

DRAFT FINAL

Grandview Mine and Mill Site Engineering Evaluation/Cost Analysis

December 23, 2009

Prepared for:

Grandview Mine and Mill Site Respondents:

Blue Tee Corp.
Seattle City Light
Teck American Incorporated
Washington Resources, LLC

Prepared by:



Formation Environmental, LLC
2500 55th Street, Suite 200
Boulder, Colorado 80301

TABLE OF CONTENTS

	<u>Page</u>
LIST OF FIGURES	v
LIST OF APPENDICES	v
CERTIFICATION	vii
1.0 INTRODUCTION.....	1
2.0 SITE CHARACTERIZATION	3
2.1 Site Location, Description, and Status	3
2.1.1 Type of Facility and Operational Status	4
2.1.2 Topography and Site Layout.....	5
2.1.3 Surrounding Land Use and Populations	5
2.1.4 Ecological Resources and Sensitive Ecosystems	6
2.1.5 Geology	7
2.1.6 Hydrology/Hydrogeology	8
2.1.7 Meteorology	10
2.2 Previous Investigations	10
2.2.1 Ecology & Environment	10
2.2.2 Bureau of Land Management	12
2.2.3 URS	12
2.2.4 TechLaw	13
2.2.5 ENTACT	13
2.3 Previous Removal Actions	14
2.3.1 Washington Resources Action.....	14
2.3.2 EPA Action.....	14
2.4 Source, Nature, and Extent of Contamination	15
2.4.1 Contaminants of Potential Concern	15
2.4.2 Source Material Investigations.....	16
2.5 Streamlined Risk Evaluation	17
3.0 IDENTIFICATION OF REMOVAL ACTION SCOPE, GOALS, AND OBJECTIVES.....	19

3.1	Statutory Limits.....	19
3.2	Scope of the Removal Action	19
3.3	Goals and Objectives of the Removal Action	19
3.4	Compliance with ARARs and Other Criteria.....	20
3.5	Determination of Removal Schedule	20
4.0	IDENTIFICATION OF GENERAL RESPONSE ACTIONS.....	21
4.1	No Action	21
4.2	Institutional Controls	21
4.3	Containment	22
4.4	Consolidation.....	22
4.5	Treatment	22
4.6	Off-Site Disposal	23
5.0	IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES	24
5.1	Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea	26
5.1.1	MM1: No Action	27
5.1.2	MM2: Consolidate in On-Site Repository at Lower Level Mill Area	29
5.1.3	MM3: Consolidate in On-Site Repository at Tailings Accumulation Area	32
5.1.4	MM4: Disposal at Teck Pend Oreille Operations	36
5.1.5	MM5: Off-Site Disposal in a Landfill.....	40
5.2	Tailings Accumulation Subarea	43
5.2.1	TA1: No Action.....	43
5.2.2	TA2: Consolidate in On-Site Repository at Lower Level Mill Area.....	45
5.2.3	TA3: Consolidate in On-Site Repository at Tailings Accumulation Subarea 48	
5.2.4	TA4: Disposal at Teck Pend Oreille Operations	51
5.2.5	TA5: Off-Site Disposal in a Landfill	55
5.3	Man-Made Ditch and Downgradient Ditch Subarea	58
5.3.1	MD1: No Action.....	58
5.3.2	MD2: Consolidate in On-Site Repository at Lower Level Mill Area.....	60
5.3.3	MD3: Consolidate in On-Site Repository at Tailings Accumulation Subarea 63	
5.3.4	MD4: Disposal at Teck Pend Oreille Operations	66
5.3.5	MD5: Off-Site Disposal in a Landfill	70

6.0	COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES	74
6.1	Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea	75
6.1.1	Effectiveness	75
6.1.2	Implementability	76
6.1.3	Cost	76
6.2	Tailings Accumulation Subarea	76
6.2.1	Effectiveness	76
6.2.2	Implementability	77
6.2.3	Cost	77
6.3	Man-Made Ditch and Downgradient Ditch Subarea	77
6.3.1	Effectiveness	78
6.3.2	Implementability	78
6.3.3	Cost	79
7.0	RECOMMENDED REMOVAL ACTION ALTERNATIVE	80
8.0	REFERENCES.....	82

LIST OF TABLES

<u>Table</u>	<u>Title</u>
1	Source Material Locations and Estimated Volumes
2	Identification of Contaminants of Potential Concern (COPCs)
3	Analysis of Removal Action Alternatives Against CERCLA Criteria
4	Comparative Analysis of Removal Action Alternatives
5	Present Value of Recommended Removal Action Alternative
6	Detailed Cost Estimate Information – Recommended Removal Action Alternative

LIST OF FIGURES

<u>Figure</u>	<u>Title</u>
1	General Site Location
2	Site Layout
3	Approximate Boundaries of Site and Site Subareas
4	Map of Project APE Showing Recorded Resources Locations

LIST OF APPENDICES

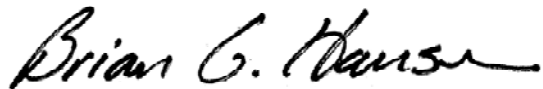
<u>Appendix</u>	<u>Title</u>
A	Excerpted Information from E&E, ENTACT, and URS Reports and Pend Orielle PUD Water Supply Well Logs
B	Applicable and/or Relevant and Appropriate Requirements (ARARs)
C	Detailed Cost Estimates

LIST OF ACRONYMS

ACT	Able Clean-Up Technologies
APE	Area of Potential Effects
ARAR	Applicable and/or Relevant and Appropriate Requirement
AOC	Administrative Order on Consent
BLM	Bureau of Land Management
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	Contaminant of Potential Concern
cy	cubic yard
E&E	Ecology & Environment
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
GRA	General Response Action
HHMSSL	EPA Region 6 Human Health Medium Specific Screening Levels
IC	institutional control
MTCA	Model Toxics Control Act
NCP	National Contingency Plan
O&M	operations and maintenance
PA/SI	Preliminary Assessment/Site Investigation
PHC	petroleum hydrocarbon compounds
PUD	Public Utility District
RA	Removal Assessment
RAO	Removal Action Objective
SARA	Superfund Amendment and Reauthorization Act
TBC	To Be Considered
TCLP	Toxicity Characteristic Leaching Procedure
UECA	Washington State Uniform Environmental Covenant Act
XRF	x-ray fluorescence
WAC	Washington Administrative Code

CERTIFICATION

Under penalty of law, I certify that to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of the Report, dated December 23, 2009, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A handwritten signature in black ink that reads "Brian G. Hansen". The signature is written in a cursive, flowing style.

Brian G. Hansen, P.E.

December 23, 2009

1.0 INTRODUCTION

This Engineering Evaluation/Cost Analysis (EE/CA) addresses contamination identified at the Grandview Mine and Mill Site (Site), Pend Oreille County, Washington. The Site consists of a former mine and mill located near Metaline Falls, Washington. The purpose of the EE/CA is to summarize the nature and extent of soil contamination associated with the Site, and to evaluate alternatives for the purpose of selecting an appropriate response action to address such contamination. Potential impacts to groundwater underlying the Site and to surface water and Pend Oreille River sediments are not included within the scope of this EE/CA.

This EE/CA was prepared pursuant to an Administrative Order on Consent (AOC) No. 10-2009-0118 (February 25, 2009) between Blue Tee Corp., Seattle City Light, Teck American Incorporated ("Teck"), and Washington Resources, LLC ("Washington Resources") (hereinafter collectively referenced as the Respondents), and the United States Environmental Protection Agency (EPA).

The Site is located adjacent to the Pend Oreille River approximately two miles northeast of Metaline Falls (Figure 1). The entire Site is approximately 17.1 acres; almost all of this area has been affected by the former mining and milling operations. The Site is the location of former mineral exploration, mining, and milling activities that were conducted between the late 1920s through 1964. Historic mining-related features at the Site include several buildings and concrete foundations, several drainage ditches, and a tailings deposit. Figure 2 shows the general layout of the Site and Figure 3 shows the approximate Site boundaries and the approximate property ownership boundaries (based, in part on information provided by Seattle City Light, 2008).

The response action described in this EE/CA will be conducted pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). This EE/CA has been prepared in accordance with and in a manner consistent with the National Contingency Plan (NCP) and EPA's *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA* (EPA, 1993).

The Site characterization information, and identification and analyses of removal action alternatives presented in this EE/CA are based both on the findings of previous investigations and reports conducted at the Site performed by others and the Site-specific investigations performed by the Respondents.

2.0 SITE CHARACTERIZATION

This section of the EE/CA provides general information regarding the Site including the location, type of former operations conducted at the Site, and a synopsis of the Site history. The geography and topography of the area are described along with descriptions of the regional geology and soils, adjacent land use, population near the Site, meteorology, and sensitive ecosystems. Previous response actions that have occurred at the Site are also described. Information related to the source, nature, and extent of contamination associated with the Site, including analytical data from sampling efforts conducted at the Site, is presented in this section. Finally, a streamlined risk evaluation is presented to provide an overall characterization of the potential impacts to human health and the environment associated with hazardous substances found at the Site, and to provide a basis for evaluating whether response actions recommended in this EE/CA protect human health and the environment.

2.1 Site Location, Description, and Status

The Site is located approximately two miles northeast of Metaline Falls, Washington, in the Metaline Mining District ("District") (Figure 1). The District contains low grade lead-zinc ores which were mined from the late 1900s to recent time. The Grandview Mine was developed in the late 1920s by Grandview Mines, Inc. and was operated until 1964. After operations were discontinued, most of the mining and milling equipment was removed from the Site, but several buildings associated with former mining and milling operations remain on the Site. In addition, scattered small accumulations of development rock or unprocessed ore associated with former mining operations, and flotation tailings associated with former milling operations, are located on the Site (see excerpted figures from the 2001 Preliminary Assessment/Site Investigation; E&E, 2001).

Since mining was discontinued in the mid 1960s, the Site has been largely vacant. A caretaker for the property has lived in a log cabin on the Site for over 20 years. Over this period, the caretaker has demolished buildings, salvaged equipment and materials, and generally maintained the property for Washington Resources. Reportedly, there has also been some timber production and unauthorized removal of rock from the Site since mining operations were discontinued. Although not open to the public, there are signs of trespass and recreational use on the Site.

2.1.1 Type of Facility and Operational Status

The Metaline Mining District contains low grade lead and zinc ores that were mined from the early 1900s until recently. The Grandview Site operated from the late 1920s through 1964 and was one of several mines in the Metaline Mining District. The Site is not currently operational. After the operations were discontinued, most of the mining and milling equipment was removed from the Site, though several buildings and concrete foundations that were associated with the mining and milling operations remain.

When in operation, ore and development rock were extracted from the underground mine workings through a mine opening at the Upper Level Mine Area. The development rock was stockpiled on-Site. The ore was transported from the Upper Level Mine Area to the Lower Level Mill Area where the ore was crushed and milled. The resulting tailings from the milling operation were reportedly directed by one or more wooden flumes located in ditches to locations down slope of the Lower Level Mill Area. A deposit of tailings is located approximately 400 feet from the Pend Oreille River in an area referred to as the Tailings Accumulation Area (Figure 2). Zinc and lead concentrates, which were the products of the milling operation, were transported to off-Site facilities for further processing.

A cultural resources evaluation survey of the Site was conducted in September, 2009 as required by the AOC and its associated Statement of Work. The purpose of the survey was to assist the Respondents in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, by locating and characterizing cultural resources within the project area and to offer recommendations regarding resource eligibility for listing in the National Registry of Historic Places. The results of the survey are presented in AHS/EWU, 2009. Several cultural resources were identified at the Site, as shown on Figure 4. These resources include former building foundations and partially intact structures, ore carts, etc. The survey concluded that only one structure at the Site is eligible for listing on the National Register of Historic Places: the log cabin currently occupied by the Site caretaker (cultural resource GV-14 on Figure 4). Due to this eligibility, and because it is currently occupied, the log cabin will not be damaged, removed, or modified as part of the response action identified in this EE/CA.

2.1.2 Topography and Site Layout

The general layout of the Grandview Site is shown on Figure 2. The Site elevation is approximately 2,400 feet above mean sea level (ft amsl) at the Lower Level Mill Area. As previously noted, the Site is located near the east bank of the Pend Oreille River. The Upper Level Mine Area is the easternmost and topographically most elevated portion of the Site. The Lower Level Mill Area is separated from the Upper Level Mine Area by a short forested slope. Most of the Upper Level Mine Area and the Lower Level Mill Area is located on property owned by Washington Resources.

A drainage ditch, which contained a wooden flume that transported tailings, extends from the west of the Lower Level Mill Area approximately 2,000 feet to the Tailings Accumulation Area (the "Drainage Ditch"). The Tailings Accumulation Area is contained within the property boundary of Teck.

The drainage ditch which extends approximately 500 feet from the Tailings Accumulation Area to the east bank of the Pend Oreille River is referenced herein as the Downgradient Ditch. Another drainage ditch, referenced herein as the Man-Made Ditch, departs from the Drainage Ditch approximately 150 feet above the Tailings Accumulation Area and ends at the river bank bluff a few hundred feet downstream of the Downgradient Ditch. Most of the Downgradient Ditch and some of the Man-Made Ditch are located on property owned by Seattle City Light. The entire Site, as depicted on Figure 3, covers approximately 17.1 acres. An approximate breakdown of that area by Site subarea is as follows:

- Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea: 14.3 acres
- Tailings Accumulation Subarea: 1.2 acres
- Man-Made Ditch and Downgradient Ditch Subarea: 1.6 acres

2.1.3 Surrounding Land Use and Populations

The area near the Site is primarily rural. Forestry, livestock grazing, mining, recreation, and localized agriculture are principal uses. Teck's Pend Oreille Operations are located less than one mile to the north of the Site but were never part of the of the Grandview Site operations. The Pend Oreille Operations, which include an underground zinc mine, a mill, and a lined

tailings impoundment, were temporarily shut down in late 2008 and transitioned to a care-and-maintenance mode in early 2009.

The 2008 population of Pend Oreille County was estimated to be approximately 12,900, yielding a population density of approximately 8.4 persons per square mile. The 2008 population of Metaline Falls, the closest town to the Site, was 230 (U.S. Census Bureau web site; City-Data.com). A small residential area, Pend Oreille Village, is located south of the Tailings Accumulation Area. The closest residence in Pend Oreille Village is approximately 200 feet from the Tailings Accumulation Area. The Circle Motel is located at the intersection of State Highway 31 and the Grandview Flats Road and is approximately 0.25 miles east of the Site. In addition, and as previously discussed, the Site caretaker resides in the log cabin in the Lower Level Mill Area (Figure 4). The removal actions developed and evaluated in this EE/CA specifically exclude the caretaker's residence, which will remain intact due to its eligibility for listing on the National Register of Historic Places, though the access road to the residence is included in the response action. The community of Metaline is located approximately one mile south-southeast of, and on the opposite side of the Pend Oreille River, from Metaline Falls.

2.1.4 Ecological Resources and Sensitive Ecosystems

Ecological resources within the Site area are limited. Vegetation within the Upper Level Mine Area and the Lower Level Mill Area consists of low growing forbs and shrubs typical of disturbed areas. Several small trees (aspen and fir) are located within these areas, but the rocky substrate and poor soil quality likely limits the vegetation growth. Similarly, the Tailings Accumulation Area is mostly barren with sparse vegetation located primarily at the edges of the tailings material. These areas may have very limited habitat potential to small populations of small mammals and several small bird species were observed foraging within or near Upper Level Mine and Lower Level Mill areas. Larger animals likely only come into contact with source materials (i.e., development rock and/or tailings) when travelling through the area, as several game trails were observed crossing the northern portion of the Upper Level Mine Area.

The Drainage Ditch, Downgradient Ditch, and Man-Made Ditch areas are located within the coniferous forests typical of northeastern Washington. The forests primarily comprise maturing Douglas fir (*Pseudotsuga menziesii*) and Western Hemlock (*Tsuga heterophylla*). Similar forested areas surround most of the Grandview Site and are likely home to numerous bird and mammal species.

EPA has indicated that three federally threatened or endangered species may occur in the vicinity of the Site (September 8, 2009 e-mail message from E. Liverman, EPA Region 10). These species are:

- the grizzly bear (*Ursus actos horribilis*),
- the Canada lynx (*Lynx Canadensis*), and
- the bull trout (*Salvelinus confluentus*).

The Respondents will prepare a Biological Assessment, as required by the AOC and its associated Statement of Work, to evaluate the potential effects of the Site removal action once it is selected by EPA. The Biological Assessment will also identify any Washington Department of Fish and Wildlife endangered, threatened, candidate, sensitive, and priority species and habitats that may occur in the vicinity of the Site, including the Pend Oreille River.

2.1.5 Geology

The Grandview Site is situated in the Okanogan Highlands geologic province to the east of the Cascade Range and north of the Columbia Basin. The Okanogan Highlands are characterized by rounded mountains with elevations up to 8,000 feet above sea level and deep, narrow valleys.

In the eastern Highlands, Precambrian metasedimentary rocks are overlain by marine rocks representing each of the Paleozoic geologic time periods. The Cambrian record starts with sandstone (now quartzite) followed by shale and then limestone that grade into rocks of the Ordovician Period. All of these rocks were subjected to metamorphism during Jurassic through Eocene time.

Cambrian rocks, in particular, are important sources of mineral wealth. Near Metaline Falls, large Mississippi Valley-type zinc deposits were mined by room-and-pillar mining methods. All Paleozoic and some younger rocks have been repeatedly folded into a northeast-trending regional structure called the Kootenay Arc, which extends northeastward for 150 miles into British Columbia and contains numerous lead-zinc mines.

The Okanogan Highlands were covered by ice sheets during the Pleistocene Epoch. As the ice sheets retreated to the north, lakes formed in the valleys of the Columbia and Pend Oreille Rivers. Along the Canadian boundary, terrace deposits indicate lake levels 2,000 feet above

current sea level. Melt waters filled these lakes with sand, silt, and clay (Lasmanis, 1991). The presence of these lakes resulted in the development of benches at various levels above the rivers that are part of the current regional topography.

2.1.6 Hydrology/Hydrogeology

No perennial streams are present on the Grandview Site. Intermittent drainage appears to occur in the Drainage Ditch, Downgradient Ditch, and possibly the Man-Made Ditch following precipitation events. An intermittent, unnamed spring begins at a location above and to the east of the Site and flows across the Site toward the head of the Drainage Ditch. Since tailings are present in low areas and drainages at the Site, it is possible that tailings are mobilized to the Pend Oreille River during run-off events.

Groundwater beneath the Site has not been extensively investigated. Well log reports document the presence of 35 wells within the 4-mile radius of the Site. Driller logs indicate that groundwater is present between 18 and 180 feet below ground surface. Whether these are separate aquifers is unknown (E&E, 2001). The top three to five feet of subsurface native soil in the Tailings Accumulation Area near Pend Oreille Village consists of top soil. Top soil is underlain by a mixture of sand, gravel, clay, and boulders. A significant portion of the subsurface soils at the site consist of fine-grained sands and clay. Bedrock is found at depths greater than 200 feet below ground surface. Groundwater exists locally within fractures in the bedrock and within overlying unconsolidated deposits (E&E, 2003).

As discussed in Section 2.2.1, groundwater sampling has revealed that groundwater near Pend Oreille Village contains metals at levels that are elevated above background concentrations, with two groundwater samples exceeding the federal maximum contaminant level for arsenic (E&E, 2001; 2002). The wells in which these exceedances were noted are owned by the Pend Oreille Public Utility District (PUD) and are located in the southeastern portion of Pend Oreille Village (Figure 3). Based on information provided by the Pend Oreille PUD, the wells are approximately 40 feet apart. The direction of groundwater flow in the Site vicinity is uncertain; however, if it is inferred that the uppermost groundwater system flows generally west toward the Pend Oreille River, the locations of the Pend Oreille PUD wells would be hydraulically side-gradient to the Site (i.e., not directly downgradient of the Site). Well logs provided by the Pend Oreille PUD are included in Appendix A and indicate the following well details (depths are in feet below ground surface [bgs]; [POPUD, 2009]):

	<u>Well #1 (AAJ808)</u>	<u>Well #2 (AAJ805)</u>
Total Depth:	237 feet	228 feet
Screened Interval:	193 feet to 200 feet	203 feet to 223 feet
Static Water Level:	125 feet	123 feet

These wells are not in regular use by the Pend Oreille PUD as water supply wells but are instead maintained as emergency sources of water. The Pend Oreille PUD owns two other wells, designated AAJ806 and AAJ809, that are located near Well #1 and Well #2, but indicated that these wells are not in use and are scheduled to be decommissioned (POPUD, 2009). No other water supply wells are known to be in proximity to the Site.

2.1.6.1 Sample Results for Pend Oreille PUD Wells

The Pend Oreille PUD reports that the Well #1 and Well #2 are sampled on an approximate quarterly basis. The information provided by the Pend Oreille PUD indicates that groundwater extracted by these wells continues to exhibit exceedances of the Federal primary MCL for arsenic as well as Federal secondary MCLs for iron and manganese. The information does not indicate exceedances of MCLs for any organic compounds (POPUD, 2009).

2.1.6.2 Overall Potential for Groundwater Impacts

There appears to be a low potential for COPC sources at the Site to affect groundwater. In 1999, Teck submitted a petition to the Washington Department of Ecology to exempt mill tailings at the Pend Oreille Operations from the state's dangerous waste and extremely hazardous waste regulations due to the tailings' low potential to leach metals to infiltrating precipitation and snowmelt (Teck, 1999). The flotation tailings evaluated in Teck's petition were produced during the 1970s and, due to similarities in the ores mined at the Pend Oreille Operations and at the Site, as well as the flotation processes used at both facilities, the tailings produced at both facilities are similar. Teck's petition demonstrated that the tailings are not acid-forming, do not leach significant quantities of metals to infiltrating waters (as demonstrated through leach testing), have not impacted soil immediately underlying the tailings, and have not impacted groundwater in the vicinity of the tailings impoundment. The petition concluded that "*after 20 years of uncontrolled, subaerial deposition, mill tailings have had no measurable effect on groundwater with respect to RCRA metals*" (this includes arsenic, which was not shown to

exceed the Federal primary MCL of 0.01 mg/L in the vicinity of the tailings impoundment). The low potential for the Grandview tailings to affect groundwater is supported by sampling conducted by URS on behalf of Teck, which also show low metals concentrations in soil underlying tailings in the tailings accumulation area, and thus a low potential for metals mobilization to groundwater (URS, 2007).

Semi-volatile organic contaminants of potential concern (COPCs) were shown to be present in the former drum disposal area during the PA/SI. As previously noted, sampling results from the Pend Oreille PUD emergency water supply wells indicate no exceedances of Federal MCLs for organic compounds.

2.1.7 Meteorology

The following climate data for the Grandview Site were compiled from the Metaline Falls, Washington monitoring station (Cascade Earth Sciences, 2007).

- Total average precipitation is approximately 28 inches per year.
- The average minimum temperature of approximately 17 degrees Fahrenheit occurs in January.
- The average maximum temperature of approximately 84 degrees Fahrenheit occurs in July.
- The annual prevailing wind direction is from the north-northwest to the south-southeast.

2.2 Previous Investigations

Summaries of previous investigations and response actions at the Grandview Site are provided in the following subsections.

2.2.1 Ecology & Environment

In October, 2000, Ecology and Environment, Inc. (E&E) conducted a Preliminary Assessment/Site Investigation (PA/SI) of the Grandview Site under a contract with EPA (E&E, 2001). Tailings were documented in the Drainage Ditch that connects the Lower Level Mill Area with the Tailings Accumulation Area as well as in the Downgradient Ditch that lies between

the Tailings Accumulation Area and the bluff that forms the bank of the Pend Oreille River (Figure 2). The PA/SI also documented that approximately 100 to 200 abandoned drums were previously present in the upper portion of the Drainage Ditch (see approximate location on Figure 2). These drums had been removed by the property owner, Washington Resources, LLC, prior to the PA/SI in between June and December, 2000. The drums were disposed at the Graham Road Disposal Facility located in Medical Lake, Washington (ENTACT, 2008).

During the PA/SI, surface water samples were collected from the unnamed spring and the Pend Oreille River and, as previously discussed, groundwater samples were collected from the off-line Pend Oreille Village wellhead. The concentrations of lead and zinc in the unnamed spring and the Pend Oreille River exceeded the National Recommended Water Quality Criteria for acute freshwater exposure, and the concentration of cadmium in the Pend Oreille River exceeded the criteria for chronic freshwater exposure. As noted previously, the concentration of arsenic in groundwater samples collected from the wellhead exceeded the Safe Drinking Water Action Maximum Contaminant Level. In addition, sediment samples were collected from the unnamed spring and the Pend Oreille River. Concentrations of cadmium, lead, and zinc were detected in the sediment of the unnamed spring, and concentrations of lead and zinc were detected in the Pend Oreille River sediment which exceeded the NOAA Screening Quick Reference Tables Probable Effects Levels guidelines and the Consensus-Based Probable Effect Concentration guidelines.

The PA/SI included the collection and analysis of samples from potential source areas and affected media. Source area sampling addressed the Tailings Accumulation Area, development rock piles, Drainage Ditch, and abandoned drum disposal area. Based on these analyses, the on-Site sources were characterized as containing concentrations of arsenic, cadmium, copper, manganese, mercury, selenium, lead, and zinc that exceed Washington State Model Toxics Control Act (MTCA) Method A Soil Cleanup Levels for Industrial Properties and/or EPA Region 6 Human Health Medium Specific Screening Levels (HHMSSLs). Several semi-volatile organic compounds were detected in surface soil samples collected from the abandoned drum storage area.

EPA and E&E representatives toured the Grandview Site in August 2003 to better define the extent of tailings in the Tailings Accumulation Area and to conduct a reconnaissance of the Downgradient Ditch. Tailings were observed to be present along the length of the Downgradient Ditch to the edge of the bluff above the Pend Oreille River.

2.2.2 Bureau of Land Management

Representatives of the Bureau of Land Management (BLM), EPA, and E&E conducted a visual inspection of the Grandview Site and surrounding area in June 2001 that included a field screening of the Lower Level Mill Area using portable x-ray fluorescence (XRF) equipment. Locations screened included development rock areas to the west and south of the caretaker's residence and on the west side of a former loading shed foundation. The XRF results indicated lead levels that exceeded MTCA Method A Soil Cleanup Levels for Unrestricted Land Use and EPA Region 6 HHMSSLs.

2.2.3 URS

Teck retained URS Corporation ("URS") to further characterize the Tailings Accumulation Area. URS conducted field work in September 2006 to define the nature and extent of the tailings in the Tailings Accumulation Area including volume, metals concentrations, and waste characteristics. The investigation included 28 hand-auger soil borings, 15 test pits, and the collection of tailings samples for chemical and geotechnical analyses. URS concluded that the Tailings Accumulation Area contains 20,700 cubic yards (cy) of tailings, at a maximum thickness of 11 to 19 feet.

Concentrations of lead and cadmium in all tailings samples exceeded the MTCA Method A Soil Cleanup Levels for Unrestricted Land Use. Arsenic exceeded the MTCA Method A Soil Cleanup Level for Unrestricted Land Use in 10 of 16 samples. Native soil samples collected from beneath the tailings were generally lower than the respective MTCA Method A Soil Cleanup Levels for Unrestricted Land Use. Five tailings samples and five native soils samples were analyzed for waste characteristics (soluble metals) using the Toxicity Characteristic Leaching Procedure (TCLP). All five tailings samples analyzed by the TCLP exceeded the toxicity criterion for lead; none of the five native soil samples, which were collected from areas underlying the tailings, analyzed by the TCLP exceeded any toxicity criteria. URS also identified an additional channel (the Man-Made Ditch), which was observed to contain residual tailings and extends from the lower portion of the Drainage Ditch to the bluff above the Pend Oreille River, bypassing the Tailings Accumulation Area (Figure 2) (URS, 2007).

2.2.4 TechLaw

A Removal Assessment (RA) of the Grandview Site was conducted in August 2007 by TechLaw Incorporated ("TechLaw") as a contractor to EPA. The RA was conducted to assess the need for removal actions within Pend Oreille Village and to assess data gaps in the Upper Level Mine Area pursuant to CERCLA. Six surface soil samples were collected from the Upper Level Mine Area and 121 soil samples were collected from a total of 20 residential lots in Pend Oreille Village and the Lower Level Mill Area. Six residential lots, including the caretaker's residence, were found to contain soil cadmium and/or lead concentrations exceeding MTCA Method A Soil Cleanup Levels for Unrestricted Land Use. XRF screening in the Upper Level Mill Area indicated metals concentrations exceeding the MTCA Method A Soil Cleanup Levels for Industrial Properties. Analytical results showed that lead, arsenic, cadmium, and methylene chloride exceeded MTCA Method A soil Cleanup Levels and/or the Region 6 HHMSLs (TechLaw, 2008). Methylene chloride is a common laboratory contaminant, is not typically used in milling operations and, accordingly, is not thought to be related to the Grandview Site.

2.2.5 ENTACT

ENTACT, LLC ("ENTACT") conducted supplemental investigations at the Grandview Site on behalf of the Respondents in 2008. The purposes of the supplemental investigations were to: (1) determine whether additional areas of the Site are affected by historic mining or milling operations beyond those identified by previous investigations, and (2) better define the nature and extent of all source materials on the Site to support preparation of the EE/CA. Field work associated with the supplemental investigation was conducted from September 15th through 18th, 2008. The field work included screening for metals using portable XRF equipment and screening for volatile organic constituents using a photoionization detector. Laboratory analyses of selected samples were conducted to confirm the field screening results. Field surveys were made to better delineate the extent and volume of development rock and tailings in the Upper Level Mine Area, the Lower Level Mill Area, the Drainage Ditch, the Tailings Accumulation Area, the Downgradient Ditch, and the Man-Made Ditch. ENTACT opined that URS' volume estimate for the Tailings Accumulation Area of 20,700 cy may also include tailings in the Downgradient Ditch. ENTACT's volume estimates were 18,000 cy and 915 cy for the Tailings Accumulation Area and the Downgradient Ditch, respectively. The supplemental investigation confirmed the presence of several contaminants above soil cleanup criteria, identified additional areas impacted by the former mining and milling operations, and developed volume estimates for all of

the areas impacted by development rock and tailings (ENTACT, 2008). These volume estimates, which are discussed in Section 2.4.2, are used in the development and evaluation of removal action alternatives in this EE/CA.

2.3 Previous Removal Actions

Two previous removal actions conducted at the Site are discussed below.

2.3.1 Washington Resources Action

Between May 22 and June 21, 2000 Washington Resources collected and disposed of the abandoned drums discovered as part of the EPA PA/SI described in Section 2.2.1. Approximately 175 drums and miscellaneous pieces of metal were removed from the ditch and staged on the Lower Mill Area. Of the removed drums, only 15 contained any residual material and this material was determined to be petroleum hydrocarbon compounds (PHC). Washington Resources consolidated the residual PHC into two drums and Able Clean-up Technologies, Inc. (ACT) of Spokane, Washington was contracted to dispose of the original 15 drums that contained the residual material and the two drums of PHC. On December 5, 2000, ACT disposed of these drums at the Graham Road Landfill located near Spokane, Washington. The remaining empty drums were crushed and transported by Washington Resources to the Pend Oreille Solid Waste Facility in Lone, Washington and disposed as solid waste.

2.3.2 EPA Action

During the week of September 10, 2007, EPA conducted a time-critical removal action to address the immediate human health and ecological threats posed by the elevated lead concentrations in Pend Oreille Village. Approximately 110 cubic yards of driveway material having a lead concentration greater than 250 milligrams/kilogram were excavated as part of the time-critical removal action. The excavated areas were backfilled with clean fill, graded for control of surface water drainage, and compacted. The excavated materials were staged in the Tailings Accumulation Area as an interim measure pending final cleanup. The materials were placed on and then covered with 20-mil polyethylene sheeting, and the sheet was secured in-place with sandbags and rope. In addition to the EPA activity, Teck, without an order, agreed to fence and apply a dust suppressant to the Tailings Accumulation Area to minimize fugitive dust, and Washington Resources provided access for sampling of the Grandview Mine caretaker's

residence, and to restrict access to the Upper Level Mine Area (EPA, 2009).

2.4 Source, Nature, and Extent of Contamination

The site characterization information is relevant to only soil, and this section addresses only soil. The following subsections identify the inorganic and organic contaminants based on the previous investigations; summarize the available analytical results; and describe the locations, areal extents, and volumes of the mining related source materials and affected soils at the Site.

2.4.1 Contaminants of Potential Concern

The COPCs for the various source materials and potentially affected media at the Site are based on the type and characteristics of the source material or media and the extent of information and data on the source materials, and potentially affected media present at the Site.

Excerpted data tables and sample location figures from the PA/SI (E&E, 2001) as well as the ENTACT and URS reports are provided in Appendix A. These tables and figures present the available inorganic and organic sample information for the Site. The PA/SI data characterize materials throughout the Site. The ENTACT data characterize development rock and/or tailings in the Upper Level Mine Area and the Lower Level Mill Area whereas the URS data characterize tailings in the Tailings Accumulation Area.

The excerpted chemical data in Appendix A were compared to screening criteria to identify COPCs. Those criteria are:

- MTCA cleanup values for Unrestricted Land Uses (WAC 173-340-700);
- MTCA Table 749-3 soil concentrations for plants and animals (WAC 173-340-7493).
- EPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites (May, 2009);
- Natural Background Soil Metals Concentrations in Washington State (Ecology, 1994); and
- USEPA Ecological Soil Screening Levels (ECO-SSLs).

Note that the MTCA criteria are ARARS whereas the EPA Regional RSLs are to-be-considered requirements. The Natural Background Soil Metals Concentrations and the ECO-SSLs are neither ARARs nor to-be-considered requirements (see Appendix B).

The maximum measured concentration of each analyte represented in Appendix A was compared to each of the five screening criteria. If the maximum concentration exceeded any of these criteria, the analyte was identified as a COPC. Table 2 provides a summary of this screening evaluation. Based on the screening process, the following metals are considered to be COPCs: aluminum, antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, silver, vanadium, and zinc. All COPCs will be addressed to achieve their respective clean up levels, as established by the ARARs (Appendix B).

The semi-volatile organic compounds known to be present in the former drum storage area are considered to be COPCs. Further, analytical data for this area also shows metals above actionable concentrations.

2.4.2 Source Material Investigations

Source materials at the Grandview Site comprise development rock, tailings, and soil at the former drum disposal area that contains semi-volatile organic constituents

Development rock consists of angular to subangular material ranging from coarse fines to fragments roughly 2 to 3 inches in diameter, possessing an overall light grey coloration. The development rock appears to be predominantly fine-grained sedimentary rock. Accumulations of development rock are present in the Lower Level Mill Area and the Upper Level Mine Area. In addition, based on visual observations and recorded metal concentrations, development rock has been used to surface portions of the Upper Level Mine Area, the Lower Level Mill Area, and access roads on the Site.

Tailings observed at the Site consist of a light grey, friable powder material. The tailings are generally distinct from native soil material which varies from light yellow to light brown sand and loam. Tailings are present in the area west of the Grandview Flat Road (i.e., access road to the Lower Level Mill Area), the Drainage Ditch, the Tailings Accumulation Area, the Downgradient Ditch, and the Man-Made Ditch.

Soil impacted by semi-volatile organic constituents should appear similar to the aforementioned native soil.

Metals concentrations associated with the source materials, including concentrations of the COPCs lead, arsenic, and cadmium, are presented in excerpted tables and figures from the

ENTACT and URS reports (Appendix A). As previously discussed, ENTACT investigated the areal extents and volumes of COPC source materials (development rock and tailings) in the Upper Level Mine Area, Lower Level Mill Area, Drainage Ditch, and Man-Made Ditch. ENTACT also estimated the volume of tailings in the Tailings Accumulation Area, as did URS (ENTACT, 2008; URS, 2007). These estimates were made by measuring metals concentrations in suspected development rock and tailings using a portable XRF unit, as previously discussed, and comparing the XRF results to MTCA Method A cleanup levels for unrestricted land use and/or industrial properties. Metals concentrations that exceeded these criteria were taken to be indicative of the presence of development rock and/or tailings. The areal extent of these materials was measured using global positioning system (GPS) equipment and other surveying equipment. The vertical extent of these materials was estimated by measuring metals concentrations in samples collected using hand augers (ENTACT, 2008).

The estimated volumes of source material, based on these studies, are summarized in Table 1. As shown, there are an estimated 12,220 cy of development rock and 29,075 cy of tailings present at the Site, for a total of 41,295 cy of source material. The locations of the development rock and tailings accumulations are shown on the excerpted figures presented in Appendix A. In addition, an unknown amount of soil impacted by semi-volatile organic constituents is present in the former drum storage area. Finally, there may be some areas of soil that have been impacted by COPCs originating from the development rock and tailings.

2.5 Streamlined Risk Evaluation

This streamlined risk evaluation for the Site was prepared using the general guidance provided in the EPA's Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA (EPA, 1993). This risk evaluation is intermediate in scope between limited evaluation conducted for emergency removal actions and the conventional baseline assessment normally conducted for remedial actions.

The purpose of this evaluation is to identify the COPCs by comparing the analytical results of the EE/CA and other field investigations to standards that are potential human health or ecological chemical-specific ARARs for the action. The results of this comparison with screening levels will confirm the potential human health and ecological risks posed by the site that justifies a removal action. The comparison will also help to focus the alternatives development by identifying the particular source or sources of contamination and associated

risk. Furthermore, the results of the streamlined risk evaluation will provide the basis for developing appropriate cleanup levels as part of the Removal Action.

This streamlined risk evaluation for the Site assumes any mine waste materials and mine-waste contaminated soils with COPCs pose an actual or potential threat to human health or welfare, or the environment. COPCs exceeding human health and ecological screening criteria in source materials and affected media are summarized in Table 2. Site investigations have adequately defined the extent of the COPCs that are present in source materials and soils to proceed with this EE/CA.

3.0 IDENTIFICATION OF REMOVAL ACTION SCOPE, GOALS, AND OBJECTIVES

This section presents the objectives for the proposed removal action at the site. The purpose, scope, and scheduling requirements for implementation of the removal action alternatives are also described in this section in order to define removal action requirements based on time, budget, technical feasibility, and relevant criteria and standards.

3.1 Statutory Limits

To the extent that a private entity undertakes the proposed CERCLA removal action, the statutory limits (monetary ceiling and duration) for fund-financed removal actions do not apply.

3.2 Scope of the Removal Action

The removal actions presented within this EE/CA are intended to address the human health and ecological risks identified within the streamlined human health and ecological risk evaluations.

3.3 Goals and Objectives of the Removal Action

The goal of this EE/CA is to effectively address the mine waste related contamination associated with former mining and milling activities in soil at the Site, and to reduce the potential for this affected media to act as a source to surface water and ground water, in a manner that is protective of human health and the environment and to attain applicable or relevant and appropriate requirements (ARARs) to the extent practicable considering the exigencies of the situation.

Based on the potential human health and ecological risks identified for the Site, the following removal action objectives (RAOs) have been identified for the Site:

Human Receptors

- Prevent human exposure to contaminated soil containing hazardous substances at concentrations that exceed potential cleanup levels, and
- Reduce loadings of hazardous substances to surface water and groundwater so that loadings do not cause exceedances of potential surface water and groundwater ARARs.

Ecological Receptors

- Reduce ecological exposures to contaminated soil containing hazardous substances at concentrations that may result in unacceptable risks, and
- Reduce loadings of hazardous substances to sediment, surface water, and groundwater so that loadings do not cause exceedances that may result in unacceptable ecological risks.

3.4 Compliance with ARARs and Other Criteria

Section 300.415(i) of the NCP provides that removal actions pursuant to CERCLA section 106 attain ARARs under Federal or State environmental laws or facility siting laws, to the extent practicable considering the urgency of the situation and the scope of the removal. In addition to legally binding laws and regulations, many federal and state environmental and public health programs also develop criteria, policies, guidance, and proposed standards that are not legally binding; however, they may provide useful information or recommended procedures. These “to-be-considered” (TBCs) materials are not potential ARARs, but are evaluated along with ARARs. Applicable ARARs and TBCs for this EE/CA are summarized in Appendix B.

3.5 Determination of Removal Schedule

The general schedule for removal activities, including both the start and completion time for the action, will be subject to negotiation of another AOC with the Respondents for conduct of the action itself.

4.0 IDENTIFICATION OF GENERAL RESPONSE ACTIONS

Based on the analysis of the nature and extent of contamination and on the RAOs developed in the previous section, a limited number of technically practicable and implementable technologies appropriate for addressing the RAOs were identified. Technologies represent specific components or processes that are part of a potential cleanup. The various alternatives may be combined into a single removal action.

Identification of general response action (GRA) alternatives considered:

- No action;
- Institutional Controls (ICs);
- Containment;
- Consolidation;
- Treatment; and
- Off-Site Disposal.

For the purposes of this analysis, monitoring alone was not considered as a specific alternative. However, monitoring is considered to have application for all alternatives to determine whether or not a technology is achieving removal action objectives and to evaluate its continuing effectiveness.

4.1 No Action

This alternative would leave the existing conditions as they currently exist. Contamination that is present would remain in-place, and no removal actions would be taken.

4.2 Institutional Controls

Institutional controls (ICs) are administrative or legal measures and access modifications that do not involve construction or physically changing the site. Some examples of ICs include easements, covenants, well drilling restrictions, and special building permit requirements. ICs are designed to lower the potential for people and the environment to be exposed to contamination, and are normally used when waste is left on-Site and when there is a limit to the activities that can safely take place at the site. ICs are typically meant to supplement engineering controls.

4.3 Containment

In-place and on-Site containment alternatives are directed at controlling contaminant movement and preventing contaminated materials and media from coming into contact with potential receptors. Containment includes capping or covering with a variety of materials including gravel, soil, and vegetation. Depending on the hydraulic conditions, the cap design may include geotextiles to further restrict contaminant mobility, and/or engineered erosion control layers. Containment generally requires grading and surface water run-on and run-off control to provide proper drainage and to minimize future maintenance requirements. Containment requires the use of ICs and long-term monitoring and maintenance to ensure the continuing effectiveness of containment.

4.4 Consolidation

The footprint of contaminated media could be reduced by excavating contaminated materials and hauling the materials to be contained in-place or elsewhere on-Site. The excavated area will be graded to eliminate depressions that may hold water and to eliminate abrupt transitions in topography; clean fill may also be used if grading alone cannot eliminate depressions or abrupt topographic transitions. Consolidation generally requires grading, revegetation, and surface water run-on and run-off control to provide proper drainage and to minimize future maintenance requirements. Consolidation requires the use of ICs and long-term monitoring and maintenance to ensure the continuing effectiveness of containment.

4.5 Treatment

Treatment is intended to remove or render non-hazardous contaminants in media. Treatment can be accomplished on-Site using chemicals, microorganisms, or mechanical means. In many instances, a treatability study is necessary to assure the attainment of treatment objectives. Monitoring and maintenance is required to ensure the continuing effectiveness of treatment.

4.6 Off-Site Disposal

The excavation and off-Site disposal of contaminated materials would eliminate the human health and ecological exposure pathways of concern. Excavation generally requires grading, revegetation, and surface water run-on and run-off control to provide proper drainage controls. The excavated materials would be disposed of off-Site at an appropriate disposal facility.

5.0 IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

In this section, removal action alternatives are identified and individually analyzed against the criteria of effectiveness, implementability, and cost, per EPA guidance (EPA, 1993). These criteria are described below.

- Effectiveness – How well each alternative protects public health and the environment and achieves the RAOs. The effectiveness criterion includes the following sub-criteria:

Protectiveness

- Protective of public health and community
- Protective of workers during implementation
- Protective of the environment
- Complies with ARARs

Ability to Achieve RAOs

- Level of treatment/containment expected
- No residual effect concerns
- Will maintain control until long-term solution is implemented

- Implementability – The technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation. The implementability criterion includes the following sub-criteria:

Technical Feasibility

- Construction and operational considerations
- Demonstrated performance/useful life
- Adaptable to environmental conditions
- Contributes to remedial performance
- Can be implemented in 1 year

Availability

- Equipment
- Personnel and services
- Outside laboratory testing capacity

Off-site treatment and disposal capacity

Post-removal site control (PRSC; also referenced as operations and maintenance or O&M)

Administrative Feasibility

Permits required

Easements or right-of-ways required

Impact on adjoining property

Ability to impose ICs

Likelihood of obtaining exemption from statutory limits (if needed)

- Cost - The direct and indirect capital costs and annual PRSC costs associated with an alternative, on a net present value basis (in this case, 2009 dollars). The present value estimates are for comparative purposes only. The cost criterion includes the following sub-criteria:

Capital Cost

PRSC Cost

Present Value Cost

Removal action alternatives were developed for subareas of the Site, as follows:

- Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea;
- Tailings Accumulation Subarea; and
- Man-Made Ditch and Downgradient Ditch Subarea.

