred in and around the Northport, WA area:

- In 2003, EPA initiated an RSE in Northport and identified residential and commercial properties where response actions were necessary due to the historical operations of the Le Roi smelter. In 2004, EPA completed TCRAs at 29 residential properties in Northport [Ref. 38, p. 11].
- In 2015, Teck conducted soil removal actions under EPA oversight at properties in Northport. The work was conducted in connection with the UCR site. EPA determined that lead contamination presented an imminent and substantial endangerment to public health and the environment. Additional removal actions at residential properties in Northport outside of the town proper were conducted by Teck under EPA oversight in 2017 and 2018 [Ref. 38, p. 11].

- In October 2019, EPA conducted an RSE at 18 residential properties located in the town of Northport. EPA conducted removal assessments at properties sampled in 2003 and 2004 where lead concentrations were at or above 700 mg/kg, but no soil removal action was taken. The property removal assessments included interviews with property owners or representatives regarding any changes to the property condition or its use since the 2003/2004 RSE, as well as other property walk-through activities. EPA determined that soil sampling was appropriate on 12 of the 18 properties. In 2020, EPA completed TCRAs at 15 properties in the town of Northport [Ref. 38, p. 11].
- During the most recent RSE in 2021, EPA sampled 43 properties in the town of Northport. Between August 2022 and October 2022, EPA conducted TCRAs at 15 properties where lead was detected above 630 mg/kg [Refs. 38, p. 20; 57, p. 1].

Based on the above, soil contamination in Northport (including AOC A) is attributable to historical comingled aerial deposition from both the Cominco smelter and the Le Roi smelter (while it was active sporadically between 1897 and 1921), as well as continued aerial deposition from the Cominco smelter after the closure of the Le Roi smelter.

Area Hazardous Waste Quantity

Hazardous Constituent Quantity

The hazardous constituent quantity for AOC A could not be adequately determined according to the HRS requirements; that is, the total mass of all CERCLA hazardous substances in the AOC is not known and cannot be estimated with reasonable confidence [Ref. 1, Section 2.4.2.1.1]. There is insufficient historical and current data (manifests, PRP records, State records, permits, waste concentration data, etc.) available to adequately calculate the total or partial mass of all CERCLA hazardous substances in AOC A. Therefore, there is insufficient information to calculate the hazardous constituent quantity for AOC A with reasonable confidence. As a result, the evaluation of hazardous waste quantity proceeds to the evaluation of *Tier B*, Hazardous Wastestream Quantity [Ref 1, Section 2.4.2.1.1].

Hazardous Constituent Quantity (S) Value: NS

Are the data complete for hazardous constituent quantity for this area? No

Hazardous Wastestream Quantity

The hazardous wastestream quantity for AOC A could not be adequately determined according to the HRS requirements; that is, the total mass of all hazardous wastestreams plus the mass of any additional CERCLA pollutants and contaminants in AOC A 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, waste concentration data, etc.) available to adequately calculate the total mass or partial mass of the hazardous wastestreams plus the mass of all CERCLA pollutants and contaminants in AOC A. Therefore, there is insufficient information to evaluate the hazardous wastestream quantity for AOC A with reasonable confidence. Scoring proceeds to the evaluation of *Tier C*, Volume [Ref. 1, Section 2.4.2.1.2].

Hazardous Wastestream Quantity (W) Value: NS

Are the data complete for hazardous wastestream quantity for this area? No

Volume

Tier C, Volume is restricted to other source types and is not applicable (NA) to the contaminated soil source type for the soil exposure component [Ref. 1, Section 5.1.1.2.2].

Volume (V) Assigned Value = NA

Area

Sampling and analytical results from the EPA RSE conducted in 2021 show that surface soil in a residential area to the southwest of the former Le Roi smelter property is contaminated with metals [see **Figure 4, Table 20** of this HRS documentation record]. Typically, all soil within the AOC between sample locations documenting observed contamination, excluding areas covered by impervious surfaces, is inferred as contaminated soil. However since EPA has conducted removal activities at many properties in the Northport, WA dating back to 2003, not all properties were included within the AOC polygon; when determining the area of the AOC for HRS scoring purposes, a conservative approach was taken and only contaminated properties from the 2021 RSE sampling event that did not have soil removals were included in the area delineation. Due to the fact that an area for the AOC cannot be reasonably estimated, an HRS conservative approach was taken and an area measure of >0 is assigned for AOC A.

Dimensions of AOC (ft²) = >0

Equation for Assigning Value (Ref. 1, Sections 2.4.2.1.4 and 5.2.2.2, Table 5-2): Area (A)/34,000

Area (A) Assigned Value: >0

Area Hazardous Waste Quantity Value

The area hazardous waste quantity value is >0 for Tier D – Area [Ref. 1, Section 2.4.2.1.4, Table 5-2].

=====
Area of Observed Contamination Hazardous Waste Quantity Value: >0

Summary of Site ContaminationLevel I Samples

TABLE 21 - LEVEL I SAMPLES								
Hazardous Substance	Property ID	Sample ID	Date	Depth (in. bgs)	Result mg/kg	Benchmark		References
						Cancer Risk	Non-Cancer Risk	
Arsenic (mg/kg)	5	JEAP6	9/26/21	11-12	40	0.772	39.1	2, p.10; 38, pp. 228-230, 249, 274-275, 353, 2,207, 2,241
	08	JEAK0	9/21/21	0-1	33			2, p. 30; 38, pp. 90-91, 177-179, 198, 280-281, 356, 986, 1,026
	21	JEAM5	9/24/21	0-1*	33			2, p. 10; 38, pp. 94, 200-202, 204, 306-307. 354, 1,618, 1,636
	23	JEAH8	9/20/21	6-7	60			2, p. 10; 38, pp. 88-89, 177-179, 187, 310, 311, 355, 983, 1,015
	53	JDHG2	9/27/21	0-1	38			2, p. 10; 38, pp. 96, 205-207, 220, 348-349, 357, 1,903, 1,931

mg/kg = milligrams per kilogram

in. = inches

bgs = below ground surface

* Reference 38 has conflicting information with regard to the depth of soil sample JEAM5; Pages 306-307 indicates a depth of 0-1 inch bgs; page 354 indicates a sample depth of 6-7 inches bgs. Reference 38, page 14 indicates that sampling depths for yards were typically 0-1 inch; therefore, since the sample was collected from a front yard, it is likely that the sample depth for Sample JEAM5 was 0-1 inch bgs.

Note: Background concentration for arsenic is evaluated as 11 mg/kg (Observed Contamination = 33 mg/kg or above) [Ref. 39, p. 51].

Note – Property 53 (which is included in AOC A [Sample JDHG2]) was noted to be a vacant lot during sampling; it was recently purchased and there are plans to build a house on the lot. Therefore, while the sample concentration exceeds the relevant benchmark, since no dwellings are known to currently exist on the property, resident populations are not scored below for Property 53 [Ref. 38, pp. 80, 96, 348-349].

