APPENDIX A

SUMMARY OF MINE AND MILL INVESTIGATIONS IN STEVENS COUNTY, WASHINGTON

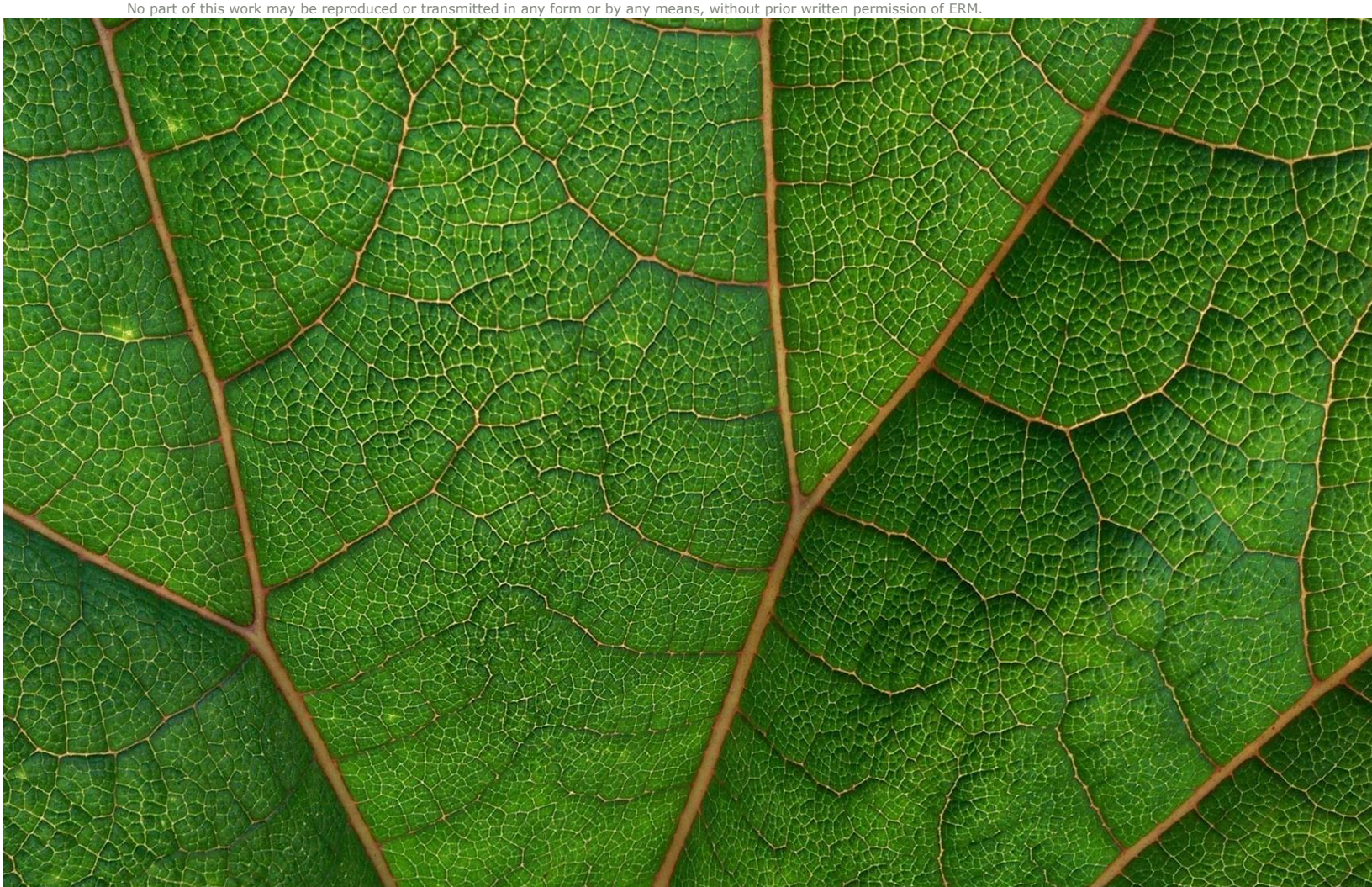
Appendix A: Summary of Mine and Mill Investigations in Stevens County, Washington

Final Upland RI Report, Upper Columbia River, Washington

PREPARED FOR
Teck American Incorporated

DATE
August 2025

REFERENCE
0766662



CONTENTS

LIST OF MAPS

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

Acronym	Description
µg/L	microgram(s) per liter
AOI	area(s) of interest
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Ecology	Washington State Department of Ecology
EE/CA	engineering evaluation and cost analysis

Acronym	Description
EPA	U.S. Environmental Protection Agency
FS	feasibility study
HDPE	high density polyethylene
mg/kg	milligram(s) per kilogram
MTCA	Model Toxics Control Act
OU	operable unit
PA/SI	preliminary assessment and site inspection
RA	removal assessment
RI	remedial investigation
SPLP	Synthetic Precipitation Leaching Procedure
TCLP	Toxicity Characteristic Leaching Procedure
UCR	Upper Columbia River
XRF	x-ray fluorescence

1. INTRODUCTION

The objective of this appendix to the Remedial Investigation (RI) Report for Operable Unit (OU) 3 (hereafter, Upland RI report) is to summarize the results of investigations and cleanup activities for mine and mill sites in Stevens County, Washington.