These subareas are shown on Figure 3 and were identified as a means of simplifying the development and analysis of removal action alternatives due to geographic proximity and/or similarity of source materials. This EE/CA identifies the removal action alternative for each subarea that best satisfies the aforementioned evaluation criteria through the comparative analysis process (Section 6.0). The combination of the subarea alternatives that best satisfies the evaluation criteria comprises the recommended removal action alternative for the Site (Section 7.0).

Detailed cost estimate information for the subarea-specific alternatives is provided in Appendix C, which is organized as follows. A summary of the present value estimates for the subarea-specific removal action alternatives is presented on Table C-1. Detailed present value cost estimate information for removal action alternatives for the Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea; the Tailings Accumulation Subarea; and the Downgradient Ditch and Man-Made Ditch Subarea are presented on Tables C-2 through C-4, respectively. Detailed cost estimate information for subarea alternatives are presented on Tables C-5 through C-16, as described in the subsections below. Note that the cost estimates for the subarea alternatives, as presented on Tables C-5 through C-16 do not reflect present value. The present value calculations are applied on the Site-wide alternative tables (Tables C-2 through C-4). The detailed cost estimates are based on EPA guidance (EPA, 1988 and 2000). As previously noted, the present value estimates are for comparative purposes only.

5.1 Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea

The Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea is estimated to contain a total of 12,220 cy of development rock and 7,220 cy of tailings. Most of this subarea is situated on property owned by Washington Resources. In addition, for the purposes of this EE/CA, it is assumed that 500 cy of affected soil from the former drum disposal area will need to be addressed for a total of 19,940 cy of source material in this subarea. This estimate is used for cost estimating purposes; the actual volume of material to be addressed will be determined by confirmation sampling during cleanup activities.

Five removal action alternatives were developed for this subarea, as follows (a shorthand designation was assigned to each alternative, and to alternatives developed for other subareas, to facilitate cross-referencing):

- MM1 – No Action
- MM2 – Consolidate in On-Site Repository at Lower Level Mill Area
- MM3 – Consolidate in On-Site Repository at Tailings Accumulation Area
- MM4 – Disposal at Teck Pend Oreille Operations
- MM5 – Off-Site Disposal in a Landfill

These removal action alternatives are described and individually evaluated against the criteria of effectiveness, implementability, and cost in the following subsections. Table 3 provides a summary of these analyses. For those alternatives involving excavation, the excavated area will be graded, and clean backfill material will be used to the extent necessary to eliminate depressions that may hold water and abrupt transitions in topography. Details regarding the net present value estimates of the alternatives are provided in Appendix C.

5.1.1 MM1: No Action

This alternative consists of the No-Action GRA (Section 4.1). It would not address the removal action objective because hazardous substances would be left in-place with no change in existing conditions. This alternative provides a baseline against which to compare the removal action alternatives.

5.1.1.1 Effectiveness

The no-action alternative is not considered to provide long-term or short-term effectiveness and permanence because contaminated material would remain at the Site and because it does not adhere to the ARARs identified for this removal action. A summary of this alternative relative to the effectiveness criteria is as follows:

Protectiveness

- Protective of public health and community: not protective.
- Protective of workers during implementation: not protective
- Protective of the environment: not protective.
- Complies with ARARs: not compliant.

Ability to Achieve RAOs

- Level of treatment/containment expected: no treatment/containment.
- No residual effect concerns: impacts would continue unabated.
- Will maintain control until long-term solution is implemented: no.

5.1.1.2 Implementability

The no-action alternative would technically easy to implement, but would be unacceptable because it does not protect human health and the environment. A summary of this alternative

relative to the implementability criteria is as follows.

Technical Feasibility

Construction and operational considerations: no construction.

Demonstrated performance/useful life: no demonstrated performance.

Adaptable to environmental conditions: not applicable.

Contributes to remedial performance: no.

Can be implemented in 1 year: yes.

Availability

Equipment: no equipment needed.

Personnel and services: no personnel or services needed.

Outside laboratory testing capacity: no outside testing needed.

Off-site treatment and disposal capacity: no off-Site treatment or disposal.

PRSC: no PRSC would be implemented.

Administrative Feasibility

Permits required: none.

Easements or right of ways required: none.

Impact on adjoining property: none.

Ability to impose ICs: no ICs would be imposed.

Likelihood to obtain exemption from statutory limits: not applicable.

5.1.1.3 Cost

No costs are associated with the no-action alternative. A summary of this alternative relative to the cost criteria is as follows.

Capital Cost: \$0.

PRSC Cost: \$0.

Present Value Cost: \$0.

5.1.2 MM2: Consolidate in On-Site Repository at Lower Level Mill Area

Alternative MM2 includes the ICs, Containment, and Consolidation GRAs (Sections 4.2, 4.3, and 4.4, respectively). It would entail consolidation of all COPC source material in the Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea into a repository to be constructed in the Lower Level Mill area. Components of Alternative MM2 are listed below.

- The repository would be constructed at the former crusher location, against the hillside in the north end of the Lower Level Mill Area on property owned by Washington Resources.
- The existing concrete silo and appurtenant concrete structures would be demolished and incorporated into the repository, along with other ancillary debris.
- 5,905 cy of development rock are already present in the repository footprint area and would only require regrading rather than transport.
- 6,315 cy of development rock (comprising 2,935 cy of surfacing material from the Lower Level Mill Area, 890 cy of surfacing material from the Historic Homesite Area, and 2,490 cy of surfacing material from the Grandview Flat and Upper Level Access Road) would be excavated and transported on existing on-Site roadways to the repository location.
- 7,220 cy of tailings (comprising 6,580 cy of tailings from the Drainage Ditch and 640 cy of tailings from the Distressed/Unvegetated Area west of the Grandview Flat road) would be excavated and transported to the repository location. This may require the construction of a temporary haul road in the Drainage Ditch. The Drainage Ditch would be reconstructed to restore hydraulic functionality. Tailings in the Distressed/Unvegetated Area would be hauled using existing, on-Site roadways.
- The former drum storage area will be investigated for semi-volatile organic compounds and metal constituents, and dependent on the analytical data, cleanup alternatives such as land-farming, consolidation, and off-Site disposal will be evaluated for implementation. For cost-estimating purposes, an assumed 500 cy of soil would be excavated from the former drum disposal area and hauled to the repository location.
- All excavated areas would be graded and/or backfilled with clean material to eliminate areas of standing water and/or abrupt transitions in topography. Further, all areas disturbed during construction will be graded to control for surface water run on and run-

off, and seeded and mulched in a manner appropriate for the area.

- The repository would have 3:1 side slopes and flatter top slopes. The mine-waste contaminated materials, which are of low leaching potential (see Section 2.1.6.2), will be consolidated beneath a minimum of 12 inches of clean material that will be revegetated. Cover soil will be obtained from an on-site borrow source.
- The repository would have an appropriately sized run-on control ditch to capture and route storm water around the repository and into the Drainage Ditch.
- As long as mine-waste contaminants remain on-Site above actionable concentrations, a long-term monitoring program would be implemented to ensure the continuing effectiveness of the removal action and to monitor Site conditions. As part of the monitoring program, annual or episodic inspections of the repository, as well as existing drainage systems would be evaluated for functionality, and the protective barriers would be inspected at several locations for clean soil cover thickness and evaluated to verify that the COPCs remain adequately contained.
- Because mine waste contamination will be left on-Site beneath a protective barrier, ICs such as restrictive covenants will be selected and implemented to maintain the integrity of the cleanup action, thus assuring the continued protection of human health and the environment and the integrity of the cleanup action.
- Best Management Practices (BMPs) would be implemented during construction to protect workers, the community, and the environment from short-term construction impacts such as erosion, fugitive dust, and other similar potential impacts.

5.1.2.1 Effectiveness

Alternative MM2 would be effective. It would provide long-term effectiveness and permanence because the COPC source materials would be isolated from direct contact by human and environmental receptors. It would also isolate COPC source materials from erosion by wind and/or surface water run-off. Consolidation and capping is a proven approach for addressing source materials such as the development rock and tailings located in the Upper Level Mine and Lower Level Mill and Drainage Ditch Subarea. Alternative MM2 would also provide short-term effectiveness because the repository construction can be accomplished using standard earth-

moving construction methods and associated BMPs that should not impose unacceptable risks to workers or to nearby residents. This alternative could be implemented in a single construction season. Alternative MM2 would meet ARARs because COPC source materials that exceed MTCA Method A Soil Cleanup Levels would no longer be present at the surface and/or because ICs would be implemented to ensure that future land use would result in acceptable levels of exposure to any remaining COPCs.

A summary of this alternative relative to the effectiveness criteria is as follows:

Protectiveness

Protective of public health and community: protective.

Protective of workers during implementation: protective

Protective of the environment: protective.

Complies with ARARs: compliant.

Ability to Achieve RAOs

Level of treatment/containment expected: no treatment; containment in repository.

No residual effect concerns: PRSC would be required to address residual effects.

Will maintain control until long-term solution is implemented: no further action expected.

5.1.2.2 Implementability

Alternative MM2 would be implementable. Implementation would be accomplished using standard construction methods and all goods and services required to implement such construction are expected to be readily available in the Site area. ICs would be implementable because the Washington State Uniform Environmental Covenant Act (UECA) contains procedural requirements ensuring that restrictive covenants are enforceable.

A summary of this alternative relative to the implementability criteria is as follows.

Technical Feasibility

Construction and operational considerations: feasible.

Demonstrated performance/useful life: yes.

Adaptable to environmental conditions: yes.

Contributes to remedial performance: yes.

Can be implemented in 1 year: yes.

Availability

Equipment: available.

Personnel and services: available.

Outside laboratory testing capacity: available.

Off-site treatment and disposal capacity: no off-Site treatment or disposal.

PRSC: repository monitoring and maintenance required.

Administrative Feasibility

Permits required: any permits should be readily available.

Easements or right of ways required: none anticipated.

Impact on adjoining property: minimal

Ability to impose ICs: ICs can be imposed.

Likelihood to obtain exemption from statutory limits: not applicable.

5.1.2.3 Cost

Cost estimates for Alternative MM2 are provided in Appendix C, Tables C-2 and C-5. A summary of this alternative relative to the cost criteria is as follows.

Capital Cost: \$362,712.

PRSC Cost: \$4,860 per year, years 1-5; \$2,430 per year, years 6-30.

Present Value Cost: \$403,000 (rounded).

5.1.3 MM3: Consolidate in On-Site Repository at Tailings Accumulation Area

Alternative MM3 includes the ICs, Containment, and Consolidation GRAs (Sections 4.2, 4.3, and 4.4, respectively). It would entail consolidation of all COPC source material from the Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea into a repository to be constructed in the Tailings Accumulation Area. Components of Alternative MM3 are listed below.

- 12,220 cy of development rock (comprising 5,905 cy of development rock and 2,935 cy of surfacing material from the Lower Level Mill Area, 890 cy of surfacing material from the Historic Homesite Area, and 2,490 cy of surfacing material from the Grandview Flat and Upper Level Access Road) would be excavated and transported using on-Site roadways, Highway 31, and streets in Pend Oreille Village to the repository location.

- 7,220 cy of tailings (comprising 6,580 cy of tailings from the Drainage Ditch and 640 cy of tailings from the Distressed/Unvegetated Area west of the Grandview Flat road) would be excavated and transported to the repository location. The Drainage Ditch would be reconstructed to restore hydraulic functionality. Tailings in the Drainage Ditch would be hauled directly to the repository location, possibly through the use of a new, temporary road. Tailings from the Distressed/Unvegetated Area would be transported using on-Site roadways, Highway 31, and streets in Pend Oreille village to the repository location
- The former drum storage area would be investigated for semi-volatile organic compounds and metal constituents, and dependent on the analytical data, cleanup alternatives such as land-farming, consolidation, and off-Site disposal would be evaluated for implementation. For cost-estimating purposes, an assumed 500 cy of soil would be excavated from the former drum disposal area and hauled to the repository location.
- All excavated areas would be graded and/or backfilled with clean material to eliminate areas of standing water and/or abrupt transitions in topography. Further, all areas disturbed during construction would be graded to control for surface water run on and run-off, and seeded and mulched in a manner appropriate for the area.
- The repository would have 3:1 side slopes and flatter top slopes. The mine-waste contaminated materials, which are of low leaching potential (see Section 2.1.6.2), will be consolidated beneath a minimum of 12 inches of clean material that will be revegetated. Cover soil will be obtained from an on-site borrow source.
- The repository would have an appropriately sized run-on control ditch to capture and route storm water, including that accumulating in the Drainage Ditch, around the repository.
- As long as mine-waste contaminants remain on-Site above actionable concentrations, a long-term monitoring program would be implemented to ensure the continuing effectiveness of the removal action and to monitor Site conditions. As part of the monitoring program, annual or episodic inspections of the repository, as well as existing drainage systems would be evaluated for functionality, and the protective barriers would be inspected at several locations for clean soil cover thickness and evaluated to verify

that the COPCs remain adequately contained.

- Because mine waste contamination would be left on-Site beneath a protective barrier, ICs such as restrictive covenants will be selected and implemented to maintain the integrity of the cleanup action, thus assuring the continued protection of human health and the environment and the integrity of the cleanup action.
- BMPs would be implemented during construction to protect workers, the community, and the environment from short-term construction impacts such as erosion, fugitive dust, and other similar potential impacts.

5.1.3.1 Effectiveness

Alternative MM3 would be effective. It would provide long-term effectiveness and permanence because the COPC source materials would be isolated from direct contact by human and environmental receptors. It would also isolate COPC source materials from erosion by wind and/or surface water run-off. Consolidation and capping is a proven approach for addressing source materials such as the development rock and tailings located in the Upper Level Mine and Lower Level Mill and Drainage Ditch Subarea. However, Alternative MM3 would result in the construction of a repository near a residential area (Pend Oreille Village) and sensitive habitat in the Pend Oreille River. Alternative MM3 would also provide short-term effectiveness because the repository construction can be accomplished using standard earth-moving construction methods and BMPs that should not impose unacceptable risks to workers or to nearby residents. This alternative could be implemented in a single construction season. Alternative MM3 would meet ARARs because COPC source materials that exceed MTCA Method A Soil Cleanup Levels would no longer be present at the surface and/or because ICs would be implemented to ensure that future land use would result in acceptable levels of exposure to any remaining COPCs.

A summary of this alternative relative to the effectiveness criteria is as follows:

Protectiveness

Protective of public health and community: protective.

Protective of workers during implementation: protective

Protective of the environment: protective.

Complies with ARARs: compliant.

Ability to Achieve RAOs

Level of treatment/containment expected: no treatment; containment in repository.

No residual effect concerns: PRSC would be required to address residual effects.

Will maintain control until long-term solution is implemented: no further action expected.

5.1.3.2 Implementability

Alternative MM3 would be implementable. It would be accomplished using standard construction methods and all goods and services required to implement such construction are expected to be readily available in the Site area. ICs would be implementable because the Washington State UECA contains procedural requirements ensuring that restrictive covenants are enforceable.

A summary of this alternative relative to the implementability criteria is as follows.

Technical Feasibility

Construction and operational considerations: feasible.

Demonstrated performance/useful life: yes.

Adaptable to environmental conditions: yes.

Contributes to remedial performance: yes.

Can be implemented in 1 year: yes.

Availability

Equipment: available.

Personnel and services: available.

Outside laboratory testing capacity: available.

Off-site treatment and disposal capacity: no off-Site treatment or disposal.

PRSC: repository monitoring and maintenance required.

Administrative Feasibility

Permits required: any permits should be readily available.

Easements or right of ways required: none anticipated.

Impact on adjoining property: minimal

Ability to impose ICs: ICs can be imposed.

Likelihood to obtain exemption from statutory limits: not applicable.

5.1.3.3 Cost

Cost estimates Alternative MM3 are presented in Appendix C, Tables C-2 and C-6. A summary of this alternative relative to the cost criteria is as follows.

Capital Cost: \$416,665.

PRSC Cost: \$5,400 per year, years 1-5; \$2,700 per year, years 6-30.

Present Value Cost: \$461,000 (rounded).

5.1.4 MM4: Disposal at Teck Pend Oreille Operations

Alternative MM4 includes the Treatment and Off-Site Disposal GRAs (Sections 4.5 and 4.6, respectively). It would entail excavating all COPC source material from the Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea and transporting it to the Teck Pend Oreille Operations. Components of Alternative MM4 are listed below.

- Development rock present as surfacing material in the Lower Level Mill Area (2,935 cy), the Historic Homesite Area (890 cy), the Grandview Flat and Upper Level Access Roads (2,490 cy), and the North Pile near the former crusher (5,905 cy) would be excavated and transported to the Teck Pend Oreille Operations. Such transport would be implemented using existing on-Site roadways without the need to utilize Highway 31.
- Tailings present in the Drainage Ditch (6,580 cy) and in the Distressed/Unvegetated Area West of Grandview Flat Road (640 cy) would be excavated and transported to the Teck Pend Oreille Operations. Such transport would be implemented using existing on-Site roadways without the need to utilize Highway 31.
- The former drum storage area would be investigated for semi-volatile organic compounds and metal constituents, and dependent on the analytical data, cleanup alternatives such as land-farming, consolidation, and off-Site disposal would be evaluated for implementation. For cost-estimating purposes, an assumed 500 cy of soil would be excavated from the former drum disposal area and hauled to the Pend Oreille Operations.
- Once at the Pend Oreille Operations, the development rock and tailings would be routed through the facility's mill to extract salable metals, to the extent practicable, and the resulting tailings would be directed to the facility's lined tailings impoundment. This

would address the CERCLA preference for treatment as a component of the removal action over conventional containment or land disposal approaches. Alternatively, the development rock and tailings could be directly disposed in the lined tailings impoundment. According to Teck, either approach would require revision of the existing conditional order for the Pend Oreille Operations.

- All excavated areas would be graded and/or backfilled with clean material to eliminate areas of standing water and/or abrupt transitions in topography. Further, all areas disturbed during construction will be graded to control for surface water run on and run-off, and seeded and mulched in a manner appropriate for the area.
- PRSC would be implemented on the seeded areas until vegetation success parameters have been met, after which vegetation should be well established and further erosion should be minimal.
- BMPs would be implemented during construction to protect workers, the community, and the environment from short-term construction impacts such as erosion, fugitive dust, and other similar potential impacts.

5.1.4.1 Effectiveness

Alternative MM4 would be effective. It would provide long-term effectiveness and permanence because the COPC source materials would be isolated from direct contact by human and environmental receptors through placement into an engineered tailings impoundment. It would also isolate COPC source materials from erosion by wind and/or surface water run-off. If the material is milled prior to disposal, this alternative would also reduce the concentrations of COPCs in the material and potentially yield salable metals. Alternative MM4 would provide short-term effectiveness because the excavation and hauling of the COPC source materials can be accomplished using standard earth-moving construction methods and BMPs that should not impose unacceptable risks to workers or to nearby residents. This alternative could be implemented in a single construction season. Alternative MM4 would meet ARARs because COPC source materials that exceed MTCA Method A Soil Cleanup Levels would no longer be present at the surface and/or because ICs would be implemented to ensure that future land use would result in acceptable levels of exposure to any remaining COPCs.

A summary of this alternative relative to the effectiveness criteria is as follows:

Protectiveness

Protective of public health and community: protective.

Protective of workers during implementation: protective

Protective of the environment: protective.

Complies with ARARs: compliant.

Ability to Achieve RAOs

Level of treatment/containment expected: treatment if milling is implemented;
containment in TDF3 (lined).

No residual effect concerns: PRSC would be required to address residual effects.

Will maintain control until long-term solution is implemented: no further action expected.

5.1.4.2 Implementability

Alternative MM4 would be implementable, assuming that any issues involving the state conditional order and related regulatory requirements are successfully addressed. Requirements of Washington law and regulations must be considered with respect to any removal action alternative that would involve transporting the Grandview Mine materials to Teck's nearby Pend Oreille Operations for final disposal. This alternative would involve disposal at Teck's existing Tailings Disposal Facility No. 3 (TDF3). While tailings and other mining wastes such as those at the Grandview Mine Site (as well as those contained in TDF3) are exempted from federal hazardous waste regulation by the Bevill Amendment, Washington state does not recognize this exemption and regulates tailings and other mine wastes under its dangerous waste regulations and under the Washington Metals Mining and Milling Operations Act, RCW Ch. 78.56. As a result, TDF3 is currently permitted to operate by the Washington Department of Ecology under a conditional order issued under the aforementioned statute. Disposal of wastes in TDF3 which are *not* derived from the Pend Oreille Operations is not currently allowed by the conditional order. In addition, the disposal of wastes from the Grandview Mine at TDF3 may involve the need for a treatability study and/or treatment/recycling prior to disposal and a variance from the Washington Department of Ecology's dangerous waste regulations dealing with recycled materials.

Implementation would be accomplished using standard construction methods and all goods and services required to implement such construction are expected to be readily available in the Site area.

A summary of this alternative relative to the implementability criteria is as follows.

Technical Feasibility

Construction and operational considerations: feasible.

Demonstrated performance/useful life: yes.

Adaptable to environmental conditions: yes.

Contributes to remedial performance: yes.

Can be implemented in 1 year: yes.

Availability

Equipment: available.

Personnel and services: available.

Outside laboratory testing capacity: available.

Off-site treatment and disposal capacity: Teck Pend Oreille Operations has sufficient milling capacity (if milling is implemented) and disposal capacity in TDF3.

PRSC: monitoring and maintenance of TDF3 required.

Administrative Feasibility

Permits required: would require modification of conditional order.

Easements or right of ways required: none anticipated.

Impact on adjoining property: minimal

Ability to impose ICs: ICs can be imposed.

Likelihood to obtain exemption from statutory limits: not applicable.

5.1.4.3 Cost

Cost estimates for Alternative MM4 are presented in Appendix C, Tables C-2 and C-7. A summary of this alternative relative to the cost criteria is as follows.

Capital Cost: \$674,858.

PRSC Cost: \$4,680 per year, years 1-5; \$2,340 per year, years 6-30.

Present Value Cost: \$713,000 (rounded).

This estimate assumes direct disposal of the development rock and tailings in the Pend Oreille Operations tailings impoundment without milling. Based on information from Teck, costs would increase if the material were to be milled prior to disposal in the tailings impoundment.

5.1.5 MM5: Off-Site Disposal in a Landfill

Alternative MM5 includes the Treatment and Off-Site Disposal GRAs (Sections 4.5 and 4.6, respectively). It would entail excavating all COPC source materials from the Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea and transporting it to an appropriate landfill. Components of Alternative MM5 are described below.

- 12,220 cy of development rock would be transported to and disposed at Waste Management's Graham Road facility in Medical Lake, Washington. This would require extensive use of Highway 31 and other public roadways.
- The 7,220 cy of tailings present in this subarea are assumed to fail TCLP criterion for lead based on the available information (see Section 2.2.3). The Graham Road facility cannot accept material that fails TCLP criteria. Therefore, the tailings would be treated by mixing them with triple superphosphate (TSP), either through mixing of wind rows with a bulldozer or in a batch plant, to reduce lead mobility (this type of treatment is often referred to as stabilization/fixation). Upon confirmation that the amended tailings no longer fail the TCLP criterion for lead, they would be transported to the Graham Road facility for disposal. This would require extensive use of Highway 31 and other public roadways. Direct disposal at Chemical Waste Management's hazardous waste landfill in Arlington, Oregon (the closest hazardous waste landfill to the Site) was also preliminarily considered, but this alternative was found to be much more costly due to long haul distances and high tipping fees. Therefore, direct disposal of tailings from the Grandview Site at this hazardous waste landfill was screened from further consideration.
- The former drum storage area will be investigated for semi-volatile organic compounds and metal constituents, and dependent on the analytical data, cleanup alternatives such as land-farming, consolidation, and off-Site disposal will be evaluated for implementation. For cost-estimating purposes, an assumed 500 cy of soil would be excavated from the former drum disposal area and hauled to the off-Site disposal facility.
- All excavated areas would be graded and/or backfilled with clean material to eliminate areas of standing water and/or abrupt transitions in topography. Further, all areas disturbed during construction will be graded to control for surface water run on and run-off, and seeded and mulched in a manner appropriate for the area.

- Operations and maintenance would be implemented on the seeded areas until vegetation success parameters are met, after which vegetation should be well established and further erosion should be minimal.
- BMPs would be implemented during construction to protect workers, the community, and the environment from short-term construction impacts such as erosion, fugitive dust, and other similar potential impacts.

5.1.5.1 Effectiveness

Alternative MM5 would be effective. It would be consistent with treatment as a favored component of a removal action under CERCLA and would provide long-term effectiveness and permanence because the COPC source materials would be isolated from direct contact by human and environmental receptors through placement in a regulated landfill. In addition, treatment of the tailings and placement in a landfill would limit the mobility of the metal COPCs. Alternative MM5 would provide short-term effectiveness because the excavation and hauling of the COPC source materials, and treatment of the tailings and affected soils from the former drum disposal area, can be accomplished using standard earth-moving construction methods and BMPs that should not impose unacceptable risks to workers or to nearby residents. This alternative could be implemented in a single construction season. Alternative MM5 would meet ARARs because COPC source materials that exceed MTCA Method A Soil Cleanup Levels would no longer be present at the surface and/or because ICs would be implemented to ensure that future land use would result in acceptable levels of exposure to any remaining COPCs.

A summary of this alternative relative to the effectiveness criteria is as follows:

Protectiveness

Protective of public health and community: protective.

Protective of workers during implementation: protective

Protective of the environment: protective.

Complies with ARARs: compliant.

Ability to Achieve RAOs

Level of treatment/containment expected: treatment to limit leaching; containment in off-Site disposal facility.

No residual effect concerns: none.

Will maintain control until long-term solution is implemented: no further action expected.

5.1.5.2 Implementability

Alternative MM5 would be implementable. Implementation would be accomplished using standard construction and hauling methods and all goods and services required to implement such construction are expected to be readily available in the Site area as well as at the receiving landfill.

A summary of this alternative relative to the implementability criteria is as follows.

Technical Feasibility

Construction and operational considerations: feasible.

Demonstrated performance/useful life: yes.

Adaptable to environmental conditions: yes.

Contributes to remedial performance: yes.

Can be implemented in 1 year: yes.

Availability

Equipment: available.

Personnel and services: available.

Outside laboratory testing capacity: available.

Off-site treatment and disposal capacity: material would be treated on-Site; off-Site disposal facility would be selected based on adequate capacity.

PRSC: limited to revegetation.

Administrative Feasibility

Permits required: any permits should be readily available.

Easements or right of ways required: none anticipated.

Impact on adjoining property: minimal

Ability to impose ICs: ICs can be imposed.

Likelihood to obtain exemption from statutory limits: not applicable.

5.1.5.3 Cost

Cost estimates for Alternative MM5 are presented in Appendix C, Tables C-2 and C-8. A

summary of this alternative relative to the cost criteria is as follows.

Capital Cost: \$4,101,273.

PRSC Cost: \$4,680 per year, years 2-5; \$2,340 per year, years 6-31.

Present Value Cost: \$4,140,000 (rounded).

5.2 Tailings Accumulation Subarea

The Tailings Accumulation Subarea is estimated to contain a total of 19,700 cy of tailings and is located on property owned by Teck. This estimate is used for cost estimating purposes; the actual volume of material to be addressed will be determined by confirmation sampling during cleanup activities.

Five removal action alternatives were developed for this subarea, as follows (a shorthand designation was assigned to each alternative, and to alternatives developed for other subareas, to facilitate cross-referencing):

- TA1 – No Action
- TA2 – Consolidate in On-Site Repository at Lower Level Mill Area
- TA3 – Consolidate in On-Site Repository at Tailings Accumulation Subarea
- TA4 – Disposal at Teck Pend Oreille Operations
- TA5 – Off-Site Disposal in a Landfill

These removal action alternatives are described and individually evaluated against the criteria of effectiveness, implementability, and cost in the following subsections. Table 3 provides a summary of these analyses. For those alternatives involving excavation, the excavated area will be graded, and clean backfill material will be used to the extent necessary, to eliminate depressions that may hold water and abrupt transitions in topography. Details regarding the net present value estimates of the alternatives are provided in Appendix C.

5.2.1 TA1: No Action

This alternative includes the No-Action GRA (Section 4.1). It would not address the removal action objective because hazardous substances would be left in-place with no change in

existing conditions. This alternative provides a baseline against which to compare the removal action alternatives.

5.2.1.1 Effectiveness

The no-action alternative is not considered to provide long-term or short-term effectiveness and permanence because contaminated material would remain at the Site and because it does not adhere to the ARARs identified for this removal action. A summary of this alternative relative to the effectiveness criteria is as follows:

Protectiveness

Protective of public health and community: not protective.

Protective of workers during implementation: not protective

Protective of the environment: not protective.

Complies with ARARs: not compliant.

Ability to Achieve RAOs

Level of treatment/containment expected: no treatment/containment.

No residual effect concerns: impacts would continue unabated.

Will maintain control until long-term solution is implemented: no.

5.2.1.2 Implementability

The no-action alternative would be technically easy to implement, but would be unacceptable because it does not protect human health and the environment. A summary of this alternative relative to the implementability criteria is as follows.

Technical Feasibility

Construction and operational considerations: no construction.

Demonstrated performance/useful life: no demonstrated performance.

Adaptable to environmental conditions: not applicable.

Contributes to remedial performance: no.

Can be implemented in 1 year: yes.

Availability

Equipment: no equipment needed.

Personnel and services: no personnel or services needed.

Outside laboratory testing capacity: no outside testing needed.

Off-site treatment and disposal capacity: no off-Site treatment or disposal.

PRSC: no PRSC would be implemented.

Administrative Feasibility

Permits required: none.

Easements or right of ways required: none.

Impact on adjoining property: none.

Ability to impose ICs: no ICs would be imposed.

Likelihood to obtain exemption from statutory limits: not applicable.

5.2.1.3 Cost

No costs are associated with the no-action alternative. A summary of this alternative relative to the cost criteria is as follows.

Capital Cost: \$0.

PRSC Cost: \$0 per year.

Present Value Cost: \$0.

5.2.2 TA2: Consolidate in On-Site Repository at Lower Level Mill Area

Alternative TA2 includes the ICs, Containment, and Consolidation GRAs (Sections 4.2, 4.3, and 4.4, respectively). It would entail excavation and transport of tailings in the Tailings Accumulation Subarea to a repository to be constructed in the Lower Level Mill Area. Components of Alternative TA2 are listed below.

- The repository would be constructed at the former crusher location, against the hillside in the north end of the Lower Level Mill Area on property owned by Washington Resources.
- The existing concrete silo and appurtenant concrete structures would be demolished and incorporated into the repository, along with other ancillary debris.
- 19,700 cy of tailings would be excavated and hauled to the repository location. This would necessitate hauling through a portion of Pend Oreille Village and on State Highway 31 for approximately one-half mile to the Grandview Flat Road, which provides access to the Lower Level Mill Area.

- All excavated areas would be graded and/or backfilled with clean material to eliminate areas of standing water and/or abrupt transitions in topography. Further, all areas disturbed during construction will be graded to control for surface water run on and run-off, and seeded and mulched in a manner appropriate for the area.
- The repository would have 3:1 side slopes and flatter top slopes. The mine-waste contaminated materials, which are of low leaching potential (see Section 2.1.6.2), will be consolidated beneath a minimum of 12 inches of clean material that will be revegetated. Cover soil will be obtained from an on-site borrow source.
- The repository would have an appropriately sized run-on control ditch to capture and route storm water around the repository and into the Drainage Ditch.
- As long as mine-waste contaminants remain on-Site above actionable concentrations, a long-term monitoring program would be implemented to ensure the continuing effectiveness of the removal action and to monitor Site conditions. As part of the monitoring program, annual or episodic inspections of the repository, as well as existing drainage systems would be evaluated for functionality, and the protective barriers would be inspected at several locations for clean soil cover thickness and evaluated to verify that the COPCs remain adequately contained.
- Because mine waste contamination would be left on-Site beneath a protective barrier, ICs such as restrictive covenants would be selected and implemented to maintain the integrity of the cleanup action, thus assuring the continued protection of human health and the environment and the integrity of the cleanup action.
- BMPs would be implemented during construction to protect workers, the community, and the environment from short-term construction impacts such as erosion, fugitive dust, and other similar potential impacts.

5.2.2.1 Effectiveness

Alternative TA2 would be effective. It would provide long-term effectiveness and permanence because the tailings would be isolated from direct contact by human and environmental receptors. It would also isolate the tailings from erosion by wind and/or surface water run-off. Consolidation and capping is a proven approach for addressing source materials such as the

tailings located in the Tailings Accumulation Subarea. Alternative TA2 would provide short-term effectiveness because the repository construction can be accomplished using standard earth-moving construction methods and BMPs that should not impose unacceptable risks to workers or to nearby residents. This alternative could be implemented in a single construction season. Alternative TA2 would meet ARARs because tailings that exceed MTCA Method A Soil Cleanup Levels would no longer be present at the surface and/or because ICs would be implemented to ensure that future land use would result in acceptable levels of exposure to any remaining COPCs.

A summary of this alternative relative to the effectiveness criteria is as follows:

Protectiveness

- Protective of public health and community: protective.
- Protective of workers during implementation: protective
- Protective of the environment: protective.
- Complies with ARARs: compliant.

Ability to Achieve RAOs

- Level of treatment/containment expected: no treatment; containment in repository.
- No residual effect concerns: PRSC would be required to address residual effects.
- Will maintain control until long-term solution is implemented: no further action expected.

5.2.2.2 Implementability

Alternative TA2 would be implementable. Implementation would be accomplished using standard construction methods and all goods and services required to implement such construction are expected to be readily available in the Site area. ICs would be implementable because the Washington State UECA contains procedural requirements ensuring that restrictive covenants are enforceable.

A summary of this alternative relative to the implementability criteria is as follows.

Technical Feasibility

- Construction and operational considerations: feasible.
- Demonstrated performance/useful life: yes.
- Adaptable to environmental conditions: yes.
- Contributes to remedial performance: yes.

Can be implemented in 1 year: yes.

Availability

Equipment: available.

Personnel and services: available.

Outside laboratory testing capacity: available.

Off-site treatment and disposal capacity: no off-Site treatment or disposal.

PRSC: repository monitoring and maintenance required.

Administrative Feasibility

Permits required: any permits should be readily available.

Easements or right of ways required: none anticipated.

Impact on adjoining property: minimal

Ability to impose ICs: ICs can be imposed.

Likelihood to obtain exemption from statutory limits: not applicable.

5.2.2.3 Cost

Cost estimates for Alternative TA2, including PRSC are presented in Appendix C, Tables C-3 and C-9). A summary of this alternative relative to the cost criteria is as follows.

Capital Cost: \$361,244.

PRSC Cost: \$2,580 per year, years 1-5; \$1,290 per year, years 6-30.

Present Value Cost: \$383,000 (rounded).

5.2.3 TA3: Consolidate in On-Site Repository at Tailings Accumulation Subarea

Alternative TA3 includes the ICs, Containment, and Consolidation GRAs (Sections 4.2, 4.3, and 4.4, respectively). It would entail regrading the Tailings Accumulation Subarea to create a tailings repository. Components of Alternative TA3 are listed below.

- The Tailings Accumulation Subarea would be shaped and regraded to minimize the footprint area of the tailings and to create a stable repository with positive drainage.
- All excavated areas would be graded and/or backfilled with clean material to eliminate areas of standing water and/or abrupt transitions in topography. Further, all areas disturbed during construction would be graded to control for surface water run on and

run-off, and seeded and mulched in a manner appropriate for the area.

- The repository would have 3:1 side slopes and flatter top slopes. The mine-waste contaminated materials, which are of low leaching potential (see Section 2.1.6.2), will be consolidated beneath a minimum of 12 inches of clean material that will be revegetated. Cover soil will be obtained from an on-site borrow source.
- The repository would have an appropriately sized run-on control ditch to capture and route storm water, including that accumulating in the Drainage Ditch, around the repository and into the Downgradient Ditch or Man-Made Ditch (after tailings are removed from the ditches; see Section 5.3).
- As long as mine-waste contaminants remain on-Site above actionable concentrations, a long-term monitoring program would be implemented to ensure the continuing effectiveness of the removal action and to monitor Site conditions. As part of the monitoring program, annual or episodic inspections of the repository, as well as existing drainage systems would be evaluated for functionality, and the protective barriers would be inspected at several locations for clean soil cover thickness and evaluated to verify that the COPCs remain adequately contained.
- Because mine waste contamination would be left on-Site beneath a protective barrier, ICs such as restrictive covenants would be selected and implemented to maintain the integrity of the cleanup action, thus assuring the continued protection of human health and the environment and the integrity of the cleanup action.
- BMPs would be implemented during construction to protect workers, the community, and the environment from short-term construction impacts such as erosion, fugitive dust, and other similar potential impacts.

5.2.3.1 Effectiveness

Alternative TA3 would be effective. It would provide long-term effectiveness and permanence because the tailings would be isolated from direct contact by human and environmental receptors. It would also isolate tailings from erosion by wind and/or surface water run-off. Consolidation and capping is a proven approach for addressing source materials such as the tailings located in the Tailings Accumulation Subarea. However, Alternative TA3 would result in

the construction of a repository near a residential area (Pend Oreille Village) and sensitive habitat in the Pend Oreille River. Alternative TA3 would provide short-term effectiveness because the repository construction can be accomplished using standard earth-moving construction methods and BMPs that should not impose unacceptable risks to workers or to nearby residents. This alternative could be implemented in a single construction season. Alternative TA3 would meet ARARs because tailings that exceed MTCA Method A Soil Cleanup Levels would no longer be present at the surface and/or because ICs would be implemented to ensure that future land use would result in acceptable levels of exposure to any remaining COPCs.

A summary of this alternative relative to the effectiveness criteria is as follows:

Protectiveness

Protective of public health and community: protective.

Protective of workers during implementation: protective

Protective of the environment: protective.

Complies with ARARs: compliant.

Ability to Achieve RAOs

Level of treatment/containment expected: no treatment; containment in repository.

No residual effect concerns: PRSC would be required to address residual effects.

Will maintain control until long-term solution is implemented: no further action expected.

5.2.3.2 Implementability

Alternative TA3 would be implementable. It would be accomplished using standard construction methods and all goods and services required to implement such construction are expected to be readily available in the Site area. ICs would be implementable because the Washington State UECA contains procedural requirements ensuring that restrictive covenants are enforceable.

A summary of this alternative relative to the implementability criteria is as follows.

Technical Feasibility

Construction and operational considerations: feasible.

Demonstrated performance/useful life: yes.

Adaptable to environmental conditions: yes.

Contributes to remedial performance: yes.

Can be implemented in 1 year: yes.

Availability

Equipment: available.

Personnel and services: available.

Outside laboratory testing capacity: available.

Off-site treatment and disposal capacity: no off-Site treatment or disposal.

PRSC: repository monitoring and maintenance required.

Administrative Feasibility

Permits required: any permits should be readily available.

Easements or right of ways required: none anticipated.

Impact on adjoining property: minimal

Ability to impose ICs: ICs can be imposed.

Likelihood to obtain exemption from statutory limits: not applicable.

5.2.3.3 Cost

Cost estimate information for Alternative TA3 is presented in Appendix C, Tables C-3 and C-10.

A summary of this alternative relative to the cost criteria is as follows.

Capital Cost: \$155,049.

PRSC Cost: \$1,920 per year, years 1-5; \$960 per year, years 6-30.

Present Value Cost: \$171,000 (rounded).

5.2.4 TA4: Disposal at Teck Pend Oreille Operations

Alternative TA4 includes the Treatment and Off-Site Disposal GRAs (Sections 4.5 and 4.6, respectively). It would entail excavating all tailings from the Tailings Accumulation Subarea and transporting them to the Teck Pend Oreille Operations for milling or direct disposal. Components of Alternative TA4 are listed below.

- 19,700 cy of tailings would be excavated and hauled to the Pend Oreille Operations. This would necessitate hauling through a portion of Pend Oreille Village and on State Highway 31 for approximately one-half mile to the Grandview Flat Road, which provides

access to the Lower Level Mill Area. Secondary roads would then be used to complete the haul.

- Once at the Pend Oreille Operations, the tailings would be routed through the facility's mill to extract salable metals, to the extent practicable, and the resulting tailings stream would be directed to the facility's lined tailings impoundment. This would address the CERCLA preference for treatment as a component of the removal action over conventional containment or land disposal approaches. Alternatively, the tailings could be directly disposed in the lined tailings impoundment. According to Teck, either approach would require revision of the existing conditional order for the Pend Oreille Operations.
- All excavated areas would be graded and/or backfilled with clean material to eliminate areas of standing water and/or abrupt transitions in topography. Further, all areas disturbed during construction will be graded to control for surface water run on and run-off, and seeded and mulched in a manner appropriate for the area.
- PRSC would be implemented on the seeded areas until vegetation success parameters have been met, after which vegetation should be well established and further erosion should be minimal.
- BMPs would be implemented during construction to protect workers, the community, and the environment from short-term construction impacts such as erosion, fugitive dust, and other similar potential impacts.

5.2.4.1 Effectiveness

Alternative TA4 would be effective. It would provide long-term effectiveness and permanence because the tailings would be isolated from direct contact by human and environmental receptors through placement into an engineered tailings impoundment. It would also isolate COPC source materials from erosion by wind and/or surface water run-off. If the tailings are milled prior to disposal, this alternative would also reduce the concentrations of COPCs in the tailings and potentially yield salable metals. Alternative TA4 would provide short-term effectiveness because the excavation and hauling of the COPC source materials can be accomplished using standard earth-moving construction methods and BMPs that should not impose unacceptable risks to workers or to nearby residents. This alternative could be

implemented in a single construction season. Alternative TA4 would meet ARARs because COPC source materials that exceed MTCA Method A Soil Cleanup Levels would no longer be present at the surface and/or because ICs would be implemented to ensure that future land use would result in acceptable levels of exposure to any remaining COPCs.

A summary of this alternative relative to the effectiveness criteria is as follows:

Protectiveness

Protective of public health and community: protective.

Protective of workers during implementation: protective

Protective of the environment: protective.

Complies with ARARs: compliant.

Ability to Achieve RAOs

Level of treatment/containment expected: treatment if milling is implemented;
containment in TDF3 (lined).

No residual effect concerns: PRSC would be required to address residual effects.

Will maintain control until long-term solution is implemented: no further action expected.

5.2.4.2 Implementability

Alternative TA4 would be implementable, assuming that any issues involving the state conditional order and related regulatory requirements are successfully addressed. Requirements of Washington law and regulations must be considered with respect to any removal action alternative that would involve transporting the Grandview Mine materials to Teck's nearby Pend Oreille Operations for final disposal. This alternative would involve disposal at Teck's existing TDF3. While tailings and other mining wastes such as those at the Grandview Mine Site (as well as those contained in TDF3) are exempted from federal hazardous waste regulation by the Bevill Amendment, Washington state does not recognize this exemption and regulates tailings and other mine wastes under its dangerous waste regulations and under the Washington Metals Mining and Milling Operations Act, RCW Ch. 78.56. As a result, TDF3 is currently permitted to operate by the Washington Department of Ecology under a conditional order issued under the aforementioned statute. Disposal of wastes in TDF3 which are *not* derived from the Pend Oreille Operations is not currently allowed by the conditional order. In addition, the disposal of wastes from the Grandview Mine at TDF3 may involve the need for a treatability study and/or treatment/recycling prior to disposal and a variance from the

Washington Department of Ecology's dangerous waste regulations dealing with recycled materials.

Implementation would be accomplished using standard construction methods and all goods and services required to implement such construction are expected to be readily available in the Site area.

A summary of this alternative relative to the implementability criteria is as follows.

Technical Feasibility

Construction and operational considerations: feasible.

Demonstrated performance/useful life: yes.

Adaptable to environmental conditions: yes.

Contributes to remedial performance: yes.

Can be implemented in 1 year: yes.

Availability

Equipment: available.

Personnel and services: available.

Outside laboratory testing capacity: available.

Off-site treatment and disposal capacity: Teck Pend Oreille Operations has sufficient milling capacity (if milling is implemented) and disposal capacity in TDF3.

PRSC: monitoring and maintenance of TDF3 required.

Administrative Feasibility

Permits required: would require modification of conditional order.

Easements or right of ways required: none anticipated.

Impact on adjoining property: minimal

Ability to impose ICs: ICs can be imposed.

Likelihood to obtain exemption from statutory limits: not applicable.

5.2.4.3 Cost

Cost estimate information for Alternative TA4 is presented in Appendix C, Tables C-3 and C-11. A summary of this alternative relative to the cost criteria is as follows.

Capital Cost: \$620,413.

PRSC Cost: \$1,860 per year, years 1-5; \$930 per year, years 6-30.

Present Value Cost: \$636,000 (rounded).