Level II Samples

TABLE 22 - LEVEL II SAMPLES								
Hazardous Substance	Property ID	Sample ID	Date	Depth (in. bgs)	Result mg/kg	Benchmark		References
						Cancer Risk	Non-Cancer Risk	
Lead (mg/kg)	01	JEAH0	9/19/21	0-1	530	NE	NE	2, p. 30; 38, pp. 87, 177-179, 182, 266-267, 353, 983, 1,010
	6	JEAN7	9/26/21	0-1	380			2, p. 30; 38, pp. 95, 228-230, 240, 276-277, 353, 2,206, 2,232
	17	JEAM6	9/24/21	0-1	310			2, p. 30; 38, pp. 94, 228-231, 298, 299, 354, 2,206, 2,223
	19	JEAQ2	9/26/21	6-7	600			2, p. 30; 38, pp. 95, 251-253, 258, 302-303, 354, 2,477, 2,529
	19	JEAQ1	9/26/21	0-1	370			2, p. 30; 38, pp. 95, 251-253, 257, 302, 303, 354, 2,477, 2,528
	20	JEAJ7	9/21/21	0-1	580			2, p. 30; 38, pp. 90-91, 177-179, 195, 304-305, 354, 986, 1,023
	22	JEAJ6	9/21/21	6-7	540			2, p. 30; 38, pp. 90-91, 177-179, 194, 308-309, 355, 986, 1,022
	22	JEAJ5	9/21/21	0-1	420			2, p. 30; 38, pp. 90-91, 177-179, 193, 308-309, 355, 986, 1,021
	29	JEAQ7	9/27/21	0-1	520			2, p. 30; 38, pp. 96, 251-253, 262, 320-321, 355, 2,477, 2,533
	33	JEAP9	9/26/21	0-1	320			2, p. 30; 38, pp. 95, 251-253, 255, 328-329, 356, 2,477, 2,526
	43	JEAK9	9/22/21	0-1	460			2, p. 30; 38, pp. 91-92, 131-133, 140, 338-339, 356, 1,305, 1,330
	45	JDHF0	9/27/21	6-7	490			2, p. 30; 38, pp. 96, 205-208, 340-341, 356, 1,902, 1,919
	51	JDHF6	9/27/21	0-1	610			2, p. 30; 38, pp. 205-207, 214, 344-345, 356, 1,902, 1,925

TABLE 22 - LEVEL II SAMPLES								
Hazardous Substance	Property ID	Sample ID	Date	Depth (in. bgs)	Result mg/kg	Benchmark		References
						Cancer Risk	Non-Cancer Risk	
	51	JDHF5	9/27/21	0-1	340	NE	NE	2, p. 30; 38, pp. 96, 205-207, 213, 344-345, 357, 1,902, 1,924
	54	JDHG5	9/28/21	0-1	370			2, p. 30, 38, pp. 97-98, 205-207, 222, 350-351, 357, 1,902, 1,933

mg/kg = milligrams per kilogram

NE = Not Established

Although Property 25 qualified for inclusion in AOC A, resident populations are not scored for Property 25 since portions of the composite sampling area (for composite soil sample JEAJ2) are located greater than 200 feet from the property dwelling [Ref. 38, pp. 58, 314-315].

5.1.1 RESIDENT POPULATION THREAT

5.1.1.1 Likelihood of Exposure

Analytical results for surface soil samples collected by EPA in 2021 from residential properties show concentrations of lead and arsenic at concentrations significantly above published background concentrations for northeast Washington [see **Table 6 and 20; Figure 4** of this HRS documentation record; Ref. 39, pp. 51-52]. All samples were collected from the top 2 feet of soil (i.e., 0 to 2 feet bgs) and the areas of the properties encompassing the 30-point composite soil samples were located within 200 feet of the on-property residences [Ref. 38, pp. 266, 274, 276, 280, 298, 302, 304, 306, 308, 310, 320, 328, 338, 340, 344, 348, 350]. As described previously, the detections of lead and arsenic are attributable to sources associated with the Cominco smelter and the Le Roi smelter [see **Section 2.2.2** of this HRS documentation record].

Based on these considerations, the value assigned to the likelihood of exposure factor category is 550 [Ref. 1, Section 5.1.1.1].

Resident Population Threat Likelihood of Exposure Factor Category Value: 550

5.1.1.2 Waste Characteristics5.1.1.2.1 Toxicity

TABLE 23 - TOXICITY FACTOR VALUES		
Hazardous Substance	Toxicity Factor Value	Reference
INORGANICS		
Arsenic	10,000	2, p. 8
Lead	10,000	2, p. 28

Toxicity Factor Value: 10,000

5.1.1.2.2 Hazardous Waste Quantity

TABLE 24 – HAZARDOUS WASTE QUANTITY		
<u>Area Letter</u>	<u>Area Hazardous Waste Quantity Value</u>	<u>Constituent Quantity Data Complete? (Y/N)</u>
A	>0	No

Sum of values: >0

The hazardous waste quantity value of >0 is assigned for AOC A; this corresponds to an HWQ Factor Value of 1 based on Table 2-6 of the HRS. According to the HRS, the greater of that value or 10 is assigned as the HWQ Factor Value because the hazardous constituent quantity is not adequately determined [Ref. 1, Section 2.4.2.2 and 5.1.1.2.2]. Therefore, an HWQ Factor Value of 10 is assigned for the soil exposure component.

5.1.1.2.3 Calculation of Waste Characteristics Factor Category Value

Toxicity Factor Value (10,000) x Hazardous Waste Quantity Factor Value (10) = 100,000. According to HRS Table 2-1, the value corresponds to a Waste Characteristics Factor Category Value of 18.

Waste Characteristics Factor Value: 18
[Ref. 1, Section 5.1.1.2.3 and Table 2-7]

Hazardous Waste Quantity Factor Value: 10
Waste Characteristics Factor Category Value: 18

5.1.1.3 TARGETSLevel I Concentrations

Sample ID: JEAP6

AOC Letter: A

Reference for Benchmark: 2, p. 10

TABLE 25 – Level I Concentrations for Sample ID: JEAP6			
Hazardous Substance	Hazardous Substance Concentration (mg/kg)	Benchmark Concentration (mg/kg)	Benchmark
Arsenic	40	0.772	Cancer Risk

Sample ID: JEAK0

AOC Letter: A

Reference for Benchmark: 2, p. 10

TABLE 26 – Level I Concentrations for Sample ID: JEAK0			
Hazardous Substance	Hazardous Substance Concentration (mg/kg)	Benchmark Concentration (mg/kg)	Benchmark
Arsenic	470	0.772	Cancer Risk

Sample ID: JEAM5

AOC Letter: A

Reference for Benchmark: 2, p. 10

TABLE 27 – Level I Concentrations for Sample ID: JEAM5			
Hazardous Substance	Hazardous Substance Concentration (mg/kg)	Benchmark Concentration (mg/kg)	Benchmark
Arsenic	33	0.772	Cancer Risk

Sample ID: JEAH8

AOC Letter: A

Reference for Benchmark: 2, p. 10

TABLE 28 – Level I Concentrations for Sample ID: JEAH8			
Hazardous Substance	Hazardous Substance Concentration (mg/kg)	Benchmark Concentration (mg/kg)	Benchmark
Arsenic	60	0.772	Cancer Risk

5.1.1.3.1 Residential Individual

AOC Letter: A

Level of Contamination: (Level I/Level II): Level 1

References: 1, Section 5.1.1.3.1; 2, pp. 10

Since there is at least one documented resident individual living on a property within an AOC and within 200 feet of contamination subject to Level I actual contamination, a Resident Individual Factor value of 50 is applicable [**Table 29** of this HRS documentation record; Ref. 1, section 5.1.1.3 and 5.1.1.3.1].

Resident Individual Factor Value: 50

5.1.1.3.2 Resident Population5.1.1.3.2.1 Level I Concentrations

Observed contamination has been observed at residences in AOC A [see **Section 5.1.0** of this HRS documentation record]. The population of the residences was obtained by multiplying the number of residences by the U.S. Census (2017-2021) average persons per dwelling in Stevens County, Washington [Ref. 45, p. 2]. Based on residential sampling conducted by EPA in 2021, a total of 4 homes are subject to Level I concentrations.