Mining and mining-related operations have occurred throughout northeastern Washington and southeastern British Columbia since the mid to late 1800s. There are no active metal mining operations currently within the OU 3 study area[1], but there are ongoing nonmetal operations (e.g., limestone and gravel quarries). Area mines and mills are included in the list of known and potential sources of contamination to the Upper Columbia River (UCR) Site (USEPA 2008).[2]

A number of the mining and mining-related operations within the OU 3 study area have been investigated by the U.S. Environmental Protection Agency (EPA) or others. These include 39 sites along tributaries to the Upper Columbia River in Stevens County that were evaluated as part of the Stevens County Mines and Mills Preliminary Assessment and Site Inspection (PA/SI) (USEPA 2002) and the Young America Mine/Mill site, which is located in Stevens County near Bossburg Flat Beach (Map A-1). Cleanup actions have been completed, are in progress, or are planned at several of these mines and mill sites.

2. SUMMARY OF STEVENS COUNTY MINES AND MILLS PA/SI

The purpose of the Stevens County Mines and Mills PA/SI (USEPA 2002) was to identify and investigate potential sources of contamination to the Upper Columbia River and evaluate potential impacts to receptors via the surface water pathway. Of the 39 sites investigated by EPA, 18 sites met criteria for sample collection. These criteria included: 1) the identification of potential sources of contamination, and 2) observation of possible impacts to receptors via the surface water migration pathway[3]. Soil, sediment, surface water, waste rock, and/or tailings were sampled at these facilities. Table A-1 provides dates of operation, geologic unit(s) mined, primary commodity(ies) produced, estimated total production, and site status for each site evaluated during the PA/SI.

[1] For the purposes of the Upland RI report, the OU 3 study area is defined as the boundary of Upper Lake Roosevelt Water Resource Inventory Area.
[2] Per the June 2, 2006, Settlement Agreement for Implementation of Remedial Investigation and Feasibility Study (RI/FS) at the Upper Columbia River Site (referred to herein as the UCR Site or Site), the Site consists of the areal extent of hazardous substances contamination within the United States in or adjacent to the Upper Columbia River, including the Franklin D. Roosevelt Lake, from the U.S.-Canada border south to the Grand Coulee Dam, and all suitable areas in proximity to such contamination necessary for implementation of the response actions (RI/FS) described therein.
[3] Two sites, the Le Roi/Northport Smelter and Deep Creek Mine, were also evaluated for the soil exposure pathway.

The types of samples collected during the PA/SI, the associated analytical results, and the conclusions from the PA/SI are summarized in Table A-2. Of the 18 sites where sampling was performed:

- Eleven sites were recommended for no further action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): Black Rock Mine/Mill, Copper King Mine, Daisy Mine, Deep Creek Mine, Electric Point Mine/Mill, Gladstone Mine/Mill, Great Western Mine, Iroquois Mine, Northwest Alloys, Red Top Mine, and Sierra Zinc Mine/Mill.
- Seven sites were concluded to have metals concentrations in environmental media that indicate that harmful chemicals may be migrating to receptors: Anderson Calhoun Mine/Mill, Last Chance Mine/Mill, L-Bar/Northwest Magnesite, Le Roi/Northport Smelter, Melrose Mine, Napoleon Mine/Mill, and Van Stone Mine/Mill.
- Five sites were recommended for further action by EPA: Anderson Calhoun Mine/Mill, Last Chance Mine/Mill, L-Bar/Northwest Magnesite[4], Le Roi/Northport Smelter, Van Stone Mine/Mill.

The extent of soil impacts around the mine and mill sites is expected to be localized; however, because of the limited number of soil samples collected during the PA/SI and the focus of the PA/SI on evaluating potential impacts to the Upper Columbia River via the surface water pathway, the data collected during the PA/SI does not support an evaluation of the extent of soil metals impacts at or surrounding the subset of mine and mill sites that were selected for sampling.

3. STEVENS COUNTY MINE AND MILL SITES WHERE ADDITIONAL INVESTIGATION AND/OR CLEANUP WAS COMPLETED

Additional investigation activities and/or cleanup actions have been completed and/or are ongoing at the PA/SI sites Anderson Calhoun Mine/Mill, Last Chance Mine/Mill, L-Bar/Northwest Magnesite, Le Roi/Northport Smelter, and Van Stone Mine/Mill sites, which were recommended for further action by EPA in the PA/SI (USEPA 2002). Although not recommended for further action by EPA in the PA/SI (USEPA 2002), cleanup actions and/or additional investigation activities have also been conducted at the Sierra Zinc Mine/Mill and Deep Creek Mine sites (Table A-2). Investigation and cleanup work completed in association with the Le Roi/Northport Smelter is described in detail in Sections 2.10.1.2 and 3.7 of the Upland RI report and in Appendix B of the Upland RI report.