This cost estimate assumes direct disposal of the tailings in the Pend Oreille Operations tailings impoundment without milling. Based on information from Teck, costs would increase if the material were to be milled prior to disposal in the tailings impoundment.

5.2.5 TA5: Off-Site Disposal in a Landfill

Alternative TA5 includes the Treatment and Off-Site Disposal GRAs (Sections 4.5 and 4.6, respectively). It would entail excavating all tailings from the Tailings Accumulation Subarea and transporting it to an appropriate landfill for disposal. Components of Alternative TA5 are listed below.

- The 19,700 cy of tailings present in this subarea would be disposed at Waste Management's Graham Road facility in Medical Lake, WA. The tailings are assumed to fail TCLP criterion for lead based on the available information (see Section 2.2.3). The Graham Road facility cannot accept material that fails TCLP criteria. Therefore, the tailings would be treated using by mixing them with triple superphosphate (TSP), either by mixing wind rows with a bull dozer or in a batch plant, to reduce lead mobility (this type of treatment is often referred to as stabilization/fixation). Upon confirmation that the amended tailings no longer fail the TCLP criterion for lead, they would be transported to the Graham Road facility for disposal. This would entail extensive use of Highway 31 as well as other public roadways. As discussed for Alternative MM5, disposal with treatment at the Graham Road facility was found to be less costly than direct disposal in the nearest hazardous waste landfill.
- All excavated areas would be graded and/or backfilled with clean material to eliminate areas of standing water and/or abrupt transitions in topography. Further, all areas disturbed during construction will be graded to control for surface water run on and run-off, and seeded and mulched in a manner appropriate for the area.
- Operations and maintenance would be implemented on the seeded areas until vegetation success parameters have been met, after which vegetation should be well established and further erosion should be minimal.

- BMPs would be implemented during construction to protect workers, the community, and the environment from short-term construction impacts such as erosion, fugitive dust, and other similar potential impacts.

5.2.5.1 Effectiveness

Alternative TA5 would be effective. It would provide long-term effectiveness and permanence because the tailings would be isolated from direct contact by human and environmental receptors through placement in a regulated landfill. In addition, treatment of the tailings and placement in a landfill would limit the mobility of COPCs. Alternative TA5 would provide short-term effectiveness because the excavation and hauling of the COPC source materials, and treatment of the tailings, can be accomplished using standard earth-moving construction methods and BMPs that should not impose unacceptable risks to workers or to nearby residents. This alternative could be implemented in a single construction season. Alternative TA5 would meet ARARs because COPC source materials that exceed MTCA Method A Soil Cleanup Levels would no longer be present at the surface and/or because ICs would be implemented to ensure that future land use would result in acceptable levels of exposure to any remaining COPCs.

A summary of this alternative relative to the effectiveness criteria is as follows:

Protectiveness

Protective of public health and community: protective.
Protective of workers during implementation: protective
Protective of the environment: protective.
Complies with ARARs: compliant.

Ability to Achieve RAOs

Level of treatment/containment expected: treatment to limit leaching; containment in off-Site disposal facility.
No residual effect concerns: none.
Will maintain control until long-term solution is implemented: no further action expected.

5.2.5.2 Implementability

Alternative TA5 would be implementable. Implementation would be accomplished using standard construction and hauling methods and all goods and services required to implement such construction are expected to be readily available in the Site area as well as at the receiving landfills.

A summary of this alternative relative to the implementability criteria is as follows.

Technical Feasibility

Construction and operational considerations: feasible.

Demonstrated performance/useful life: yes.

Adaptable to environmental conditions: yes.

Contributes to remedial performance: yes.

Can be implemented in 1 year: no.

Availability

Equipment: available.

Personnel and services: available.

Outside laboratory testing capacity: available.

Off-site treatment and disposal capacity: material would be treated on-Site; off-Site disposal facility would be selected based on adequate capacity.

PRSC: limited to revegetation.

Administrative Feasibility

Permits required: any permits should be readily available.

Easements or right of ways required: none anticipated.

Impact on adjoining property: minimal

Ability to impose ICs: ICs can be imposed.

Likelihood to obtain exemption from statutory limits: not applicable.

5.2.5.3 Cost

Cost estimate information for Alternative TA5 is presented in Appendix C, Tables C-3 and C-12. A summary of this alternative relative to the cost criteria is as follows.

Capital Cost: \$7,230,498.

PRSC Cost: \$1,860 per year, years 3-7; \$930 per year, years 8-32.

Present Value Cost: \$6,780,000 (rounded).

5.3 Man-Made Ditch and Downgradient Ditch Subarea

The Man-Made Ditch and Downgradient Ditch contain a total of 2,155 cy of tailings (1,155 cy in the Man-Made Ditch and 1,000 cy in the Downgradient Ditch). This estimate is used for cost estimating purposes; the actual volume of material to be addressed will be determined by confirmation sampling during cleanup activities. Most of the Downgradient Ditch and some of the Man-Made Ditch are situated on property owned by Seattle City Light.

Five removal action alternatives were developed for this subarea, as follows (a shorthand designation was assigned to each alternative, and to alternatives developed for other subareas, to facilitate cross-referencing):

- MD1 – No Action
- MD2 – Consolidate in On-Site Repository at Lower Level Mill Area
- MD3 – Consolidate in On-Site Repository at Tailings Accumulation Subarea
- MD4 – Disposal at Teck Pend Oreille Operations
- MD5 – Off-Site Disposal in a Landfill

These removal action alternatives are described and individually evaluated against the criteria of effectiveness, implementability, and cost in the following subsections. Table 3 provides a summary of these analyses. For those alternatives involving excavation, the excavated area would be graded, and clean backfill material would be used to the extent necessary, to eliminate depressions that may hold water and abrupt transitions in topography. Details regarding the net present value estimates of the alternatives are provided in Appendix C.

5.3.1 MD1: No Action

This alternative consists of the No-Action GRA (Section 4.1). It would not address the removal action objective because hazardous substances would be left in-place with no change in existing conditions. This alternative provides a baseline against which to compare the removal

action alternatives.

5.3.1.1 Effectiveness

The no-action alternative is not considered to provide long-term or short-term effectiveness and permanence because contaminated material would remain at the Site and because it does not adhere to the ARARs identified for this removal action. A summary of this alternative relative to the effectiveness criteria is as follows:

Protectiveness

Protective of public health and community: not protective.

Protective of workers during implementation: not protective

Protective of the environment: not protective.

Complies with ARARs: not compliant.

Ability to Achieve RAOs

Level of treatment/containment expected: no treatment/containment.

No residual effect concerns: impacts would continue unabated.

Will maintain control until long-term solution is implemented: no.

5.3.1.2 Implementability

The no-action alternative would be technically easy to implement, but would be unacceptable because it does not protect human health and the environment. A summary of this alternative relative to the implementability criteria is as follows.

Technical Feasibility

Construction and operational considerations: no construction.

Demonstrated performance/useful life: no demonstrated performance.

Adaptable to environmental conditions: not applicable.

Contributes to remedial performance: no.

Can be implemented in 1 year: yes.

Availability

Equipment: no equipment needed.

Personnel and services: no personnel or services needed.

Outside laboratory testing capacity: no outside testing needed.

Off-site treatment and disposal capacity: no off-Site treatment or disposal

PRSC: no PRSC would be implemented.

Administrative Feasibility

Permits required: none.

Easements or right of ways required: none.

Impact on adjoining property: none.

Ability to impose ICs: no ICs would be imposed.

Likelihood to obtain exemption from statutory limits: not applicable.

5.3.1.3 Cost

No costs are associated with the no-action alternative. A summary of this alternative relative to the cost criteria is as follows.

Capital Cost: \$0.

PRSC Cost: \$0 per year.

Present Value Cost: \$0.

5.3.2 MD2: Consolidate in On-Site Repository at Lower Level Mill Area

Alternative MD2 includes the ICs, Containment, and Consolidation GRAs (Sections 4.2, 4.3, and 4.4, respectively). Tailings in the Man-Made Ditch and Downgradient Ditch would be excavated and transported to a repository location in the Lower Level Mill Area. Components of Alternative MD2 are listed below.

- The repository would be constructed at the former crusher location, against the hillside in the north end of the Lower Level Mill Area on property controlled by Washington Resources.
- The existing concrete silo and appurtenant concrete structures would be demolished and incorporated into the repository, along with other ancillary debris.
- 2,155 cy of tailings would be excavated from the Man-Made Ditch and Downgradient Ditch Subarea and hauled to the repository location. This would necessitate hauling

through Pend Oreille Village and on State Highway 31 for approximately one-half mile to the Grandview Flat Road, which provides access to the Lower Level Mill Area.

- All excavated areas would be graded and/or backfilled with clean material to eliminate areas of standing water and/or abrupt transitions in topography. Further, all areas disturbed during construction will be graded to control for surface water run on and run-off, and seeded and mulched in a manner appropriate for the area.
- The repository would have 3:1 side slopes and flatter top slopes. The mine-waste contaminated materials, which are of low leaching potential (see Section 2.1.6.2), will be consolidated beneath a minimum of 12 inches of clean material that will be revegetated. Cover soil will be obtained from an on-site borrow source.
- The repository would have an appropriately sized run-on control ditch to capture and route storm water around the repository and into the Drainage Ditch.
- As long as mine-waste contaminants remain on-Site above actionable concentrations, a long-term monitoring program would be implemented to ensure the continuing effectiveness of the removal action and to monitor Site conditions. As part of the monitoring program, annual or episodic inspections of the repository, as well as existing drainage systems would be evaluated for functionality, and the protective barriers would be inspected at several locations for clean soil cover thickness and evaluated to verify that the COPCs remain adequately contained.
- Because mine waste contamination would be left on-Site beneath a protective barrier, ICs such as restrictive covenants would be selected and implemented to maintain the integrity of the cleanup action, thus assuring the continued protection of human health and the environment and the integrity of the cleanup action.
- BMPs would be implemented during construction to protect workers, the community, and the environment from short-term construction impacts such as erosion, fugitive dust, and other similar potential impacts.

5.3.2.1 Effectiveness

Alternative MD2 would be effective. It would provide long-term effectiveness and permanence because the tailings would be isolated from direct contact by human and environmental

receptors. It would also isolate tailings from erosion by wind and/or surface water run-off. Consolidation and capping is a proven approach for addressing source materials such as the tailings located in the Man-Made Ditch and Downgradient Ditch Subarea. Alternative MD2 would provide short-term effectiveness because the repository construction can be accomplished using standard earth-moving construction methods and BMPs that should not impose unacceptable risks to workers or to nearby residents. This alternative could be implemented in a single construction season. Alternative MD2 would meet ARARs because tailings that exceed MTCA Method A Soil Cleanup Levels would no longer be present at the surface and/or because ICs would be implemented to ensure that future land use would result in acceptable levels of exposure to any remaining COPCs.

A summary of this alternative relative to the effectiveness criteria is as follows:

Protectiveness

- Protective of public health and community: protective.
- Protective of workers during implementation: protective
- Protective of the environment: protective.
- Complies with ARARs: compliant.

Ability to Achieve RAOs

- Level of treatment/containment expected: no treatment; containment in repository.
- No residual effect concerns: PRSC would be required to address residual effects.
- Will maintain control until long-term solution is implemented: no further action expected.

5.3.2.2 Implementability

Alternative MD2 would be implementable. Implementation would be accomplished using standard construction methods and all goods and services required to implement such construction are expected to be readily available in the Site area. ICs would be implementable because the Washington State UECA contains procedural requirements ensuring that restrictive covenants are enforceable.

A summary of this alternative relative to the implementability criteria is as follows.

Technical Feasibility

- Construction and operational considerations: feasible.
- Demonstrated performance/useful life: yes.

Adaptable to environmental conditions: yes.

Contributes to remedial performance: yes.

Can be implemented in 1 year: yes.

Availability

Equipment: available.

Personnel and services: available.

Outside laboratory testing capacity: available.

Off-site treatment and disposal capacity: no off-Site treatment or disposal.

PRSC: repository monitoring and maintenance required.

Administrative Feasibility

Permits required: any permits should be readily available.

Easements or right of ways required: none anticipated.

Impact on adjoining property: minimal

Ability to impose ICs: ICs can be imposed.

Likelihood to obtain exemption from statutory limits: not applicable.

5.3.2.3 Cost

Cost estimate information for Alternative MD2 is presented in Appendix C, Tables C-4 and C-13.

A summary of this alternative relative to the cost criteria is as follows.

Capital Cost: \$107,482.

PRSC Cost: \$780 per year, years 1-5; \$390 per year, years 6-30.

Present Value Cost: \$114,000 (rounded).

5.3.3 MD3: Consolidate in On-Site Repository at Tailings Accumulation Subarea

Alternative MD3 includes the ICs, Containment, and Consolidation GRAs (Sections 4.2, 4.3, and 4.4, respectively). It would entail removing all tailings from the Man-Made Ditch and Downgradient Ditch and placing them in a repository at the Tailings Accumulation Subarea. Components of Alternative MD3 are as follows:

- 2,155 cy of tailings would be excavated from the Man-Made Ditch and Downgradient Ditch and transported to the Tailings Accumulation Subarea where they would be placed in a repository.

- All excavated areas would be graded and/or backfilled with clean material to eliminate areas of standing water and/or abrupt transitions in topography. Further, all areas disturbed during construction will be graded to control for surface water run on and run-off, and seeded and mulched in a manner appropriate for the area.
- The repository would have 3:1 side slopes and flatter top slopes. The mine-waste contaminated materials, which are of low leaching potential (see Section 2.1.6.2), will be consolidated beneath a minimum of 12 inches of clean material that will be revegetated. Cover soil will be obtained from an on-site borrow source.
- The repository would have an appropriately sized run-on control ditch to capture and route storm water (including that originating in the Drainage Ditch) around the repository and into the Downgradient Ditch or Man-Made Ditch.
- As long as mine-waste contaminants remain on-Site above actionable concentrations, a long-term monitoring program would be implemented to ensure the continuing effectiveness of the removal action and to monitor Site conditions. As part of the monitoring program, annual or episodic inspections of the repository, as well as existing drainage systems would be evaluated for functionality, and the protective barriers would be inspected at several locations for clean soil cover thickness and evaluated to verify that the COPCs remain adequately contained.
- Because mine waste contamination would be left on-Site beneath a protective barrier, ICs such as restrictive covenants would be selected and implemented to maintain the integrity of the cleanup action, thus assuring the continued protection of human health and the environment and the integrity of the cleanup action.
- BMPs would be implemented during construction to protect workers, the community, and the environment from short-term construction impacts such as erosion, fugitive dust, and other similar potential impacts.

5.3.3.1 Effectiveness

Alternative MD3 would be effective. It would provide long-term effectiveness and permanence because the tailings would be isolated from direct contact by human and environmental receptors. It would also isolate tailings from erosion by wind and/or surface water run-off.

Consolidation and capping is a proven approach for addressing source materials such as the tailings located in the Man-Made Ditch and Downgradient Ditch Subarea. However, Alternative MD3 would result in the construction of a repository near a residential area (Pend Oreille Village) and sensitive habitat in the Pend Oreille River. Alternative MD3 would provide short-term effectiveness because the tailings repository would be constructed at the Tailings Accumulation Subarea, eliminating the need to haul tailings on public roads and reducing the duration of the removal action construction and thus limiting risks to workers and the public and because the repository construction can be accomplished using standard earth-moving construction methods and BMPs that should not impose unacceptable risks to workers or to nearby residents. This alternative could be implemented in a single construction season. Alternative MD3 would meet ARARs because tailings that exceed MTCA Method A Soil Cleanup Levels would no longer be present at the surface and/or because ICs would be implemented to ensure that future land use would result in acceptable levels of exposure to any remaining COPCs.

A summary of this alternative relative to the effectiveness criteria is as follows:

Protectiveness

Protective of public health and community: protective.

Protective of workers during implementation: protective

Protective of the environment: protective.

Complies with ARARs: compliant.

Ability to Achieve RAOs

Level of treatment/containment expected: no treatment; containment in repository.

No residual effect concerns: PRSC would be required to address residual effects.

Will maintain control until long-term solution is implemented: no further action expected.

5.3.3.2 Implementability

Alternative MD3 would be implementable. It would be accomplished using standard construction methods and all goods and services required to implement such construction are expected to be readily available in the Site area. ICs would be implementable because the Washington State UECA contains procedural requirements ensuring that restrictive covenants are enforceable.

A summary of this alternative relative to the implementability criteria is as follows.

Technical Feasibility

Construction and operational considerations: feasible.

Demonstrated performance/useful life: yes.

Adaptable to environmental conditions: yes.

Contributes to remedial performance: yes.

Can be implemented in 1 year: yes.

Availability

Equipment: available.

Personnel and services: available.

Outside laboratory testing capacity: available.

Off-site treatment and disposal capacity: no off-Site treatment or disposal.

PRSC: repository monitoring and maintenance required.

Administrative Feasibility

Permits required: any permits should be readily available.

Easements or right of ways required: none anticipated.

Impact on adjoining property: minimal

Ability to impose ICs: ICs can be imposed.

Likelihood to obtain exemption from statutory limits: not applicable.

5.3.3.3 Cost

Cost estimate information for Alternative MD3 is presented in Appendix C, Tables C-4 and C-14.

A summary of this alternative relative to the cost criteria is as follows.

Capital Cost: \$83,572.

PRSC Cost: \$780 per year, years 1-5; \$390 per year, years 6-30.

Present Value Cost: \$90,000 (rounded).

5.3.4 MD4: Disposal at Teck Pend Oreille Operations

Alternative MD4 includes the Treatment and Off-Site Disposal GRAs (Sections 4.5 and 4.6, respectively). It would entail excavating all tailings from the Man-Made Ditch and Downgradient

Ditch Subarea and transporting them to the Teck Pend Oreille Operations for milling or direct disposal. Components of Alternative MD4 are listed below.

- 2,155 cy of tailings would be excavated and hauled to the Pend Oreille Operations. This would necessitate hauling through Pend Oreille Village and on State Highway 31 for approximately one-half mile to the Grandview Flat Road, which provides access to the Lower Level Mill Area. Secondary roads would then be used to complete the haul.
- Once at the Pend Oreille Operations, the tailings would be routed through the facility's mill to extract salable metals, to the extent practicable, and the resulting tailings stream would be directed to the facility's lined tailings impoundment. This would address the CERCLA preference for treatment as a component of the removal action over conventional containment or land disposal approaches. Alternatively, the tailings could be directly disposed in the lined tailings impoundment. According to Teck, either approach would require revision of the existing conditional order for the Pend Oreille Operations.
- All excavated areas would be graded and/or backfilled with clean material to eliminate areas of standing water and/or abrupt transitions in topography. Further, all areas disturbed during construction will be graded to control for surface water run on and run-off, and seeded and mulched in a manner appropriate for the area.
- PRSC would be implemented on the seeded areas until vegetation success parameters have been met, after which vegetation should be well established and further erosion should be minimal.
- BMPs would be implemented during construction to protect workers, the community, and the environment from short-term construction impacts such as erosion, fugitive dust, and other similar potential impacts.

5.3.4.1 Effectiveness

Alternative MD4 would be effective. It would provide long-term effectiveness and permanence because the tailings would be isolated from direct contact by human and environmental receptors through placement into an engineered tailings impoundment. It would also isolate tailings from erosion by wind and/or surface water run-off. If the tailings are milled prior to

disposal, this alternative would also reduce the concentrations of COPCs in the tailings and potentially yield salable metals. Alternative MD4 would provide short-term effectiveness because the excavation and hauling of the tailings can be accomplished using standard earth-moving construction methods and BMPs that should not impose unacceptable risks to workers or to nearby residents. This alternative could be implemented in a single construction season. Alternative MD4 would meet ARARs because tailings that exceed MTCA Method A Soil Cleanup Levels would no longer be present at the surface and/or because ICs would be implemented to ensure that future land use would result in acceptable levels of exposure to any remaining COPCs.

A summary of this alternative relative to the effectiveness criteria is as follows:

Protectiveness

Protective of public health and community: protective.

Protective of workers during implementation: protective

Protective of the environment: protective.

Complies with ARARs: compliant.

Ability to Achieve RAOs

Level of treatment/containment expected: treatment if milling is implemented;
containment in TDF3 (lined).

No residual effect concerns: PRSC would be required to address residual effects.

Will maintain control until long-term solution is implemented: no further action expected.

5.3.4.2 Implementability

Alternative MD4 would be implementable, assuming that any issues involving the state conditional order and related regulatory requirements are successfully addressed. Requirements of Washington law and regulations must be considered with respect to any removal action alternative that would involve transporting the Grandview Mine materials to Teck's nearby Pend Oreille Operations for final disposal. This alternative would involve disposal at Teck's existing TDF3. While tailings and other mining wastes such as those at the Grandview Mine Site (as well as those contained in TDF3) are exempted from federal hazardous waste regulation by the Bevill Amendment, Washington state does not recognize this exemption and regulates tailings and other mine wastes under its dangerous waste regulations and under the Washington Metals Mining and Milling Operations Act, RCW Ch. 78.56. As a result, TDF3 is

currently permitted to operate by the Washington Department of Ecology under a conditional order issued under the aforementioned statute. Disposal of wastes in TDF3 which are *not* derived from the Pend Oreille Operations is not currently allowed by the conditional order. In addition, the disposal of wastes from the Grandview Mine at TDF3 may involve the need for a treatability study and/or treatment/recycling prior to disposal and a variance from the Washington Department of Ecology's dangerous waste regulations dealing with recycled materials.

Implementation would be accomplished using standard construction methods and all goods and services required to implement such construction are expected to be readily available in the Site area.

A summary of this alternative relative to the implementability criteria is as follows.

Technical Feasibility

Construction and operational considerations: feasible.

Demonstrated performance/useful life: yes.

Adaptable to environmental conditions: yes.

Contributes to remedial performance: yes.

Can be implemented in 1 year: yes.

Availability

Equipment: available.

Personnel and services: available.

Outside laboratory testing capacity: available.

Off-site treatment and disposal capacity: Teck Pend Oreille Operations has sufficient milling capacity (if milling is implemented) and disposal capacity in TDF3.

PRSC: monitoring and maintenance of TDF3 required.

Administrative Feasibility

Permits required: would require modification of conditional order.

Easements or right of ways required: none anticipated.

Impact on adjoining property: minimal

Ability to impose ICs: ICs can be imposed.

Likelihood to obtain exemption from statutory limits: not applicable.

5.3.4.3 Cost

Cost estimate information for Alternative MD4 is presented in Appendix C, Tables C-4 and C-15. A summary of this alternative relative to the cost criteria is as follows.

Capital Cost: \$104,503.

PRSC Cost: \$720 per year, years 1-5; \$360 per year, years 6-30.

Present Value Cost: \$110,000 (rounded).

This cost estimate assumes direct disposal of the tailings in the Pend Oreille Operations tailings impoundment without milling. Based on information from Teck, costs would increase if the material were to be milled prior to disposal in the tailings impoundment.

5.3.5 MD5: Off-Site Disposal in a Landfill

Alternative MD5 includes the Treatment and Off-Site Disposal GRAs (Sections 4.5 and 4.6, respectively). It would entail excavating all tailings from the Man-Made Ditch and Downgradient Ditch Subarea and transporting them to an appropriate landfill for disposal. Components of Alternative MD5 are listed below.

- The 2,155 cy of tailings present in this subarea would be disposed at Waste Management's Graham Road facility in Medical Lake, WA. The tailings are assumed to fail TCLP criterion for lead based on the available information (see Section 2.2.3). The Graham Road facility cannot accept material that fails TCLP criteria. Therefore, the tailings would be treated using by mixing them with triple superphosphate (TSP), either by mixing wind rows with a bull dozer or in a batch plant, to reduce lead mobility (this type of treatment is often referred to as stabilization/fixation). Upon confirmation that the amended tailings no longer fail the TCLP criterion for lead, they would be transported to the Graham Road facility for disposal. This would require extensive use of Highway 31 as well as other public roadways. As discussed for Alternatives MM5 and TA5, disposal with treatment at the Graham Road facility was found to be less costly than direct disposal in the nearest hazardous waste landfill.
- All excavated areas would be graded and/or backfilled with clean material to eliminate areas of standing water and/or abrupt transitions in topography. Further, all areas disturbed during construction will be graded to control for surface water run on and run-

off, and seeded and mulched in a manner appropriate for the area.

- PRSC would be implemented on the seeded areas until vegetation success parameters have been met, after which vegetation should be well established and further erosion should be minimal.
- BMPs would be implemented during construction to protect workers, the community, and the environment from short-term construction impacts such as erosion, fugitive dust, and other similar potential impacts.

5.3.5.1 Effectiveness

Alternative MD5 would be effective. It would provide long-term effectiveness and permanence because the tailings would be isolated from direct contact by human and environmental receptors through placement in a regulated landfill. In addition, treatment of the tailings and placement in a landfill would limit the mobility of COPCs. Alternative MD5 would also provide short-term effectiveness because the excavation and hauling of the tailings can be accomplished using standard earth-moving construction methods and BMPs that should not impose unacceptable risks to workers or to nearby residents. This alternative could be implemented in a single construction season. Alternative MD5 would meet ARARs because tailings that exceed MTCA Method A Soil Cleanup Levels would no longer be present at the surface and/or because ICs would be implemented to ensure that future land use would result in acceptable levels of exposure to any remaining COPCs.

A summary of this alternative relative to the effectiveness criteria is as follows:

Protectiveness

Protective of public health and community: protective.

Protective of workers during implementation: protective

Protective of the environment: protective.

Complies with ARARs: compliant.

Ability to Achieve RAOs

Level of treatment/containment expected: treatment to limit leaching; containment in off-Site disposal facility.

No residual effect concerns: none.

Will maintain control until long-term solution is implemented: no further action expected.

5.3.5.2 Implementability

Alternative MD5 would be implementable. Implementation would be accomplished using standard construction and hauling methods and all goods and services required to implement such construction are expected to be readily available in the Site area as well as at the receiving landfills.

A summary of this alternative relative to the implementability criteria is as follows.

Technical Feasibility

Construction and operational considerations: feasible.

Demonstrated performance/useful life: yes.

Adaptable to environmental conditions: yes.

Contributes to remedial performance: yes.

Can be implemented in 1 year: yes.

Availability

Equipment: available.

Personnel and services: available.

Outside laboratory testing capacity: available.

Off-site treatment and disposal capacity: material would be treated on-Site; off-Site disposal facility would be selected based on adequate capacity.

PRSC: limited to revegetation.

Administrative Feasibility

Permits required: any permits should be readily available.

Easements or right of ways required: none anticipated.

Impact on adjoining property: minimal

Ability to impose ICs: ICs can be imposed.

Likelihood to obtain exemption from statutory limits: not applicable.

5.3.5.3 Cost

Cost estimate information for Alternative MD5 is presented in Appendix C, Tables C-4 and C-16. A summary of this alternative relative to the cost criteria is as follows.

Capital Cost: \$849,922.

PRSC Cost: \$720 per year, years 1-5; \$360 per year, years 6-30.

Present Value Cost: \$856,000 (rounded).

6.0 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

This section presents a comparative analysis of the removal action alternatives developed for the previously identified subareas of the Grandview Site. The purpose of this analysis is to compare the advantages and disadvantages of each alternative brought forth in the detailed analysis against the evaluation criteria presented in Section 5.0. The comparison focuses on the significant areas of difference, especially identification of any alternative that is clearly superior in meeting a criterion.

The No-Action alternatives (MM1, TA1, and MD1) would not be effective because they would not result in protection of human health and the environment or comply with ARARs. Therefore, these alternatives are not discussed further. The remaining removal action alternatives under evaluation in this comparative analysis are:

Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea

- MM2 – Consolidate in On-Site Repository at Lower Level Mill Area
- MM3 – Consolidate in On-Site Repository at Tailings Accumulation Area
- MM4 – Disposal at Teck Pend Oreille Operations
- MM5 – Off-Site Disposal in a Landfill

Tailings Accumulation Subarea

- TA2 – Consolidate in On-Site Repository at Lower Level Mill Area
- TA3 – Consolidate in On-Site Repository at Tailings Accumulation Subarea
- TA4 – Disposal at Teck Pend Oreille Operations
- TA5 – Off-Site Disposal in a Landfill

Man-Made Ditch and Downgradient Ditch Subarea

- MD2 – Consolidate in On-Site Repository at Lower Level Mill Area
- MD3 – Consolidate in On-Site Repository at Tailings Accumulation Subarea
- MD4 – Disposal at Teck Pend Oreille Operations

- MD5 – Off-Site Disposal in a Landfill

The comparative analysis is presented in the following subsections. A summary of the comparative analysis is presented on Table 4.

6.1 Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea

The following subsections provide the comparative analysis of Alternatives MM2, MM3, MM4, and MM5.

6.1.1 Effectiveness

As discussed in Section 5.1 and its subsections, all of the retained Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea alternatives (MM2, MM3, MM4, and MM5) would be effective because each would provide overall protection of human health and the environment, comply with ARARs, and achieve the RAOs.

Alternatives MM4 and MM5 provide an equal level of long-term effectiveness and permanence because, under each of these alternatives, COPC source materials would be placed in engineered structures with synthetic liners that are designed and monitored to effectively contain waste material. In addition, MM4 and MM5 may involve treatment of some of the metal COPC source materials, either through milling (MM4) or stabilization/fixation (MM5) prior to disposal. Alternatives MM2 and MM3, though still effective, provide a somewhat lower level of long-term effectiveness and permanence than MM4 and MM5 because MM2 and MM3 do not include use of synthetic liners in the repository design or treatment of the COPC source materials. However, the consolidation and capping actions included in MM2 and MM3 comprise a proven approach for addressing source materials such as those present in the Upper Level Mine and Lower Level Mill Subarea.

Alternative MM2 provides a higher level of short-term effectiveness than alternatives MM4 and MM5 because, under MM2, COPC source materials would be excavated and moved within the Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea. Alternatives MM3, MM4, and MM5 would entail hauling COPC source material on public roads and thus would result in some increased risk to workers and the public relative to MM2.

6.1.2 Implementability

Alternatives MM2, MM3, MM4, and MM5 are equally implementable. This assumes the successful resolution of any conditional order and related regulatory issues associated with Alternative MM4 that were discussed in Section 5.0.

6.1.3 Cost

The estimated net present value of Alternatives MM2, MM3, MM4, and MM5 are as follows (Appendix C):

- Alternative MM2: \$402,000
- Alternative MM3: \$461,000
- Alternative MM4: \$713,000
- Alternative MM5: \$4,140,000

6.2 Tailings Accumulation Subarea

The following subsections provide the comparative analysis of Alternatives TA2, TA3, TA4, and TA5.

6.2.1 Effectiveness

As discussed in Section 5.2 and its subsections, all of the retained Tailings Accumulation Subarea alternatives (TA2, TA3, TA4, and TA5) would be effective because each would provide overall protection of human health and the environment, comply with ARARs, and achieve the RAOs.

Alternatives TA4 and TA5 provide an equal level of long-term effectiveness and permanence because, under each of these alternatives, tailings would be placed in engineered structures with synthetic liners that are designed and monitored to effectively contain waste material. In addition, TA4 and TA5 may involve treatment of the tailings, either through milling (TA4) or stabilization/fixation (TA5) prior to disposal. Alternatives TA2 and TA3, though still effective, provide an equal but somewhat lower level of long-term effectiveness and permanence than TA4 and TA5 because TA2 and TA3 do not include use of synthetic liners in the conceptual

repository design or treatment of the tailings. However, the consolidation and capping actions included in TA2 and TA3 comprise a proven approach for addressing source materials such as those present in the Tailings Accumulation Subarea.

Alternative TA3 provides the highest level of short-term effectiveness because the tailings repository would be constructed at the Tailings Accumulation Subarea, eliminating the need to haul tailings on public roads, reducing the duration of the removal action construction, and thus limiting risks to workers and the public. Alternatives TA2 and TA4 provide an equivalent level of short-term effectiveness, but lower than that for TA3, because both would entail hauling tailings through Pend Oreille Village and brief use of the state highway to access the Grandview Flats road. Alternative TA5 provides the lowest level of short-term effectiveness because construction associated with stabilization/fixation would increase the project duration and because hauling the tailings to a landfill would entail extensive use of public roads resulting in increased risks to workers and the public.

6.2.2 Implementability

Alternatives TA2, TA3, TA4, and TA5 are equally implementable. This assumes the successful resolution of any conditional order and related regulatory issues associated with TA4 that were discussed in Section 5.0.

6.2.3 Cost

The estimated net present value of Alternatives TA2, TA3, TA4, and TA5 are as follows (Appendix C):

- Alternative TA2: \$383,000
- Alternative TA3: \$171,000
- Alternative TA4: \$636,000
- Alternative TA5: \$6,780,000

6.3 Man-Made Ditch and Downgradient Ditch Subarea

The following subsections provide the comparative analysis of Alternatives MD2, MD3, MD4, and MD5.

6.3.1 Effectiveness

As discussed in Section 5.3 and its subsections, all of the retained Man-Made Ditch and Downgradient Ditch Subarea alternatives (MD2, MD3, MD4, and MD5) would be effective because each would provide overall protection of human health and the environment, comply with ARARs, and achieve the RAOs.

Alternatives MD4 and MD5 provide an equal level of long-term effectiveness and permanence because, under each of these alternatives, tailings would be placed in engineered structures with synthetic liners that are designed and monitored to effectively contain waste material. In addition, MD4 and MD5 involve treatment of the tailings, either through milling (MD4) or stabilization/fixation (MD5) prior to disposal. Alternatives MD2 and MD3, though still effective, provide an equal but somewhat lower level of long-term effectiveness and permanence than MD4 and MD5 because MD2 and MD3 do not include use of synthetic liners in the conceptual repository design or treatment of the tailings. However, the consolidation and capping actions included in MD2 and MD3 comprise a proven approach for addressing source materials such as those present in the Man-Made Ditch and Downgradient Ditch Subarea.

Alternative MD3 provides the highest level of short-term effectiveness because the tailings repository would be constructed at the Tailings Accumulation Subarea, eliminating the need to haul tailings on public roads and reducing the duration of the removal action construction and thus limiting risks to workers and the public. Alternatives MD2 and MD4 provide an equivalent level of short-term effectiveness because both would entail hauling tailings through Pend Oreille Village and brief use of the state highway to access the Grandview Flats road. Alternative MD5 provides the lowest level of short-term effectiveness because construction associated with stabilization/fixation would increase the project duration and because hauling the tailings to a landfill would entail extensive use of public roads, and concomitant increased risks to the public.

6.3.2 Implementability

Alternatives MD2, MD3, MD4, and MD5 are equally implementable, assuming successful resolution of any conditional order and related regulatory issues associated with MD4 that are discussed in Section 5.0.

6.3.3 Cost

The estimated net present value of Alternatives MD2, MD3, MD4, and MD5 are as follows (Appendix C):

- Alternative MD2: \$114,000
- Alternative MD3: \$90,000
- Alternative MD4: \$110,000
- Alternative MD5: \$856,000

7.0 RECOMMENDED REMOVAL ACTION ALTERNATIVE

The recommended removal action alternative consists of a combination of three subarea-specific alternatives. These subareas are the Upper Level Mine, Lower Level Mill and Drainage Ditch Subarea; the Tailings Accumulation Subarea; and the Man-Made Ditch and Downgradient Ditch Subarea. As detailed in Sections 5.0 and 6.0, all of the removal action alternatives for these subareas are effective and implementable (with the exception of the no-action alternatives). Therefore, any combination of the subarea-specific removal action alternatives could be identified as the recommended removal action alternative because the threshold criteria of effectiveness and implementability would be met. As detailed in Section 6.0 and summarized on Table 4, each of the subarea-specific alternatives possesses slight advantages and disadvantages with regard to the effectiveness sub-criteria of long-term effectiveness and permanence and short-term effectiveness. However, these slight advantages and disadvantages do not clearly differentiate any subarea-specific alternatives as being superior to other alternatives.

The estimated cost (present value) of the combination of subarea-specific alternatives forming the recommended removal action alternative therefore becomes an important consideration in the selection of the recommended removal action alternative. The least costly alternative would be the combination of subarea-specific alternatives MM2, TA3, and MD3. However, this combination would result in the undesirable creation of two separate on-Site repositories, one at the Lower Level Mill Area and one at the Tailings Accumulation Area, each with its associated PRSC obligations and land-use restrictions. In addition, a repository located in the Tailings Accumulation Area has the further undesirable attributes of being located adjacent to a residential area (Pend Oreille Village) and sensitive habitat in the Pend Oreille River.

Two combinations of subarea-specific alternatives would result in the creation of a single on-Site repository, as follows:

- MM2 , TA2, and MD2; repository located at the Lower Level Mill Area; and
- MM3, TA3, and MD3; repository located at the Tailings Accumulation area.

The latter combination of sub-area specific alternatives would result in the construction of a repository in the Tailings Accumulation Area, which has undesirable attributes, as previously noted. **Therefore, the Respondents have selected the combination of alternatives MM2,**

TA2, and MD2 as the recommended removal action alternative to be implemented at the Site. This alternative would result in the creation of a single repository for all Site development rock and tailings at the Lower Level Mill Area on property owned by Respondent Washington Resources. Table 5 provides the estimated present value of the recommended removal action alternative (\$847,000). Detailed cost information supporting this present value estimate is provided on Table 6 and was extracted from relevant portions of Appendix C. The estimated present value of the recommended removal action alternative is less than the sum of the individual estimated present values for subarea-specific alternatives MM2, TA2, and MD2 because duplicative items such as mobilization have been removed and because lower allowances are invoked for project management, remedial design, and construction management, consistent with EPA guidance (EPA, 2000).

8.0 REFERENCES

- AHS/EWU, 2009. Cultural Resources Survey of the Grandview Mine and Mill Site, Pend Oreille County, Washington. Prepared for the Grandview Mine and Mill Site Respondents under contract to Formation Environmental, LLC. Prepared by Archaeological and Historical Services, Eastern Washington University. November.
- Cascade Earth Sciences, 2007. Engineering Evaluation/Cost Analysis, Oriole Mine, Colville National Forest, Pend Oreille County, Washington. Prepared for the U.S. Forest Service by Cascade Earth Sciences, Spokane, WA. May.
<http://www.fs.fed.us/r6/colville/projects/oriole-mine/documents/final-EE/CA.pdf>
- City-Data.com. <http://www.city-data.com/city/Metaline-Falls-Washington.html>
- E&E, 2001. Grandview Mine Preliminary Assessment/Site Investigation. Technical Direction Document (TDD) No. 01-01-015. Prepared for U.S. EPA under Contract 68-SO-01-01 by Ecology & Environment, Inc. October.
- E&E, 2002. Preliminary Assessments and Site Investigations Report, Lower Pend Oreille River Mines and Mills, Pend Oreille County, Washington. TDD: 01-08-0009. Prepared for U.S. EPA under Contract 68-SO-01-01 by Ecology & Environment, Inc. April.
- E&E, 2003. Grandview and Josephine Mines Removal Assessment Report, Metaline Falls, Washington. TDD: 03-05-0003. Prepared for U.S. EPA under Contract 68-SO-01-01 by Ecology & Environment, Inc. November.
- ENTACT, 2008. Final Draft Supplemental Investigation Report, Grandview Mine/Mill Site Reconnaissance, Metaline Falls, Washington. Prepared by ENTACT, LLC on behalf of Blue Tee Corp., Seattle City Light, Teck Cominco Washington Incorporated, and Washington Resources, LLC. December.
- EPA, 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final. EPA/540/G-89/004. OSWER Directive 9355.3-01. October.
- EPA, 1993. Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA. August.
- EPA, 2000. A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. EPA 540-R-00-002. OSWER Directive 9355.0-75. July.
- EPA, 2009. Web site providing information on Pend Oreille Village time-critical action.
http://www.epaossc.net/site_profile.asp?site_id=3472
- Lasmanis, R. 1991. The geology of Washington: Rocks and Minerals, v. 66, no. 4, p. 262-277. © Copyright Heldref Publications (Helen Dwight Reid Educational Foundation).
<http://www.dnr.wa.gov/ResearchScience/Topics/GeologyofWashington/Pages/okanogan.aspx>
- POPUD, 2009. Personal communication with Mark "Bubba" Scott of the Pend Oreille Public Utility District, with data subsequently provided to Formation Environmental, LLC by

electronic mail. Data include well location map, two well logs, and various water quality reports.

Seattle City Light, 2008. Seattle City Light Boundary Hydroelectric Project – FERC Project No. 2144, Map Version 1/24/2008.

TechLaw, 2008. Removal Assessment Report, Revision 2. Prepared for U.S. EPA by TechLaw, Inc. under TDD No. 07-06-0005 Document No. TO-001-07-09-0006-DCH147. March.

Teck, 1999. Petition to Exempt Dangerous Waste Pursuant to 173-303-072(3) and 910(3). Submitted to the Washington Department of Ecology, Eastern Regional Office by Cominco American Incorporated. April.

URS, 2007. Final Draft Site Characterization Report, Grandview Tailings, Pend Oreille Village, Washington. Prepared for Teck Cominco American Incorporated by URS Corporation. January.

U.S. Census Bureau. <http://quickfacts.census.gov/qfd/states/53/53051.html>

TABLES

Table 1**Source Material Locations and Estimated Volumes**

SOURCE MATERIAL	LOCATION	ESTIMATED VOLUME¹
DEVELOPMENT ROCK	Surfacing Material, Lower Level Mill Area	2,935 cy
	Surfacing Material, Historic Homesite Area (Lower Level Mill Area)	890 cy
	Surfacing Material, Grandview Flat and Upper Level Access Roads	2,490 cy
	North Pile (at former crusher location)	5,905 cy
	TOTAL DEVELOPMENT ROCK VOLUME	12,220 cy
TAILINGS	Distressed/Unvegetated Area West of Grandview Flat Road (Lower Level Mill Area)	640 cy
	Drainage Ditch	6,580 cy
	Tailings Accumulation Area ²	19,700 cy
	Downgradient Ditch ²	1,000 cy
	Man-Made Ditch	1,155 cy
	TOTAL TAILINGS VOLUME	29,075 cy
SOIL	Impacted soil in former drum disposal area (assumed)	500 cy

¹ These estimates were made by measuring metals concentrations in suspected development rock and tailings using a portable XRF unit and comparing the XRF results to MTCA Method A cleanup levels for unrestricted land use and/or industrial properties. Metals concentrations that exceeded these criteria were taken to be indicative of the presence of development rock and/or tailings. The areal extent of these materials was measured using global positioning system (GPS) equipment and other surveying equipment. The vertical extent of these materials was estimated by measuring metals concentrations in samples collected using hand augers (ENTACT, 2008).

² As previously discussed, Entact opined that URS' volume estimate for the Tailings Accumulation Area may also include tailings in the Downgradient Ditch. For conservatism, volume estimates for the Tailings Accumulation Area and Downgradient Ditch were made by pro-rating URS' aggregate volume estimate for these features (20,700 cy) by the relative amounts estimated by Entact (18,000 cy for the Tailings Accumulation Area and 915 cy for the Downgradient Ditch).