Level I Samples

TABLE 29 – LEVEL I RESIDENT POPULATION						
AOC Letter	Sample ID	Property No.	Number of Buildings	County Multiplier	Population	References
A	JEAP6	5	1	2.51	2.51	38, pp. 228-230, 249, 274-275, 353, 2,207, 2,241; 45, p. 2
	JEAK0	08	1	2.51	2.51	38, pp. 90-91, 177-179, 198, 280-281, 356, 986, 1,026; 45, p. 2
	JEAM5	21	1	2.51	2.51	38, pp. 94, 200-202, 204, 306-307, 354, 1,618, 1,636; 45, p. 2
	JEAH8	23	1	2.51	2.51	38, pp. 88-89, 177-179, 187, 310-311, 355, 983, 1,015; 45, p. 2

Note – Property 53 (which is included in AOC A [Sample JDHG2]) was noted to be a vacant lot during sampling; it was recently purchased and there are plans to build a house on the lot. Since no dwellings are known to currently exist on the property, resident populations are not scored for Property 53 [Ref. 38, pp. 80, 96, 348-349].

Sum of individuals subject to Level I concentrations: 10.04
Sum of individuals subject to Level I concentrations x 10: 100.4
Level I Concentrations Factor Value: 100.4

5.1.1.3.2.2 Level II Concentrations

Observed contamination has been documented at residences in AOC A [see **Section 5.1.0** of this HRS documentation record]. The population of the residences was obtained by multiplying the number of residences by the U.S. Census (2017-2021) average persons per dwelling in Stevens County, Washington [Ref. 45, p. 2]. Based on residential sampling conducted by EPA in 2021, a total of 12 homes are subject to Level II concentrations

Level II Samples

TABLE 30 – LEVEL II SAMPLES		
Sample ID	Property No.	Hazardous Substance
JEAH0	01	Lead
JEAN7	6	Lead
JEAM6	17	Lead
JEAQ2	19	Lead
JEAQ1	19	Lead

TABLE 30 – LEVEL II SAMPLES		
Sample ID	Property No.	Hazardous Substance
JEAJ7	20	Lead
JEAJ6	22	Lead
JEAJ5	22	Lead
JEAQ7	29	Lead
JEAP9	33	Lead
JEAK9	43	Lead
JDHF0	45	Lead
JDHF6	51	Lead
JDHF5	51	Lead
JDHG5	54	Lead

Level II Residential Population Targets

TABLE 31 – LEVEL II RESIDENT POPULATION						
AOC Letter	Sample ID	Property No.	Number of Buildings	County Multiplier	Population	References
A	JEAH0	01	1	2.51	2.51	38, pp. 87, 177-179, 182, 266-267, 353, 983, 1,010; 45, p. 2
	JEAN7	6	1	2.51	2.51	38, pp. 95, 228-230, 240, 276-277, 353, 2,206, 2,232; 45, p. 2
	JEAM6	17	1	2.51	2.51	38, pp. 94, 228-231, 298-299, 354, 2,206, 2,223; 45, p. 2
	JEAQ2	19	1	2.51	2.51	38, pp. 95, 251-253, 258, 302-303, 354, 2,477, 2,529; 45, p. 2
	JEAQ1					38, pp. 95, 251-253, 257, 302-303, 354, 2,477, 2,528; 45, p. 2
	JEAJ7	20	1	2.51	2.51	38, pp. 90-91, 177-179, 195, 304-305, 354, 986, 1,023; 45, p. 2
	JEAJ6	22	1	2.51	2.51	38, pp. 90-91, 177-179, 194, 308-309, 355, 986, 1,022; 45, p. 2
	JEAJ5					38, pp. 90-91, 177-179, 193, 308-309, 355, 986, 1,021; 45, p. 2
	JEAQ7	29	1	2.51	2.51	38, pp. 96, 251-253, 262, 320-321, 355, 2,477, 2,533; 45, p. 2
	JEAP9	33	1	2.51	2.51	38, pp. 95, 251-253, 255, 328-329, 356, 2,477, 2,526; 45, p. 2
	JEAK9	43	1	2.51	2.51	38, pp. 91-92, 131-133, 140, 338-339, 356, 1,305, 1,330; 45, p. 2
	JDHF0	45	1	2.51	2.51	38, pp. 96, 205-208, 340-341, 356, 1,902, 1,919; 45, p. 2

TABLE 31 – LEVEL II RESIDENT POPULATION						
AOC Letter	Sample ID	Property No.	Number of Buildings	County Multiplier	Population	References
	JDHF6	51	1	2.51	2.51	38, pp. 96, 205-207, 214, 344-345, 356, 1,902, 1,925; 45, p. 2
	JDHF5					38, pp. 205-207, 213, 344-345, 357, 1,902, 1,924; 45, p. 2
	JDHG5	54	1	2.51	2.51	38, pp. 97-98, 205-207, 222, 350-351, 357, 1,902, 1,933; 45, p. 2

Note: Property 22 was previously noted to be a trailer park; however, photos note that this lot is being used as a back yard for the dwelling on the adjacent parcel to the northeast. An above-ground swimming pool and garden were noted in sampling photos indicating that this parcel is utilized by residents of the adjacent parcel. The adjacent parcel to the northwest is owned by the same person. Based on an evaluation of these conditions, the resident population associated with Property 22 is scored [Ref. 38, p. 53, 90]. Also, although Property 25 qualified for inclusion in AOC A, resident populations are not scored for Property 25 since portions of the composite sampling area (for composite soil sample JEAJ2) are located greater than 200 feet from the property dwelling [Ref. 38, pp. 58, 314-315].

Sum of individuals subject to Level II concentrations: 30.12

Level I Concentrations Factor Value: 100.4
Level II Concentrations Factor Value: 30.12
[Ref. 1, section 5.1.1.3.2.2]

5.1.1.3.3 Workers

Several parcels within the AOC are owned by businesses; however, the number of workers who work in these buildings is not known. A worker value of 0 is assigned. [Ref. 1, Table 5-4].

<u>Area Letter</u>	<u>Number of Workers</u>
A	0

Total workers: 0
HRS Factor Value (Table 5-4): 0

5.1.1.3.4 Resources

Resource Descriptor(s):

There are no resource uses in an area of observed soil contamination; therefore, the assigned value is 0 [Ref. 1, Section 5.1.1.3.4].

Workers Factor Value: 0
Resources Factor Value: 0

5.1.1.3.5 Terrestrial Sensitive Environments

There are no known terrestrial sensitive environments within an area of observed contamination. Therefore, a terrestrial sensitive environments factor is assigned a value of 0.

Terrestrial Sensitive Environment Factor Value (EC): 0

[Ref. 1, Section 5.1.1.3.5]

Terrestrial Sensitive Environments Factor Value: 0

5.1.2 NEARBY POPULATION THREAT

The nearby population threat has not been scored.

APPENDIX A

INDIVIDUAL FACILITY HAZARD RANKING SYSTEM SCORESHEETS AND SCORING NARRATIVES

The Upper Columbia River site includes releases from sources associated with the Cominco and Le Roi smelters; contamination from each has comingled in surface water sediments and in soil. HRS Scoresheets and scoring information for each smelter are provided in the following pages. This information demonstrates that even if the Cominco and Le Roi smelters were evaluated independently, both would qualify for placement on the NPL.