TABLE 2 - IDENTIFICATION OF CONTAMINANTS OF POTENTIAL CONCERN (COPCs)

SCREENING CRITERIA										MAXIMUM SITE CONCENTRATION								
Contaminant	Model Toxics Control Act Cleanup values for Unrestricted Land Uses (mg/kg)	MTCA Table 749-3 Soil Concentrations for Plants and Animals (mg/kg)			EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites (mg/kg)	Natural Background Soil Metals Concentrations in Washington State (90th percentile) (mg/kg)	USEPA Ecological Soil Screening Levels (mg/kg)				Maximum Measured Concentration at Grandview Site	Sample Designation	Source Report	Table Number	Location ID #	Depth bgs (in)	Sampling Date	COPC?
Target Analyte List Metals (mg/kg)		Plants	Soil Biota	Wildlife	Residential Soil		Plants	Invertebrates	Birds	Mammals	(mg/Kg)							
Aluminum		50			77000	21376					11800	ABANDONED CONTAINER AND DRUM AREA SURFACE SOIL SAMPLES	E&E 2001	6-3	DA02SS	0-6		NO
Antimony					Antimony (metallic)													
Arsenic		5			31		NA	78	NA	0.27	10.1	FORMER WASTEWATER DRAINAGE DITCH SURFACE SOIL SAMPLES	E&E 2001	6-8	FD01SS	0-6		YES
	20			7	Inorganic 0.39	9.34	18	NA	43	46	98.4	Lower Level Mill Area Tailings Material	ENTACT, 2008	2	LL-04		9/16/2008	YES
Barium		500		102	15000		NA	330	NA	2000	189	ABANDONED CONTAINER AND DRUM AREA SURFACE SOIL SAMPLES	E&E 2001	6-3	DA04SS	0-6		NO
Cadmium	2	4	20	14	70	0.72	32	140	0.77	0.36	1230	Lower Level Mill Area Tailings Material	ENTACT, 2008	2	LL-04		9/16/2008	YES
Chromium	Chromium III 2000	Chromium VI 19	Chromium (Total)		Chromium Total (1:6 ratio Cr VI:Cr III)		Chromium III											
		42	42	67	280	17.81	NA	NA	26	34	133	FORMER WASTEWATER DRAINAGE DITCH SURFACE SOIL SAMPLES	E&E 2001	6-8	FD01SS	0-6		YES
Cobalt		20			23		13	NA	120	230	10.2	ABANDONED CONTAINER AND DRUM AREA SURFACE SOIL SAMPLES	E&E 2001	6-3	DA01SS	0-6		NO
Copper		100	50	217	3100	21.61	70	80	28	49	3730	FORMER WASTEWATER DRAINAGE DITCH SURFACE SOIL SAMPLES	E&E 2001	6-8	FD01SS	0-6		YES
Iron					55000	25026					31900	ABANDONED CONTAINER AND DRUM AREA SURFACE SOIL SAMPLES	E&E 2001	6-3	DA06SS	0-6		YES
Lead					Lead and Compounds													
	250	50	500	118	400	14.91	120	1700	11	56	43000	FORMER WASTEWATER DRAINAGE DITCH SURFACE SOIL SAMPLES	E&E 2001	6-8	FD01SS	0-6		YES
Magnesium											62900	WASTE ROCK PILE SUBSURFACE SOIL SAMPLES	E&E 2001	6-2	WP02SB	24-36		No Criteria
Manganese		1100		1500	1800	663.5	220	450	4300	4000	784	FORMER WASTEWATER DRAINAGE DITCH SURFACE SOIL SAMPLES	E&E 2001	6-8	FD09SS	0-6		YES
Mercury			Mercury, inorganic 0.1	5.5	Mercury (elemental) 4.3	0.02												
	2	0.3									78.6	Lower Level Mill Area Tailings Material	ENTACT, 2008	2	LL-04		9/16/2008	YES
Selenium		1	70	0.3	390		0.52	4.1	1.2	0.63	6.4	FORMER WASTEWATER DRAINAGE DITCH SURFACE SOIL SAMPLES	E&E 2001	6-8	FD01SS	0-6		YES
Silver		2			390		560	NA	4.2	14	7.4	FORMER WASTEWATER DRAINAGE DITCH SURFACE SOIL SAMPLES	E&E 2001	6-8	FD01SS	0-6		YES
Thallium					Thallium (Soluble Salts)													
		1			5.1						4.1	ABANDONED CONTAINER AND DRUM AREA SURFACE SOIL SAMPLES	E&E 2001	6-3	DA06SS	0-6		NO
Vanadium		2			Vanadium (Metallic) 550		NA	NA	7.8	280	24.6	WASTE ROCK PILE SUBSURFACE SOIL SAMPLES	E&E 2001	6-2	WP03SB	24-36		YES
Zinc		86	200	360	Zinc (Metallic) 23000	66.4	160	120	46	79	521000	Lower Level Mill Area Tailings Material	ENTACT, 2008	2	LL-04		9/16/2008	YES

TABLE 3
ANALYSIS OF REMOVAL ACTION ALTERNATIVES AGAINST CERCLA CRITERIA
GRANDVIEW MINE AND MILL SITE

UPPER LEVEL MINE, LOWER LEVEL MILL, AND DRAINAGE DITCH SUBAREA			
12,220 cy total development rock, 7,220 cy tailings, 500 cy soil (assumed)			
Removal Action Alternative Component	Effectiveness	Implementability	Cost
MM1: No Action	Not Effective	Not Applicable	No Cost
MM2: Consolidate in On-Site Repository at Lower Level Mill Area	Effective	Implementable	\$403,000
MM3: Consolidate in On-Site Repository at Tailings Accumulation Subarea	Effective	Implementable	\$461,000
MM4: Disposal at Teck Pend Oreille Facility	Effective	Implementable	\$713,000
MM5: Off-Site Disposal	Effective	Implementable	\$4,140,000
TAILINGS ACCUMULATION SUBAREA			
19,700 cy tailings			
Removal Action Alternative Component	Effectiveness	Implementability	Cost
TA1: No Action	Not Effective	Not Applicable	No Cost
TA2: Consolidate in On-Site Repository at Lower Level Mill Area	Effective	Implementable	\$383,000
TA3: Consolidate in On-Site Repository at Tailings Accumulation Subarea	Effective	Implementable	\$171,000
TA4: Disposal at Teck Pend Oreille Operations	Effective	Implementable	\$636,000
TA5: Off-Site Disposal in a Landfill	Effective	Implementable	\$6,780,000
MAN-MADE DITCH AND DOWNGRAIDENT DITCH SUBAREA			
2,155 cy tailings.			
Removal Action Alternative Component	Effectiveness	Implementability	Cost
MD1: No Action	Not Effective	Not Applicable	No Cost
MD2: Consolidate in On-Site Repository at Lower Level Mill Area	Effective	Implementable	\$114,000
MD3: Consolidate in On-Site Repository at Tailings Accumulation Subarea	Effective	Implementable	\$90,000
MD4: Disposal at Teck Pend Oreille Operations	Effective	Implementable	\$110,000
MD5: Off-Site Disposal in a Landfill	Effective	Implementable	\$856,000

TABLE 4
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
GRANDVIEW MINE AND MILL SITE

UPPER LEVEL MINE, LOWER LEVEL MILL, AND DRAINAGE DITCH SUBAREA				
12,220 cy total development rock, 7,220 cy tailings, 500 cy soil (assumed)				
CERCLA Criteria	MM2: Consolidate in On-Site Repository at Lower Level Mill Area	MM3: Consolidate in On-Site Repository at Tailings Accumulation Subarea	MM4: Disposal at Teck Pend Oreille Operations	MM5: Off-Site Disposal in a Landfill
Effectiveness	Lower level of long-term effectiveness and permanence than MM4 and MM5. Higher level of short-term effectiveness than MM3, MM4, and MM5	Lower level of long-term effectiveness and permanence than MM4 and MM5. Higher level of short-term effectiveness than MM4 and MM5. Lower level of short-term effectiveness than MM2.	Higher level of long-term effectiveness and permanence than MM2 and MM3. Equal to MM5 in terms of long-term effectiveness and permanence. Lower level of short-term effectiveness than MM2 and MM3 but higher level of short-term effectiveness than MM5.	Higher level of long-term effectiveness and permanence MM2 and MM3. Equal to MM4 in terms of long-term effectiveness and permanence. Lower level of short-term effectiveness than MM2, MM3, and MM4.
Implementability	MM2, MM3, MM4, and MM5 are equally implementable assuming that any issues involving state conditional order and regulatory requirements associated with TA4 are successfully addressed.	MM2, MM3, MM4, and MM5 are equally implementable assuming that any issues involving state conditional order and regulatory requirements associated with TA4 are successfully addressed.	MM2, MM3, MM4, and MM5 are equally implementable assuming that any issues involving state conditional order and regulatory requirements associated with TA4 are successfully addressed.	MM2, MM3, MM4, and MM5 are equally implementable assuming that any issues involving state conditional order and regulatory requirements associated with TA4 are successfully addressed.
Cost	\$403,00	\$461,000	\$713,000	\$4,140,000

TABLE 4
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
GRANDVIEW MINE AND MILL SITE

TAILINGS ACCUMULATION SUBAREA				
19,700 cy tailings				
CERCLA Criteria	TA2: Consolidate in On-Site Repository at Lower Level Mill Area	TA3: Consolidate in On-Site Repository at Tailings Accumulation Subarea	TA4: Disposal at Teck Pend Oreille Operations	TA5: Off-Site Disposal in a Landfill
Effectiveness	<p>Lower level of long-term effectiveness and permanence than TA4 and TA5. Equal to TA3 in terms of long-term effectiveness and permanence.</p> <p>Lower level of short-term effectiveness than TA3. Equal to TA4 in terms of short-term effectiveness. Higher level of short-term effectiveness than TA5.</p>	<p>Lower level of long-term effectiveness and permanence than TA4 and TA5. Equal to TA2 in terms of long-term effectiveness and permanence.</p> <p>Higher level of short-term effectiveness than TA2, TA4, and TA5.</p>	<p>Higher level of long-term effectiveness and permanence than TA2 and TA3. Equal to TA5 in terms of long-term effectiveness and permanence.</p> <p>Equal to TA2 in terms of short-term effectiveness. Lower level of short-term effectiveness than TA3. Higher level of short-term effectiveness than TA5.</p>	<p>Higher level of long-term effectiveness and permanence than TA2 and TA3. Equal to TA4 in terms of long-term effectiveness and permanence.</p> <p>Lower level of short-term effectiveness than TA2, TA3, and TA4.</p>
Implementability	TA2, TA3, TA4, and TA5 are equally implementable assuming that any issues involving state conditional order and regulatory requirements associated with TA4 are successfully addressed.	TA2, TA3, TA4, and TA5 are equally implementable assuming that any issues involving state conditional order and regulatory requirements associated with TA4 are successfully addressed.	TA2, TA3, TA4, and TA5 are equally implementable assuming that any issues involving state conditional order and regulatory requirements associated with TA4 are successfully addressed.	TA2, TA3, TA4, and TA5 are equally implementable assuming that any issues involving state conditional order and regulatory requirements associated with TA4 are successfully addressed.
Cost	\$383,000	\$171,000	\$636,000	\$6,780,000

TABLE 4
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
GRANDVIEW MINE AND MILL SITE

MAN-MADE DITCH AND DOWNGRAIENT DITCH SUBAREA				
2,155 cy tailings.				
CERCLA Criteria	MD2: Consolidate in On-Site Repository at Lower Level Mill Area	MD3: Consolidate in On-Site Repository at Tailings Accumulation Subarea	MD4: Disposal at Teck Pend Oreille Operations	MD5: Off-Site Disposal in a Landfill
Effectiveness	<p>Lower level of long-term effectiveness and permanence than MD4 and MD5. Equal to MD3 in terms of long-term effectiveness and permanence.</p> <p>Lower level of short-term effectiveness than MD3. Equal to MD4 in terms of short-term effectiveness. Higher level of short-term effectiveness than MD5.</p>	<p>Lower level of long term effectiveness and permanence than MD4 and MD5. Equal to MD2 in terms of long-term effectiveness and permanence.</p> <p>Higher level of short-term effectiveness than MD2, MD4, and MD5.</p>	<p>Higher level of long-term effectiveness and permanence than MD2 and MD3. Equal to MD5 in terms of long-term effectiveness and permanence.</p> <p>Equal to MD2 in terms of short-term effectiveness. Lower level of short-term effectiveness than MD3. Higher level of short-term effectiveness than MD5.</p>	<p>Higher level of long-term effectiveness and permanence than MD2 and MD3. Equal to MD4 in terms of long-term effectiveness and permanence.</p> <p>Lower level of short-term effectiveness than MD2, MD3, and MD4.</p>
Implementability	MD2, MD3, MD4, and MD5 are equally implementable assuming that any issues involving state conditional order and regulatory requirements associated with MD4 are successfully addressed.	MD2, MD3, MD4, and MD5 are equally implementable assuming that any issues involving state conditional order and regulatory requirements associated with MD4 are successfully addressed.	MD2, MD3, MD4, and MD5 are equally implementable assuming that any issues involving state conditional order and regulatory requirements associated with MD4 are successfully addressed.	MD2, MD3, MD4, and MD5 are equally implementable assuming that any issues involving state conditional order and regulatory requirements associated with MD4 are successfully addressed.
Cost	\$114,000	\$90,000	\$110,000	\$856,000

TABLE 5
PRESENT VALUE OF RECOMMENDED REMOVAL ACTION ALTERNATIVE
(MM2 + TA2 + MD2)

Item	Notes	Start Year ⁽¹⁾	End Year ⁽²⁾	Estimated Cost ⁽³⁾	Present Value ⁽⁴⁾
<u>MM2 + TA2 + MD2 - Consolidate in On-Site Repository at Lower Level Mill Area</u>					
Capital Costs	Table 5	0	0	\$779,252	\$779,252
PRSC Costs, Years 1-5 (Repository Maintenance)	Table 5	1	5	\$8,220	\$33,704
PRSC Costs, Years 6-30 (Repository Inspections)	Table 5	6	30	\$4,110	\$34,149
Total Present Value					\$847,105

Notes:

For Present Value calculations, the Discount Rate used is.... 7%

Costs and Present Value are based on "constant" or "real" 2009 dollars not adjusted for future inflation.

Unless identified separately, burden and profits are included in unit costs.

- ⁽¹⁾ Start Year is the year during which the capital construction or the O&M activities begin. Costs are assumed to be incurred on the first day of the year indicated.
- ⁽²⁾ End Year is the year during which the capital construction or the O&M activities are completed. Costs are assumed to be incurred on the first day of the year indicated.
Though a 30-year PRSC period is shown, a long-term monitoring program would be implemented as long as contaminants remain on-Site above actionable levels.
- ⁽³⁾ Capital Costs are totals for the activity, not annualized; Annual O&M Costs are annualized to represent one year only; Periodic Costs are one-time or repeating (not annual) costs.
- ⁽⁴⁾ Present Value represents the total cost over the project life based on a discount rate applied to the estimated cost for each year after Year 0 (2009).

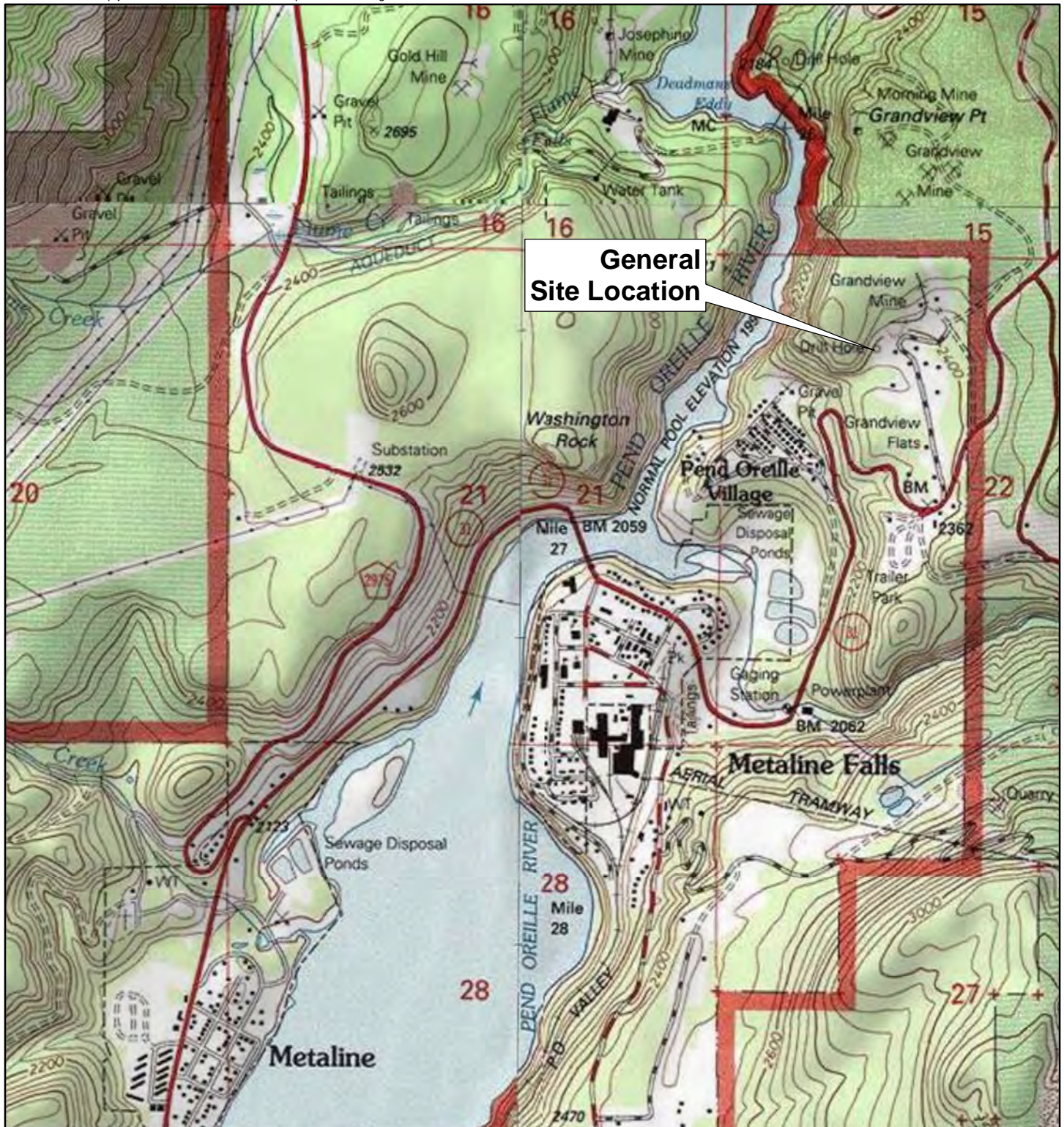
TABLE 6
DETAILED COST ESTIMATE INFORMATION
RECOMMENDED REMOVAL ACTION ALTERNATIVE (MM2 + TA2 + MD2)

Item	Notes	Quantity	Unit	Unit Cost	Total Cost
Capital Costs					
Direct Construction - MM2					
Consolidation GRA:					
Clear and grub	a	2.9	acre	\$8,980	\$26,042
Demolish silo, etc in lower area	a	1	each	\$11,000	\$11,000
Regrade development rock in lower area	a	5,905	cy	\$1.90	\$11,220
Excav/haul dev rock from mill, homesite, roads	a	6,315	cy	\$3.50	\$22,103
Excavate/haul drum area soils	a	500	cy	\$3.50	\$1,750
Excav/haul tailings from drainage/distressed area	a	7,220	cy	\$3.70	\$26,714
Grade excavated areas for drainage	a	7.2	acre	\$1,100	\$7,920
Place materials in repository - 12" lifts	a	14,085	cy	\$2.30	\$32,396
Containment GRA:					
Haul/place cover soil - 1' thick	a	1,410	cy	\$14.80	\$20,868
Grade runon control ditch at repository	a	225	ft	\$60	\$13,500
Seed and mulch all excavation/repository areas	a	8.1	acre	\$2,400	\$19,440
Institutional Controls GRA:					
Institutional controls	a	1	each	\$10,000	\$10,000
Direct Construction - TA2					
Consolidation GRA:					
Excav/haul tailings from tailings accumulation area	a	19,700	cy	\$3.80	\$74,860
Demolish silo, etc in lower area	a	1	each	\$11,000	\$11,000
Grade excavated areas for drainage	a	3.1	acre	\$1,100	\$3,410
Place materials in repository - 12" lifts	a	19,700	cy	\$2.30	\$45,310
Containment GRA:					
Haul/place cover soil - 1' thick	a	1,975	cy	\$14.80	\$29,230
Grade runon control ditch at repository	a	300	ft	\$60	\$18,000
Seed and mulch all excavation/repository areas	a	4.3	acre	\$2,400	\$10,320
Institutional Controls GRA:					
Institutional controls	a	1	each	\$10,000	\$10,000
Direct Construction - MD2					
Consolidation GRA:					
Clear and grub	a	1.2	acre	\$8,980	\$10,776
Demolish silo, etc in lower area	a	1	each	\$11,000	\$11,000
Excav/haul tailings from ditch areas	a	2,155	cy	\$4.00	\$8,620
Grade excavated areas for drainage	a	1.2	acre	\$1,100	\$1,320
Place materials in repository - 12" lifts	a	2,155	cy	\$2.30	\$4,957
Containment GRA:					
Haul/place cover soil - 1' thick	a	221	cy	\$14.80	\$3,271
Grade runon control ditch at repository	a	35	ft	\$60	\$2,100
Seed and mulch all excavation/repository areas	a	1.3	acre	\$2,400	\$3,120
Institutional Controls GRA:					
Institutional controls	a	1	each	\$10,000	\$10,000
Direct Construction Subtotal					\$460,245
Indirect Construction					
Mobilization/Demobilization	b	5%			\$23,012
BMPs, Worker Protection, etc.	b	3%			\$11,506
Indirect Construction Subtotal					\$34,518
Construction Subtotal					\$494,763
Contingencies					
Scope	b	10%			\$49,476
Bid	b	15%			\$74,214
Subtotal					\$618,454
Project Management (inc. submittals)	b	6%			\$37,107
Remedial Design (inc. submittals)	b	12%			\$74,214
Construction Management (inc. submittals)	b	8%			\$49,476
TOTAL CAPITAL COSTS					\$779,252
Annual PRSC Costs					
Maint. of repository (yrs 1-5)	c	13.7	acre	\$600	\$8,220
Inspection of repository (yrs 6-30)	c	13.7	acre	\$300	\$4,110

Notes

- a For details, see Appendix C, Table C-5 for MM2, C-10 for TA2, and C-13 for MD2.
- b Based on EPA FS Cost Guidance.
- c Maintenance and inspection costs are assumed..

FIGURES



GRANDVIEW MINE AND MILL SITE METALINE FALLS, WA

FIGURE 1

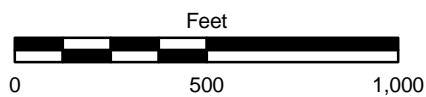
GENERAL SITE LOCATION

PRJ: 1524-001-900	Jul 20, 2009
REV: 0	BY: CRL CHECKED:

NEWFIELDS



3



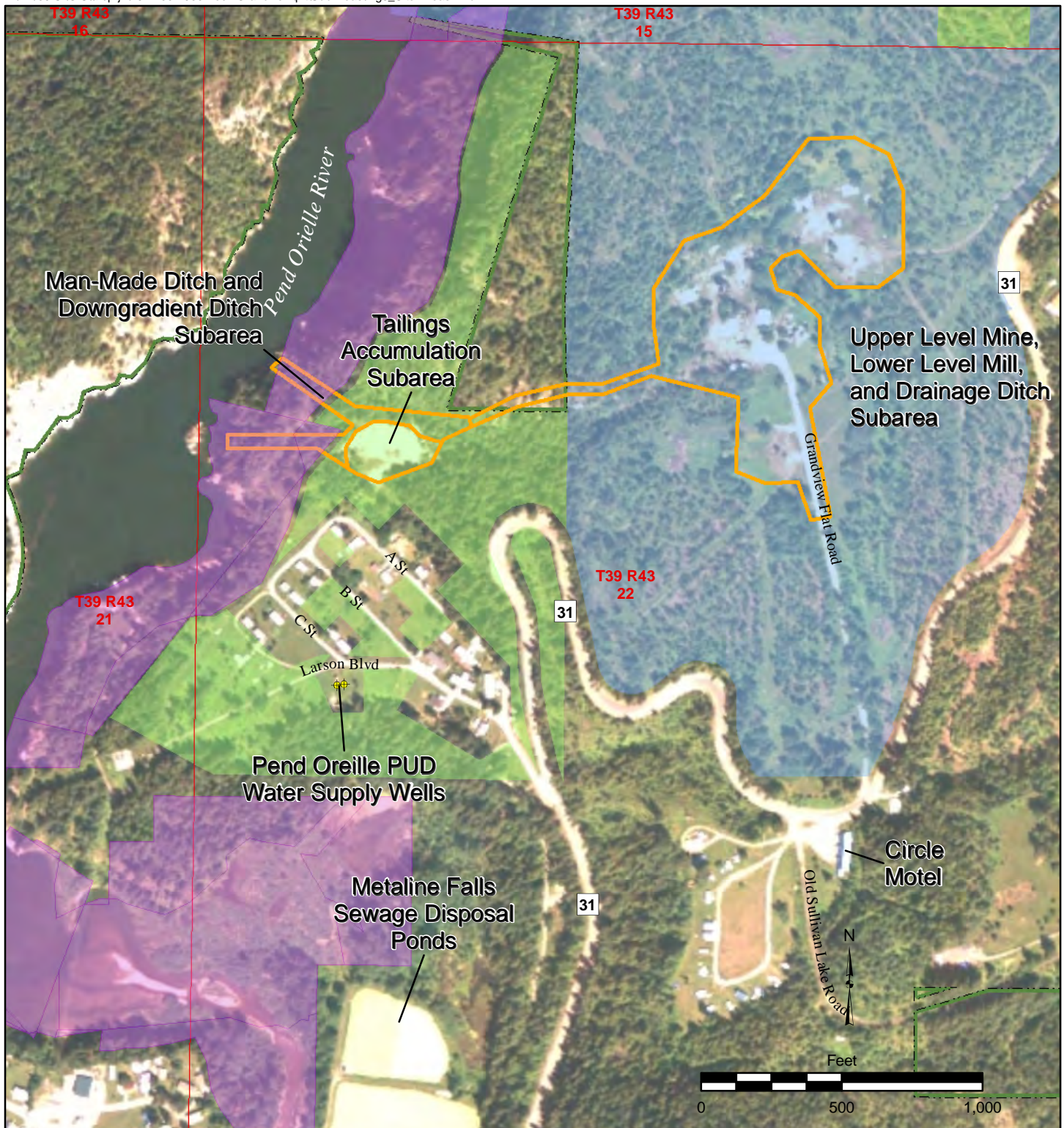
GRANDVIEW MINE AND MILL SITE
METALINE FALLS, WA

FIGURE 2

SITE LAYOUT

PRJ: 1524-001-900	Sep 02, 2009
REV: 0	BY: CRL CHECKED:





Legend

	Section Boundary		U.S. Ownership
	Approximate Boundaries of Site and Site Subareas		City Of Seattle
	Water Supply Well		Teck
			Washington Resources Llc

NOTE: Property Boundaries Subject To Verification

GRANDVIEW MINE AND MILL SITE METALINE FALLS, WA

FIGURE 3

APPROXIMATE BOUNDARIES OF SITE AND SITE SUBAREAS

PRJ: 1524-001-900

Dec 22, 2009

REV: 0

BY: CRL

CHECKED:

NEWFIELDS

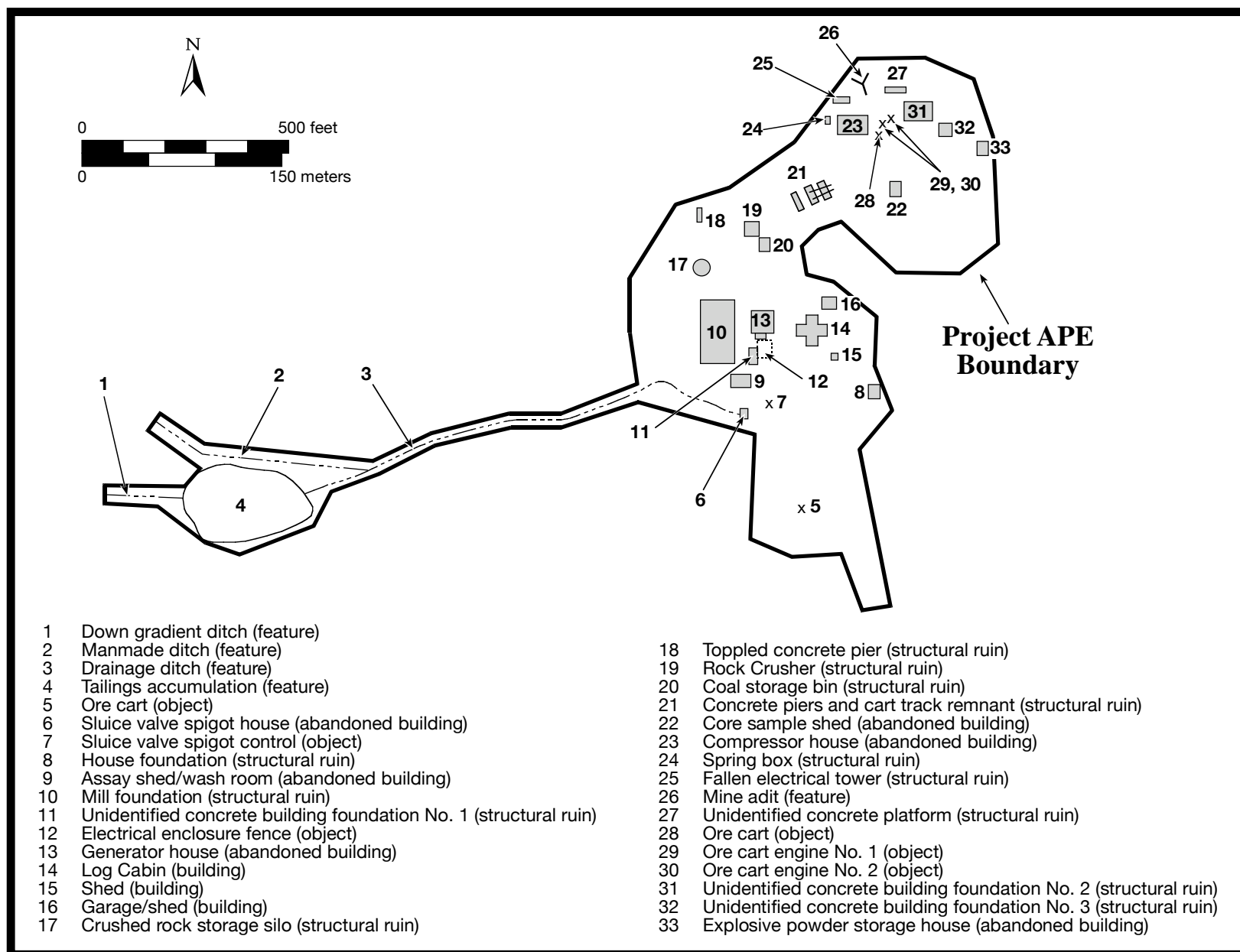


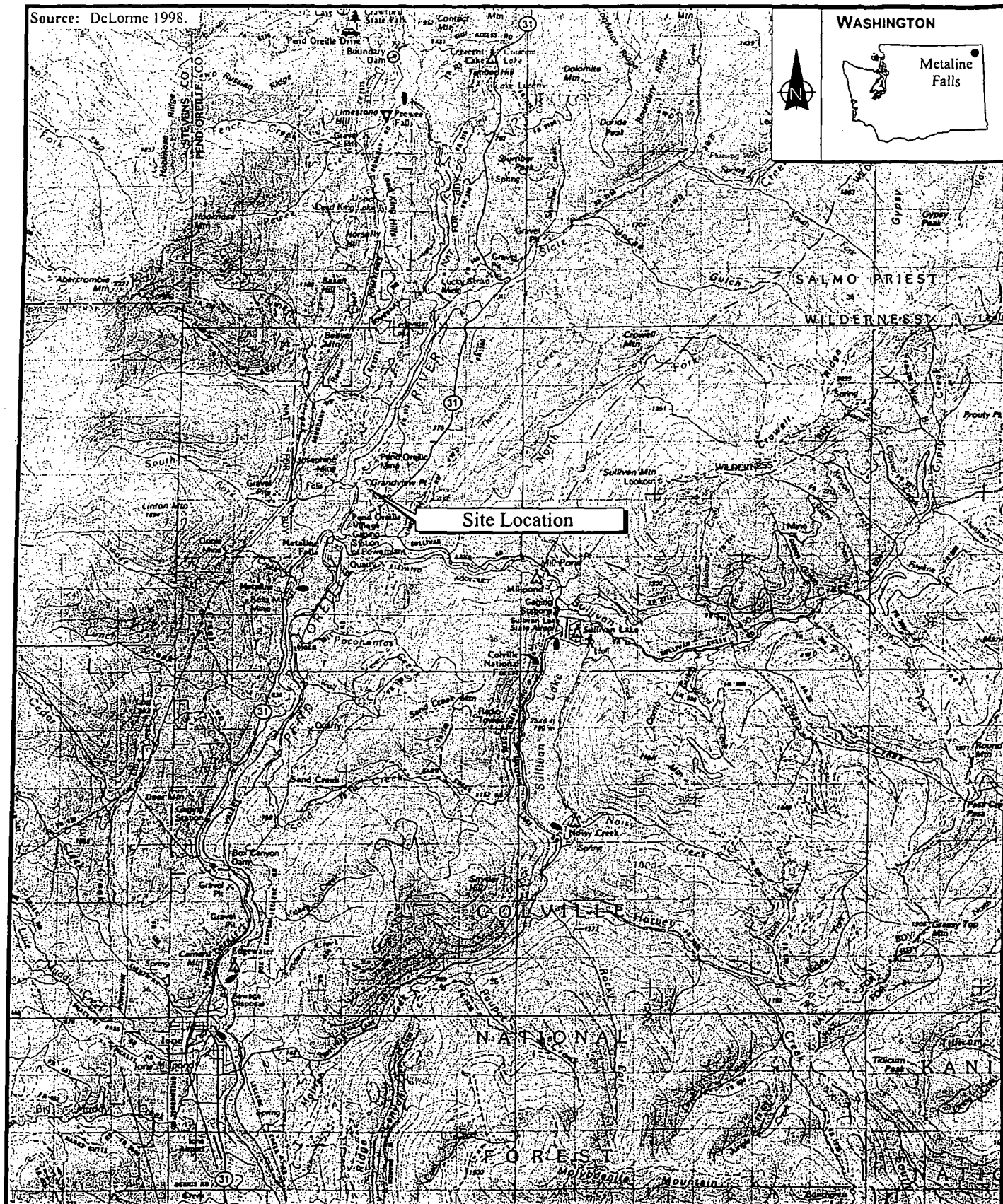
Figure 4. Map of project APE showing recorded resources locations.

APPENDIX A
Excerpted Material from ENTACT and URS Reports

EXCERPTED TABLES AND FIGURES FROM E&E, 2001

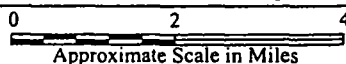
Source: DeLorme 1998.

WASHINGTON



ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

GRANDVIEW MINE
PRELIMINARY ASSESSMENT/
SITE INSPECTION
Metaline Falls, Washington



Approximate Scale in Miles

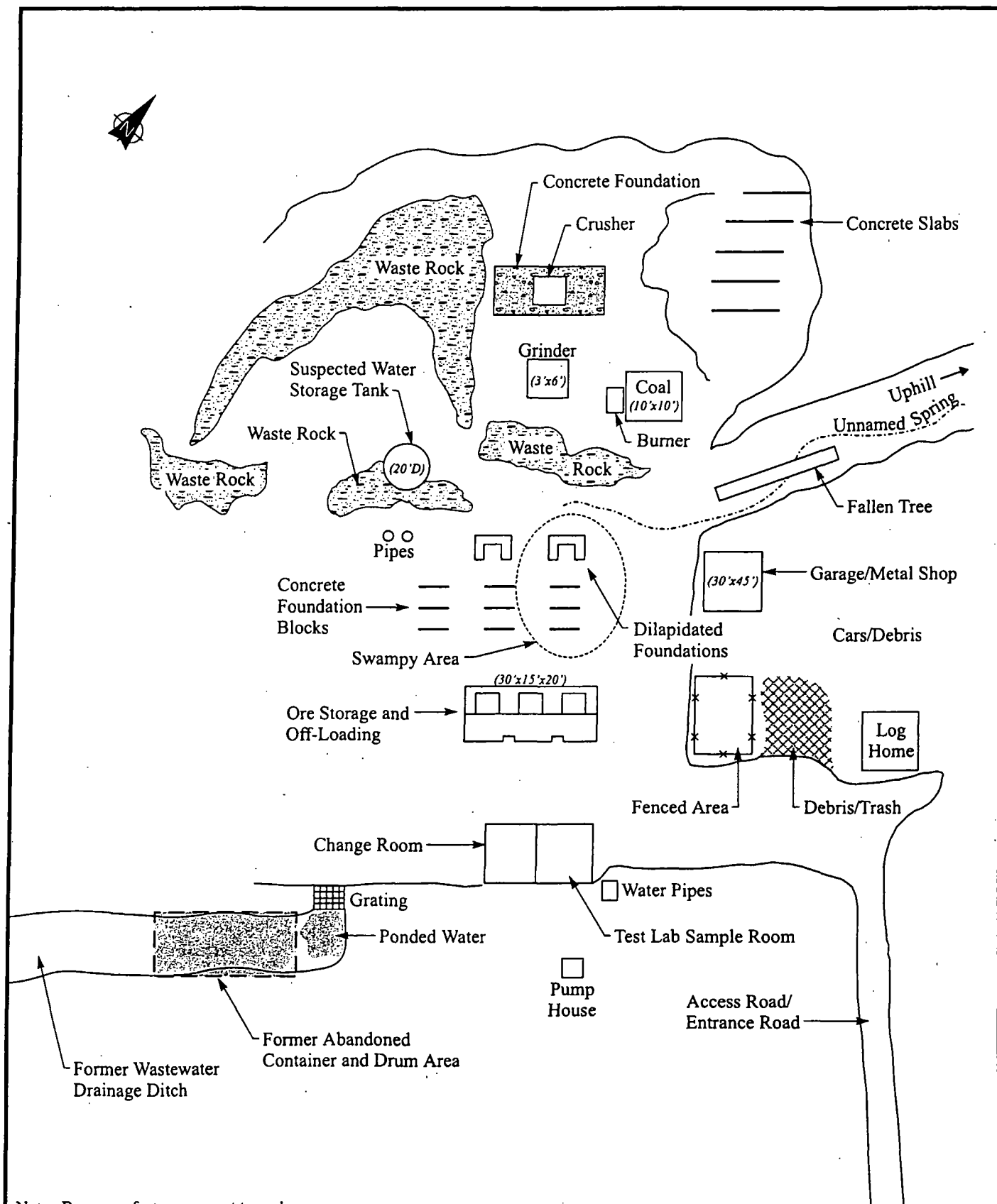
Figure 2-1

SITE VICINITY MAP

Date:
02-18-01

Drawn by:
AES

10:START-2\01010015\5627\fig 2-1



Note: Base map features are not to scale.



ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

GRANDVIEW MINE
PRELIMINARY ASSESSMENT/
SITE INSPECTION
Metaline Falls, Washington

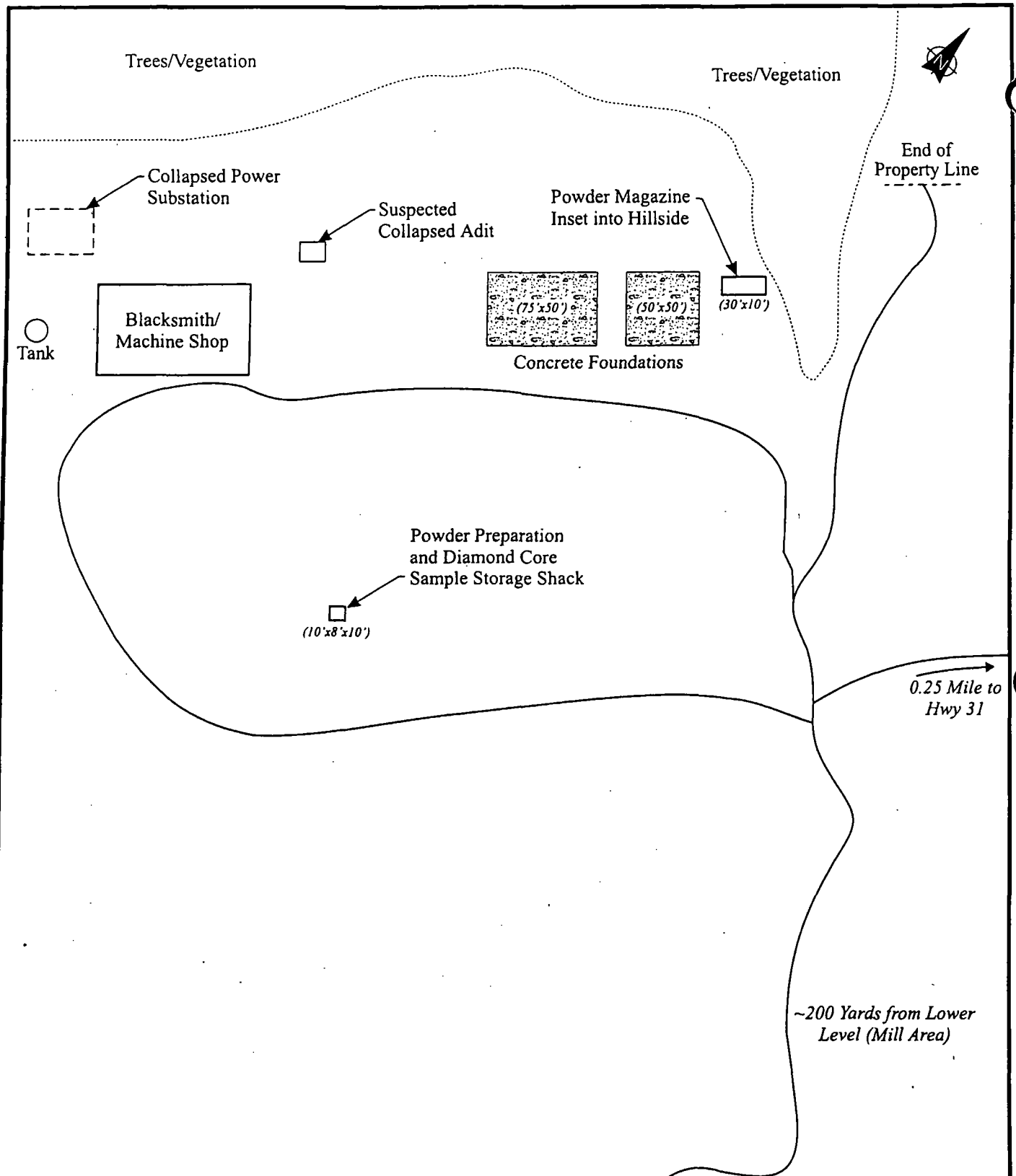
Not to Scale

Figure 2-2
SITE LOCATION MAP
LOWER LEVEL-MILL AREA

Date:
02-20-01

Drawn by:
AES

10:START-2\01010015\S627\fig 2-2



Note: Base map features are not to scale.



ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

**GRANDVIEW MINE
PRELIMINARY ASSESSMENT/
SITE INSPECTION
Metaline Falls, Washington**

Not to Scale

Date:
02-20-01

Drawn by:
AES

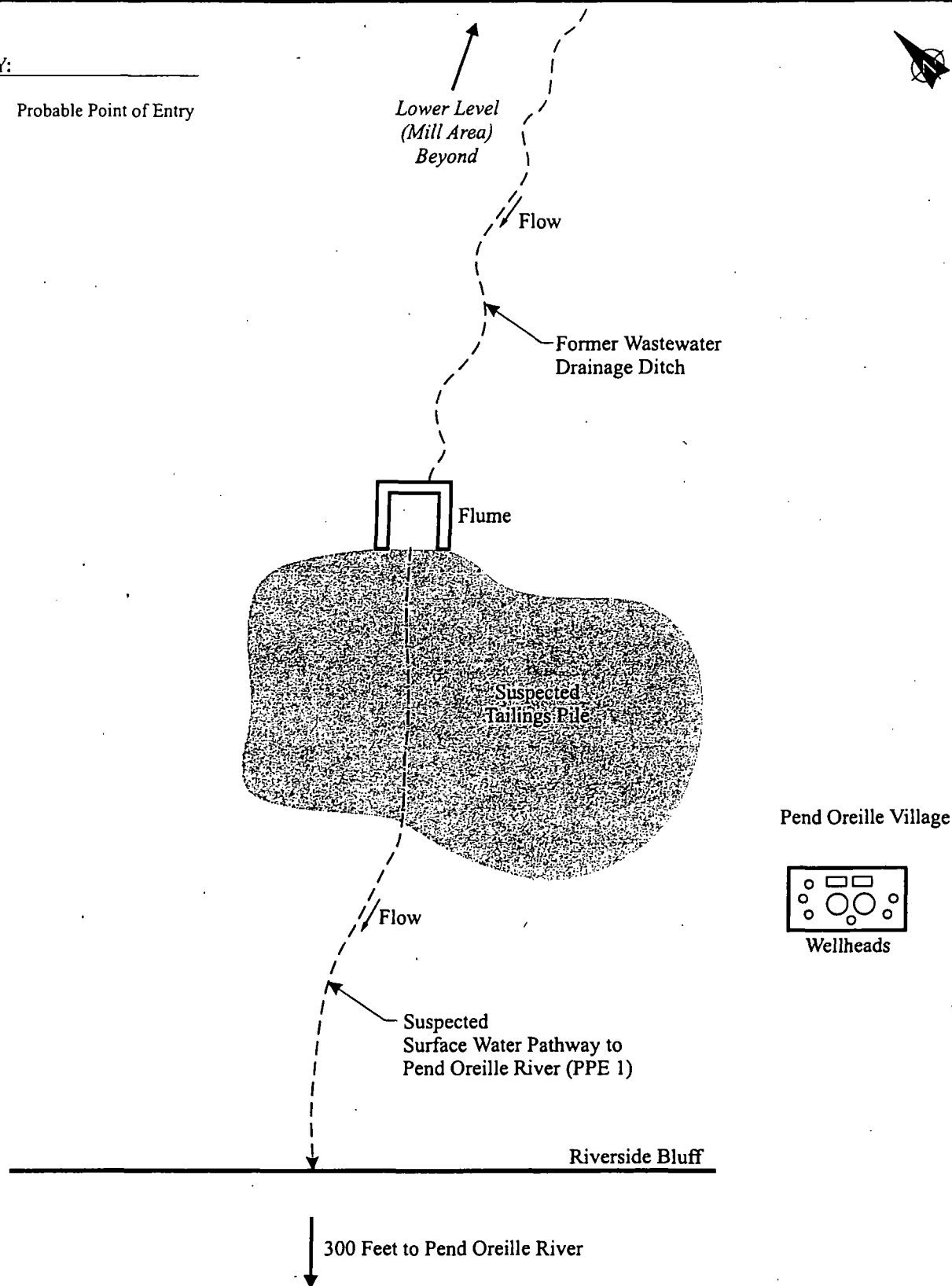
Figure 2-3

**SITE LOCATION MAP
UPPER LEVEL-MINE AREA**

10:START-2\01010015\5627\fig 2-3

KEY:

PPE Probable Point of Entry



Note: Base map features are not to scale.



ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

**GRANDVIEW MINE
PRELIMINARY ASSESSMENT/
SITE INSPECTION
Metaline Falls, Washington**

Not to Scale

Date:
02-20-01

Drawn by:
AES

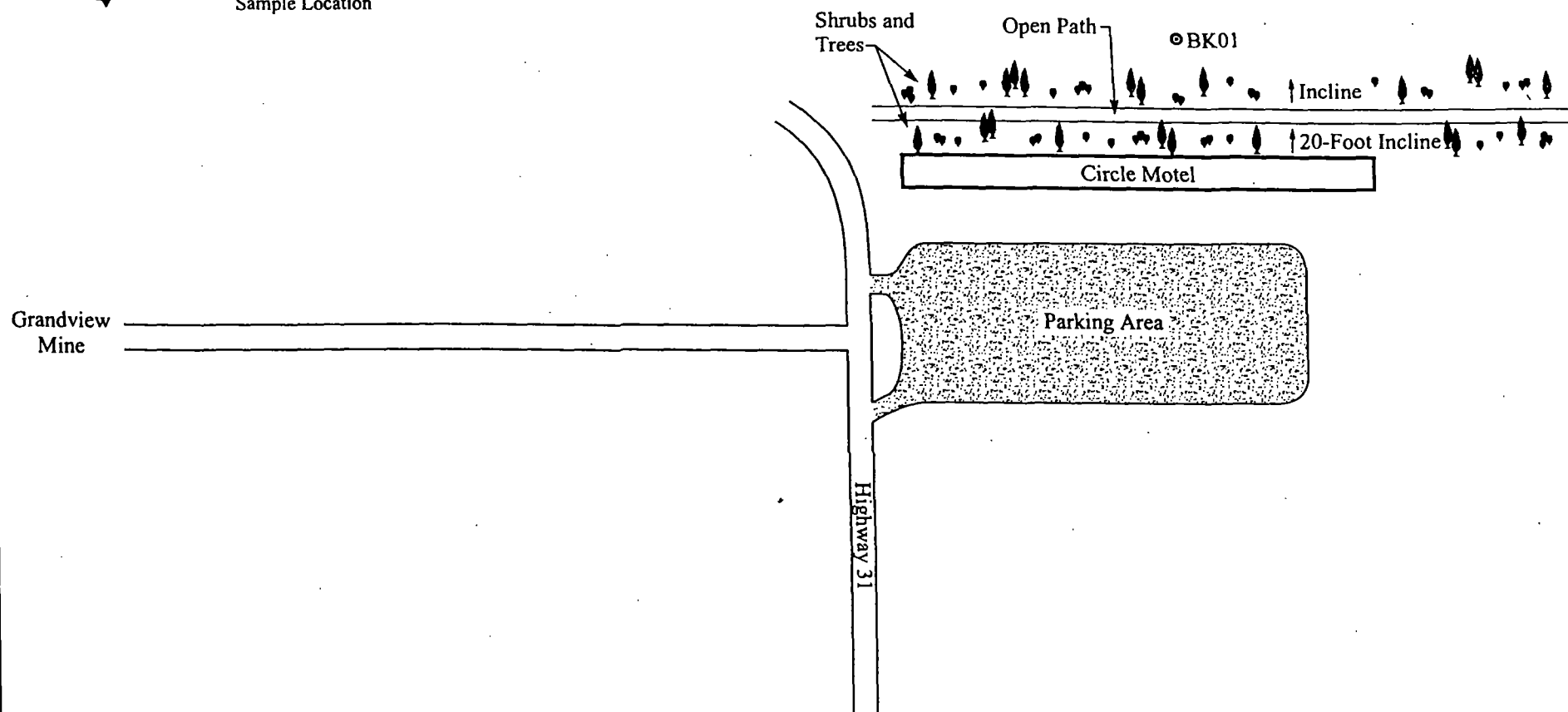
**Figure 2-4
SITE LOCATION MAP
PPE TO PEND OREILLE RIVER**

10:START-2\01010015\5627\fig 2-4



Key:

- ⊙ Background Surface Soil Sample Location



Note: Base map features are not to scale.



ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

**GRANDVIEW MINE
PRELIMINARY ASSESSMENT/SITE INSPECTION
Metaline Falls, Washington**

0 100 200
Approximate Scale in Feet

**Figure 3-1
SAMPLE LOCATION MAP
BACKGROUND SOIL**

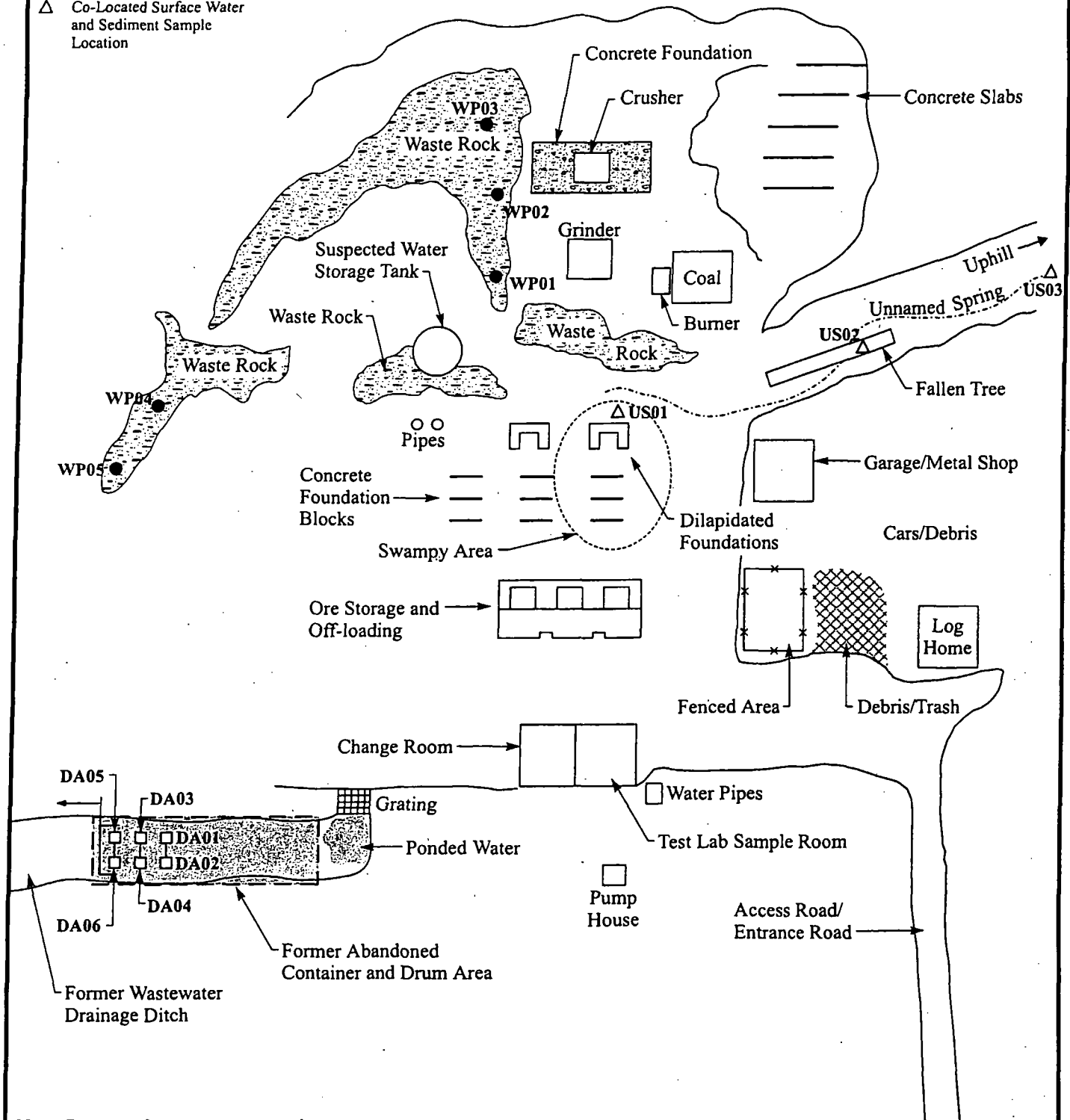
Date:
02-20-01

Drawn by:
AES

10:START-2\01010015\S627\fig 3-1

KEY:

- Subsurface Soil Sample Location
- Surface Soil Sample Location
- △ Co-Located Surface Water and Sediment Sample Location



Note: Base map features are not to scale.



ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

**GRANDVIEW MINE
PRELIMINARY ASSESSMENT/
SITE INSPECTION
Metaline Falls, Washington**

Not to Scale

Date:
02-20-01

Drawn by:
AES

**Figure 3-2
SAMPLE LOCATION MAP
LOWER LEVEL-MILL AREA**

10:START-2\01010015\5627\fig 3-2

KEY:

PPE Probable Point of Entry

● Co-Located Surface and Subsurface Soil Sample Location

□ Surface Soil Sample Location

△ Co-Located Surface Water and Sediment Sample Location

△ Background Co-Located Surface Water and Sediment Sample Location

TP01 (Five-Point Composite Sample)

TP02 (Five-Point Composite Sample)

FD01

FD02

FD03

FD04

FD05

FD06

FD07

FD08

FD09

△ PR01

PR02△

BK02△

Power Station

Flow

Former Wastewater Drainage Ditch

Flume

Suspected Tailings Pile

Pend Oreille Village

Wellheads

Flow

Suspected Surface Water Pathway to Pend Oreille River (PPE 1)

Riverside Bluff

300 Feet to Pend Oreille River

Pend Oreille River

Note: Base map features are not to scale.



ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

GRANDVIEW MINE
PRELIMINARY ASSESSMENT/
SITE INSPECTION
Metaline Falls, Washington

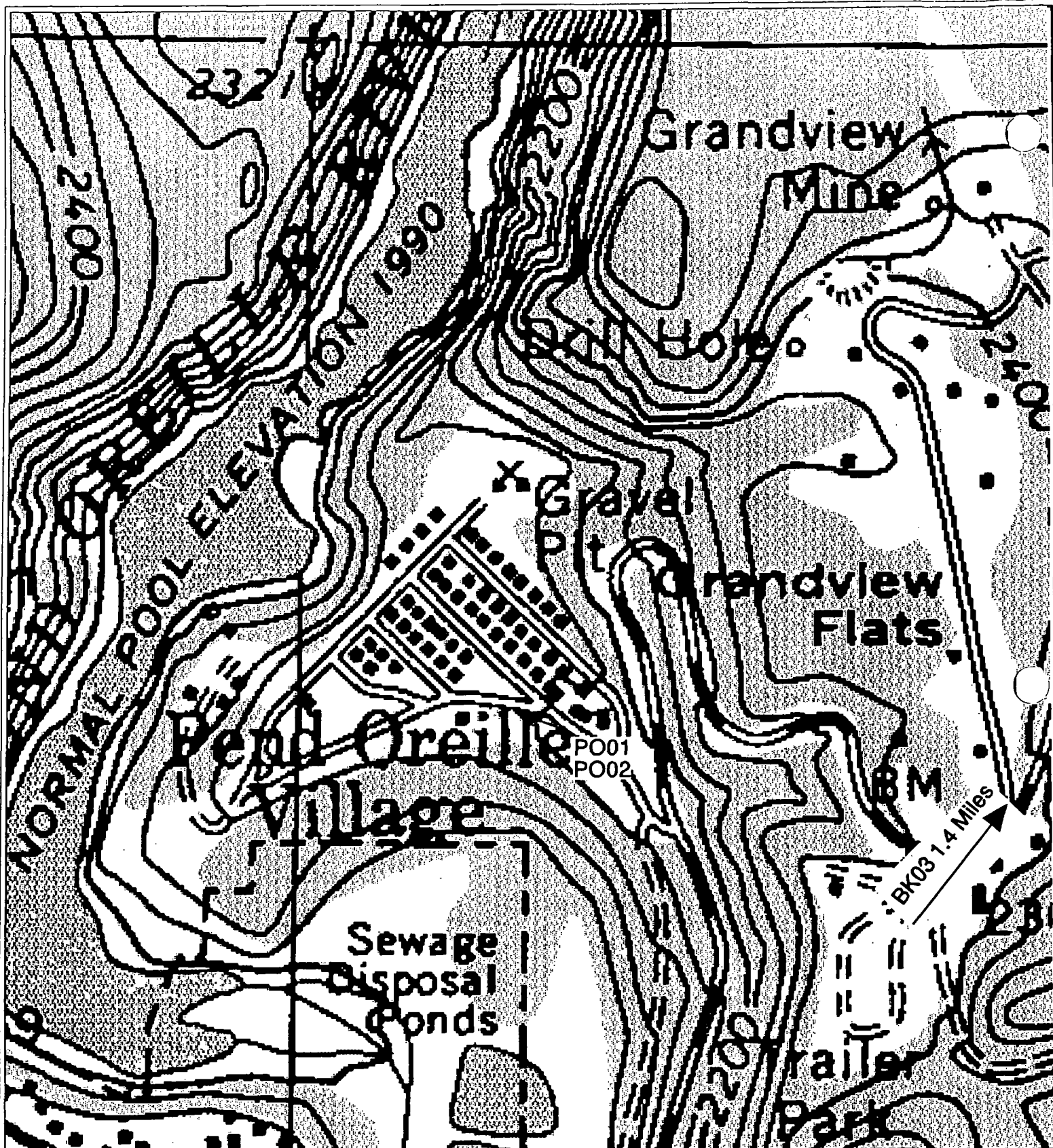
0 100 200
Approximate Scale in Feet

Figure 3-3
SAMPLE LOCATION MAP
PPE TO PEND OREILLE RIVER

Date:
02-20-01

Drawn by:
AES

10:START-2\01010015\5627\fig 3-3



Legend

- Sample Location



Figure 3-4

GRANDVIEW MINE

GROUNDWATER SAMPLE LOCATION MAP



Metalline Falls, Washington

Table 6-1

**SUSPECTED TAILINGS PILE SOIL SAMPLES
ANALYTICAL RESULTS SUMMARY
GRANDVIEW MINE PRELIMINARY ASSESSMENT/SITE INSPECTION
METALINE FALLS, WASHINGTON**

EPA Sample Number	00434238	00434224	00434225	00434226	00434227
CLP Sample Number	MJ00BM	MJCG27	MJ00BC	MJ00BD	MJ00BE
Location ID Number	BK01SS	TP01SS	TP01SB	TP02SS	TP02SB
Depth (inches bgs)	0-6	0-6	24-36	0-6	24-36
Description	Background	Source			
Gamma Spectroscopy (pCi/g)					
Bi214	0.799	1.20	0.956	2.47	1.67
Cs137	1.31	0.0239	0.025 UJ	0.0213	0.021 UJ
K40	15.2	0.876	1.40 U	1.14	1.04 U
Pa234m	NDL	2.70 J	1.46 J	6.20 J	3.30 J
Pb212	0.974	0.0945	0.0561	0.0525	0.0666
Pb214	0.878	1.39	1.06	2.78	1.86
Ra223	NDL	NDL	NDL	0.386	NDL
Ra226	1.41 J	3.46 J	2.81 J	3.25 J	1.54 J
Ra228	0.910	0.0692	0.077 UJ	0.099 UJ	0.0556
Th234	NDL	1.76 J	2.04 J	3.73 J	2.50 J
U235	NDL	0.208 J	0.169 J	0.268 J	0.176 J
Bi212	0.980	NDL	0.271	NDL	NDL
Ra224	0.605	NDL	NDL	NDL	NDL
Tl208	0.289	0.0161	0.0143 U	0.0178	0.0115 U
TAL Metals (mg/kg)					
Aluminum	12300	279	102	150	126
Arsenic	5.2	11.9	8.8	15.1	13.6
Barium	222	6.2 JB	4.9 JB	4.9 JB	6.2 JB
Cadmium	0.12 U	58.4	42.2	44.5	49.6
Calcium	25200	116000	127000	101000	113000
Chromium	20.7	3.4	2.4	5.8	5.8
Cobalt	8.7 JB SQL = 12.3 U	0.34 JB	0.26 U	0.30 JB	0.41 JB
Copper	17.8	46.8	35.6	42.1	91.5
Iron	16400	2670	2280	2760	3770
Lead	67.8	1670	2260	929	2130
Magnesium	3580	54900	55400	49500	60000
Manganese	616	260	251	240	299
Mercury	0.06 UJK	1.5 JL	0.95 JL	1.3 JL	1.7 JL
Nickel	18.4 JK	8.0 JB	4.7 JB	9.9	10.0
Potassium	2090	79.6 JB	64.4 JB	64.3 JB	64.3 JB
Selenium	0.96 U	1.1	0.83 U	0.83 U	1.1
Silver	0.36 U	0.58 JB	0.56 JB	0.5 JB	0.6 JB
Sodium	234 JB	150 JB	174 JB	124 JB	155 JB
Thallium	2.6	1.7 U	1.7 U	1.7 U	1.7 U
Vanadium	29.7	13.5	8.6 JB	17.3	15.9
Zinc	245	19100	11700	14600	15900

Key is on the next page.

Table 6-1

**SUSPECTED TAILINGS PILE SOIL SAMPLES
ANALYTICAL RESULTS SUMMARY
GRANDVIEW MINE PRELIMINARY ASSESSMENT/SITE INSPECTION
METALINE FALLS, WASHINGTON**

Note:	Bold type indicates that the sample concentration is above the detection limit. Underlined type indicates that the sample concentration is significant as defined in Section 5.
Key:	
B	= The associated sample result is less than the method detection limit, but greater than or equal to the instrument detection limit.
bgs	= Below ground surface.
Bi212	= Bismuth 212.
Bi214	= Bismuth 214.
CLP	= Contract Laboratory Program.
Cs137	= Cesium 137.
EPA	= United States Environmental Protection Agency.
ID	= Identification.
J	= The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.
K	= Unknown bias.
K40	= Potassium 40.
L	= Low bias.
mg/kg	= Milligrams per kilogram.
NDL	= No detection limit.
Pa234m	= Protactinium 234m.
Pb212	= Lead 212.
Pb214	= Lead 214.
pCi/g	= Picocuries per gram.
Ra223	= Radium 223.
Ra224	= Radium 224.
Ra226	= Radium 226.
Ra228	= Radium 228.
SQL	= Sample quantitation limit.
TAL	= Target Analyte List.
Th234	= Thorium 234.
Tl208	= Thallium 208.
U	= The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.
U235	= Uranium 235.
UJ	= The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

Table 6-2

**WASTE ROCK PILE SUBSURFACE SOIL SAMPLES
ANALYTICAL RESULTS SUMMARY
GRANDVIEW MINE PRELIMINARY ASSESSMENT/SITE INSPECTION
METALINE FALLS, WASHINGTON**

EPA Sample Number	00434238	00434207	00434208	00434209	00434210	00434211
CLP Sample Number	MJ00BM	MJCG14	MJCG15	MJCG16	MJCG17	MJCG18
Location ID Number	BK01SS	WP01SB	WP02SB	WP03SB	WP04SB	WP05SB
Depth (inches bgs)	0-6	24-36	24-36	24-36	24-36	24-36
Description	Background	Source				
Gamma Spectroscopy (pCi/g)						
Bi214	0.799	4.23	3.11	2.34	1.57	1.50
Cs137	1.31	0.0659	0.0189	0.028 UJ	0.021 UJ	0.0733
K40	15.2	2.09 U	1.33 U	3.45 U	1.72 U	1.25 U
Pa234m	NDL	4.80 J	5.12 J	4.78 J	2.38 J	2.51 J
Pb212	0.974	0.118	0.101	0.230	0.116	0.0709
Pb214	0.878	4.90	3.45	2.61	1.78	1.71
Ra223	NDL	0.329	0.218	0.194	0.126	0.184
Ra226	1.41 J	11.1 J	5.48 J	3.01 J	1.17 J	4.19 J
Ra228	0.910	0.0938	0.0749	0.177 J	0.083	0.069 UJ
Rn219	NDL	0.275	0.214	NDL	0.132	NDL
Th227	NDL	0.400	0.278	NDL	NDL	NDL
Th234	NDL	4.11 J	3.01 J	2.78 J	2.07 J	1.67 J
U235	NDL	0.654 J	0.161 J	0.234 J	0.180 J	0.248 J
Bi212	0.980	NDL	NDL	NDL	0.123	NDL
Ra224	0.605	NDL	NDL	NDL	NDL	0.243
Tl208	0.289	0.036 U	0.0254 U	0.0654 U	0.0250 U	0.0158 U
TAL Metals (mg/kg)						
Aluminum	12300	518	236	1500	501	458
Arsenic	5.2	18.4	16.4	44.0	17.2	25.5
Barium	222	20.8 JB	16.5 JB	28.8 JB	12.7 JB	21.0 JB
Cadmium	0.12 U	23.3	13.0	16.0	2.8	3.2
Calcium	25200	151000	151000	150000	185000	194000
Chromium	20.7	1.8 JB	1.1 JB	4.7	2.2	1.3 JB
Cobalt	8.7 JB SQL = 12.3 U	0.50 JB	0.28 JB	2.0 JB	0.56 JB	0.49 JB
Copper	17.8	13.6	6.0 U	14.5	8.7	11.2
Iron	16400	2960	2360	5780	2140	2090
Lead	67.8	3850	4930	810	351	575
Magnesium	3580	47900	62900	53900	48300	24400
Manganese	616	245	210	262	197	116
Mercury	0.06 UJK (0.1 U AC)	1.1	1.0	0.71	0.34	1.5
Nickel	18.4 JK	15.1 JK (11.2 AC)	11.9 JK (8.81 AC)	35.7 JK (26.4 AC)	20.4 JK (15.1 AC)	14.9 JK (11.0 AC)
Potassium	2090	152 JB	137 JB	494 JB	267 JB	126 JB
Selenium	0.96 U	1.1	0.80 U	1.5	0.80 U	0.82 U
Sodium	234 JB	142 JB	155 JB	178 JB	168 JB	126 JB
Thallium	2.6	1.8 JB	2.2	3.2	1.6 U	1.7 U
Vanadium	29.7	11.4	8.9 JB	24.6	20.2	13.9
Zinc	245	7310	3830	7420	729	1040

Key is on the next page.

Table 6-2

**WASTE ROCK PILE SUBSURFACE SOIL SAMPLES
ANALYTICAL RESULTS SUMMARY
GRANDVIEW MINE PA/SI
METALINE FALLS, WASHINGTON**

Note: **Bold type** indicates that the sample concentration is above the detection limit.
 Underlined type indicates that the sample concentration is significant as defined in Section 5.

Key:

AC = Adjusted concentration.
B = The associated sample result is less than the method detection limit, but greater than or equal to the instrument detection limit.
bgs = Below ground surface.
Bi212 = Bismuth 212.
Bi214 = Bismuth 214.
CLP = Contract Laboratory Program.
Cs137 = Cesium 137.
EPA = United States Environmental Protection Agency.
ID = Identification.
J = The analyte was positively identified.
 The associated numerical value is the approximate concentration of the analyte in the sample.
K = Unknown bias.
K40 = Potassium 40.
mg/kg = Milligrams per kilogram.
NDL = No detection limit.
Pa234m = Protactinium 234m.
Pb212 = Lead 212.
Pb214 = Lead 214.
pCi/g = Picocuries per gram.
Ra223 = Radium 223.
Ra224 = Radium 224.
Ra226 = Radium 226.
Ra228 = Radium 228.
Rn219 = Radon 219.
SQL = Sample quantitation limit.
TAL = Target Analyte List.
Th227 = Thorium 227.
Th234 = Thorium 234.
Tl208 = Thallium 208.
U = The material was analyzed for, but was not detected above the level of the associated value.
 The associated value is either the sample quantitation limit or the sample detection limit.
U235 = Uranium 235.
UJ = The material was analyzed for, but was not detected.
 The associated value is an estimate and may be inaccurate or imprecise.

Table 6-3

**ABANDONED CONTAINER AND DRUM AREA SURFACE SOIL SAMPLES
ANALYTICAL RESULTS SUMMARY
GRANDVIEW MINE PRELIMINARY ASSESSMENT/SITE INSPECTION
METALINE FALLS, WASHINGTON**

EPA Sample Number	00434238	00434212	00434213	00434214	00434215	00434216	00434217
CLP Sample Number	MJ00BM	MJCG19	MJCG20	MJCG21	MJCG22	MJCG23	MJCG24
Location ID Number	BK01SS	DA01SS	DA02SS	DA03SS	DA04SS	DA05SS	DA06SS
Depth (inches bgs)	0-6	0-6	0-6	0-6	0-6	0-6	0-6
Description	Background	Source					
Gamma Spectroscopy (pCi/g)							
Bi214	0.799	2.28	0.943	3.45	2.48	6.45	3.70
Cs137	1.31	1.01	1.03	0.317	0.907	0.170	0.599
K40	15.2	12.7	13.3	1.61	4.05	0.948	9.23
Pa234m	NDL	2.18 J	NDL	10.7 J	4.39 J	6.00 J	8.25 J
Pb212	0.974	1.27	1.11	0.160	0.332	0.0776	0.595
Pb214	0.878	2.54	1.05	3.86	2.77	7.04	4.04
Ra223	NDL	0.221	NDL	0.519	NDL	0.554	0.366
Ra226	1.41 J	7.11 J	1.45 J	6.11 J	2.56 J	9.06 J	9.98 J
Ra228	0.910	1.12	1.03	0.18 UJ	0.278	0.24 UJ	0.606
Rn219	NDL	NDL	NDL	0.401	NDL	0.652	NDL
Th227	NDL	0.171	NDL	0.466	NDL	0.561	NDL
Th234	NDL	3.24 J	NDL	4.96 J	3.46 J	7.36 J	3.30 J
U235	NDL	0.425 J	NDL	0.348 J	0.289 J	0.431 J	0.594 J
Bi212	0.980	1.01	1.27	0.335	NDL	NDL	0.907
Ra224	0.605	0.946	0.842	NDL	NDL	NDL	NDL
Tl208	0.289	0.349	0.352	0.0607	0.0903	0.0249	0.187
TAL Metals (mg/kg)							
Aluminum	12300	11400	11800	1570	5570	307	6470
Arsenic	5.2	6.9	6.2	13.3	15.3	7.9	64.9
Barium	222	99.8	107	26.4 JB	189	5.2 JB	57.4
Cadmium	0.12 U	5.9	9.3	11.5	67.5	8.4	99.5
Calcium	25200	31400	16600	82200	76900	90300	30700
Chromium	20.7	19.4	17.5	48.8	10.1	5.5	16.3
Cobalt	8.7 JB SQL = 12.3 U	10.2 JB	9.8 JB	3.3 JB	5.4 JB	0.33 JB	9.4 JB
Copper	17.8	74.8	65.8	236	212	35.1	216
Iron	16400	16900	17200	26300	10900	2790	31900
Lead	67.8	705	1490	5110	14600	264	3640
Magnesium	3580	15700	4410	42000	34000	48900	16900
Manganese	616	519	450	342	338	219	300
Mercury	0.06 UJK (0.1 U AC)	0.26 JK (0.14 AC)	0.25 JK (0.14 AC)	0.97	1.9	0.35 JK (0.19 AC)	6.0
Nickel	18.4 JK (24.8 AC)	22.2 JK (16.4 AC)	19.7 JK (14.6 AC)	25.1 JK (18.6 AC)	20.2 JK (15.0 AC)	5.7 JB	37.2 JK (27.6 AC)
Potassium	2090	631 JB	909 JB	265 JB	813 JB	150 JB	902 JB
Selenium	0.96 U	1.4 JB	1.2 U	1.1 U	3.0	0.94 U	2.1
Sodium	234 JB	143 JB	158 JB	281 JB	723 JB	136 JB	198 JB
Thallium	2.6	3.4	3.1	2.3 U	2.8	1.9 U	4.1
Vanadium	29.7	18.5	18.3	18.5	22.4	21.2	19.5
Zinc	245	1860	3400	2900	21800	1790	36200

Key is at the end of the table.

Table 6-3

**ABANDONED CONTAINER AND DRUM AREA SURFACE SOIL SAMPLES
ANALYTICAL RESULTS SUMMARY
GRANDVIEW MINE PRELIMINARY ASSESSMENT/SITE INSPECTION
METALINE FALLS, WASHINGTON**

EPA Sample Number	00434238	00434212	00434213	00434214	00434215	00434216	00434217
CLP Sample Number	MJ00BM	MJCG19	MJCG20	MJCG21	MJCG22	MJCG23	MJCG24
Location ID Number	BK01SS	DA01SS	DA02SS	DA03SS	DA04SS	DA05SS	DA06SS
Depth (inches bgs)	0-6	0-6	0-6	0-6	0-6	0-6	0-6
Description	Background	Source					
SVOCs (µg/kg)							
2,4-Dimethylphenol	NA	59.3 U	89.5	166	778	161	278
4-Methylphenol	NA	80.8 JQ	101 JQ	158	277	124	138
9H-Fluorene	NA	12.8 JQ	72.3 U	53.2 U	29.8 U	36.7 U	38.1 U
Acenaphthene	NA	59.3 U	72.3 U	53.2 U	29.8 U	36.7 U	30.3 JQ
Anthracene	NA	5.8 JQ	72.3 U	53.2 U	7.5 JQ	36.7 U	38.1 U
Benzaldehyde	NA	126 JL	135 JL	37.4 JL	52.9 JQ	5.3 JQ	26.2 JQ
Benzo[b]Fluoranthene	NA	119 U	145 U	106 U	76.7	73.4 U	76.1 U
Benzoic Acid	NA	614	794	539	256 JQ	367 U	381 UJK
Chrysene	NA	59.3 U	72.3 U	53.2 U	70.6	36.7 U	38.1 U
Dibenzofuran	NA	59.3 U	72.3 U	10.9 JQ	18.6 JQ	36.7 U	41.8
Ethanone, 1-phenyl-	NA	28.2 JQ	34.5 JQ	10.1 JQ	16.3 JQ	36.7 U	10.9 JQ
Fluoranthene	NA	22.4 JQ	72.3 U	21.3 JQ	24.3 JQ	36.7 U	11.2 JQ
Indeno(1,2,3-cd)pyrene	NA	296 U	361 U	186 JQ	149 U	184 U	190 U
Naphthalene	NA	59.3 U	72.3 U	53.2 U	31	36.7 U	38.1 U
Naphthalene, 2-methyl-	NA	14.8 JQ	21 JQ	22.8 JQ	51.1	36.7 U	139
Phenanthrene	NA	59.3 U	72.3 U	53.2 U	33.3	36.7 U	19.2 JQ
Phenol	NA	101	130	70.1	41.1	43.3	46.3
Phenol, 2-methyl-	NA	59.3 U	66.1 JQ	51.1 JQ	196	25.6 JQ	56.5
Pyrene	NA	59.3 U	38.6 JQ	19.2 JQ	43.8	36.7 U	11.1 JQ

Key is on the next page.

Table 6-3

**ABANDONED CONTAINER AND DRUM AREA SURFACE SOIL SAMPLES
ANALYTICAL RESULTS SUMMARY
GRANDVIEW MINE PRELIMINARY ASSESSMENT/SITE INSPECTION
METALINE FALLS, WASHINGTON**

Note: Bold type indicates that the sample concentration is above the detection limit.
Underlined type indicates that the sample concentration is significant as defined in Section 5.

Key:

AC = Adjusted concentration.
B = The associated sample result is less than the method detection limit, but greater than or equal to the instrument detection limit.
bgs = Below ground surface.
Bi212 = Bismuth 212.
Bi214 = Bismuth 214.
CLP = Contract Laboratory Program.
Cs137 = Cesium 137.
EPA = United States Environmental Protection Agency.
ID = Identification.
J = The analyte was positively identified.
The associated numerical value is the approximate concentration of the analyte in the sample.
K = Unknown bias.
K40 = Potassium 40.
L = Low bias.
mg/kg = Milligrams per kilogram.
μg/kg = Micrograms per kilogram.
NA = Not analyzed.
NDL = No detection limit.
Pa234m = Protactinium 234m.
Pb212 = Lead 212.
Pb214 = Lead 214.
pCi/g = Picocuries per gram.
Q = The associated sample result is less than the sample quantitation limit.
Ra223 = Radium 223.
Ra224 = Radium 224.
Ra226 = Radium 226.
Ra228 = Radium 228.
Rn219 = Radon 219.
SQL = Sample quantitation limit.
SVOCs = Semivolatile organic compounds.
TAL = Target Analyte List.
Th227 = Thorium 227.
Th234 = Thorium 234.
Tl208 = Thallium 208.
U = The material was analyzed for, but was not detected above the level of the associated value.
The associated value is either the sample quantitation limit or the sample detection limit.
U235 = Uranium 235.
UJ = The material was analyzed for, but was not detected.
The associated value is an estimate and may be inaccurate or imprecise.

**FORMER WASTEWATER DRAINAGE DITCH SURFACE SOIL SAMPLES
ANALYTICAL RESULTS SUMMARY
GRANDVIEW MINE PRELIMINARY ASSESMENT/SITE INSPECTION
METALINE FALLS, WASHINGTON**

EPA Sample Number	00434238	00434218	00434219	00434220	00434221	00434222	00434223	00434228	00434229	00434230
CLP Sample Number	MJ00BM	MJCG25	MJCG26	MJCG27	MJCG28	MJCG29	MJCG30	MJ00BE	MJ00BG	MJ00BH
Location ID Number	BK01SS	FD01SS	FD02SS	FD03SS	FD04SS	FD05SS	FD06SS	FD07SS	FD08SS	FD09SS
Depth (inches bgs)	0-6	0-6	0-6	0-6	0-6	0-6	0-6	0-6	0-6	0-6
Description	Background	Target								
Gamma Spectroscopy (pCi/g)										
Bi214	0.799	3.87	4.11	4.34	5.24	2.89	2.09	2.29	2.63	1.48
Cs137	1.31	0.0671	0.07	0.348	0.216	0.421	0.228	0.129	0.0530	0.295
K40	15.2	1.28	1.34	1.18	1.81	2.89	1.24	0.989	1.09	12.7
Pa234m	NDL	8.37 J	8.79 J	7.14 J	8.89 J	4.87 J	7.39 J	3.96 J	7.08 J	2.28 J
Pb212	0.974	0.115	0.065	0.0850	0.126	0.141	0.0793	0.0762	0.0703	0.918
Pb214	0.878	4.21	4.39	4.77	5.68	3.11	2.33	2.54	2.86	1.67
Ra223	NDL	0.415	0.324	0.496	0.531	NDL	0.267	0.218	0.198	0.161
Ra226	1.41 J	7.52 J	3.58 J	6.82 J	10.3 J	8.31 J	3.71 J	6.84 J	4.58 J	4.12 J
Ra228	0.910	0.11 UJ	0.2 UJ	0.19 UJ	0.14 UJ	0.163	0.12 UJ	0.15 UJ	0.092 UJ	0.864
Rn219	NDL	0.415	NDL	0.385	0.582	0.247	NDL	NDL	NDL	NDL
Th227	NDL	NDL	NDL	NDL	0.503	0.333	NDL	NDL	0.272	NDL
Th234	NDL	5.29 J	5.55 J	6.38 J	5.27 J	3.69 J	3.57 J	3.58 J	2.98 J	0.689 J
U235	NDL	0.347 J	0.523	0.355 J	0.412 J	0.500 J	0.187 J	0.404 J	0.170 J	0.249 J
Bi212	0.980	NDL	NDL	NDL	NDL	NDL	NDL	NDL	NDL	0.986
Ra224	0.605	NDL	NDL	NDL	NDL	NDL	NDL	NDL	NDL	0.688
Tl208	0.289	0.0364	0.0223	NDL	0.0332	0.0215	0.0163	NDL	NDL	0.275
TAL Metals (mg/kg)										
Aluminum	12300	537	425	546	946	3010	1110	760	264	11300
Antimony	0.89 U	10.1 JB	8.6 JB	0.77 U	1.3 JB	0.91 U	0.85 U	0.77 U	1.2 U	1.1 U
Arsenic	5.2	31.2	22.1	9.3	13.7	16.8	15.7	12.6	12.1	13.5
Barium	222	63.6	10.8 JB	20.8 JB	20.4 JB	100	51.4	30.5 JB	69.7	109
Cadmium	0.12 U	26.4	27.8	15.6	23.2	41.8	35	30	28.1	19.9
Calcium	25200	81400	99300	99600	111000	134000	126000	104000	106000	52800
Chromium	20.7	133	33.3	4.7	10.0	9.4	8.3	10.6	7.5	13.9
Cobalt	8.7 JB SQL = 12.3 U	4.8 JB	1.7 JB	0.46 JB	1 JB	1.7 JB	0.67 JB	1.2 JB	0.44 JB	6.8 JB
Copper	17.8	3730	658	46.8	132	233	170	858	38.0	67.0
Iron	16400	30500	13900	3170	5710	5470	4500	5100	3240	19500
Lead	67.8	43000	23200	1250	2840	5560	3870	921	9520	1970
Magnesium	3580	43200	52300	50500	53300	51100	56900	47800	55600	19000
Manganese	616	468	395	217	287	283	278	277	265	784
Mercury	0.06 UJK	3.9	0.99	0.54	1.0	2.4	1.2 JL	0.34 JL	0.92 JL	0.83 JL
Nickel	18.4 JK	40.7 JK (30.1481 AC)	22.3 JK (16.5185 AC)	8.0 JB	10.8 JK (8 AC)	13.9 JK (10.2963 AC)	12.1	12.4	9.0	16.6
Potassium	2090	118 JB	116 JB	212 JB	266 JB	1890	308 JB	112 JB	80.7 JB	1160 JB
Selenium	0.96 U	6.4	3.5	0.83 U	0.93 U	1.3	1.1 JB	0.84 U	1.3	1.7
Silver	0.36 U	7.4	3.3 U	0.63 U	0.83 U	1.4 U	1.0 JB	0.49 JB	1.3 JB	0.84 JB
Sodium	234 JB	149 JB	139 JB	142 JB	126 JB	334 JB	150 JB	145 JB	142 JB	179 JB
Thallium	2.6	3.0	2.3	2.5	1.9 U	2.8	1.9 U	1.7 U	1.6 U	2.3 JB
Vanadium	29.7	17.5	19.0	18.7	22.1	21.8	21.9	17.5	18.9	24.3
Zinc	245	7890	8120	4570	6160	12100	11600	11100	10300	6390

Key is on the next page.

10:START-201010015/S627

Table 7-8

**FORMER WASTEWATER DRAINAGE DITCH SURFACE SOIL SAMPLES
ANALYTICAL RESULTS SUMMARY
GRANDVIEW MINE PRELIMINARY ASSESSEMENT/SITE INSPECTION
METALINE FALLS, WASHINGTON**

Note: Bold type indicates that the sample concentration is above the detection limit.
Underlined type indicates that the sample concentration is elevated as defined in Section 5.

Key:

AC = Adjusted concentration.
B = The associated sample result is less than the method detection limit,
but greater than or equal to the instrument detection limit.
bgs = Below ground surface.
Bi212 = Bismuth 212.
Bi214 = Bismuth 214.
CLP = Contract Laboratory Program.
Cs137 = Cesium 137.
EPA = United States Environmental Protection Agency.
ID = Identification.
J = The analyte was positively identified.
The associated numerical value is the approximate concentration of the analyte in the sample.
K = Unknown bias.
K40 = Potassium 40.
L = Low bias.
mg/kg = Milligrams per kilogram.
NDL = No detection limit.
Pa234m = Protactinium 234m.
Pb212 = Lead 212.
Pb214 = Lead 214.
pCi/g = Picocuries per gram.
Ra223 = Radium 223.
Ra224 = Radium 224.
Ra226 = Radium 226.
Ra228 = Radium 228.
Rn219 = Radon 219.
SQL = Sample quantitation limit.
TAL = Target Analyte List.
Th227 = Thorium 227.
Th234 = Thorium 234.
Tl208 = Thallium 208.
U = The material was analyzed for, but was not detected above the level of the associated value.
The associated value is either the sample quantitation limit or the sample detection limit.
U235 = Uranium 235.
UJ = The material was analyzed for, but was not detected.
The associated value is an estimate and may be inaccurate or imprecise.

7-20

EXCERPTED TABLES AND FIGURES FROM URS, 2007

Table 3-1
Field Exploration Locations and Tailings Thickness Data

Exploration	Date and Time	Position ¹	Tailings Thickness, feet	Base of Tailings Elevation, feet ²
TEST PT 01	26-SEP-06 9:06:14AM	N48 52.168 W117 21.908	3	-3
TEST PT 02	26-SEP-06 9:41:37AM	N48 52.176 W117 21.888	4.5	-4.5
TEST PT 03	26-SEP-06 10:19:45AM	N48 52.180 W117 21.887	7.7	-7.7
TEST PT 04	26-SEP-06 11:19:07AM	N48 52.185 W117 21.875	7.7	-7.7
TEST PT 05	26-SEP-06 12:27:02PM	N48 52.190 W117 21.867	11	-11
TEST PT 06	26-SEP-06 1:33:18PM	N48 52.192 W117 21.833	7.2	2.8 ²
TEST PT 07	26-SEP-06 2:40:53PM	N48 52.170 W117 21.831	4	-4
TEST PT 08	26-SEP-06 3:21:54PM	N48 52.180 W117 21.853	8	-8
TEST PT 09	26-SEP-06 4:06:34PM	N48 52.169 W117 21.867	9.5	-9.5
TEST PT 10	26-SEP-06 4:55:26PM	N48 52.172 W117 21.878	9.5	-9.5
TEST PT 11	26-SEP-06 5:24:41PM	N48 52.172 W117 21.864	9	-9
TEST PT 12	26-SEP-06 5:55:52PM	N48 52.164 W117 21.834	5	-5
TEST PT 13	26-SEP-06 6:22:17PM	N48 52.164 W117 21.858	8.5	-8.5
TEST PT 14	26-SEP-06 6:54:19PM	N48 52.165 W117 21.872	10.5	-10.5
TEST PT 15	26-SEP-06 7:27:10PM	N48 52.168 W117 21.885	7	-7
HAND AG 01	25-SEP-06 12:27:07PM	N48 52.146 W117 21.863	0	0
HAND AG 02	25-SEP-06 12:45:19PM	N48 52.147 W117 21.860	0.75	-0.75
HAND AG 03	25-SEP-06 2:05:06PM	N48 52.154 W117 21.869	0.75	-0.75
HAND AG 04	25-SEP-06 3:01:45PM	N48 52.162 W117 21.884	>7.0 (equipment maximum)	Not used
HAND AG 05	25-SEP-06 3:41:00PM	N48 52.160 W117 21.882	6	-6
HAND AG 06	25-SEP-06 5:03:19PM	N48 52.164 W117 21.860	4	-4
HAND AG 07	25-SEP-06 5:21:13PM	N48 52.155 W117 21.895	3	-3
HAND AG 08	25-SEP-06 5:46:31PM	N48 52.151 W117 21.888	1.2	-1.2
HAND AG 09	25-SEP-06 6:07:45PM	N48 52.146 W117 21.896	1.4	-1.4
HAND AG 10	27-SEP-06 8:28:26AM	N48 52.146 W117 21.900	0.1	-0.1
HAND AG 11	27-SEP-06 8:48:15AM	N48 52.149 W117 21.903	1	-1
HAND AG 12	27-SEP-06 9:02:03AM	N48 52.151 W117 21.902	0.1	-0.1
HAND AG 13	27-SEP-06 9:22:37AM	N48 52.161 W117 21.912	2	-2
HAND AG 14	27-SEP-06 9:38:08AM	N48 52.163 W117 21.911	0.4	-0.4
HAND AG 15	27-SEP-06 10:25:59AM	N48 52.163 W117 21.924	0.5	-0.5
HAND AG 16	27-SEP-06 11:39:20AM	N48 52.166 W117 21.928	0.8	-0.8
HAND AG 17	27-SEP-06 11:54:22AM	N48 52.170 W117 21.939	2	-2
HAND AG 18	27-SEP-06 12:03:45PM	N48 52.164 W117 21.940	1	-1
HAND AG 20	27-SEP-06 12:21:53PM	N48 52.164 W117 21.955	1	-1
HAND AG 21	27-SEP-06 12:29:06PM	N48 52.161 W117 21.958	0.5	-0.5

Table 3-1 (Continued)
Field Exploration Locations and Tailings Thickness Data

Exploration	Date and Time	Position ¹	Tailings Thickness, feet	Base of Tailings Elevation, feet ²
HAND AG 22	27-SEP-06 12:41:48PM	N48 52.158 W117 21.959	0	0
HAND AG 23	27-SEP-06 1:02:25PM	N48 52.164 W117 21.949	3	-3
HAND AG 24	27-SEP-06 1:18:33PM	N48 52.169 W117 21.950	0	0
HAND AG 25	27-SEP-06 1:26:02PM	N48 52.167 W117 21.951	0.6	-0.6
HAND AG 26	27-SEP-06 2:24:08PM	N48 52.187 W117 21.886	0.7	-0.7
HAND AG 27	27-SEP-06 2:43:32PM	N48 52.193 W117 21.858	>1.5 (stopped by rock)	Not used
HAND AG 28	27-SEP-06 3:01:29PM	N48 52.178 W117 21.827	>1.7 (stopped by rock)	Not used
HAND AG 29	27-SEP-06 3:14:32PM	N48 52.160 W117 21.808	>7.0 (equipment maximum)	Not used

Note:

¹ Datum is the North American Datum of 1983 (NAD83)

² Tailings elevations are referenced to arbitrary elevations of 0 feet established for the western and central portions of the Site and +10 feet established for the eastern portion of the Site (test pit TP-06).