Hazard Ranking System Scoresheets and Scoring Narrative

Cominco Smelter

**WORKSHEET FOR COMPUTING HRS SITE SCORE
COMINCO SMELTER**

	<u>S</u>	<u>S²</u>
1. Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	Not Scored	
2a. Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	100.00	10,000
2b. Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	Not Scored	
2c. Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	100.00	10,000
3a. Soil Exposure Component Score (S_{se}) (from Table 5-1, line 22)	21.66	469.15
3b. Subsurface Intrusion Component Score (S_{ssi}) (from Table 5-11, line 12)	Not Scored	
3c. Soil Exposure and Subsurface Intrusion Pathway Score (S_{sessi}) (from Table 5-11, line 13)	21.66	469.15
4. Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	Not Scored	
5. Total of $S_{gw}^2 + S_{sw}^2 + S_{sessi}^2 + S_a^2$	10,469.15	
6. HRS Site Score Divide the value on line 5 by 4 and take the square root	51.15	

COMINCO SMELTER
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	Not Scored
2b.	Runoff	25	Not Scored
2c.	Distance to Surface Water	25	Not Scored
2d.	Potential to Release by Overland Flow (lines 2a x [2b + 2c])	500	Not Scored
3.	Potential to Release by Flood:		
3a.	Containment (Flood)	10	Not Scored
3b.	Flood Frequency	50	Not Scored
3c.	Potential to Release by Flood (lines 3a x 3b)	500	Not Scored
4.	Potential to Release (lines 2d + 3c, subject to a maximum of 500)	500	Not Scored
5.	Likelihood of Release (higher of lines 1 and 4)	550	550
Waste Characteristics:			
6.	Toxicity/Persistence	(a)	Not Scored
7.	Hazardous Waste Quantity	(a)	Not Scored
8.	Waste Characteristics	100	Not Scored
Targets:			
9.	Nearest Intake	50	Not Scored
10.	Population:		Not Scored
10a.	Level I Concentrations	(b)	Not Scored
10b.	Level II Concentrations	(b)	Not Scored
10c.	Potential Contamination	(b)	Not Scored
10d.	Population (lines 10a + 10b + 10c)	(b)	Not Scored
11.	Resources	5	Not Scored
12.	Targets (lines 9 + 10d + 11)	(b)	Not Scored
Drinking Water Threat Score:			
13.	Drinking Water Threat Score ([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)	100	Not Scored
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 x 10 ⁸
16.	Hazardous Waste Quantity	(a)	1,000,000
17.	Waste Characteristics	1,000	1,000

Factor Categories and Factors		Maximum Value	Value Assigned
Targets:			
18.	Food Chain Individual	50	45
19.	Population:		
19a.	Level I Concentrations	(b)	0
19b.	Level II Concentrations	(b)	0.03
19c.	Potential Human Food Chain Contamination	(b)	Not Scored
19d.	Population (lines 19a + 19b + 19c)	(b)	0.03
20.	Targets (lines 18 + 19d)	(b)	45.03
21.	Human Food Chain Threat Score ([lines 14 x 17 x 20]/82,500, subject to a maximum of 100)	100	100.00
Environmental Threat			
Likelihood of Release:			
22.	Likelihood of Release (same value as line 5)	550	550
23.	Ecosystem Toxicity/Persistence/Bioaccumulation	(a)	5 x 10 ⁸
24.	Hazardous Waste Quantity	(a)	1,000,000
25.	Waste Characteristics	1,000	1,000
Targets:			
26.	Sensitive Environments:		
26a.	Level I Concentrations	(b)	0
26b.	Level II Concentrations	(b)	175
26c.	Potential Contamination	(b)	Not Scored
26d.	Sensitive Environments (lines 26a + 26b + 26c)	(b)	175
27.	Targets (value from 26d)	(b)	175
Environmental Threat Score:			
28.	Environmental Threat Score ([lines 22 x 25 x 27]/82,500, subject to a maximum of 60)	60	60.00
Surface Water Overland/Flood Migration Component Score For A Watershed			
29.	Watershed Score ^c (lines 13 + 21 + 28, subject to a maximum of 100)	100	100.00
Surface Water Overland/Flood Migration Component Score			
30.	Component Score (S _{of}) ^c , (highest score from line 29 for all watersheds evaluated, subject to a maximum of 100)	100	100.00

^aMaximum value applies to waste characteristics category.

^bMaximum value not applicable.

^cDo not round to nearest integer.

COMINCO SMELTER
HRS TABLE 5-1, SOIL EXPOSURE COMPONENT SCORESHEET

Factor Categories and Factors	Maximum Value	Value Assigned
Resident Population Threat		
Likelihood of Exposure:		
1. Likelihood of Exposure	550	550
Waste Characteristics:		
2. Toxicity	(a)	10,000
3. Hazardous Waste Quantity	(a)	10
4. Waste Characteristics	100	18
Targets:		
5. Resident Individual	50	50
6. Resident Population:		
6a. Level I Concentrations	(b)	100.4
6b. Level II Concentrations	(b)	30.12
6c. Resident Population (lines 6a + 6b)	(b)	130.52
7. Workers	15	0
8. Resources	5	0
9. Terrestrial Sensitive Environments	(c)	0
10. Targets (lines 5 + 6c + 7 + 8 + 9)	(b)	180.52
Resident Population Threat Score:		
11. Resident Population Threat (lines 1 x 4 x 10)	(b)	1,787,148
Nearby Population Threat		
Likelihood of Exposure:		
12. Attractiveness/Accessibility	100	Not Scored
13. Area of Contamination	100	Not Scored
14. Likelihood of Exposure	500	Not Scored
Waste Characteristics:		
15. Toxicity	(a)	Not Scored
16. Hazardous Waste Quantity	(a)	Not Scored
17. Waste Characteristics	100	Not Scored
Targets:		
18. Nearby Individual	1	Not Scored
19. Population Within 1 Mile	(b)	Not Scored
20. Targets (lines 18 + 19)	(b)	Not Scored
Nearby Population Threat Score:		
21. Nearby Population Threat (lines 14 x 17 x 20)	(b)	Not Scored
Soil Exposure Component Score		
22. Soil Exposure Component Score ^d (S _{se}), (lines [11 +21]/82,500, subject to a maximum of 100)	100	21.66

^aMaximum value applies to waste characteristics category.

^bMaximum value not applicable.

^cNo specific maximum value applies to factor. However, pathway score based solely on terrestrial sensitive environments is limited to maximum of 60.

^dDo not round to nearest integer.

COMINCO SMELTER SCORING INFORMATION

Source

The source (i.e., Source 1) at the Cominco Smelter includes Cominco Outfalls Slag [see **Section 2.2**, Source 1 of this HRS documentation record].

SURFACE WATER MIGRATION PATHWAY

Likelihood of Release

The likelihood of release value is based on an observed release to the UCR. Observed releases by direct observation and chemical analysis are evaluated [see **Section 4.1.2.1.1** of this HRS documentation record].

Surface Water Likelihood of Release Factor Category Value: 550

Human Food Chain Threat – Waste Characteristics

The source hazardous waste quantity value sum (4,313,132.10 for Source 1) corresponds to a hazardous waste quantity factor value of 1,000,000 in HRS Table 2-6 [Ref. 1, Section 2.4.2.2]. The HRS states that if any target is subject to Level I or Level II concentrations, assign either the value for Table 2-6 or a value of 100, whichever is greater, as the hazardous waste quantity factor value for that pathway [Ref. 1, Section 2.4.2.2]. Therefore, a hazardous waste quantity factor value of 1,000,000 is assigned for the surface water migration pathway.