Table 3-2
Estimated Area and Volume of Tailings

Feature	Estimated Area, acres	Estimated Volume, cubic yards
Main Tailings Area	3.1	20,700
TCAI- Property	2.5	19,800
Non-TCAI Property	0.6	900
Drainage East of Main Tailings Area (TCAI Property)	0.3	500
Channel North of Main Tailings Area	0.2	140
Totals for TCAI Property	3.0	20,440

**Table 3-3
Total Metals Results**

Sample ID	Sample Depth, ft	Material Type	Total Metals, mg/kg				
			Arsenic	Cadmium	Lead	Mercury	Zinc
TP-01-T	2-2.5	Tailings	43	78.9	2650	0.737	20,700
TP-02-T	0.5-4.5 (composite)	Tailings	40	33.1	2200	0.642	8,390
TP-03-T	4-6 (composite)	Tailings	27	110	3320	1.26	28,900
TP-04-T	0-7 (composite)	Tailings	33	68.5	3380	0.777	18,800
TP-05-T	1-10 (composite)	Tailings	32	69.5	2700	0.992	18,800
TP-06-T	6-6.5	Tailings	26	93.1	2150	0.880	28,500
TP-07-T	1-1.5	Tailings	16	68.3	3320	1.65	16,700
TP-08-T	0.5-1	Tailings	20	46.7	1030	1.05	12,500
TP-09-T	0-9 (composite)	Tailings	23	56.6	2220	1.51	14,500
TP-10-T	2-9 (composite)	Tailings	<13*	50.5	1430	1.10	14,000
TP-11-T	1-8 (composite)	Tailings	13	51.6	1560	1.02	14,300
TP-12-T	1.5-2	Tailings	15	59.1	1280	1.57	17,700
TP-13-T	1-3.5 (composite)	Tailings	15	39.3	856	0.282	12,100
TP-14-T	2-8 (composite)	Tailings	14	37.8	1320	0.940	10,300
TP-15-T	2-2.5	Tailings	24	24.7	547	0.642	7,550
UD-5-T	0.3-0.4	Tailings	13.1	22.3	813	0.628	5,740
TP-01-S	4.5-5	Native soil	5.8	0.96	31.2	0.068	1,870
TP-02-S	5.5-6	Native soil	7.0	1.02	51.2	0.045	2,610
TP-03-S	9-9.5	Native soil	6.9	<0.20	16.8	<0.033	353
TP-04-S	9-9.5	Native soil	3.4	2.45	71.9	<0.033	1,210
TP-05-S	14-14.5	Native soil	2.7	2.35	48.5	0.132	968
TP-06-S	9-9.5	Native soil	3.2	0.94	17.2	0.057	594
TP-07-S1	4.5-5	Native soil	7.7	0.44	17.4	<0.033	933
TP-07-S2	8.5-9	Native soil	6.4	<0.20	12.3	<0.033	59.1
TP-08-S	9-9.5	Native soil	2.9	1.03	9.91	<0.033	982
TP-09-S01	9.5-10	Native soil	4.1	0.48	31.8	<0.033	913
TP-09-S02	15-15.5	Native soil	6.3	<0.20	16.3	<0.033	155
TP-10-S	11-11.5	Native soil	2.9	0.94	9.99	<0.033	1,440
TP-11-S	10.5-11	Native soil	3.6	0.45	12.4	<0.033	390

Table 3-3 (Continued)
Total Metals Results

Sample ID	Sample Depth, ft	Material Type	Total Metals, mg/kg				
			Arsenic	Cadmium	Lead	Mercury	Zinc
TP-12-S	6-6.5	Native soil	3.1	1.07	71.2	0.058	1,310
TP-13-S	10.5-11	Native soil	5.0	1.64	46.7	<0.033	2,180
TP-14-S	11.5-12	Native soil	<2.5	<0.20	15.7	<0.033	695
TP-15-S	8-8.5	Native soil	5.4	<0.20	15.4	<0.033	1,690
UD-5-S	1.2	Native soil	7.2	2.97	144	0.060	941
Background level, statewide, 90 th percentile (WDOE Publication #94-115)			7	1	17	0.07	86
Background soil sample BK02SS (EPA 2002)			3.5	0.86 J (0.86 SQL)	47.2 JK (68 AC)	<0.06	201
MTCA Method A cleanup level for unrestricted land use			20	2	250	2	24,000 (1)

Notes:

(1) There is no MTCA Method A soil cleanup level for zinc. The concentration listed is the MTCA Method B direct contact soil cleanup level for unrestricted land use.

*Elevated detection limit due to matrix interference

Boldface type denotes concentration equals or exceeds MTCA Method A cleanup level for unrestricted land use (for zinc, MTCA Method B cleanup level for unrestricted land use)

AC - Adjusted concentration

B - The reported concentration is between the instrument detection limit and the contract-required detection limit.

J - The analyte was positively identified. The associated numerical value is an estimate.

K - Unknown bias

SQL - Sample quantitation limit

Table 3-4
Summary of TCLP Results

Sample	Depth, feet	Material Type	Concentration in TCLP Extract, mg/L							
			Silver	Arsenic	Barium	Cadmium	Chromium	Mercury	Lead	Selenium
TP-02-T	2-2.5	Tailings	<0.05	<0.05	<1.0	0.328	<0.05	<0.0002	5.23	<0.05
TP-06-T	6-6.5	Tailings	<0.05	<0.05	<1.0	0.623	<0.05	0.00025	7.99	<0.05
TP-10-T	2-9 (composite)	Tailings	<0.05	<0.05	<1.0	0.42	<0.05	<0.0002	6.59	<0.05
TP-12-T	1.5-2	Tailings	<0.05	<0.05	<1.0	0.778	<0.05	<0.0002	8.72	<0.05
TP-14-T	2-8 (composite)	Tailings	<0.05	<0.05	<1.0	0.413	<0.05	<0.0002	8.32	<0.05
TP-02-S	5.5-6	Native soil	<0.05	<0.05	2.24	0.017	<0.05	<0.0002	<0.05	0.06
TP-06-S	9-9.5	Native soil	<0.05	<0.05	<1.0	0.0197	<0.05	<0.0002	<0.05	<0.05
TP-10-S	11-11.5	Native soil	<0.05	<0.05	1.07	<0.01	<0.05	<0.0002	<0.05	<0.05
TP-12-S	6-6.5	Native soil	<0.05	<0.05	1.65	0.0432	<0.05	<0.0002	0.351	<0.05
TP-14-S	11.5-12	Native soil	<0.05	<0.05	1.28	0.0113	<0.05	<0.0002	0.097	<0.05
Regulatory Level			5.0	5.0	100	1.0	5.0	0.2	5.0	1.0

Note:

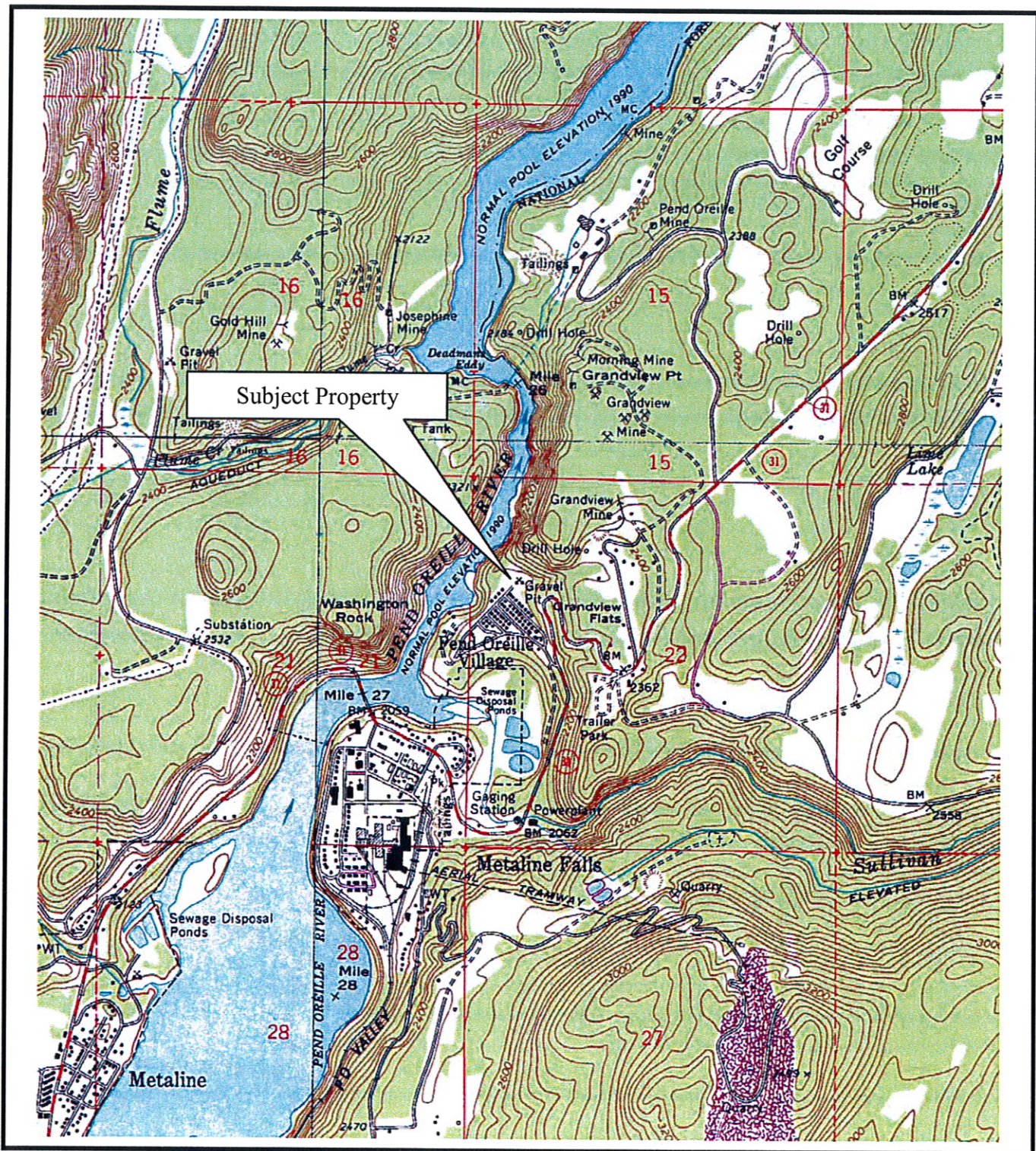
Boldface type denotes concentration equals or exceeds regulatory level (40 CFR 261.24; WAC 173-303-90)

Table 3-5
Summary of Geotechnical Testing Results

Test		Units	Test Method	Sample Number				
				TP-02-T	TP-08-T	TP-02-S	TP-08-S	TP-12-S
Moisture Content		%	ASTM C-566	2.9	2.9	10.2	52.7	38.8
Sieve Analysis			ASTM C-136/ ASTM C-117					
Sieve size	¾”	% passing		-	-	100	-	100
	½”			-	-	98	-	94
	3/8”			-	-	97	100	92
	#4			100	-	95	100-	90
	#10			100-	100	90	99	87
	#16			100-	100-	87	97	84
	#30			98	100-	82	96	80
	#40			94	96	79	91	77
	#100			64	41	68	80	66
	#200			44	19	56	75	55
Specific Gravity			ASTM C-128					
Bulk		unitless		2.665	2.728	-	-	-
Bulk (saturated surface dry)				2.676	2.742	-	-	-
Apparent				2.695	2.766	-	-	-
Absorption			%	0.41	0.50	-	-	-
Dry Density								
10 blows		pcf		77	83	60	34	50
30 blows		pcf		83	88	65	39	59
60 blows		pcf		88	94	69	41	63

Note:
pcf - pounds per cubic foot

FIGURES



USGS 7.5 Minute Topographic Map, Metaline Falls, WA, dated 1956. Scale 1:24,000.



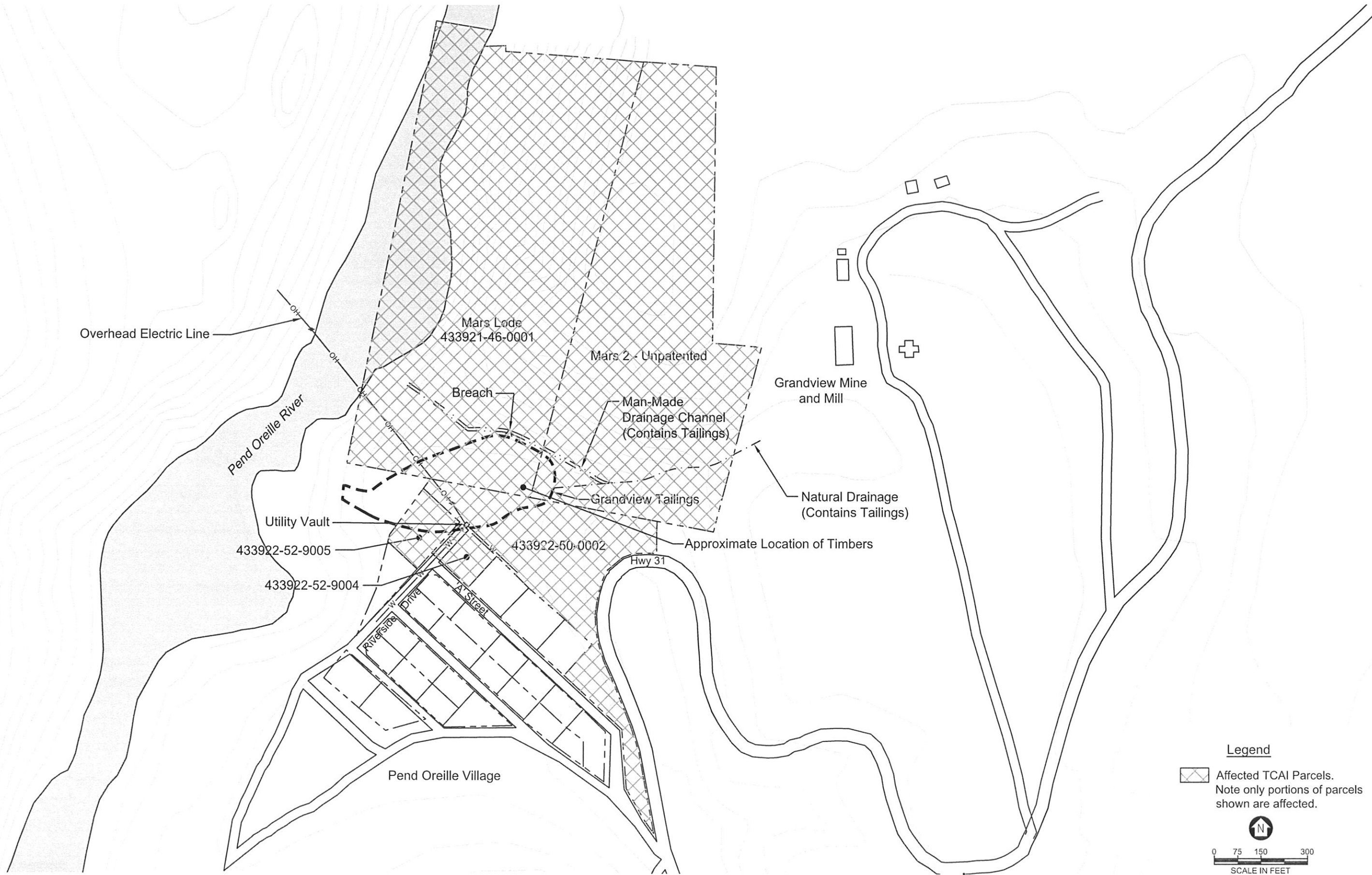
URS

SITE VICINITY MAP

January 2007
36298195.00001

Teck Cominco American Incorporated
Grandview Tailings Area
Metaline Falls, Washington

FIGURE 1-1



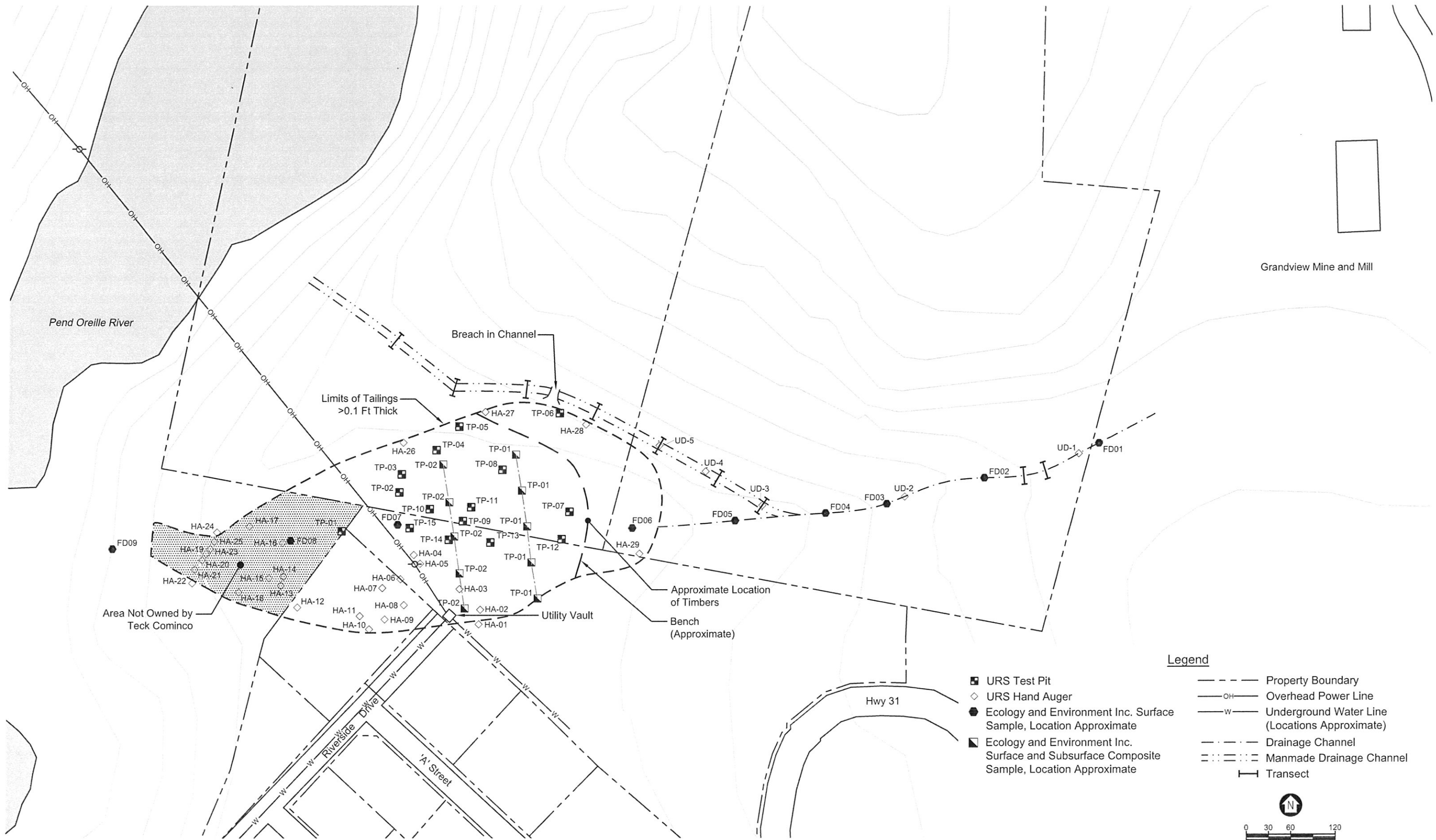
Legend

Affected TCAI Parcels. Note only portions of parcels shown are affected.

N

0 75 150 300
SCALE IN FEET

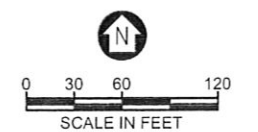
DRAFT



DRAFT

Legend

- URS Test Pit
- ◇ URS Hand Auger
- Ecology and Environment Inc. Surface Sample, Location Approximate
- Ecology and Environment Inc. Surface and Subsurface Composite Sample, Location Approximate
- - - Property Boundary
- OH- Overhead Power Line
- W- Underground Water Line (Locations Approximate)
- - - Drainage Channel
- - - Manmade Drainage Channel
- ┌─┐ Transect

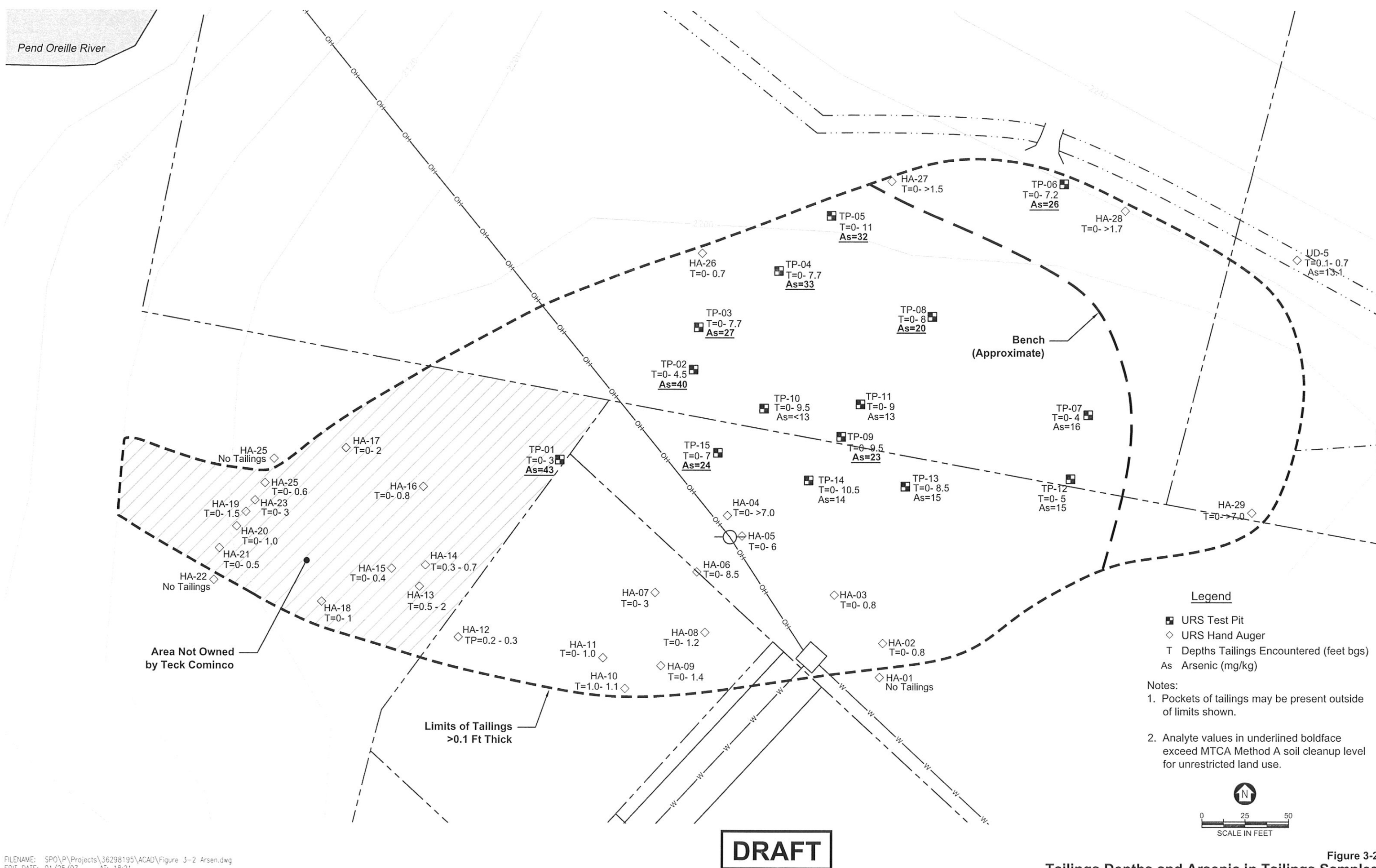


FILENAME: SPO\Projects\36298195\ACAD\Figure 3-1.dwg
EDIT DATE: 01/25/07 AT: 18:04

URS

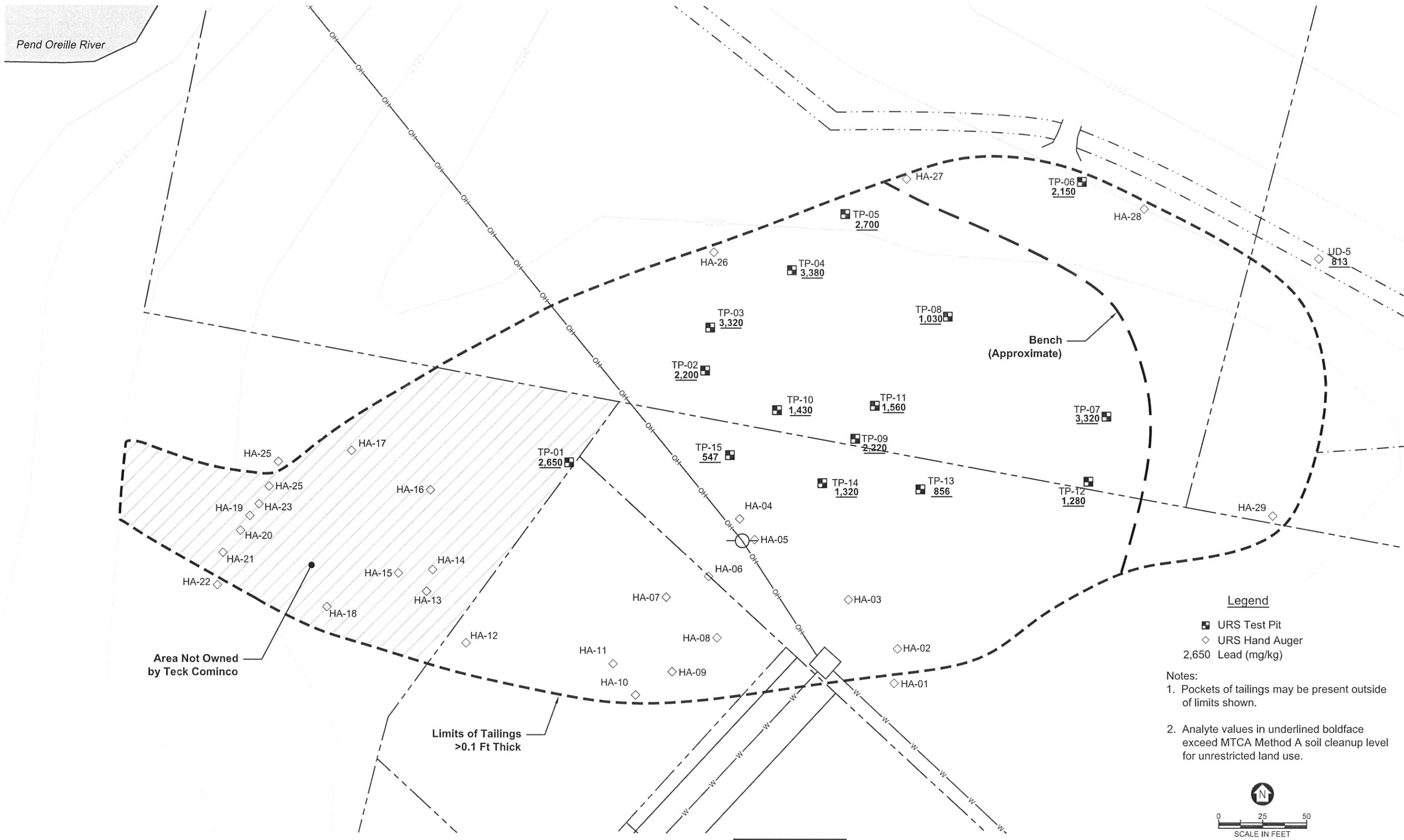
**Figure 3-1
Sample Location Map**

Teck Cominco American Incorporated
Pend Oreille Village, WA
Grandview Mine Tailings



FILENAME: SPO\Projects\36298195\ACAD\Figure 3-2 Arsen.dwg
EDIT DATE: 01/25/07 AT: 18:21





DRAFT

Pend Oreille River

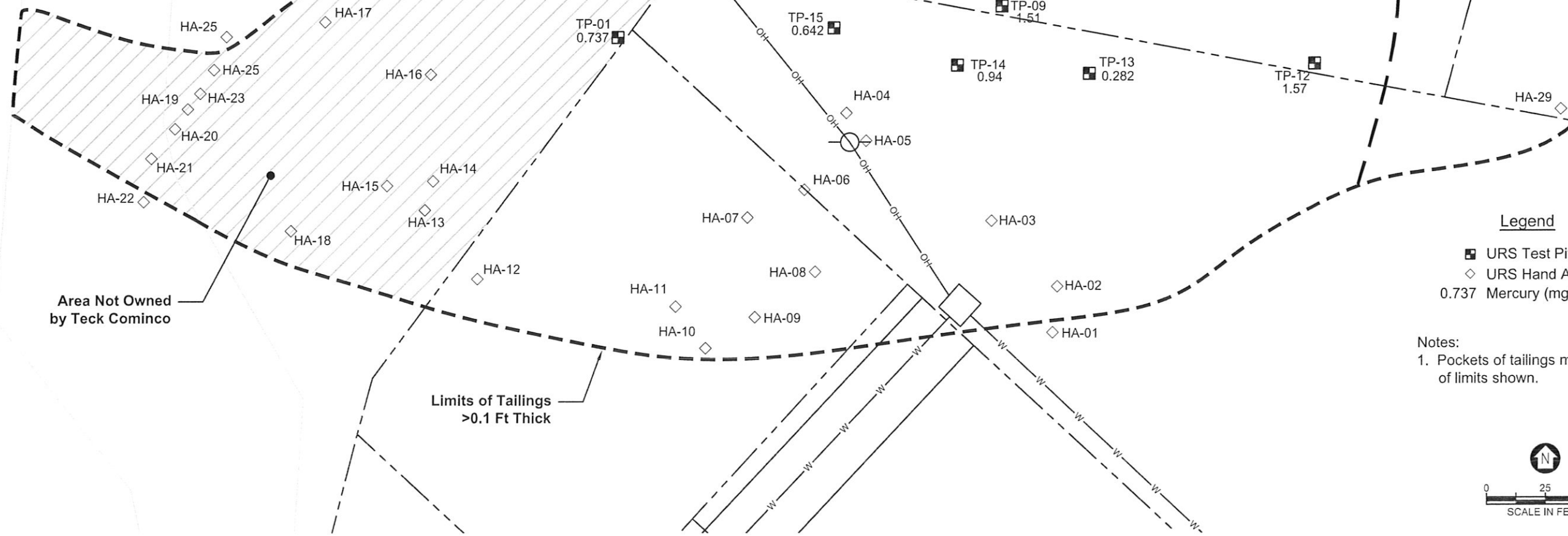
2040

2120

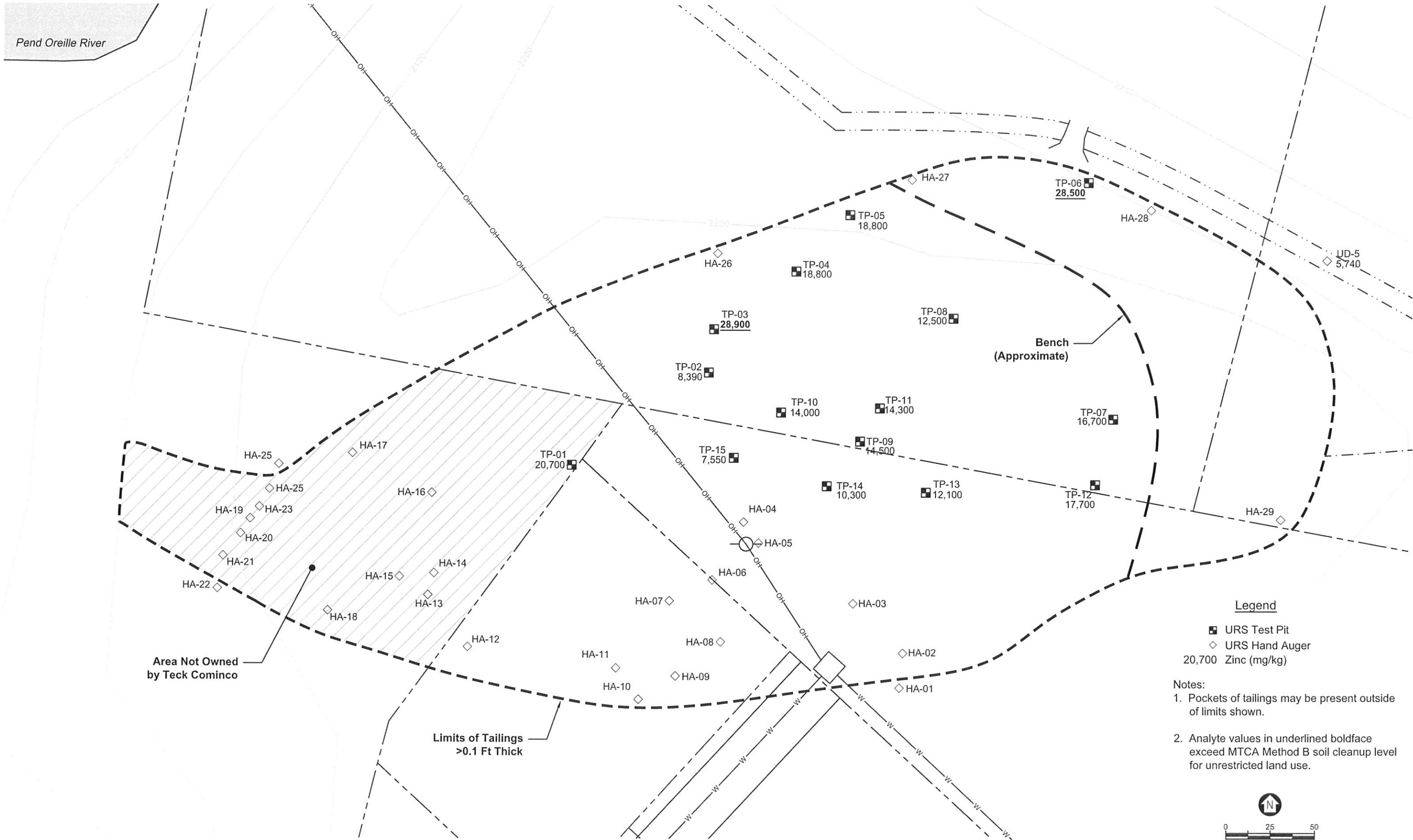
2200

2260

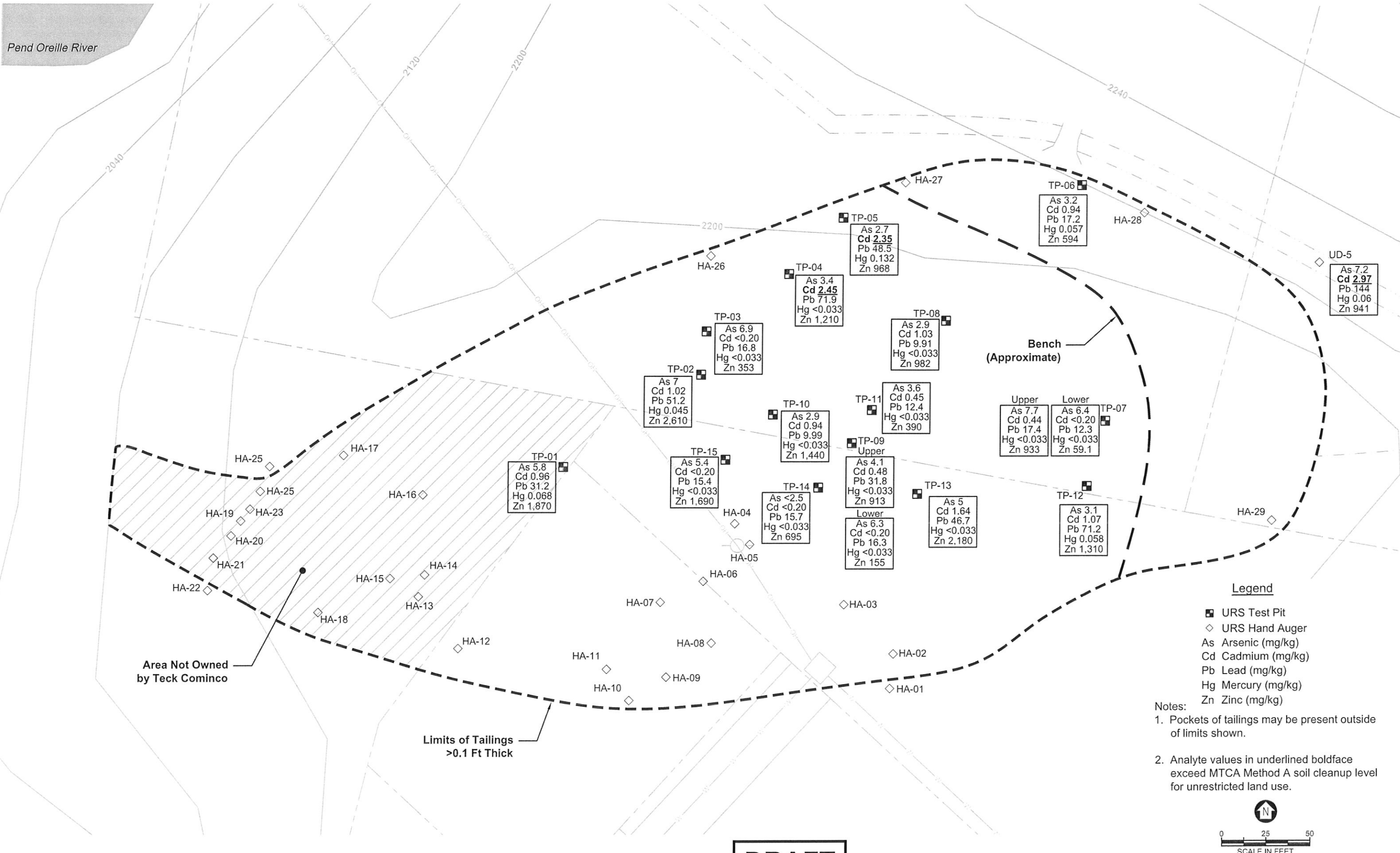
2240



DRAFT



Pend Oreille River



URS

DRAFT

Arsenic, Cadmium, Lead, Mercury, and Zinc in Native Soil Samples

Teck Cominco American Incorporated
Pend Oreille Village, WA
Grandview Mine Tailings

EXCERPTED TABLES AND FIGURES FROM ENTACT, 2008

Table 1
XRF and Corresponding Laboratory Results for Surfacing Material
Grandview Mine/Mill Site Reconnaissance
September 2008
Metaline Falls, WA

													Laboratory Verification Sample Results (mg/kg)				
													Researched No Data	20	2	2	250
													Researched No Data	200	10	2	1,000
Sample ID	Sample Date	Zinc	Zn +/-	Arsenic	As +/-	Cadmium	Cd +/-	Mercury	Hg +/-	Lead	Pb +/-		Zn	As	Cd	Hg	Pb
Historic Homesites																	
LL-02	9/16/08	16,578.21	304.46	420.48	52.83	<68.46	na	< 46.10	na	5,771.67	113.77						
LL-03	9/16/08	9,878.45	194.81	<186.76	na	<67.35	na	< 45.13	na	8,378.72	161.47	5,980	8.69	16	0.26	3,870	
LL-21	9/16/08	15,790.10	292.59	241.87	54.47	73.79	22.74	< 46.65	na	6,352.25	124.29	13,500	11	43	1.38	5,070	
LL-22	9/16/08	14,572.76	285.09	433.39	66.99	<71.50	na	< 50.58	na	8,629.13	171.13						
LL-23	9/16/08	18,277.03	376.91	1,267.79	97.62	<77.62	na	< 65.52	na	14,728.44	300.52	19,800	10.9	60.7	0.945	12,300	
Grandview Flat Road and access road to Upper Level Mine Area																	
LL-10	9/16/08	5,303.94	107.77	<52.10	na	<64.25	na	< 25.09	na	699.25	22.96						
LL-11*	9/16/08	43,125.34	852.94	108.56	31.17	132.95	26.50	< 58.24	na	1,584.83	46.22						
LL-14*	9/16/08	834.84	26.60	<22.64	na	<56.99	na	< 17.09	na	142.96	9.06						
LL-24	9/16/08	5,544.95	110.35	<65.25	na	<63.38	na	< 25.68	na	1,146.75	31.05						
LL-25	9/16/08	1,706.40	46.08	<42.33	na	<64.07	na	< 18.53	na	444.07	17.55	1,350	5.71	4.5	0.0882	364	
LL-26	9/16/08	853.06	29.29	<33.42	na	<63.14	na	< 20.26	na	286.53	13.69						
UL-LL-Access	9/16/08	5,185.05	110.81	<40.25	na	<67.30	na	< 22.95	na	359.59	16.43	668	5.19	2.93	0.0634	470	
Lower Level Mill Area surface area																	
LL-27	9/17/08	28,623.79	555.32	<202.19	na	<74.36	na	< 59.62	na	8,439.93	173.90						
LL-27-1.0-2.0'	9/17/08	4,191.99	80.58	<14.47	na	<57.96	na	< 22.01	na	41.16	5.74	10,100	6.94	17.4	0.274	941	
LL-27-1.0-2.0'/FD	9/17/08											9,180	7.73	14.78	0.256	1,370	
LL-28	9/17/08	2,954.58	61.79	84.29	27.91	<58.45	na	< 25.97	na	2,220.92	45.43						
LL-29	9/17/08	5,151.90	107.30	<91.11	na	<66.36	na	< 27.54	na	2,193.65	50.71						
LL-30	9/17/08	14,676.03	284.04	<195.63	na	<71.01	na	< 50.34	na	8,965.24	175.36						
LL-31	9/17/08	13,533.06	261.10	463.30	65.34	<68.58	na	< 48.47	na	8,483.06	165.10						
LL-31-0.5-1.0'	9/17/08	96.52	9.53	<12.56	na	<58.90	na	< 15.40	na	17.54	4.91	69.9	4.63	0.372	<0.0050	14.7	
LL-32	9/17/08	10,115.66	189.80	<90.30	na	<65.38	na	< 31.90	na	2,174.48	50.26						
LL-34-0-0.5'	9/18/08	5,763.47	107.87	<87.12	na	<60.42	na	< 28.99	na	2,351.88	49.06						
LL-35-0-0.5'	9/18/08	16,301.07	303.91	<229.64	na	80.45	23.00	< 58.06	na	12,749.70	235.34						
LL-36-0-0.5'	9/18/08	2,421.44	53.47	<74.17	na	<59.16	na	< 23.89	na	1,865.19	39.91						

Black **BOLD** values indicate the value exceeds the MTCA Method A Unrestricted Land Use cleanup levels

Red **BOLD** values indicate the value exceeds MTCA Method A Industrial cleanup levels

<LOD: below instrument's detection limit

LL: Lower Level

TP: Tailings Pile

D: Drainage Ditch

SD: Secondary Ditch (man-made ditch)

UL: Upper Level

S: South

N: North

mg/kg: milligrams per kilogram

<: compound not detected above Method Reporting Limit (MRL)

(+/-): margin of error

*: soil samples collected along roadside to determine lateral extent

na: precision ranges are not applicable for non-detectable results

According to WDOE Cleanup Levels and Risk Calculations (CLARC) database, "Researched-No Data" means research has been conducted and no data exists in the database for this parameter.

Table 2
Lower Level Mill Area XRF and Corresponding Laboratory Results for Tailings Material
Grandview Mine/Mill Site Reconnaissance
September 2008
Metaline Falls, WA

												Laboratory Verification Sample Results (mg/kg)				
												Researched No Data	20	2	2	250
												Researched No Data	200	10	2	1,000
Sample ID	Sample Date	Zinc	Zn +/-	Arsenic	As +/-	Cadmium	Cd +/-	Mercury	Hg +/-	Lead	Pb +/-	Zn	As	Cd	Hg	Pb
Unvegetated Areas along Grandview Flat Road																
LL-01 ^(a)	9/16/08	13,655.14	247.41	< 58.53	na	<66.63	na	< 31.39	na	891.69	27.02					
LL-04	9/16/08	1,117,257.13	69,549.55	< 704.38	na	1,025.48	117.11	< 618.92	na	9,406.43	639.45	521,000	98.4	1,230	78.6	9,150
LL-05	9/16/08	295,926.69	8,949.67	< 173.21	na	546.13	46.90	< 198.52	na	2,177.70	91.08					
LL-05-0-0.5'	9/18/08	5,958.46	109.25	< 13.06	na	<61.18	na	< 22.45	na	19.34	4.98	8,620	5.72	84.4	0.0845	<46.6
LL-06	9/16/08	485,440.56	20,035.83	< 350.39	na	665.71	66.83	< 322.17	na	5,215.46	251.72					
LL-07*	9/16/08	2,455.30	54.84	< 33.44	na	<59.10	na	< 20.31	na	325.93	13.75					
LL-08	9/16/08	53,171.24	1,028.36	< 74.56	na	156.21	26.24	< 58.33	na	1,036.26	34.15					
LL-09	9/16/08	884,541.19	49,623.76	< 384.88	na	956.20	100.91	< 527.69	na	3,525.78	244.92					
LL-12	9/16/08	34,460.46	666.82	< 60.98	na	142.84	24.73	< 50.10	na	701.99	26.28					
LL-13*	9/16/08	1,317.80	32.36	< 22.72	na	<51.01	na	< 13.74	na	169.33	8.94	2,010	3.64	6.16	0.188	183
LL-15*	9/16/08	2,927.59	58.33	< 25.46	na	<54.83	na	< 18.91	na	218.57	10.52					
LL-16*	9/16/08	2,690.58	57.83	< 23.20	na	<58.75	na	< 16.21	na	153.70	9.44					
LL-17	9/16/08	77,171.65	1,650.45	< 85.45	na	223.42	29.69	< 81.38	na	1,195.09	41.74					
LL-18	9/16/08	29,823.17	540.27	< 54.07	na	108.92	23.07	< 45.63	na	643.22	23.33					
LL-19	9/16/08	2,631.66	57.31	< 23.68	na	<58.06	na	< 19.08	na	151.35	9.47					
LL-20	9/16/08	548.02	21.26	< 21.41	na	<58.65	na	< 17.94	na	114.39	8.40					
LL-33*	9/18/08	748.71	24.60	< 25.62	na	<56.46	na	< 15.49	na	205.05	10.53					
Drainage Ditch																
TP-D-500'	9/17/08	5,502.82	106.67	< 74.10	na	<62.61	na	< 29.49	na	1,648.81	38.79					
TP-D-500'-S-48'	9/17/08	5,530.14	111.66	< 67.28	na	<64.32	na	< 27.00	na	1,169.00	31.87	6,520	7.52	19.4	0.492	1,190
TP-D-500'-N-37'	9/18/08	4,112.95	83.38	< 57.75	na	<59.09	na	< 19.96	na	985.84	26.99					
TP-D-500'-S-88'	9/18/08	1,469.78	38.89	< 34.39	na	<59.36	na	< 16.76	na	338.67	14.12	1,510	7.2	5.06	0.177	347
TP-D-500-BLUFF	9/18/08	2,462.17	59.28	< 45.27	na	<62.32	na	< 21.71	na	559.99	19.99	2,650	6.1	8.06	0.22	620
Man-made Ditch																
TP-SD-01-0-0.5'	9/17/08											3,150	11.6	14.5	0.436	1,070
TP-SD-01-0-0.5'/FD	9/17/08	2,586.30	56.98	< 55.91	na	<60.02	na	< 24.10	na	1,086.45	27.90					
TP-SD-02-0-0.5'	9/17/08	2,582.97	56.01	< 51.86	na	<57.62	na	< 21.43	na	918.27	24.62	3,310	12.5	15.4	0.46	1,110
TP-SD-03-0-0.5'	9/17/08	1,955.00	48.11	< 44.56	na	<59.82	na	< 22.82	na	587.58	19.61	3,370	8.2	14	0.548	895
												3,570	8.45	11.9	0.29	833

Black **BOLD** values indicate the value exceeds the MTCA Method A Unrestricted Land Use cleanup levels

Red **BOLD** values indicate the value exceeds MTCA Method A Industrial cleanup levels

LL: Lower Level

TP: Tailings Pile

D: Drainage Ditch

SD: Secondary Ditch (man-made ditch)

UL: Upper Level

S: South

N: North

mg/kg: milligrams per kilogram

(+/-): margin of error

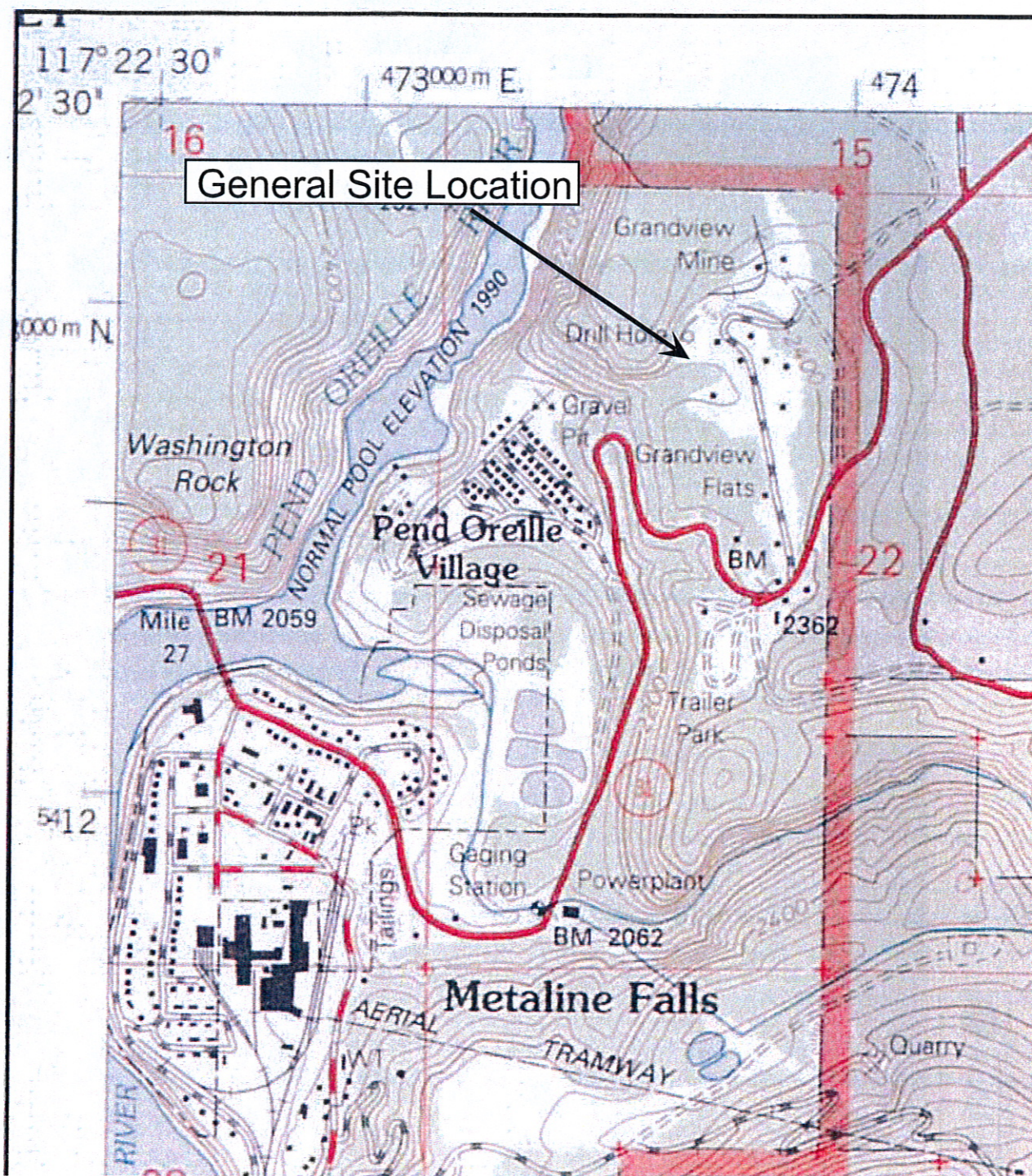
< : compound not detected above Method Reporting Limit (MRL)

*: soil samples collected from surrounding vegetated areas to determine lateral extent

na: precision ranges are not applicable for non-detectable results

^(a): small distressed area near Highway 31 entrance

According to WDOE Cleanup Levels and Risk Calculations (CLARC) database, "Researched-No Data" means research has been conducted and no data exists in the database for this parameter.

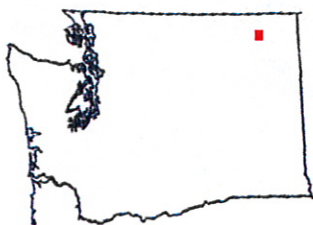


1992 USGS 7.5 Minute Historical Topographic Map
 Scale 1:24,000
 Metaline Falls Quadrangle
 Source: Environmental Data Resources, Inc.




Grandview Mine/Mill Property
 Metaline Falls, Washington

Figure 1
 General Site Location





 ENTACT Leading the Nation in Customer Care	Grandview Mine/Mill Property Metaline Falls, Washington
<p>Figure 2 Site Layout Site Reconnaissance, September 2008</p>	



LEGEND

- ▲ XRF results below MTCA Method A cleanup levels
- XRF results above MTCA Method A cleanup levels for unrestricted land uses
- XRF results above MTCA Method A cleanup levels for industrial properties



Grandview Mine/Mill Property
Metaline Falls, Washington

Figure 3
Lower Level Mill Area Sampling - Unvegetated Area and Homesite Area
Site Reconnaissance, September 2008



LEGEND

- XRF results above MTCA Method A cleanup levels for industrial properties



Grandview Mine/Mill Property
Metaline Falls, Washington

Figure 4
Lower Level Mill Area Sampling along Grandview Flat Road
Site Reconnaissance, September 2008



LEGEND


- XRF results above MTCA Method A cleanup levels for unrestricted land uses
- XRF results above MTCA Method A cleanup levels for industrial properties



Grandview Mine/Mill Property
Metaline Falls, Washington

Figure 5
Tailings Accumulation Area and Drainage Ditches
Site Reconnaissance, September 2008



 ENTACT Leading the Nation in Customer Care	Grandview Mine/Mill Property Metaline Falls, Washington
<p>Figure 6</p> <p>Upper Level Mine Area and Lower Level Mill Area</p> <p>Site Reconnaissance, September 2008</p>	



LEGEND

- XRF results above MTCA Method A cleanup levels for industrial properties



Grandview Mine/Mill Property
Metaline Falls, Washington

Figure 7
Lower Level Mill Area Sampling
Site Reconnaissance, September 2008

**WELL LOGS PROVIDED BY
PEND OREILLE PUBLIC UTILITY DISTRICT**

186341

Water Right Permit No.

ECY 050-1-20 (10/87) -1329-

Chapter 9 Construction Improvement
Chapter 10 Financial
Chapter 8 Operations and Maintenance

WATER WELL REPORT

STATE OF WASHINGTON

Water Right Permit No.

Start Card No. 23184 WELL #1
UNIQUE WELL I.D. # AAJ808

1 Copy with
by
er's Copy
s Copy

31184
Pend Oreille County P.U.D. #1 P.O. Box 190, Newport, Wa. 99156

SW 1/4 NW 1/4 Sec 22 ET 39 N. R. 43 W.M.
Pend Oreille
P.O. Village Road

USE: ☒ Domestic ☐ Industrial ☐ Municipal ☐
☐ Irrigation ☒ Test Well ☒ #3 ☐ Other ☐
☐ DeWater

WORK: Owner's number of well (if more than one) #3
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

NS: Diameter of well 8 inches.
feet. Depth of completed well 237 ft.

SECTION DETAILS:
Diam. from 8 Plus 2 ft. to 214 ft.
Diam. from 7" ft. to 193 ft.
Diam. from 7" ft. to 212 ft.

Yes ☐ No ☒
Drillator used
Drillations in. by
perforations from ft. to
perforations from ft. to
perforations from ft. to

Yes ☒ No ☐
Drill Name Halliburton
Drill Material Stainless Steel Model No. Tele
Slot size .030 from 193' ft. to 195' ft.
Slot size .60 from 195' ft. to 200' ft.

Checked: Yes ☐ No ☒ Size of gravel
ft. to

Seal: Yes ☒ No ☐ To what depth? 37 ft.
Seal in sea 0' - 18' N. at Cement, 18' - 37'

Seal data contain unusable water? Yes ☐ No ☒ Bentonite
Seal? none Depth of strata

Sealing strata off
Manufacturer's Name n/a H.P.

LEVELS: Land-surface elevation above mean sea level 125
ft. below top of well Date 11-28-94
pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

TESTS: Drawdown is amount water level is lowered below static level
Pump test made? Yes ☒ No ☐ If yes, by whom? Contractor
150 gal./min. with 27' ft. drawdown after 8 hrs.
50 " 2' 6" " 150 27' "
100 " 12 " " "

ry data (time taken as zero when pump turned off) (water level measured from well water level)
Water Level Time Water Level Time Water Level
Immediate

Date of test
test gal./min. with
gal./min. with stem set at
an flow
perature of water
Was a chemical analysis made? Yes ☐ No ☒
EASTERN REGIONAL OFFICE

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Top Soil	0	3
Boulders & Some Clay	3	4
Boulders & Brown Clay	4	10
Sand & Gravel	10	19
Boulders & Clay Conglomerate	19	31
Clay Conglomerate	31	35
Boulders	35	36
Boulders & Brown Clay	36	65
Conglomerate	65	75
Boulders	75	87
Sand Coarse 30%, Sand Med. 30%	87	169
Sand Fine 40%, Some Boulders	169	173
Bluish Green Clay Med. Sand	173	175
Laid Thru It	175	193
Cemented Fine Sand Green Clay	193	212
Laid Thru It	212	219
Very Hard Cemented Sand Green	219	237
Clay		
Cemented Fine Sand, Green		
Clay		
Med. Gravel 30%, Fine Gravel		
40%, Coarse Sand 20%		
Clay & Some Bedrock		
Bed Rock, Dolomite		

Work Started 10-3-94 Completed 6-16-95

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME C.J. WARREN & SON DRILLING
(PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address S. 3005 Best Road, Veradale, Wa. 99037
(Signed) [Signature] License No. 0515
(WELL DRILLER)

Contractor's Registration No. STWARSW1360M Date June 19 1994

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.



11x17 SCALE: 1"=40'
22x34 SCALE: 1"=20'

APPENDIX B
APPLICABLE AND/OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

Appendix B

Potential Applicable or Relevant and Appropriate Requirements (ARARs)

ARARs are defined in CERCLA Section 121 and the NCP [40 CFR Part 300]. “Applicable” requirements are those cleanup standards and other environmental protection requirements promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, location, response action, or other circumstance at a site. While not applicable to a particular circumstance at a CERCLA site, “relevant and appropriate” requirements address problems or situations sufficiently similar to those encountered at a site that their use is well suited to the site. ARARs fall into three broad categories, based on the manner in which they are applied: chemical-, action-, and location-specific. In general, only the substantive requirements of an ARAR must be implemented at site.

Chemical-specific ARARs include requirements that regulate the release to, or presence in, the environment of materials with certain chemical or physical characteristics, or containing specified chemical compounds. The requirements are usually either health- or risk-based numerical values or methodologies that establish the acceptable amount or concentration of a chemical that may remain in or be discharged to the environment.

Action-specific ARARs set performance, design, or similar controls or restrictions on particular kinds of activities related to the management of hazardous substances, pollutants, or contaminants. The ARARs are activated by the particular response action selected for implementation, and indicate how, or to what level, the alternative must achieve the requirements. Location-specific ARARs relate to the geographic or physical position of the site. Response actions may be restricted or precluded depending on the location or characteristics of the site and the requirements that apply to it. Location-specific ARARs may apply to actions in natural or man-made features. Examples of natural site features include wetlands and floodplains. An example of a man-made feature is an archaeological site.

To-Be-Considered Materials (TBCs)

TBCs are non-promulgated criteria, advisories, guidance, and proposed standards issued by federal, state, or tribal governments that, although not legally enforceable, may be helpful in establishing protective cleanup levels and developing, evaluating, or implementing remedy alternatives. If no ARARs address a particular chemical or situation, or if existing ARARs do not provide adequate information, TBCs may be available for use in developing remedial alternatives.

State Regulations

Under CERCLA, State of Washington cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated by the State of Washington are potential ARARs. Determination of whether these State of Washington standards, requirements, criteria, and limitations become ARARs is conducted using the eligibility criteria set forth in Section 121 of CERCLA (i.e., the requirements are promulgated, legally enforceable, generally applicable, more stringent than federal requirements, and identified in a timely manner). MTCA sets forth various ways to determine the numeric values for ARARs (i.e., cleanup levels) for surface water, groundwater, and soil. This includes using tables with cleanup standards for individual contaminants [WAC 173-340-704] and methods for addressing multiple contaminants and pathways [WAC 173-340-705, -706, and -708].

Potential Chemical-Specific ARARs

Chemical-specific ARARs may generally include Maximum Concentration Levels (MCLs) promulgated under the Safe Drinking Water Act and incorporated into state standards. However, the scope of the proposed response action for the Grandview Mine and Mill Site does not include treatment of contaminated groundwater. See NCP at 40 CFR 300.415(j)(2) (in determining whether compliance with ARARs is practicable, lead agency may consider scope of the removal action). As such, established federal and state standards for drinking water and groundwater will not be considered ARARs for purposes of this EE/CA.

Washington State Model Toxics Control Act [RCW 70.105D; WAC 173-340]. MTCA, including WAC 173-340-740 (unrestricted land use soil cleanup standards), and -7490 through -7494 (terrestrial ecological evaluation), is a potential ARAR under CERCLA and is applicable to soils across the Site under state law.

Potential Action-Specific ARARs

Potential action-specific ARARs for the Site are discussed below.

Resource Conservation and Recovery Act [42 USC § 6901], Subtitle C - Hazardous Waste Management [40 CFR Parts 260 to 279]. Federal hazardous waste regulations specify hazardous waste identification, management, and disposal requirements. However, pursuant to the Bevill Amendment, 42 USC § 6921(b)(3)(A), solid wastes from the extraction, beneficiation, and some processing of ores and minerals are excluded from RCRA Subtitle C requirements. However, certain of these requirements may be relevant and appropriate to ensure the safe management of some solid wastes, including principal threat materials (e.g., metal concentrates). RCRA Subtitle C

elements that may be relevant and appropriate may include, for example, selected portions of the requirements for design and operation of a hazardous waste landfill, 40 CFR Part 264, Subpart N. For the management of RCRA hazardous wastes that are not Bevill-exempt, applicability of Subtitle C provisions depend on whether the wastes are managed within an Area of Contamination (AOC). 55 FR 8760 (Mar. 8, 1990). Applicable or relevant and appropriate requirements of RCRA Subtitle C (or the state equivalent) may be satisfied by off-site disposal, consistent with the Off-Site Rule, 40 CFR 300.440. RCRA Subtitle C also provides treatment standards for debris contaminated with hazardous waste ("hazardous debris"), 40 CFR 268.45, although the lead agency may determine that such debris is no longer hazardous, consistent with 40 CFR 261.3(f)(2), or equivalent state regulations. The particular provisions of Subtitle C that are applicable or relevant and appropriate for discrete response actions will be identified through the remedial design process. Where Washington has an authorized state hazardous waste program (RCW 70.105; Chapter 173-303 WAC), it applies in lieu of the federal program.

Resource Conservation and Recovery Act [42 USC § 6901], Subtitle D - Managing Municipal and Solid Waste [40 CFR Parts 257 and 258]. Subtitle D of RCRA establishes a framework for controlling the management of non-hazardous solid waste. Subtitle D is potentially applicable to solid waste generation and management at the Site.

Washington State Hazardous Waste Management Act and Dangerous Waste Regulations [RCW 70.105; Chapter 173-303 WAC]. Washington State Dangerous Waste regulations govern the handling and disposition of dangerous waste, including identification, accumulation, storage, transport, treatment, and disposal. Washington State has not adopted an exemption for certain mining wastes (such as the Bevill Amendment) from regulation under RCRA Subtitle C. The Dangerous Waste regulations are potentially applicable to generating, handling, and managing dangerous waste at the Site, and would be potentially relevant and appropriate even if dangerous wastes are not managed during remediation.

Washington State Solid Waste Handling Standards [RCW 70.95; Chapter 173-350 WAC]. Washington State Solid Waste Handling Standards apply to facilities and activities that manage solid waste. The regulations set minimum functional performance standards for proper handling and disposal of solid waste; describe responsibilities of various entities; and stipulate requirements for solid waste handling facility location, design, construction, operation, and closure. The tailings and waste rock piles at the Site are landfills that contain solid wastes. Substantive requirements for closure and post-closure of limited purpose landfills [WAC 173-350-400] are potential ARARs. This regulation is also potentially applicable or relevant and appropriate for management of excavated soil or debris that will be generated during the Site cleanup.

Clean Water Act--National Pollution Discharge Elimination System [33 USC § 1342]. The State Department of Ecology has been delegated the authority under the federal Clean Water Act to carry out the NPDES program in the State of Washington. The NPDES regulations establish requirements for point source discharges and storm water runoff. In particular for the Site, these regulations are potentially applicable for any point source discharge of contamination to surface water, including storm water runoff at the Site. If response activities at the Site involve clearing, grading, excavating, or other response activities that will disturb more than one acre of land resulting in storm water discharges, such activities must comply with the substantive requirements for a Construction Stormwater General Permit to prevent or minimize the discharge of pollutants in storm water runoff from the disturbed areas to waters of the United States.

Federal Water Pollution Control Act--Discharge of Dredge and Fill Materials [Clean Water Act; 33 USC § 1344, Section 404]. Section 404 of the CWA establishes a program to regulate the discharge of dredged and fill materials into the waters of the United States, including wetlands. The substantive provisions of this requirement are potentially applicable to response actions involving dredging, filling, diversion, and/or construction in streams or wetlands at the Site.

Washington Clean Air Act and Implementing Regulations [WAC 173-400-040(8)]. This regulation is potentially relevant and appropriate to response actions at the Site. It requires the owner or operator of a source of fugitive dust to take reasonable precautions to prevent fugitive dust from becoming airborne and to maintain and operate the source to minimize emissions.

General Regulations for Air Pollution Sources - Washington State [RCW 70.94; Chapter 173-400 WAC]. The purpose of these regulations is to establish technically feasible and reasonably attainable standards, and to establish rules generally applicable to the control and/or prevention of the emission of air contaminants. Depending on the response action selected, these regulations are potentially applicable to the Site (e.g., generation of fugitive dust during remediation of soil and tailings, or emissions from equipment).

Potential Location-Specific ARARs

Potential location-specific potential ARARs are discussed below.

National Historic Preservation Act [16 USC § 470f; 36 CFR Parts 60, 63, 800]. The National Historic Preservation Act (NHPA) and implementing regulations require federal agencies to consider the possible effects on historic sites or structures of any actions proposed for federal funding or approval. Historic sites or structures are those included on or eligible for the National Register of Historic Places (NRHP), generally older than 50 years. If an agency finds a potential adverse effect on historic sites or structures, such agency must evaluate alternatives to “avoid, minimize, or mitigate” the impact, in consultation

with the State Historic Preservation Office (SHPO). The NHPA and implementing regulations are potentially applicable to response actions such as demolition of old mine or mill structures on the Site. In consultation with the SHPO, unavoidable impacts on historic sites or structures may be mitigated through such means as taking photographs and collecting historic records.

Archaeological Resources Protection Act [16 USC § 470aa *et seq.*; 43 CFR Part 7]. The Archaeological Resources Protection Act (ARPA) and implementing regulations prohibit the unauthorized disturbance of archaeological resources on public or Indian lands. Archaeological resources are “any material remains of past human life and activities which are of archaeological interest,” including pottery, baskets, tools, and human skeletal remains. The unauthorized removal of archaeological resources from public or Indian lands is prohibited without a permit, and any archaeological investigations at a site must be conducted by a professional archeologist. ARPA and implementing regulations are applicable for the conduct of any selected response actions that may result in ground disturbance.

Native American Graves Protection and Repatriation Act [25 USC § 3001 *et seq.*; 43 CFR Part 10]. The Native American Graves Protection and Repatriation Act (NAGPRA) and implementing regulations are intended to protect Native American graves from desecration through the removal and trafficking of human remains and “cultural items” including funerary and sacred objects. The requirements of this Act must be followed when graves are discovered or ground-disturbing activities encounter Native American burial sites. This Act is potentially applicable to the Site where response actions involve disturbance/alteration of the ground and/or site terrain.

Endangered Species Act [16 U.S.C. §§ 1531 – 1544; 50 CFR Parts 17, 402]. The Endangered Species Act (ESA) protects species of fish, wildlife, and plants that are listed as threatened or endangered with extinction. It also protects designated critical habitat for listed species. The Act outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species, including consultation with resource agencies. The requirements of this Act are potentially applicable to the Site since listed threatened or endangered species habitat areas will, or could, be impacted by response action. Consistent with ESA Section 7, if any federally designated threatened or endangered species are identified in the vicinity of remediation work, and the action may affect such species and/or their habitat, EPA will consult with USFWS to ensure that response actions are conducted in a manner to avoid adverse habitat modification and jeopardy to the continued existence of such species.

Migratory Bird Treaty Act (MBTA), 16 USC § 703 *et seq.* The MBTA makes it unlawful to “hunt, take, capture, kill” or take various other actions adversely affecting a broad range of migratory birds, including tundra swans, hawks, falcons, songbirds, without prior approval by the U.S. Fish and Wildlife Service.

(See 50 CFR 10.13 for the list of birds protected under the MBTA.) Under the MBTA, permits may be issued for take (e.g., for research) or killing of migratory birds (e.g., hunting licenses). The mortality of migratory birds due to ingestion of contaminated sediment is not a permitted take under the MBTA. The MBTA and its implementing regulations are potentially relevant and appropriate for protecting migratory bird species identified. The selected response action will be carried out in a manner that avoids the taking or killing of protected migratory bird species, including individual birds or their nests or eggs.

To-Be-Considered Materials

Potential To-Be-Considered materials are discussed below.

EPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites (May, 2009). RSLs are used for site "screening" and as initial cleanup goals, if applicable. RSLs may be retained and established as a cleanup standard.

WA Ecology Guidance for Remediation of Petroleum Contaminated Soils. Paper 91-30 (Revised November 1995). This guidance is intended to provide the information needed to clean up contamination caused by spills, overfills or leaks of petroleum, most often from underground storage tanks and associated piping. It provides information on reporting, sampling strategies, cleanup standards, and treatment and disposal options. This guidance is not intended for sites containing non-petroleum hazardous substances.

APPENDIX C
DETAILED COST INFORMATION

APPENDIX C

DETAILED COST ESTIMATES

This appendix provides discussion and supporting cost estimate tables for the subarea-specific removal action alternatives developed for the Grandview Mine and Mill Site. As detailed in the Engineering Evaluation/Cost Analysis (EECA) text, the subarea-specific removal action alternatives are:

Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea

- MM2 – Consolidate in On-Site Repository at Lower Level Mill Area
- MM3 – Consolidate in On-Site Repository at Tailings Accumulation Subarea
- MM4 – Disposal at Teck Pend Oreille Operations
- MM5 – Off-Site Disposal in a Landfill

Tailings Accumulation Subarea

- TA2 – Consolidate in On-Site Repository at Lower Level Mill Area
- TA3 – Consolidate in On-Site Repository at Tailings Accumulation Subarea
- TA4 – Disposal at Teck Pend Oreille Operations
- TA5 – Off-Site Disposal in a Landfill

Man-Made Ditch and Downgradient Ditch Subarea

- MD2 – Consolidate in On-Site Repository at Lower Level Mill Area
- MD3 – Consolidate in On-Site Repository at Tailings Accumulation Subarea
- MD4 – Disposal at Teck Pend Oreille Operations
- MD5 – Off-Site Disposal in a Landfill

These cost estimates were made in accordance with procedures in the *Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (EPA, 2000) and are expected to result in estimates that are within a range of -30 percent to +50 percent of what actual costs may be. The estimates include capital costs, operations and maintenance (O&M) costs, and periodic costs. These cost categories are described below.

Capital Costs

Capital costs are those expenditures that are required to construct a remedial action. They are exclusive of costs required to operate or maintain the action throughout its lifetime. Capital costs consist primarily of expenditures initially incurred to build or install the remedial action (e.g., construction of a groundwater treatment system and related site work). Capital costs include all labor, equipment, and material costs, including contractor markups such as overhead and profit, associated with activities such as mobilization/demobilization; monitoring; site work; installation of extraction, containment, or treatment systems; and disposal. Capital costs also include expenditures for professional/technical services that are necessary to support construction of the remedial action.

Annual Post-Removal Site Control (PRSC) Costs

PRSC (also referenced as operations and maintenance (O&M)) costs are those post-construction costs necessary to ensure or verify the continued effectiveness of a remedial action. These costs are typically estimated on an annual basis. Annual O&M costs include all labor, equipment, and material costs, including contractor markups such as overhead and profit, associated with activities such as monitoring; operating and maintaining extraction, containment, or treatment systems; and disposal. Annual O&M costs also include expenditures for professional/technical services necessary to support O&M activities.

For cost estimation, O&M activities are assumed to occur each year for a 30-year period. For Years 1-5, it is assumed that maintenance/additional revegetation will be performed as required in previously seeded areas, along with inspections of all areas an average of twice per year (annually and after severe storm events) with limited repair required. The annual PRSC cost assumed for these activities is \$600 per acre of area originally seeded (excavated and repository areas). For Years 6-30, it is assumed that the additional revegetation activities of

Years 1-5 will no longer be required, but inspections of all areas will occur at an average frequency of twice per year (annually and after severe storm events) with limited repair required. The assumed annual PRSC cost for Years 6-30 is assumed at \$300/acre.

Periodic Costs

Periodic costs are those costs that occur only once every few years (e.g., five-year reviews, equipment replacement) or expenditures that occur only once during the entire O&M period or remedial timeframe (e.g., site closeout, remedy failure/replacement). These costs may be either capital or PRSC costs, but because of their periodic nature, it is more practical to consider them separately from other capital or PRSC costs in the estimating process. For the Grandview Site, none of the subarea-specific removal action alternatives entail periodic costs.

Present Value Analysis

For each alternative, a -30 to +50 percent cost estimate is developed in accordance with procedures in the *Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (EPA, 2000). Cost estimates for each alternative are based on conceptual engineering and design and are expressed in terms of 2009 dollars. This analysis is used to evaluate the capital, O&M, and periodic costs of a remedial alternative based on its present value. A present value analysis compares expenditures for various alternatives where those expenditures occur over different time periods. By discounting all costs to a common base year, the costs for different remedial action alternatives can be compared based on a single cost figure for each alternative.

The total present value for a single alternative is equal to the full amount of all costs incurred through the end of the first year of operation, plus the series of expenditures in following years reduced by the appropriate future value/present value discount factor. This analysis allows the comparison of remedial alternatives on the basis of a single cost representing an amount that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. The present value calculations are based on the following fundamental equation:

$$P = F / (1+i)^n$$

Where: P = present worth (\$)
 F = future worth (\$)
 i = discount rate (%)
 n = time period (years)

A discount rate of 7 percent is used for the present worth calculations, consistent with EPA guidance and directives (EPA, 1988 and 2000). The discount rate represents the anticipated difference between the rate of inflation and investment return.

A summary of the present worth estimates for the subarea-specific removal action alternatives is presented on Table C-1. Detailed present worth cost estimate information for removal action alternatives for the Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea; the Tailings Accumulation Subarea; and the Downgradient Ditch and Man-Made Ditch Subarea are presented on Tables C-2 through C-4, respectively. Detailed cost estimate information for subarea alternatives are presented on Tables C-5 through C-16, as described in the subsections below. Note that the cost estimates for the subarea alternatives, as presented on Tables C-5 through C-16 do not reflect present worth. The present worth calculations are applied on the Site-wide alternative tables (Tables C-2 through C-4).

MM2 – Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea: Consolidate in On-Site Repository at Lower Level Mill Area

- Refer to Table C-5 for cost detail.
- Area for clearing and grubbing is assumed to include only ditch areas, as presented in Entact (2008) report = 2.9 acres.
- Silo (and other structures) demolition volume assumed to be 50 cy; cost is developed from RS Means (2009) based on typical demo of a silo (lump sum value).
- Regrading volume for development rock (i.e., North Pile) in Lower Level Mill Area is from Table 1 = 5,905 cy.
- Excavation and hauling of other development rock (i.e., surfacing material in mill area, historic homesite area, Grandview Flat and upper level access roads) to repository, for a distance of 1,500 ft, is from Table 1 = 6,315 cy.
- Excavation and hauling of potentially impacted soil in former drum disposal area is from Table 1 = 500 cy.
- Excavation and hauling of tailings from distressed/unvegetated area and drainage ditch to repository, for a distance of 2,000 ft, is from Table 1 = 7,220 cy.

- Total area of excavation is from Entact (2008) report = 7.2 acres; includes development rock (3.3 acres, excluding regraded rock of North Pile), tailings (3.6 acres), and soil in former drum disposal area (0.3 acre, assuming excavation of 500 cy to depth of 1 ft).
- Materials placed in repository are assumed to be spread and then compacted using a Sheepsfoot roller, 12-inch lifts, 2 passes; total volume placed is 14,085 cy (50 + 6,315 + 7,220 + 500).
- Repository surface area is estimated assuming a 10-ft average thickness; if total volume = 20,000 cy (540,000 cf), then surface area = 54,000 sf (1.24 acre), yielding a unit rate of 2.7 sf/cy;¹ for this alternative, repository surface area = $2.7 \times 14,085 = 38,030$ sf = 0.9 acre.
- Cover soil is placed at a thickness of 1 ft over the repository; volume of cover soil is calculated based on coverage over the repository surface area; $38,030$ cf = 1,410 cy.
- Runon control ditch length at the repository is assumed to be proportional to the repository dimensions/surface area (0.9 acre) and would involve grading focused in the upgradient area.
- Seeding and mulching is assumed to occur over the entire excavated and repository areas = $7.2 + 0.9 = 8.1$ acres.
- Institutional controls are assumed to require \$10,000 in capital costs for deed restrictions and other requirements associated with the on-site repository.

MM3 – Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea: Consolidate in On-Site Repository at Tailings Accumulation Area

- Refer to Table C-6 for cost detail.
- Area for clearing and grubbing is assumed to include only ditch areas, as presented in Entact (2008) report = 2.9 acres.
- Excavation and hauling of development rock (i.e., surfacing material in mill area, historic homesite area, Grandview Flat and upper level access roads, and North Pile) to repository, for a distance of 2,500 ft, is from Table 1 = 12,220 cy.
- Excavation and hauling of potentially impacted soil in former drum disposal area is from Table 1 = 500 cy.
- Excavation and hauling of tailings from distressed/unvegetated area and drainage ditch to repository, for a distance of 1,000 ft, is from Table 1 = 7,220 cy.
- Total area of excavation is from Entact (2008) report = 7.8 acres; includes development rock (3.9 acres), tailings (3.6 acres), and soil in former drum disposal area (0.3 acre, assuming excavation of 500 cy to depth of 1 ft).
- Materials placed in repository are assumed to be spread and then compacted using a Sheepsfoot roller, 12-inch lifts, 2 passes; total volume placed is 19,940 cy ($12,220 + 7,220 + 500$).
- Estimated repository surface area = $2.7 \times 19,940 = 53,838$ sf = 1.2 acre.
- Cover soil is placed at a thickness of 1 ft over the repository; volume of cover soil is calculated based on coverage over the repository surface area; $53,838$ cf = 2,000 cy.

¹ This approach is used to estimate the surface area of repositories in other subarea-specific alternatives.

- Runon control ditch length at the repository is assumed to be proportional to the repository dimensions/surface area (1.2 acre) and would involve grading focused in the upgradient area.
- Seeding and mulching is assumed to occur over the entire excavated and repository areas = $7.8 + 1.2 = 9.0$ acres.
- Institutional controls are assumed to require \$10,000 in capital costs for deed restrictions and other requirements associated with the on-site repository.

MM4 – Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea: Disposal at Teck Pend Orielle Operations

- Refer to Table C-7 for cost detail.
- Area for clearing and grubbing is same as for MM2.
- Excavation and hauling of development rock (i.e., North Pile, surfacing material in mill area, historic homesite area, Grandview Flat and upper level access roads), tailings from distressed/unvegetated area and drainage ditch, and soil in the former drum disposal area, to the Teck facility, for a distance of 2 miles, is from Table 1 = 19,940 cy (12,220 + 7,220 + 500).
- Improvements for secondary road (measured length of 0.4 mile from satellite photo) assume placement of 1.5-inch stone base, compacted 4-inch depth, over 20% of the road surface area (with total area of 25 ft x 0.4 mile); no drainage improvements are assumed.
- Total area of excavation is from Entact (2008) report = 7.8 acres; includes development rock (3.9 acres), tailings (3.6 acres), and soil in former drum disposal area (0.3 acre, assuming excavation of 500 cy to depth of 1 ft).
- Seeding and mulching is assumed to occur over the entire excavated area = 7.8 acres.
- Institutional controls are assumed to require \$5,000 in capital costs for deed restrictions and other requirements for areas formerly containing materials.

MM5 – Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea: Off-Site Disposal in a Landfill

- Refer to Table C-8 for cost detail.
- Area for clearing and grubbing is same as for MM2.
- As-is tailings are assumed to not pass TCLP for lead; to pass TCLP for lead, mixing of triple superphosphate (TSP) to tailings is assumed to be effective; assumed mixing ratio is 1 part TSP to 3 parts tailings, by volume; a total of 7,220 cy tailings requires mixing, with TSP volume of 2,407 cy (1,950 tons @ density of 0.81 ton/cy per J.R. Simplot Company, Pocatello, Idaho). Cost for TSP includes July 2009 material cost of \$430/ton (J.R. Simplot) plus assumed shipping cost of \$50/ton to the Site.
- Excavation and hauling of development rock (i.e., North Pile, surfacing material in mill area, historic homesite area, Grandview Flat and upper level access roads), tailings from distressed/unvegetated area and drainage ditch and added TSP, and soil in the former drum disposal area, for a distance of 123 miles (246 miles for cycle) to Graham Road

Landfill (special waste), is from Table 1 = 19,940 cy (12,220 + 7,220 + 500) + 2,407 cy (TSP) = 22,350 cy.

- Mixing of TSP with tailings assumes a windrow operation, with 2 windrow mixing cycles.
- Total area of excavation is same as for MM4.
- Seeding and mulching is same as for MM4.
- Institutional controls are assumed to require \$5,000 in capital costs for deed restrictions and other requirements for areas formerly containing materials.

TA2 – Tailings Accumulation Subarea: Consolidate in On-Site Repository at Lower Level Mill Area

- Refer to Table C-9 for cost detail.
- No clearing and grubbing required.
- Silo (and other structures) demolition volume assumed to be 50 cy; cost is developed from RS Means (2009) based on typical demo of a silo (lump sum value).
- Excavation and hauling of tailings from tailings accumulation area, for a distance of 2,500 ft to repository, is from Table 2-1 = 19,700 cy.
- Total area of excavation is from Entact (2008) report = 3.1 acres.
- Materials placed in repository are assumed to be spread and then compacted using a sheepsfoot roller, 12-inch lifts, 2 passes; total volume placed is 19,700 cy.
- Repository surface area is estimated assuming a 10-ft average thickness, with unit rate of 2.7 sf/cy; for this alternative, repository surface area = $2.7 \times 19,750$ (19,700 + 50 cy for silo demo) = 53,325 sf = 1.2 acre.
- Cover soil is placed at a thickness of 1 ft over the repository; volume of cover soil is calculated based on coverage over the repository surface area; 53,325 cf = 1,975 cy.
- Runon control ditch length at the repository is assumed to be proportional to the repository dimensions/surface area (1.2 acre) and would involve grading focused in the upgradient area.
- Seeding and mulching is assumed to occur over the entire excavated and repository areas = $3.1 + 1.2 = 4.3$ acres.
- Institutional controls are assumed to require \$10,000 in capital costs for deed restrictions and other requirements associated with the on-site repository.

TA3 – Tailings Accumulation Subarea: Consolidate in On-Site Repository at Tailings Accumulation Area

- Refer to Table C-10 for cost detail.
- No clearing and grubbing required.
- Regrading volume for tailings (to reduce footprint of repository), assuming 1/3 of total volume is graded, based on Table 1 = 6,600 cy (19,700/3).
- Total area of excavation is assumed at approx 2/3 of total tailings accumulation area (from Entact (2008) report) = 2.0 acres ($3.1 \times 2/3$).

- Repository surface area is estimated assuming a 10-ft average thickness, with unit rate of 2.7 sf/cy; for this alternative, repository surface area = $2.7 \times 19,700 = 53,190$ sf = 1.2 acre.
- Cover soil is placed at a thickness of 1 ft over the repository; volume of cover soil is calculated based on coverage over the repository surface area; $53,190$ cf = 1,970 cy.
- Runon control ditch length assumption for repository is same as for TA2.
- Seeding and mulching is assumed to occur over the entire excavated and repository areas = $2.0 + 1.2 = 3.2$ acres.
- Institutional controls are assumed to require \$10,000 in capital costs for deed restrictions and other requirements associated with the on-site repository.

TA4 – Tailings Accumulation Subarea: Disposal at Teck Pend Orielle Operations

- Refer to Table C-11 for cost detail.
- No clearing and grubbing required.
- Excavation and hauling of tailings from tailings accumulation area, for a distance of 2.5 miles to Teck facility, is from Table 1 = 19,700 cy.
- Improvements for secondary road is same as for MM4; no drainage improvements are assumed.
- Total area of excavation is same as for TA2.
- Seeding and mulching is assumed to occur over the entire excavated area = 3.1 acres.
- Institutional controls are assumed to require \$5,000 in capital costs for deed restrictions and other requirements for areas formerly containing materials.

TA5 – Tailings Accumulation Subarea: Off-Site Disposal in a Landfill

- Refer to Table C-12 for cost detail.
- No clearing and grubbing required.
- As-is tailings are assumed to not pass TCLP for lead; to pass TCLP for lead, mixing of triple superphosphate (TSP) to tailings is assumed to be effective; assumed mixing ratio is 1 part TSP to 3 parts tailings, by volume; a total of 19,700 cy tailings requires mixing, with TSP volume of 6,567 cy (5,320 tons @ density of 0.81 ton/cy per J.R. Simplot Company, Pocatello, Idaho). Cost for TSP includes July 2009 material cost of \$430/ton (J.R. Simplot) plus assumed shipping cost of \$50/ton to the Site.
- Excavation and hauling of tailings from tailings accumulation area, and added TSP, for a distance of 123 miles (246 miles for cycle) to Graham Road Landfill (special waste), is from Table 2-1 = 26,270 cy ($19,700 + 6,567$ cy (TSP)) = 26,270 cy.
- Mixing process for TSP is same as for MM5.
- Total area of excavation is same as for TA4.
- Seeding and mulching is same as for TA4.
- Institutional controls are assumed to require \$5,000 in capital costs for deed restrictions and other requirements for areas formerly containing materials.