Hazardous Waste Quantity Factor Value: 1,000,000

Waste Characteristics Factor Category Value

Mercury and cadmium are documented in observed releases and associated with Source 1, which has a surface water pathway containment factor value greater than 0 for the watershed, and correspond to a toxicity/persistence factor value of 10,000 and bioaccumulation potential factor value of 50,000 [Refs. 1, Section 4.1.3.2.1.4; 2, pp. 12, 32].

$$\begin{aligned} (\text{Toxicity/Persistence Factor Value}) \times (\text{Hazardous Waste Quantity Factor Value}) &= \\ 10,000 \times 1,000,000 &= 1 \times 10^{10} \\ (\text{Subject to a maximum of } 1 \times 10^8) & \\ [\text{Ref. 1, Section 4.1.3.2.3}] & \end{aligned}$$

$$\begin{aligned} (\text{Toxicity/Persistence Factor Value} \times \text{Hazardous Waste Quantity Factor Value}) \times \\ (\text{Bioaccumulation Potential Factor Value}) &= (1 \times 10^8) \times (50,000) = 5 \times 10^{12} \\ (\text{Subject to a maximum of } 1 \times 10^{12}) & \\ [\text{Ref. 1, Section 4.1.3.2.3}] & \end{aligned}$$

The resulting waste characteristics product of 1×10^{12} corresponds to a Waste Characteristics Factor Category Value of 1,000 in Table 2-7 of the HRS [Ref. 1, Section 2.4.3.1].

Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8
Hazardous Waste Quantity Factor Value: 1,000,000
Waste Characteristics Factor Category Value: 1,000

Human Food Chain Threat - Targets

Food Chain Individual: An observed release of hazardous substances associated with Source 1 and having a bioaccumulation potential factor value of 500 or greater has been documented in the UCR. There is Level II contamination of a fishery [see **Sections 4.1.2.1.1**, **4.1.3.2.1**, and **4.1.3.3** of this HRS documentation record]. Therefore, a food chain individual factor value of 45 is assigned [Ref. 1, Section 4.1.3.3.1].

Food Chain Individual Factor Value: 45

Human Food Chain Threat - Population

Level II Concentrations

The zone of actual contamination for Cominco is the area of the UCR between the most upstream PPE (PPE1) and farthest downstream observed release sample (EV001-SED-1-092619). As stated previously, contamination and targets are not scored for the portion of the UCR located in Canada (i.e., between PPE1 and the U.S.-Canada border). Scored contamination and targets are evaluated for the U.S. portion of the zone of contamination, which encompasses a length of approximately 35 miles [Figure 3 of this HRS documentation record]. The scored zone of actual contamination in the UCR is used for consumption fishing [Ref. 24, p. 1]. Species caught for consumption in the zone of actual contamination include walleye, kokanee, sturgeon, rainbow trout, and northern pike [Ref. 24, p. 1; 56, p. 1].

The food chain production for the fishery is not documented, so based on the aforementioned information, the fishery is assigned to the category “Greater than 0 to 100 pounds per year,” which corresponds to the assigned human food chain population value of 0.03 in Table 4-18 of the HRS [Ref. 1, Section 4.1.3.3.2.2]. The available documentation demonstrates that fishing for human consumption occurs within the zone of actual contamination delineated by metals detected in sediment samples at concentrations meeting observed release criteria (i.e., significantly above background and attributable to the site); therefore, the target fishery is evaluated for Level II actual contamination [Figure 3 of this HRS documentation record; Ref. 1, Section 4.1.3.3; 24, p. 1].

Level II Concentrations Factor Value: 0.03

Environmental Threat – Waste Characteristics

The source hazardous waste quantity value sum (4,313,132.10 for Source 1) corresponds to a hazardous waste quantity factor value of 1,000,000 in HRS Table 2-6 [Ref. 1, Section 2.4.2.2]. The HRS states that if any target is subject to Level I or Level II concentrations, assign either the value for Table 2-6 or a value of 100, whichever is greater, as the hazardous waste quantity factor value for that pathway [Ref. 1, Section 2.4.2.2]. Therefore, a hazardous waste quantity factor value of 1,000,000 is assigned for the surface water migration pathway.

Hazardous Waste Quantity Factor Value: 1,000,000
[Ref. 1, Table 2-6]

Waste Characteristics Factor Category Value

Cadmium and mercury are documented in observed releases and associated with Source 1, which has a surface water pathway containment factor value greater than 0 for the watershed, and correspond to an ecotoxicity/persistence factor value of 10,000 and bioaccumulation potential factor value of 50,000 [Refs. 1, Section 4.1.4.2.1.4; 2, pp. 12, 32]

$$\begin{aligned} (\text{Ecotoxicity/persistence factor value}) \times (\text{hazardous waste quantity factor value}) &= \\ 10,000 \times 1,000,000 &= 1 \times 10^{10} \\ (\text{Subject to a maximum of } 1 \times 10^8) & \\ &[\text{Ref. 1, Section 4.1.4.2.3}] \end{aligned}$$

$$\begin{aligned} (\text{Ecotoxicity/persistence factor value} \times \text{hazardous waste quantity factor value}) \times \\ (\text{bioaccumulation potential factor value}) &= (1 \times 10^8) \times (50,000) = 5 \times 10^{12} \\ (\text{Subject to a maximum of } 1 \times 10^{12}) & \\ &[\text{Ref. 1, Section 4.1.4.2.3}] \end{aligned}$$

The value of 1×10^{12} corresponds to a waste characteristics factor category value of 1,000 in Table 2-7 of the HRS [Ref. 1, Section 2.4.3.1].

Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8
Hazardous Waste Quantity Factor Value: 1,000,000
Waste Characteristics Factor Category Value: **1,000**

Environmental Threat - Targets

Level II Concentrations

There are no media-specific benchmarks for sediment; therefore, the target sensitive environment located within the scored zone of actual contamination is subject to Level II concentrations [Ref. 1, Sections 2.5 and 4.1.4.3].

Sensitive Environments

Habitat known to be used by the Bull Trout (*Salvelinus confluentus*), a Federal-designated threatened species, is subject to Level II concentrations [Refs. 1, Section 4.1.4.3; 24, p. 1, 26, p. 1; 27, p. 1; 56, p. 1]. USFWS indicates that the range for Bull Trout includes the portion of the UCR which encompasses the scored zone of contamination (i.e., from the U.S.-Canada border to Marcus, WA) [Figure 3 of this HRS documentation record; Refs. 51, p. 1-2, the range is denoted by the green line; 56, p. 1].

LEVEL II CONCENTRATIONS – SENSITIVE ENVIRONMENTS			
Sensitive Environment	Distance from PPE to Nearest Point of Sensitive Environment	Sensitive Environment Value (HRS Table 4-23)	Reference
Habitat known to be used by Federal-designated Threatened species - Bull Trout (<i>Salvelinus confluentus</i>)	0 miles	75	Refs. 24, p.1; 26, p. 1; 27, p. 1; 51, pp. 1-2; 56, p. 1

Wetlands

LEVEL II CONCENTRATIONS – WETLANDS			
Sensitive Environment	Wetland Frontage subject to Level II Contamination	Sensitive Environment Value (HRS Table 4-24)	Reference
Palustrine Wetlands	3.7 miles	100	Figure 6; Ref. 42, p. 1

Wetland Value: 100

Sensitive Environments Value: 75

Sum of Sensitive Environments Value + Wetland Value: 175

SOIL EXPOSURE COMPONENT SCORE

Area of Observed Contamination (AOC)

Based on analytical data from the RSE conducted by EPA in 2021, an area of observed contamination (AOC A) is documented [see **Section 5.1** of this HRS documentation record]. A hazardous waste quantity Tier D Area score of >0 is assigned.

RESIDENT POPULATION THREAT

Likelihood of Exposure

Analytical results for surface soil samples collected by EPA in 2021 from residential properties show concentrations of lead and arsenic at concentrations significantly above published background concentrations for northeast Washington [see **Tables 6 and 20; Figure 4** of this HRS documentation record; Ref. 39, pp. 51-52].

Resident Population Threat Likelihood of Exposure Factor Category Value: 550

WASTE CHARACTERISTICS

Toxicity

TOXICITY FACTOR VALUES		
Hazardous Substance	Toxicity Factor Value	Reference
Arsenic	10,000	2, p. 8
Lead	10,000	2, p. 28

=====
Toxicity Factor Value: 10,000

The hazardous waste quantity value of >0 is assigned for AOC A; this corresponds to an HWQ Factor Value of 1 based on Table 2-6 of the HRS. According to the HRS, the greater of that value or 10 is assigned as the HWQ Factor Value because the hazardous constituent quantity is not adequately determined [Ref. 1, Section 2.4.2.2 and 5.1.1.2.2]. Therefore, an HWQ Factor Value of 10 is assigned for the soil exposure component.

5.1.1.2.3 Calculation of Waste Characteristics Factor Category Value

Toxicity Factor Value (10,000) x Hazardous Waste Quantity Factor Value (10) = 100,000. According to HRS Table 2-1, the value corresponds to a Waste Characteristics Factor Category Value of 18.

Waste Characteristics Factor Value: 18
[Ref. 1, Section 5.1.1.2.3 and Table 2-7]

TARGETS

5.1.1.3.1 Residential Individual

AOC Letter: A

Level of Contamination: (Level I/Level II): Level 1

References: 1, Section 5.1.1.3.1; 2, pp. 10

Since there is at least one documented resident individual living on a property within an AOC and within 200 feet of contamination subject to Level I actual contamination, a Resident Individual Factor value of 50 is applicable [Table 29 of this HRS documentation record; Ref. 1, section 5.1.1.3 and 5.1.1.3.1].

Resident Individual Factor Value: 50

Resident Population

Level I Concentrations

Observed contamination has been observed at residences in AOC A [see Section 5.1.0 of this HRS documentation record]. The population of the residences was obtained by multiplying the number of residences by the U.S. Census (2017-2021) average persons per dwelling in Stevens County, Washington (i.e. 2.51 people) [Ref. 45, p. 2]. Based on residential sampling conducted by EPA in 2021, a total of 4 homes are subject to Level I concentrations [see Section 5.1.1.3 of this HRS documentation record]. Therefore, a total of 10.04 people are subject to Level I concentrations.

Sum of individuals subject to Level I concentrations: 10.04
Sum of individuals subject to Level I concentrations x 10: 100.4
Level I Concentrations Factor Value: 100.4

Level II Concentrations

Observed contamination has been documented at residences in AOC A [see Section 5.1.0 of this HRS documentation record]. The population of the residences was obtained by multiplying the number of residences by the U.S. Census (2017-2021) average persons per dwelling in Stevens County, Washington (i.e. 2.51 people) [Ref. 45, p. 2]. Based on residential sampling conducted by EPA in 2021, a total of 12 homes are subject to Level II concentrations [see Section 5.1.1.3 of this HRS documentation record]. Therefore, a total of 30.12 people are subject to Level II concentrations.

Sum of individuals subject to Level II concentrations: 30.12

Level I Concentrations Factor Value: 100.4
Level II Concentrations Factor Value: 30.12

Workers

Several parcels within the AOC are owned by businesses; however, the number of workers who work in these buildings is not known. A worker value of 0 is assigned. [Ref. 1, Table 5-4].

Area Letter

Number of Workers

A

0

Total workers: 0
HRS Factor Value (Table 5-4): 0

Resources

There are no resource uses in an area of observed soil contamination; therefore, the assigned value is 0 [Ref. 1, Section 5.1.1.3.4].

Workers Factor Value: 0
Resources Factor Value: 0

Terrestrial Sensitive Environments

There are no known terrestrial sensitive environments within an area of observed contamination. Therefore, a terrestrial sensitive environments factor is assigned a value of 0.

Terrestrial Sensitive Environment Factor Value (EC): 0

[Ref. 1, Section 5.1.1.3.5]

Terrestrial Sensitive Environments Factor Value: 0

5.1.2 NEARBY POPULATION THREAT

The nearby population threat has not been scored. [Ref. 1, Section 5.1.1.3.2.2]

Hazard Ranking System Scoresheets and Scoring Narrative

Le Roi Smelter

**WORKSHEET FOR COMPUTING HRS SITE SCORE
LE ROI SMELTER (SOURCES 2 AND 3)**

	<u>S</u>	<u>S²</u>
1. Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	Not Scored	
2a. Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	100.00	10,000
2b. Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	Not Scored	
2c. Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	100.00	10,000
3a. Soil Exposure Component Score (S_{se}) (from Table 5-1, line 22)	21.66	469.15
3b. Subsurface Intrusion Component Score (S_{ssi}) (from Table 5-11, line 12)	Not Scored	
3c. Soil Exposure and Subsurface Intrusion Pathway Score (S_{sessi}) (from Table 5-11, line 13)	21.66	469.15
4. Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	Not Scored	
5. Total of $S_{gw}^2 + S_{sw}^2 + S_{sessi}^2 + S_a^2$	10,469.15	
6. HRS Site Score Divide the value on line 5 by 4 and take the square root	51.15	

LE ROI SMELTER (SOURCES 2 AND 3)
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	Not Scored
2b.	Runoff	25	Not Scored
2c.	Distance to Surface Water	25	Not Scored
2d.	Potential to Release by Overland Flow (lines 2a x [2b + 2c])	500	Not Scored
3.	Potential to Release by Flood:		
3a.	Containment (Flood)	10	Not Scored
3b.	Flood Frequency	50	Not Scored
3c.	Potential to Release by Flood (lines 3a x 3b)	500	Not Scored
4.	Potential to Release (lines 2d + 3c, subject to a maximum of 500)	500	Not Scored
5.	Likelihood of Release (higher of lines 1 and 4)	550	550
Waste Characteristics:			
6.	Toxicity/Persistence	(a)	Not Scored
7.	Hazardous Waste Quantity	(a)	Not Scored
8.	Waste Characteristics	100	Not Scored
Targets:			
9.	Nearest Intake	50	Not Scored
10.	Population:		Not Scored
10a.	Level I Concentrations	(b)	Not Scored
10b.	Level II Concentrations	(b)	Not Scored
10c.	Potential Contamination	(b)	Not Scored
10d.	Population (lines 10a + 10b + 10c)	(b)	Not Scored
11.	Resources	5	Not Scored
12.	Targets (lines 9 + 10d + 11)	(b)	Not Scored
Drinking Water Threat Score:			
13.	Drinking Water Threat Score ([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)	100	Not Scored
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 x 10 ⁸
16.	Hazardous Waste Quantity	(a)	100
17.	Waste Characteristics	1,000	320

Factor Categories and Factors		Maximum Value	Value Assigned
Targets:			
18.	Food Chain Individual	50	45
19.	Population:		
19a.	Level I Concentrations	(b)	0
19b.	Level II Concentrations	(b)	0.03
19c.	Potential Human Food Chain Contamination	(b)	Not Scored
19d.	Population (lines 19a + 19b + 19c)	(b)	0.03
20.	Targets (lines 18 + 19d)	(b)	45.03
21.	Human Food Chain Threat Score ([lines 14 x 17 x 20]/82,500, subject to a maximum of 100)	100	96.06
Environmental Threat			
Likelihood of Release:			
22.	Likelihood of Release (same value as line 5)	550	550
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)	0
26b.	Level II Concentrations	(b)	175
26c.	Potential Contamination	(b)	Not Scored
26d.	Sensitive Environments (lines 26a + 26b + 26c)	(b)	175
27.	Targets (value from 26d)	(b)	175
Environmental Threat Score:			
28.	Environmental Threat Score ([lines 22 x 25 x 27]/82,500, subject to a maximum of 60)	60	60.00
Surface Water Overland/Flood Migration Component Score For A Watershed			
29.	Watershed Score ^c (lines 13 + 21 + 28, subject to a maximum of 100)	100	100.00
Surface Water Overland/Flood Migration Component Score			
30.	Component Score (S_{of}) ^c , (highest score from line 29 for all watersheds evaluated, subject to a maximum of 100)	100	100.00

^aMaximum value applies to waste characteristics category.