MD2 – Man-Made Ditch and Downgradient Ditch Subarea: Consolidate in On-Site Repository at Lower Level Mill Area

- Refer to Table C-13 for cost detail.
- Area for clearing and grubbing is assumed to include only ditch areas, as presented in Entact (2008) report = 1.2 acres.
- Silo (and other structures) demolition volume assumed to be 50 cy; cost is developed from RS Means (2009) based on typical demo of a silo (lump sum value).
- Excavation and hauling of tailings from ditch areas to repository, for a distance of 3,000 ft, is from Table 1 = 2,155 cy.
- Total area of excavation is from Entact (2008) report = 1.2 acres.
- Materials placed in repository are assumed to be spread and then compacted using a Sheepsfoot roller, 12-inch lifts, 2 passes; total volume placed is 2,155 cy.
- Repository surface area is estimated assuming a 10-ft average thickness, at a unit rate of 2.7 sf/cy; for this alternative, repository surface area = $2.7 \times 2,205$ (2,155 + 50 cy for silo demo) = 5,960 sf = 0.14 acre.
- Cover soil is placed at a thickness of 1 ft over the repository; volume of cover soil is calculated based on coverage over the repository surface area; 5,960 cf = 221 cy.
- Runon control ditch length at the repository is assumed to be proportional to the repository dimensions/surface area (0.14 acre) and would involve grading focused in the upgradient area.
- Seeding and mulching is assumed to occur over the entire excavated and repository areas = $1.2 + 0.14 = 1.3$ acres.
- Institutional controls are assumed to require \$10,000 in capital costs for deed restrictions and other requirements associated with the on-site repository.

MD3 – Man-Made Ditch and Downgradient Ditch Subarea: Consolidate in On-Site Repository at Tailings Accumulation Area

- Refer to Table C-14 for cost detail.
- Area for clearing and grubbing is same as for MD2.
- Excavation and hauling of tailings from ditch areas to repository, for a distance of 500 ft, is from Table 2-1 = 2,155 cy.
- Total area of excavation is same as for MD2.
- Materials placed in repository same as for MD2.
- Repository surface area is estimated assuming a 10-ft average thickness, at a unit rate of 2.7 sf/cy; for this alternative, repository surface area = $2.7 \times 2,155 = 5,820$ sf = 0.13 acre.
- Cover soil is placed at a thickness of 1 ft over the repository; volume of cover soil is calculated based on coverage over the repository surface area; 5,820 cf = 216 cy.
- Runon control ditch length at the repository is assumed to be proportional to the repository dimensions/surface area (0.13 acre) and would involve grading focused in the upgradient area.
- Seeding and mulching is assumed to occur over the entire excavated and repository areas = $1.2 + 0.13 = 1.3$ acres.
- Institutional controls are assumed to require \$10,000 in capital costs for deed restrictions and other requirements associated with the on-site repository.

MD4 – Man-Made Ditch and Downgradient Ditch Subarea: Disposal at Teck Pend Orielle Operations

- Refer to Table C-15 for cost detail.
- Area for clearing and grubbing is same as for MD2.
- Excavation and hauling of tailings from ditch area, for a distance of 2.5 miles to Teck facility, is from Table 2-1 = 2,155 cy.
- Improvements for secondary road is same as for MM4; no drainage improvements are assumed.
- Total area of excavation is same as for MD2.
- Seeding and mulching is assumed to occur over the entire excavated area = 1.2 acres.
- Institutional controls are assumed to require \$5,000 in capital costs for deed restrictions and other requirements for areas formerly containing materials.

MD5 – Man-Made Ditch and Downgradient Ditch Subarea: Off-Site Disposal in a Landfill

- Refer to Table C-16 for cost detail.
- Area for clearing and grubbing is same as for MD2.
- As-is tailings are assumed to not pass TCLP for lead; to pass TCLP for lead, mixing of triple superphosphate (TSP) to tailings is assumed to be effective; assumed mixing ratio is 1 part TSP to 3 parts tailings, by volume; a total of 2,155 cy tailings requires mixing, with TSP volume of 718 cy (580 tons @ density of 0.81 ton/cy per J.R. Simplot Company, Pocatello, Idaho). Cost for TSP includes July 2009 material cost of \$430/ton (J.R. Simplot) plus assumed shipping cost of \$50/ton to the Site.
- Excavation and hauling of tailings from ditch area, and added TSP, for a distance of 123 miles (246 miles for cycle) to Graham Road Landfill (special waste), is from Table 2-1 = 2,880 cy (2,155 + 718 cy (TSP)) = 2,880 cy.
- Mixing process for TSP is same as for MM5.
- Total area of excavation is same as for MD2.
- Seeding and mulching is same as for MD4.
- Institutional controls are assumed to require \$5,000 in capital costs for deed restrictions and other requirements for areas formerly containing materials.

TABLE C-1
SUMMARY OF PRESENT VALUE ESTIMATES

Upper Level Mine, Lower Level Mill, and Drainage Ditch Subarea

MM2: Consolidate in On-Site Repository at Lower Level Mill Area	\$402,830
MM3: Consolidate in On-Site Repository at Tailings Accumulation Area	\$461,240
MM4: Disposal at Teck Pend Oreille Operations	\$713,490
MM5: Off-Site Disposal in a Landfill	\$4,137,378

Tailings Accumulation Subarea

TA2: Consolidate in On-Site Repository at Lower Level Mill Area	\$382,541
TA3: Consolidate in On-Site Repository at Tailings Accumulation Area	\$170,898
TA4: Disposal at Teck Pend Oreille Operations	\$635,767
TA5: Off-Site Disposal in a Landfill	\$6,781,201

Man-Made Ditch and Downgradient Ditch Subarea

MD2: Consolidate in On-Site Repository at Lower Level Mill Area	\$113,921
MD3: Consolidate in On-Site Repository at Tailings Accumulation Area	\$90,011
MD4: Disposal at Teck Pend Oreille Operations	\$110,446
MD5: Off-Site Disposal in a Landfill	\$855,865

TABLE C-2
PRESENT VALUE OF REMOVAL ACTION ALTERNATIVES
UPPER LEVEL MINE, LOWER LEVEL MILL, AND DRAINAGE DITCH SUBAREA

Item	Notes	Start Year ⁽¹⁾	End Year ⁽²⁾	Frequency (years)	Estimated Cost ⁽³⁾	Present Value ⁽⁴⁾
<u>MM2 - Consolidate in On-Site Repository at Lower Level Mill Area</u>						
Capital Costs	Table C-5	0	0	n.a.	\$362,712	\$362,712
O&M Costs - Years 1-5 (post-construction)	Table C-5	1	5	n.a.	\$4,860	\$19,927
O&M Costs - Years 6-30	Table C-5	6	30	n.a.	\$2,430	\$20,190
Periodic Costs	Table C-5	0	0	n.a.	\$0	\$0
Total Present Value						\$402,830
<u>MM3 - Consolidate in On-Site Repository at Tailings Accum. Area</u>						
Capital Costs	Table C-6	0	0	n.a.	\$416,665	\$416,665
O&M Costs - Years 1-5 (post-construction)	Table C-6	1	5	n.a.	\$5,400	\$22,141
O&M Costs - Years 6-30	Table C-6	6	30	n.a.	\$2,700	\$22,434
Periodic Costs	Table C-6	0	0	n.a.	\$0	\$0
Total Present Value						\$461,240
<u>MM4 - Disposal at Teck Pend Oreille Facility</u>						
Capital Costs	Table C-7	0	0	n.a.	\$674,858	\$674,858
O&M Costs - Years 1-5 (post-construction)	Table C-7	1	5	n.a.	\$4,680	\$19,189
O&M Costs - Years 6-30	Table C-7	6	30	n.a.	\$2,340	\$19,443
Periodic Costs	Table C-7	0	0	n.a.	\$0	\$0
Total Present Value						\$713,490
<u>MM5 - Off-Site Disposal in a Landfill</u>						
Capital Costs	Table C-8	0	1	n.a.	\$4,239,964	\$4,101,273
O&M Costs - Years 1-5 (post-construction)	Table C-8	2	6	n.a.	\$4,680	\$17,934
O&M Costs - Years 6-30	Table C-8	7	31	n.a.	\$2,340	\$18,171
Periodic Costs	Table C-8	0	0	n.a.	\$0	\$0
Total Present Value						\$4,137,378

Notes:

For Present Value calculations, the Discount Rate used is.... 7%

Costs and Present Value are based on "constant" or "real" 2009 dollars not adjusted for future inflation.

Unless identified separately, burden and profits are included in unit costs.

- ⁽¹⁾ Start Year is the year during which the capital construction or the O&M activities begin. Costs are assumed to be incurred on the first day of the year indicated.
- ⁽²⁾ End Year is the year during which the capital construction or the O&M activities are completed. Costs are assumed to be incurred on the first day of the year indicated.
- ⁽³⁾ Capital Costs are totals for the activity, not annualized; Annual O&M Costs are annualized to represent one year only; Periodic Costs are one-time or repeating (not annual) costs.
- ⁽⁴⁾ Present Value represents the total cost over the project life based on a discount rate applied to the estimated cost for each year after Year 0 (2009).

**TABLE C-3
PRESENT VALUE OF REMOVAL ACTION ALTERNATIVES
TAILINGS ACCUMULATION SUBAREA**

Item	Notes	Start Year ⁽¹⁾	End Year ⁽²⁾	Frequency (years)	Estimated Cost ⁽³⁾	Present Value ⁽⁴⁾
<u>TA2 - Consolidate in On-Site Repository at Lower Level Mill Area</u>						
Capital Costs	Table C-9	0	0	n.a.	\$361,244	\$361,244
O&M Costs - Years 1-5 (post-construction)	Table C-9	1	5	n.a.	\$2,580	\$10,579
O&M Costs - Years 6-30	Table C-9	6	30	n.a.	\$1,290	\$10,718
Periodic Costs	Table C-9	0	0	n.a.	\$0	\$0
Total Present Value						\$382,541
<u>TA3 - Consolidate in On-Site Repository at Tailings Accum. Area</u>						
Capital Costs	Table C-10	0	0	n.a.	\$155,049	\$155,049
O&M Costs - Years 1-5 (post-construction)	Table C-10	1	5	n.a.	\$1,920	\$7,872
O&M Costs - Years 6-30	Table C-10	6	30	n.a.	\$960	\$7,976
Periodic Costs	Table C-10	0	0	n.a.	\$0	\$0
Total Present Value						\$170,898
<u>TA4 - Disposal at Teck Pend Oreille Facility</u>						
Capital Costs	Table C-11	0	0	n.a.	\$620,413	\$620,413
O&M Costs - Years 1-5 (post-construction)	Table C-11	1	5	n.a.	\$1,860	\$7,626
O&M Costs - Years 6-30	Table C-11	6	30	n.a.	\$930	\$7,727
Periodic Costs	Table C-11	0	0	n.a.	\$0	\$0
Total Present Value						\$635,767
<u>TA5 - Off-Site Disposal in a Landfill</u>						
Capital Costs	Table C-12	0	2	n.a.	\$7,230,498	\$6,767,790
O&M Costs - Years 1-5 (post-construction)	Table C-12	3	7	n.a.	\$1,860	\$6,661
O&M Costs - Years 6-30	Table C-12	8	32	n.a.	\$930	\$6,749
Periodic Costs	Table C-12	0	0	n.a.	\$0	\$0
Total Present Value						\$6,781,201

Notes:

For Present Value calculations, the Discount Rate used is.... 7%

Costs and Present Value are based on "constant" or "real" 2009 dollars not adjusted for future inflation.

Unless identified separately, burden and profits are included in unit costs.

- ⁽¹⁾ Start Year is the year during which the capital construction or the O&M activities begin. Costs are assumed to be incurred on the first day of the year indicated.
- ⁽²⁾ End Year is the year during which the capital construction or the O&M activities are completed. Costs are assumed to be incurred on the first day of the year indicated.
- ⁽³⁾ Capital Costs are totals for the activity, not annualized; Annual O&M Costs are annualized to represent one year only; Periodic Costs are one-time or repeating (not annual) costs.
- ⁽⁴⁾ Present Value represents the total cost over the project life based on a discount rate applied to the estimated cost for each year after Year 0 (2009).

TABLE C-4
PRESENT VALUE OF REMOVAL ACTION ALTERNATIVES
MAN-MADE DITCH AND DOWNGRAIDENT DITCH SUBAREA

Item	Notes	Start Year ⁽¹⁾	End Year ⁽²⁾	Frequency (years)	Estimated Cost ⁽³⁾	Present Value ⁽⁴⁾
<u>MD2 - Consolidate in On-Site Repository at Lower Level Mill Area</u>						
Capital Costs	Table C-13	0	0	n.a.	\$107,482	\$107,482
O&M Costs - Years 1-5 (post-construction)	Table C-13	1	5	n.a.	\$780	\$3,198
O&M Costs - Years 6-30	Table C-13	6	30	n.a.	\$390	\$3,240
Periodic Costs	Table C-13	0	0	n.a.	\$0	\$0
Total Present Value						\$113,921
<u>MD3 - Consolidate in On-Site Repository at Tailings Accum. Area</u>						
Capital Costs	Table C-14	0	0	n.a.	\$83,572	\$83,572
O&M Costs - Years 1-5 (post-construction)	Table C-14	1	5	n.a.	\$780	\$3,198
O&M Costs - Years 6-30	Table C-14	6	30	n.a.	\$390	\$3,240
Periodic Costs	Table C-14	0	0	n.a.	\$0	\$0
Total Present Value						\$90,011
<u>MD4 - Disposal at Teck Pend Oreille Facility</u>						
Capital Costs	Table C-15	0	0	n.a.	\$104,503	\$104,503
O&M Costs - Years 1-5 (post-construction)	Table C-15	1	5	n.a.	\$720	\$2,952
O&M Costs - Years 6-30	Table C-15	6	30	n.a.	\$360	\$2,991
Periodic Costs	Table C-15	0	0	n.a.	\$0	\$0
Total Present Value						\$110,446
<u>MD5 - Off-Site Disposal in a Landfill</u>						
Capital Costs	Table C-16	0	0	n.a.	\$849,922	\$849,922
O&M Costs - Years 1-5 (post-construction)	Table C-16	1	5	n.a.	\$720	\$2,952
O&M Costs - Years 6-30	Table C-16	6	30	n.a.	\$360	\$2,991
Periodic Costs	Table C-16	0	0	n.a.	\$0	\$0
Total Present Value						\$855,865

Notes:

For Present Value calculations, the Discount Rate used is.... 7%

Costs and Present Value are based on "constant" or "real" 2009 dollars not adjusted for future inflation.

Unless identified separately, burden and profits are included in unit costs.

- ⁽¹⁾ Start Year is the year during which the capital construction or the O&M activities begin. Costs are assumed to be incurred on the first day of the year indicated.
- ⁽²⁾ End Year is the year during which the capital construction or the O&M activities are completed. Costs are assumed to be incurred on the first day of the year indicated.
- ⁽³⁾ Capital Costs are totals for the activity, not annualized; Annual O&M Costs are annualized to represent one year only; Periodic Costs are one-time or repeating (not annual) costs.
- ⁽⁴⁾ Present Value represents the total cost over the project life based on a discount rate applied to the estimated cost for each year after Year 0 (2009).

TABLE C-5
UPPER LEVEL MINE, LOWER LEVEL MILL, AND DRAINAGE DITCH SUBAREA
ALTERNATIVE MM2
CONSOLIDATE IN ON-SITE REPOSITORY AT LOWER LEVEL MILL AREA

Item	Notes	Quantity	Unit	Unit Cost	Total Cost
Capital Costs					
<u>Direct Construction</u>					
Clear and grub	a	2.9	acre	\$8,980	\$26,042
Demolish silo, etc in lower area	a	1	each	\$11,000	\$11,000
Regrade development rock in lower area	a	5,905	cy	\$1.90	\$11,220
Excav/haul dev rock from mill, homesite, roads	a	6,315	cy	\$3.50	\$22,103
Excav/haul drum area soils	a	500	cy	\$3.50	\$1,750
Excav/haul tailings from drainage/distressed area	a	7,220	cy	\$3.70	\$26,714
Grade excavated areas for drainage	a	7.2	acre	\$1,100	\$7,920
Place materials in repository - 12" lifts	a	14,085	cy	\$2.30	\$32,396
Haul/place cover soil - 1' thick	a	1,410	cy	\$14.80	\$20,868
Grade runon control ditch at repository	a, b	225	ft	\$60	\$13,500
Seed and mulch all excavation/repository areas	a	8.1	acre	\$2,400	\$19,440
Institutional controls	b	1	each	\$10,000	\$10,000
Direct Construction Subtotal					\$202,952
<u>Indirect Construction</u>					
Mobilization/Demobilization	b	5%			\$10,148
Water/Sediment Control	b	3%			\$5,074
Indirect Construction Subtotal					\$15,221
Construction Subtotal					\$218,173
<u>Contingencies</u>					
Scope	c	10%			\$21,817
Bid	c	15%			\$32,726
Subtotal					\$272,716
Project Management	c	8%			\$21,817
Remedial Design	c	15%			\$40,907
Construction Management	c	10%			\$27,272
TOTAL CAPITAL COSTS					\$362,712
Annual O&M Costs					
Maintenance of seeded areas + inspections (Yr 1-5)	d	8.1	acre	\$600	\$4,860
Inspections only (Years 6-30)	e	8.1	acre	\$300	\$2,430
TOTAL ANNUAL O&M COSTS - Years 1-5					\$4,860
TOTAL ANNUAL O&M COSTS - Years 6-30					\$2,430
TOTAL PERIODIC COSTS					\$0

Notes

- a Unit cost developed from RS Means data - 2009.
- b Assumed values/professional judgment.
- c Based on EPA FS Cost Guidance.
- d For Years 1-5, annual O&M is assumed to involve maintenance/additional revegetation as required in previously seeded areas, along with inspections of all areas an average of twice per year (annually and after severe storm events) with limited repair required.
- e For Years 6-30, annual O&M is assumed to involve inspections of all areas at an average frequency of twice per year (annually and after severe storm events) with limited repair required.

TABLE C-6
UPPER LEVEL MINE, LOWER LEVEL MILL, AND DRAINAGE DITCH SUBAREA
ALTERNATIVE MM3
CONSOLIDATE IN ON-SITE REPOSITORY AT TAILINGS ACCUMULATION AREA

Item	Notes	Quantity	Unit	Unit Cost	Total Cost
Capital Costs					
<u>Direct Construction</u>					
Clear and grub	a	2.9	acre	\$8,980	\$26,042
Excav/haul dev rock from mine/mill, etc	a	12,220	cy	\$3.80	\$46,436
Excav/haul drum area soils	a	500	cy	\$3.50	\$1,750
Excav/haul tailings from drainage/distressed area	a	7,220	cy	\$3.50	\$25,270
Grade excavated areas for drainage	a	7.8	acre	\$1,100	\$8,580
Place materials in repository - 12" lifts	a	19,940	cy	\$2.30	\$45,862
Haul/place cover soil - 1' thick	a	2,000	cy	\$14.80	\$29,600
Grade runon control ditch at repository	a, b	300	ft	\$60	\$18,000
Seed and mulch all excavation/repository areas	a	9.0	acre	\$2,400	\$21,600
Institutional controls	b	1	each	\$10,000	\$10,000
Direct Construction Subtotal					\$233,140
<u>Indirect Construction</u>					
Mobilization/Demobilization	b	5%			\$11,657
Water/Sediment Control	b	3%			\$5,829
Indirect Construction Subtotal					\$17,486
Construction Subtotal					\$250,626
<u>Contingencies</u>					
Scope	c	10%			\$25,063
Bid	c	15%			\$37,594
Subtotal					\$313,282
Project Management	c	8%			\$25,063
Remedial Design	c	15%			\$46,992
Construction Management	c	10%			\$31,328
TOTAL CAPITAL COSTS					\$416,665
Annual O&M Costs					
Maintenance of seeded areas + inspections (Yr 1-5)	d	9.0	acre	\$600	\$5,400
Inspections only (Years 6-30)	e	9.0	acre	\$300	\$2,700
TOTAL ANNUAL O&M COSTS - Years 1-5					\$5,400
TOTAL ANNUAL O&M COSTS - Years 6-30					\$2,700
TOTAL PERIODIC COSTS					\$0

Notes

- a Unit cost developed from RS Means data - 2009.
- b Assumed values/professional judgment.
- c Based on EPA FS Cost Guidance.
- d For Years 1-5, annual O&M is assumed to involve maintenance/additional revegetation as required in previously seeded areas, along with inspections of all areas an average of twice per year (annually and after severe storm events) with limited repair required.
- e For Years 6-30, annual O&M is assumed to involve inspections of all areas at an average frequency of twice per year (annually and after severe storm events) with limited repair required.

TABLE C-7
UPPER LEVEL MINE, LOWER LEVEL MILL, AND DRAINAGE DITCH SUBAREA
ALTERNATIVE MM4
DISPOSAL AT TECK PEND ORIELLE FACILITY

Item	Notes	Quantity	Unit	Unit Cost	Total Cost
Capital Costs					
<u>Direct Construction</u>					
Clear and grub	a	2.9	acre	\$8,980	\$26,042
Excav/haul dev rock, tailings distressed	a	19,440	cy	\$7.70	\$149,688
Excav/haul drum area soils	a	500	cy	\$7.70	\$3,850
Improvements on secondary road - rock, etc	a	0.4	mile	\$23,000	\$9,200
Grade excavated areas for drainage	a	7.8	acre	\$1,100	\$8,580
Direct disposal at Teck tailing pond	b	19,940	cy	\$7.85	\$156,529
Seed and mulch all excavation areas	a	7.8	acre	\$2,400	\$18,720
Institutional controls	c	1	each	\$5,000	\$5,000
Direct Construction Subtotal					\$377,609
<u>Indirect Construction</u>					
Mobilization/Demobilization	c	5%			\$18,880
Water/Sediment Control	c	3%			\$9,440
Indirect Construction Subtotal					\$28,321
Construction Subtotal					\$405,930
<u>Contingencies</u>					
Scope	d	10%			\$40,593
Bid	d	15%			\$60,889
Subtotal					\$507,412
Project Management	d	8%			\$40,593
Remedial Design	d	15%			\$76,112
Construction Management	d	10%			\$50,741
TOTAL CAPITAL COSTS					\$674,858
Annual O&M Costs					
Maintenance of seeded areas + inspections (Yr 1-5)	e	7.8	acre	\$600	\$4,680
Inspections only (Years 6-30)	f	7.8	acre	\$300	\$2,340
TOTAL ANNUAL O&M COSTS - Years 1-5					\$4,680
TOTAL ANNUAL O&M COSTS - Years 6-30					\$2,340
TOTAL PERIODIC COSTS					\$0

Notes

- a Unit cost developed from RS Means data - 2009.
- b Based on information provided by Teck.
- c Assumed values/professional judgment.
- d Based on EPA FS Cost Guidance.
- e For Years 1-5, annual O&M is assumed to involve maintenance/additional revegetation as required in previously seeded areas, along with inspections of all areas an average of twice per year (annually and after severe storm events) with limited repair required.
- f For Years 6-30, annual O&M is assumed to involve inspections of all areas at an average frequency of twice per year (annually and after severe storm events) with limited repair required.

TABLE C-8
UPPER LEVEL MINE, LOWER LEVEL MILL, AND DRAINAGE DITCH SUBAREA
ALTERNATIVE MM5
OFF-SITE DISPOSAL IN A LANDFILL

Item	Notes	Quantity	Unit	Unit Cost	Total Cost
Capital Costs					
<u>Direct Construction</u>					
Clear and grub	a	2.9	acre	\$8,980	\$26,042
Mix TSP w/tailings, TripleSuperPhosphate matl delivered	a	1,950	tons	\$480	\$936,000
Mix TSP with tailings - mixing/windrow cost	a	9,630	cy	\$0.30	\$2,889
Analytical laboratory cost to confirm TCLP passes	b	2	each	\$200	\$400
Excav/haul dev rock, treated tailings	a	22,350	cy	\$40	\$894,000
Graham Road landfill fees	a	22,350	cy	\$34	\$759,900
Grade excavated areas for drainage	a	7.8	acre	\$1,100	\$8,580
Seed and mulch all excavation areas	a	7.8	acre	\$2,400	\$18,720
Institutional controls	b	1	each	\$5,000	\$5,000
Direct Construction Subtotal					\$2,651,531
<u>Indirect Construction</u>					
Mobilization/Demobilization	b	5%			\$132,577
Water/Sediment Control	b	3%			\$66,288
Indirect Construction Subtotal					\$198,865
Construction Subtotal					\$2,850,396
<u>Contingencies</u>					
Scope	c	10%			\$285,040
Bid	c	15%			\$427,559
Subtotal					\$3,562,995
Project Management	c	5%			\$178,150
Remedial Design	c	8%			\$285,040
Construction Management	c	6%			\$213,780
TOTAL CAPITAL COSTS					\$4,239,964
Annual O&M Costs					
Maintenance of seeded areas + inspections (Yr 1-5)	d	7.8	acre	\$600	\$4,680
Inspections only (Years 6-30)	e	7.8	acre	\$300	\$2,340
TOTAL ANNUAL O&M COSTS - Years 1-5					\$4,680
TOTAL ANNUAL O&M COSTS - Years 6-30					\$2,340
TOTAL PERIODIC COSTS					\$0

Notes

- a Unit cost developed from RS Means data - 2009. TSP unit cost from JR Simplot, Boise, Idaho + assumed shipping cost.
- b Assumed values/professional judgment.
- c Based on EPA FS Cost Guidance.
- d For Years 1-5, annual O&M is assumed to involve maintenance/additional revegetation as required in previously seeded areas, along with inspections of all areas an average of twice per year (annually and after severe storm events) with limited repair required.
- e For Years 6-30, annual O&M is assumed to involve inspections of all areas at an average frequency of twice per year (annually and after severe storm events) with limited repair required.

TABLE C-9
TAILINGS ACCUMULATION SUBAREA
ALTERNATIVE TA2
CONSOLIDATE IN ON-SITE REPOSITORY AT LOWER LEVEL MILL AREA

Item	Notes	Quantity	Unit	Unit Cost	Total Cost
Capital Costs					
<u>Direct Construction</u>					
Excav/haul tailings from tailings accumulation area	a	19,700	cy	\$3.80	\$74,860
Demolish silo, etc in lower area	a	1	each	\$11,000	\$11,000
Grade excavated areas for drainage	a	3.1	acre	\$1,100	\$3,410
Place materials in repository - 12" lifts	a	19,700	cy	\$2.30	\$45,310
Haul/place cover soil - 1' thick	a	1,975	cy	\$14.80	\$29,230
Grade runon control ditch at repository	a, b	300	ft	\$60	\$18,000
Seed and mulch all excavation/repository areas	a	4.3	acre	\$2,400	\$10,320
Institutional controls	b	1	each	\$10,000	\$10,000
Direct Construction Subtotal					\$202,130
<u>Indirect Construction</u>					
Mobilization/Demobilization	b	5%			\$10,107
Water/Sediment Control	b	3%			\$5,053
Indirect Construction Subtotal					\$15,160
Construction Subtotal					\$217,290
<u>Contingencies</u>					
Scope	c	10%			\$21,729
Bid	c	15%			\$32,593
Subtotal					\$271,612
Project Management	c	8%			\$21,729
Remedial Design	c	15%			\$40,742
Construction Management	c	10%			\$27,161
TOTAL CAPITAL COSTS					\$361,244
Annual O&M Costs					
Maintenance of seeded areas + inspections (Yr 1-5)	d	4.3	acre	\$600	\$2,580
Inspections only (Years 6-30)	e	4.3	acre	\$300	\$1,290
TOTAL ANNUAL O&M COSTS - Years 1-5					\$2,580
TOTAL ANNUAL O&M COSTS - Years 6-30					\$1,290
TOTAL PERIODIC COSTS					\$0

Notes

- a Unit cost developed from RS Means data - 2009.
- b Assumed values/professional judgment.
- c Based on EPA FS Cost Guidance.
- d For Years 1-5, annual O&M is assumed to involve maintenance/additional revegetation as required in previously seeded areas, along with inspections of all areas an average of twice per year (annually and after severe storm events) with limited repair required.
- e For Years 6-30, annual O&M is assumed to involve inspections of all areas at an average frequency of twice per year (annually and after severe storm events) with limited repair required.

TABLE C-10
TAILINGS ACCUMULATION SUBAREA
ALTERNATIVE TA3
CONSOLIDATE IN ON-SITE REPOSITORY AT TAILINGS ACCUMULATION AREA

Item	Notes	Quantity	Unit	Unit Cost	Total Cost
Capital Costs					
<u>Direct Construction</u>					
Regrade tailings	a	6,600	cy	\$1.90	\$12,540
Grade excavated areas for drainage	a	2.0	acre	\$1,100	\$2,200
Haul/place cover soil - 1' thick	a	1,970	cy	\$14.80	\$29,156
Grade runon control ditch at repository	a, b	300	ft	\$60	\$18,000
Seed and mulch all excavation/repository areas	a	3.2	acre	\$2,400	\$7,680
Institutional controls	b	1	each	\$10,000	\$10,000
Direct Construction Subtotal					\$79,576
<u>Indirect Construction</u>					
Mobilization/Demobilization	b	5%			\$3,979
Water/Sediment Control	b	3%			\$1,989
Indirect Construction Subtotal					\$5,968
Construction Subtotal					\$85,544
<u>Contingencies</u>					
Scope	c	10%			\$8,554
Bid	c	15%			\$12,832
Subtotal					\$106,930
Project Management	c	10%			\$10,693
Remedial Design	c	20%			\$21,386
Construction Management	c	15%			\$16,040
TOTAL CAPITAL COSTS					\$155,049
Annual O&M Costs					
Maintenance of seeded areas + inspections (Yr 1-5)	d	3.2	acre	\$600	\$1,920
Inspections only (Years 6-30)	e	3.2	acre	\$300	\$960
TOTAL ANNUAL O&M COSTS - Years 1-5					\$1,920
TOTAL ANNUAL O&M COSTS - Years 6-30					\$960
TOTAL PERIODIC COSTS					\$0

Notes

- a Unit cost developed from RS Means data - 2009.
- b Assumed values/professional judgment.
- c Based on EPA FS Cost Guidance.
- d For Years 1-5, annual O&M is assumed to involve maintenance/additional revegetation as required in previously seeded areas, along with inspections of all areas an average of twice per year (annually and after severe storm events) with limited repair required.
- e For Years 6-30, annual O&M is assumed to involve inspections of all areas at an average frequency of twice per year (annually and after severe storm events) with limited repair required.

**TABLE C-11
TAILINGS ACCUMULATION SUBAREA
ALTERNATIVE TA4
DISPOSAL AT TECK PEND OREILLE FACILITY**

Item	Notes	Quantity	Unit	Unit Cost	Total Cost
Capital Costs					
<u>Direct Construction</u>					
Excav/haul tailings from accumulation area	a	19,700	cy	\$8.50	\$167,450
Improvements on secondary road - rock, etc	a	0.4	mile	\$23,000	\$9,200
Grade excavated areas for drainage	a	3.1	acre	\$1,100	\$3,410
Direct disposal at Teck tailings pond	b	19,700	cy	\$7.85	\$154,645
Seed and mulch all excavation areas	a	3.1	acre	\$2,400	\$7,440
Institutional controls	c	1	each	\$5,000	\$5,000
Direct Construction Subtotal					\$347,145
<u>Indirect Construction</u>					
Mobilization/Demobilization	c	5%			\$17,357
Water/Sediment Control	c	3%			\$8,679
Indirect Construction Subtotal					\$26,036
Construction Subtotal					\$373,181
<u>Contingencies</u>					
Scope	d	10%			\$37,318
Bid	d	15%			\$55,977
Subtotal					\$466,476
Project Management	d	8%			\$37,318
Remedial Design	d	15%			\$69,971
Construction Management	d	10%			\$46,648
TOTAL CAPITAL COSTS					\$620,413
Annual O&M Costs					
Maintenance of seeded areas + inspections (Yr 1-5)	e	3.1	acre	\$600	\$1,860
Inspections only (Years 6-30)	f	3.1	acre	\$300	\$930
TOTAL ANNUAL O&M COSTS - Years 1-5					\$1,860
TOTAL ANNUAL O&M COSTS - Years 6-30					\$930
TOTAL PERIODIC COSTS					\$0

Notes

- a Unit cost developed from RS Means data - 2009.
- b Based on information provided by Teck.
- c Assumed values/professional judgment.
- d Based on EPA FS Cost Guidance.
- e For Years 1-5, annual O&M is assumed to involve maintenance/additional revegetation as required in previously seeded areas, along with inspections of all areas an average of twice per year (annually and after severe storm events) with limited repair required.
- f For Years 6-30, annual O&M is assumed to involve inspections of all areas at an average frequency of twice per year (annually and after severe storm events) with limited repair required.

TABLE C-12
TAILINGS ACCUMULATION SUBAREA
ALTERNATIVE TA5
OFF-SITE DISPOSAL IN A LANDFILL

Item	Notes	Quantity	Unit	Unit Cost	Total Cost
Capital Costs					
<u>Direct Construction</u>					
Mix TSP w/tailings, TripleSuperPhosphate matl delivered	a	5,320	tons	\$480	\$2,553,600
Mix TSP with tailings - mixing/windrow cost	a	26,270	cy	\$0.30	\$7,881
Analytical laboratory cost to confirm TCLP passes	b	2	each	\$200	\$400
Excav/haul treated tailings (incl TSP)	a	26,270	cy	\$40	\$1,050,800
Graham Road landfill fees	a	26,270	cy	\$34	\$893,180
Grade excavated areas for drainage	a	3.1	acre	\$1,100	\$3,410
Seed and mulch all excavation areas	a	3.1	acre	\$2,400	\$7,440
Institutional controls	b	1	each	\$5,000	\$5,000
Direct Construction Subtotal					\$4,521,711
<u>Indirect Construction</u>					
Mobilization/Demobilization	b	5%			\$226,086
Water/Sediment Control	b	3%			\$113,043
Indirect Construction Subtotal					\$339,128
Construction Subtotal					\$4,860,839
<u>Contingencies</u>					
Scope	c	10%			\$486,084
Bid	c	15%			\$729,126
Subtotal					\$6,076,049
Project Management	c	5%			\$303,802
Remedial Design	c	8%			\$486,084
Construction Management	c	6%			\$364,563
TOTAL CAPITAL COSTS					\$7,230,498
Annual O&M Costs					
Maintenance of seeded areas + inspections (Yr 1-5)	d	3.1	acre	\$600	\$1,860
Inspections only (Years 6-30)	e	3.1	acre	\$300	\$930
TOTAL ANNUAL O&M COSTS - Years 1-5					\$1,860
TOTAL ANNUAL O&M COSTS - Years 6-30					\$930
TOTAL PERIODIC COSTS					\$0

Notes

- a Unit cost developed from RS Means data - 2009. TSP unit cost from JR Simplot, Boise, Idaho + assumed shipping cost.
- b Assumed values/professional judgment.
- c Based on EPA FS Cost Guidance.
- d For Years 1-5, annual O&M is assumed to involve maintenance/additional revegetation as required in previously seeded areas, along with inspections of all areas an average of twice per year (annually and after severe storm events) with limited repair required.
- e For Years 6-30, annual O&M is assumed to involve inspections of all areas at an average frequency of twice per year (annually and after severe storm events) with limited repair required.

TABLE C-13
MAN-MADE DITCH AND DOWNGRADE DITCH SUBAREA
ALTERNATIVE MD2
CONSOLIDATE IN ON-SITE REPOSITORY AT LOWER LEVEL MILL AREA

Item	Notes	Quantity	Unit	Unit Cost	Total Cost
Capital Costs					
<u>Direct Construction</u>					
Clear and grub	a	1.2	acre	\$8,980	\$10,776
Demolish silo, etc in lower area	a	1	each	\$11,000	\$11,000
Excav/haul tailings from ditch areas	a	2,155	cy	\$4.00	\$8,620
Grade excavated areas for drainage	a	1.2	acre	\$1,100	\$1,320
Place materials in repository - 12" lifts	a	2,155	cy	\$2.30	\$4,957
Haul/place cover soil - 1' thick	a	221	cy	\$14.80	\$3,271
Grade runoff control ditch at repository	a, b	35	ft	\$60	\$2,100
Seed and mulch all excavation/repository areas	a	1.3	acre	\$2,400	\$3,120
Institutional controls	b	1	each	\$10,000	\$10,000
Direct Construction Subtotal					\$55,163
<u>Indirect Construction</u>					
Mobilization/Demobilization	b	5%			\$2,758
Water/Sediment Control	b	3%			\$1,379
Indirect Construction Subtotal					\$4,137
Construction Subtotal					\$59,301
<u>Contingencies</u>					
Scope	c	10%			\$5,930
Bid	c	15%			\$8,895
Subtotal					\$74,126
Project Management	c	10%			\$7,413
Remedial Design	c	20%			\$14,825
Construction Management	c	15%			\$11,119
TOTAL CAPITAL COSTS					\$107,482
Annual O&M Costs					
Maintenance of seeded areas + inspections (Yr 1-5)	d	1.3	acre	\$600	\$780
Inspections only (Years 6-30)	e	1.3	acre	\$300	\$390
TOTAL ANNUAL O&M COSTS - Years 1-5					\$780
TOTAL ANNUAL O&M COSTS - Years 6-30					\$390
TOTAL PERIODIC COSTS					\$0

Notes

- a Unit cost developed from RS Means data - 2009.
- b Assumed values/professional judgment.
- c Based on EPA FS Cost Guidance.
- d For Years 1-5, annual O&M is assumed to involve maintenance/additional revegetation as required in previously seeded areas, along with inspections of all areas an average of twice per year (annually and after severe storm events) with limited repair required.
- e For Years 6-30, annual O&M is assumed to involve inspections of all areas at an average frequency of twice per year (annually and after severe storm events) with limited repair required.

TABLE C-14
MAN-MADE DITCH AND DOWNGRAIDENT DITCH SUBAREA
ALTERNATIVE MD3
CONSOLIDATE IN ON-SITE REPOSITORY AT TAILINGS ACCUMULATION AREA

Item	Notes	Quantity	Unit	Unit Cost	Total Cost
Capital Costs					
<u>Direct Construction</u>					
Clear and grub	a	1.2	acre	\$8,980	\$10,776
Excav/haul tailings from ditch areas	a	2,155	cy	\$3.50	\$7,543
Grade excavated areas for drainage	a	1.2	acre	\$1,100	\$1,320
Place materials in repository - 12" lifts	a	2,155	cy	\$2.30	\$4,957
Haul/place cover soil - 1' thick	a	216	cy	\$14.80	\$3,197
Grade runon control ditch at repository	a, b	33	ft	\$60	\$1,980
Seed and mulch all excavation/repository areas	a	1.3	acre	\$2,400	\$3,120
Institutional controls	b	1	each	\$10,000	\$10,000
Direct Construction Subtotal					\$42,892
<u>Indirect Construction</u>					
Mobilization/Demobilization	b	5%			\$2,145
Water/Sediment Control	b	3%			\$1,072
Indirect Construction Subtotal					\$3,217
Construction Subtotal					\$46,109
<u>Contingencies</u>					
Scope	c	10%			\$4,611
Bid	c	15%			\$6,916
Subtotal					\$57,636
Project Management	c	10%			\$5,764
Remedial Design	c	20%			\$11,527
Construction Management	c	15%			\$8,645
TOTAL CAPITAL COSTS					\$83,572
Annual O&M Costs					
Maintenance of seeded areas + inspections (Yr 1-5)	d	1.3	acre	\$600	\$780
Inspections only (Years 6-30)	e	1.3	acre	\$300	\$390
TOTAL ANNUAL O&M COSTS - Years 1-5					\$780
TOTAL ANNUAL O&M COSTS - Years 6-30					\$390
TOTAL PERIODIC COSTS					\$0

Notes

- a Unit cost developed from RS Means data - 2009.
- b Assumed values/professional judgment.
- c Based on EPA FS Cost Guidance.
- d For Years 1-5, annual O&M is assumed to involve maintenance/additional revegetation as required in previously seeded areas, along with inspections of all areas an average of twice per year (annually and after severe storm events) with limited repair required.
- e For Years 6-30, annual O&M is assumed to involve inspections of all areas at an average frequency of twice per year (annually and after severe storm events) with limited repair required.

TABLE C-15
MAN-MADE DITCH AND DOWNGRAIDENT DITCH SUBAREA
ALTERNATIVE MD4
DISPOSAL AT TECK PEND OREILLE FACILITY

Item	Notes	Quantity	Unit	Unit Cost	Total Cost
Capital Costs					
<u>Direct Construction</u>					
Excav/haul tailings from ditches	a	2,155	cy	\$8.50	\$18,318
Improvements on secondary road - rock, etc	a	0.4	mile	\$23,000	\$9,200
Grade excavated areas for drainage	a	1.2	acre	\$1,100	\$1,320
Direct disposal at Teck tailings pond	b	2,155	cy	\$7.85	\$16,917
Seed and mulch all excavation areas	a	1.2	acre	\$2,400	\$2,880
Institutional controls	c	1	each	\$5,000	\$5,000
Direct Construction Subtotal					\$53,634
<u>Indirect Construction</u>					
Mobilization/Demobilization	c	5%			\$2,682
Water/Sediment Control	c	3%			\$1,341
Indirect Construction Subtotal					\$4,023
Construction Subtotal					\$57,657
<u>Contingencies</u>					
Scope	d	10%			\$5,766
Bid	d	15%			\$8,649
Subtotal					\$72,071
Project Management	d	10%			\$7,207
Remedial Design	d	20%			\$14,414
Construction Management	d	15%			\$10,811
TOTAL CAPITAL COSTS					\$104,503
Annual O&M Costs					
Maintenance of seeded areas + inspections (Yr 1-5)	e	1.2	acre	\$600	\$720
Inspections only (Years 6-30)	f	1.2	acre	\$300	\$360
TOTAL ANNUAL O&M COSTS - Years 1-5					\$720
TOTAL ANNUAL O&M COSTS - Years 6-30					\$360
TOTAL PERIODIC COSTS					\$0

Notes

- a Unit cost developed from RS Means data - 2009.
- b Based on information provided by Teck.
- c Assumed values/professional judgment.
- d Based on EPA FS Cost Guidance.
- e For Years 1-5, annual O&M is assumed to involve maintenance/additional revegetation as required in previously seeded areas, along with inspections of all areas an average of twice per year (annually and after severe storm events) with limited repair required.
- f For Years 6-30, annual O&M is assumed to involve inspections of all areas at an average frequency of twice per year (annually and after severe storm events) with limited repair required.

TABLE C-16
MAN-MADE DITCH AND DOWNGRADIENT DITCH SUBAREA
ALTERNATIVE MD5
OFF-SITE DISPOSAL IN A LANDFILL

Item	Notes	Quantity	Unit	Unit Cost	Total Cost
Capital Costs					
<u>Direct Construction</u>					
Mix TSP w/tailings, TripleSuperPhosphate matl delivered	a	580	tons	\$480	\$278,400
Mix TSP with tailings - mixing/windrow cost	a	2,880	cy	\$0.30	\$864
Analytical laboratory cost to confirm TCLP passes	b	2	each	\$200	\$400
Excav/haul treated tailings (incl TSP)	a	2,880	cy	\$40	\$115,200
Graham Road landfill fees	a	2,880	cy	\$34	\$97,920
Grade excavated areas for drainage	a	1.2	acre	\$1,100	\$1,320
Seed and mulch all excavation areas	a	1.2	acre	\$2,400	\$2,880
Institutional controls	b	1	each	\$5,000	\$5,000
Direct Construction Subtotal					\$501,984
<u>Indirect Construction</u>					
Mobilization/Demobilization	b	5%			\$25,099
Water/Sediment Control	b	3%			\$12,550
Indirect Construction Subtotal					\$37,649
Construction Subtotal					\$539,633
<u>Contingencies</u>					
Scope	c	10%			\$53,963
Bid	c	15%			\$80,945
Subtotal					\$674,541
Project Management	c	6%			\$40,472
Remedial Design	c	12%			\$80,945
Construction Management	c	8%			\$53,963
TOTAL CAPITAL COSTS					\$849,922
Annual O&M Costs					
Maintenance of seeded areas + inspections (Yr 1-5)	d	1.2	acre	\$600	\$720
Inspections only (Years 6-30)	e	1.2	acre	\$300	\$360
TOTAL ANNUAL O&M COSTS - Years 1-5					\$720
TOTAL ANNUAL O&M COSTS - Years 6-30					\$360
TOTAL PERIODIC COSTS					\$0

Notes

- a Unit cost developed from RS Means data - 2009. TSP unit cost from JR Simplot, Boise, Idaho + assumed shipping cost.
- b Assumed values/professional judgment.
- c Based on EPA FS Cost Guidance.
- d For Years 1-5, annual O&M is assumed to involve maintenance/additional revegetation as required in previously seeded areas, along with inspections of all areas an average of twice per year (annually and after severe storm events) with limited repair required.
- e For Years 6-30, annual O&M is assumed to involve inspections of all areas at an average frequency of twice per year (annually and after severe storm events) with limited repair required.