^bMaximum value not applicable.

^cDo not round to nearest integer.

LE ROI SMELTER (SOURCE 2 AND 3)
HRS TABLE 5-1, SOIL EXPOSURE COMPONENT SCORESHEET

Factor Categories and Factors	Maximum Value	Value Assigned
Resident Population Threat		
Likelihood of Exposure:		
1. Likelihood of Exposure	550	550
Waste Characteristics:		
2. Toxicity	(a)	10,000
3. Hazardous Waste Quantity	(a)	10
4. Waste Characteristics	100	18
Targets:		
5. Resident Individual	50	50
6. Resident Population:		
6a. Level I Concentrations	(b)	100.4
6b. Level II Concentrations	(b)	30.12
6c. Resident Population (lines 6a + 6b)	(b)	130.52
7. Workers	15	0
8. Resources	5	0
9. Terrestrial Sensitive Environments	(c)	0
10. Targets (lines 5 + 6c + 7 + 8 + 9)	(b)	180.52
Resident Population Threat Score:		
11. Resident Population Threat (lines 1 x 4 x 10)	(b)	1,787,148
Nearby Population Threat		
Likelihood of Exposure:		
12. Attractiveness/Accessibility	100	Not Scored
13. Area of Contamination	100	Not Scored
14. Likelihood of Exposure	500	Not Scored
Waste Characteristics:		
15. Toxicity	(a)	Not Scored
16. Hazardous Waste Quantity	(a)	Not Scored
17. Waste Characteristics	100	Not Scored
Targets:		
18. Nearby Individual	1	Not Scored
19. Population Within 1 Mile	(b)	Not Scored
20. Targets (lines 18 + 19)	(b)	Not Scored
Nearby Population Threat Score:		
21. Nearby Population Threat (lines 14 x 17 x 20)	(b)	Not Scored
Soil Exposure Component Score		
22. Soil Exposure Component Score ^d (S _{se}), (lines [11 +21]/82,500, subject to a maximum of 100)	100	21.66

^aMaximum value applies to waste characteristics category.

^bMaximum value not applicable.

^cNo specific maximum value applies to factor. However, pathway score based solely on terrestrial sensitive environments is limited to maximum of 60.

^dDo not round to nearest integer.

LE ROI SMELTER SCORING INFORMATION

Sources

The sources at the Le Roi smelter include Contaminated Soil (i.e., Source 2) and Sluice Box Discharge (i.e., Source 3) [see **Section 2.2** of the HRS documentation record].

SURFACE WATER MIGRATION PATHWAY

Likelihood of Release

The likelihood of release value is based on an observed release to the UCR. Observed releases by direct observation and chemical analysis are evaluated [see **Section 4.1.2.1.1** of this HRS documentation record].

Surface Water Likelihood of Release Factor Category Value: 550

Human Food Chain Threat – Waste Characteristics

The source hazardous waste quantity value sum (i.e., 0.12 for Source 2 and >0 for Source 3) corresponds to a hazardous waste quantity factor value of 1 in HRS Table 2-6 [Ref. 1, Section 2.4.2.2]. However, the HRS states that if any target is subject to Level I or Level II concentrations, assign either the value for Table 2-6 or a value of 100, whichever is greater, as the hazardous waste quantity factor value for that pathway [Ref. 1, Section 2.4.2.2]. Therefore, a hazardous waste quantity factor value of 100 is assigned for the surface water migration pathway.

Hazardous Waste Quantity Factor Value: 100

Waste Characteristics Factor Category Value

Mercury and cadmium are documented in observed releases and associated with Sources 2 and 3, which have a surface water pathway containment factor value greater than 0 for the watershed, and correspond to a toxicity/persistence factor value of 10,000 and bioaccumulation potential factor value of 50,000 [Ref. 1, Section 4.1.3.2.1.4; 2, pp. 12, 32].

$$\begin{aligned} &(\text{Toxicity/Persistence Factor Value}) \times (\text{Hazardous Waste Quantity Factor Value}) = \\ &10,000 \times 100 = 1 \times 10^6 \\ &(\text{Subject to a maximum of } 1 \times 10^8) \\ &[\text{Ref. 1, Section 4.1.3.2.3}] \end{aligned}$$

$$\begin{aligned} &(\text{Toxicity/Persistence Factor Value} \times \text{Hazardous Waste Quantity Factor Value}) \times \\ &(\text{Bioaccumulation Potential Factor Value}) = (1 \times 10^6) \times (50,000) = 5 \times 10^{10} \\ &(\text{Subject to a maximum of } 1 \times 10^{12}) \\ &[\text{Ref. 1, Section 4.1.3.2.3}] \end{aligned}$$

The resulting waste characteristics product of 5×10^{10} corresponds to a Waste Characteristics Factor Category Value of 320 in Table 2-7 of the HRS [Ref. 1, Section 2.4.3.1].

Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8
Hazardous Waste Quantity Factor Value: 100

Waste Characteristics Factor Category Value: 320

Human Food Chain Threat - Targets

Food Chain Individual: An observed release of hazardous substances associated with Source 2 and Source 3 and having a bioaccumulation potential factor value of 500 or greater has been documented in the UCR. There is Level II contamination of a fishery [see **Sections 4.1.2.1.1, 4.1.3.2.1, and 4.1.3.3** of this HRS documentation record]. Therefore, a food chain individual factor value of 45 is assigned [Ref. 1, Section 4.1.3.3.1].

Food Chain Individual Factor Value: 45

Human Food Chain Threat - Population

Level II Concentrations

The zone of actual contamination for Le Roi is the area of the UCR between the most upstream PPE (PPE2) and farthest downstream observed release sample (EV001-SED-1-092619), a length of approximately 25.4 miles [Figure 3 of this HRS documentation record]. The zone of actual contamination in the UCR is used for consumption fishing [Ref. 24, p. 1]. Species caught for consumption in the zone of actual contamination include walleye, kokanee, sturgeon, rainbow trout, and northern pike [Ref. 24, p. 1; 56, p. 1].

The food chain production for the fishery is not documented, so based on the aforementioned information, the fishery is assigned to the category “Greater than 0 to 100 pounds per year,” which corresponds to the assigned human food chain population value of 0.03 in Table 4-18 of the HRS [Ref. 1, Section 4.1.3.3.2.2]. The available documentation demonstrates that fishing for human consumption occurs within the zone of actual contamination delineated by metals detected in sediment samples at concentrations meeting observed release criteria (i.e., significantly above background and attributable to the site); therefore, the target fishery is evaluated for Level II actual contamination [Figure 3 of this HRS documentation record; Ref. 1, Section 4.1.3.3; 24, p. 1].

Level II Concentrations Factor Value: 0.03

Environmental Threat – Waste Characteristics

The source hazardous waste quantity value sum (i.e., 0.12 for Source 2 and >0 for Source 3) corresponds to a hazardous waste quantity factor value of 1 in HRS Table 2-6 [Ref. 1, Section 2.4.2.2]. However, the HRS states that if any target is subject to Level I or Level II concentrations, assign either the value for Table 2-6 or a value of 100, whichever is greater, as the hazardous waste quantity factor value for that pathway [Ref. 1, Section 2.4.2.2]. Therefore, a hazardous waste quantity factor value of 100 is assigned for the surface water migration pathway.

Hazardous Waste Quantity Factor Value: 100
[Ref. 1, Table 2-6]

Waste Characteristics Factor Category Value

Cadmium and mercury are documented in observed releases and associated with Le Roi smelter Sources 2 and 3, which have a surface water pathway containment factor value greater than 0 for the watershed, and correspond to an ecotoxicity/persistence factor value of 10,000 and bioaccumulation potential factor value of 50,000 [Ref. 1, Section 4.1.4.2.1.4; 2, pp. 12, 32]

$$\begin{aligned} (\text{Ecotoxicity/persistence factor value}) \times (\text{hazardous waste quantity factor value}) &= \\ 10,000 \times 100 &= 1 \times 10^6 \\ (\text{Subject to a maximum of } 1 \times 10^8) & \\ \text{[Ref. 1, Section 4.1.4.2.3]} & \end{aligned}$$

$$\begin{aligned} (\text{Ecotoxicity/persistence factor value} \times \text{hazardous waste quantity factor value}) \times \\ (\text{bioaccumulation potential factor value}) &= (1 \times 10^6) \times (50,000) = 5 \times 10^{10} \\ (\text{Subject to a maximum of } 1 \times 10^{12}) & \\ \text{[Ref. 1, Section 4.1.4.2.3]} & \end{aligned}$$

The value of 5×10^{10} corresponds to a waste characteristics factor category value of 320 in Table 2-7 of the HRS [Ref. 1, Section 2.4.3.1].

Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8
Hazardous Waste Quantity Factor Value: 100

Waste Characteristics Factor Category Value: 320

Environmental Threat - Targets

Level II Concentrations

There are no media-specific benchmarks for sediment; therefore, the target sensitive environment located within the zone of actual contamination is subject to Level II concentrations [Ref. 1, Sections 2.5 and 4.1.4.3].

Sensitive Environments

Habitat known to be used by the Bull Trout (*Salvelinus confluentus*), a Federal-designated threatened species, is subject to Level II concentrations [Refs. 1, Section 4.1.4.3; 24, p. 1; 26, p. 1; 27, p. 1; 56, p. 1]. USFWS indicates that the range for Bull Trout includes the portion of the UCR which encompasses the zone of contamination (i.e., from the U.S.-Canada border to Marcus, WA) [Figure 3 of this HRS documentation record; Ref. 51, pp. 1-2, the range is denoted by the green line].

LEVEL II CONCENTRATIONS – SENSITIVE ENVIRONMENTS			
Sensitive Environment	Distance from PPE to Nearest Point of Sensitive Environment	Sensitive Environment Value (HRS Table 4-23)	Reference
Habitat known to be used by Federal-designated Threatened species - Bull Trout (<i>Salvelinus confluentus</i>)	0 miles	75	Refs. 24, p.1; 26, p. 1; 27, p. 1; 51, pp. 1-2; 56, p. 1

Wetlands

LEVEL II CONCENTRATIONS – WETLANDS			
Sensitive Environment	Wetland Frontage subject to Level II Contamination	Sensitive Environment Value (HRS Table 4-24)	Reference
Palustrine Wetlands	3.04 miles	100	Figure 6; Ref. 42, p. 1

Wetland Value: 100

Sensitive Environments Value: 75

Sum of Sensitive Environments Value + Wetland Value: 175

SOIL EXPOSURE COMPONENT SCORE

Area of Observed Contamination (AOC)

Based on analytical data from the RSE conducted by EPA in 2021, an area of observed contamination (AOC A) is documented [see **Section 5.1** of this HRS documentation record]. A hazardous waste quantity Tier D Area score of >0 is assigned.

RESIDENT POPULATION THREAT

Likelihood of Exposure

Analytical results for surface soil samples collected by EPA in 2021 from residential properties show concentrations of lead and arsenic at concentrations significantly above published background concentrations for northeast Washington [see **Tables 6 and 20; Figure 4** of this HRS documentation record; Ref. 39, pp. 51-52].

Resident Population Threat Likelihood of Exposure Factor Category Value: 550

WASTE CHARACTERISTICS

Toxicity

TOXICITY FACTOR VALUES		
Hazardous Substance	Toxicity Factor Value	Reference
Arsenic	10,000	2, p. 8
Lead	10,000	2, p. 28

=====
Toxicity Factor Value: 10,000

The hazardous waste quantity value of >0 is assigned for AOC A; this corresponds to an HWQ Factor Value of 1 based on Table 2-6 of the HRS. According to the HRS, the greater of that value or 10 is assigned as the HWQ Factor Value because the hazardous constituent quantity is not adequately determined [Ref. 1, Section 2.4.2.2 and 5.1.1.2.2]. Therefore, an HWQ Factor Value of 10 is assigned for the soil exposure component.

5.1.1.2.3 Calculation of Waste Characteristics Factor Category Value

Toxicity Factor Value (10,000) x Hazardous Waste Quantity Factor Value (10) = 100,000. According to HRS Table 2-1, the value corresponds to a Waste Characteristics Factor Category Value of 18.

Waste Characteristics Factor Value: 18
[Ref. 1, Section 5.1.1.2.3 and Table 2-7]

TARGETS

5.1.1.3.1 Residential Individual

AOC Letter: A

Level of Contamination: (Level I/Level II): Level 1

References: 1, Section 5.1.1.3.1; 2, pp. 10

Since there is at least one documented resident individual living on a property within an AOC and within 200 feet of contamination subject to Level I actual contamination, a Resident Individual Factor value of 50 is applicable [Table 29 of this HRS documentation record; Ref. 1, Section 5.1.1.3 and 5.1.1.3.1].

Resident Individual Factor Value: 50

Resident Population

Level I Concentrations

Observed contamination has been observed at residences in AOC A [see Section 5.1.0 of this HRS documentation record]. The population of the residences was obtained by multiplying the number of residences by the U.S. Census (2017-2021) average persons per dwelling in Stevens County, Washington (i.e. 2.51 people) [Ref. 45, p. 2]. Based on residential sampling conducted by EPA in 2021, a total of 4 homes are subject to Level I concentrations [see Section 5.1.1.3 of this HRS documentation record]. Therefore, a total of 10.04 people are subject to Level I concentrations.

Sum of individuals subject to Level I concentrations: 10.04
Sum of individuals subject to Level I concentrations x 10: 100.4
Level I Concentrations Factor Value: 100.4

Level II Concentrations

Observed contamination has been documented at residences in AOC A [see Section 5.1.0 of this HRS documentation record]. The population of the residences was obtained by multiplying the number of residences by the U.S. Census (2017-2021) average persons per dwelling in Stevens County, Washington (i.e. 2.51 people) [Ref. 45, p. 2]. Based on residential sampling conducted by EPA in 2021, a total of 12 homes are subject to Level II concentrations [see Section 5.1.1.3 of this HRS documentation record]. Therefore, a total of 30.12 people are subject to Level II concentrations.

Sum of individuals subject to Level II concentrations: 30.12

Level I Concentrations Factor Value: 100.4
Level II Concentrations Factor Value: 30.12

Workers

Several parcels within the AOC are owned by businesses; however, the number of workers who work in these buildings is not known. A worker value of 0 is assigned. [Ref. 1, Table 5-4].

Area Letter

Number of Workers

A

0

Total workers: 0
HRS Factor Value (Table 5-4): 0

Resources

There are no resource uses in an area of observed soil contamination; therefore, the assigned value is 0 [Ref. 1, Section 5.1.1.3.4].

Workers Factor Value: 0
Resources Factor Value: 0

Terrestrial Sensitive Environments

There are no known terrestrial sensitive environments within an area of observed contamination. Therefore, a terrestrial sensitive environments factor is assigned a value of 0.

Terrestrial Sensitive Environment Factor Value (EC): 0

[Ref. 1, Section 5.1.1.3.5]

Terrestrial Sensitive Environments Factor Value: 0

5.1.2 NEARBY POPULATION THREAT

The nearby population threat has not been scored. [Ref. 1, Section 5.1.1.3.2.2]