Synopses of the investigations and, where applicable, cleanup activities, completed at the Anderson Calhoun Mine/Mill, Deep Creek Mine, Last Chance Mine/Mill, Sierra Zinc Mine/Mill, and Van Stone Mine/Mill are provided in Table A-2 and in Sections 3.1 to 3.5, below. The synopses in Sections 3.1 to 3.5 also include summaries of the findings from the original PA/SI study, where applicable. While not evaluated or investigated as part of the Stevens County Mines and Mills PA/SI (USEPA 2002), investigation and cleanup work has also been completed by EPA and others

[4] The L-Bar/Northwest Magnesite facility is near Chewelah, Washington, outside the OU 3 study area (Map A-1) and is not described in detail herein.

at the Young America Mine/Mill. The results of work completed at the Young America Mine/Mill site are provided in Section 3.6.

Of the 39 sites investigated in the PA/SI (USEPA 2002), 20 sites were not recommended for further action by EPA; however, these sites are listed as "awaiting cleanup" by the Washington State Department of Ecology (Ecology) under the Model Toxics Control Act (MTCA) (Ecology 2024b). According to Ecology, sites with "awaiting cleanup" status have been identified as having suspected or confirmed contamination through an initial investigation or site assessment; however, remedial investigation has not been initiated at these sites by owners, voluntary cleanup, or the regulatory agency.

3.1 ANDERSON CALHOUN MINE/MILL

The Anderson Calhoun Mine/Mill site is an approximately 200-acre property near Leadpoint, Washington (Map A-1). Approximately 92 acres of the property were impacted by historical operations that took place between 1910 and the early 1980s. Anderson Calhoun Mine/Mill is listed on the Ecology Toxic Cleanup Program site under Cleanup Site ID 4519, Facility Site ID 8070626. The current site status is "No Further Action" (Ecology 2024b).

Operations at the Anderson Calhoun Mine/Mill included mining of barium, lead, and zinc ores; a flotation mill used to process zinc and barite ores; a tailings impoundment; and associated infrastructure (USEPA 2007; Ecology 2017b). EPA performed a time-critical removal action in 2002, and in 2004, EPA entered into an Administrative Order of Consent under CERCLA with three potentially responsible parties to prepare an engineering evaluation and cost analysis (EE/CA). The EE/CA was prepared in 2007 (USEPA 2007). Inorganic chemicals of concern include barium, cadmium, copper, lead, selenium, and zinc (Ecology 2017b)[5]. Data from the Anderson Calhoun Mine/Mill EE/CA are described in Section 3.9 of the Upland RI report.

As part of the EE/CA, a reconnaissance soil sampling investigation of the source areas including tailings impoundment, piles south of the mill building, and waste piles was conducted. In addition to a soil screening survey of the mine/mill area, a transect survey of the soil downwind of the tailings impoundment was also conducted. Sediment and surface water samples were collected from North Fork Deep Creek, mine pits, the tailings impoundment pond, and wetlands. Groundwater and soil in and around 10 pad-mounted transformers, the assay lab dump, and underground storage tank was also included in the investigation. Soil, sediment, surface water, groundwater, and biological samples were collected in the field and analyzed in the laboratory for total metals and other chemicals of potential concern. Barium, cadmium, lead, selenium, and zinc were retained as analytes for further evaluation. Several areas across the site were considered a risk to human receptors, and various removal actions were considered as a remedy. After comparative analysis of each alternative, the removal action alternative chosen included institutional controls, excavation, consolidation and capping of the tailings and ore piles, in

[5] Organic chemicals of concern were also identified at some mines and mills sites, but they are not relevant to the Upland RI and are therefore not described here.

addition to the filling of wetlands adjacent to the mine property and re-establishment of new wetland areas with long-term monitoring (USEPA 2007).

In 2010, EPA implemented the selected remedy, which consisted of consolidation and capping of the contaminated material, demolition of several structures, establishing an environmental covenant, and installation of a fence to control access. Remedy repairs were required in 2011, and the site has been in long-term monitoring and maintenance with institutional controls since then. The last 5-year review of the site indicated that the remedy is protective of human health and the environment, while concentrations of chemicals of concern in soil remain above cleanup levels (Ecology 2017b).

3.2 DEEP CREEK MINE

Deep Creek Mine was a zinc, lead, and silver mine that closed in 1955 following 11 years of production. The mine is located 7 miles southeast of Northport, Washington (Map A-1). Peak production occurred from 1944 to 1952 (USEPA 2002). Deep Creek Mine is listed on the Ecology Toxic Cleanup Program site under Cleanup Site ID 1969, Facility Site ID 7288890. The current site status is "Awaiting Cleanup" (Ecology 2024b). Features of concern at the mine site include waste rock piles, debris, wetlands, and transformers. As part of the Stevens County Mines and Mills PA/SI (USEPA 2002), 25 total samples were collected: 5 waste rock surface soil, 18 tailings surface soil, 1 sediment, and 1 surface water samples. Elevated concentrations of cadmium, lead, mercury, and zinc were encountered in surface soil samples, and elevated concentrations of lead and zinc were encountered in the surface water (USEPA 2002).

The Deep Creek Mine features of concern were evaluated in a 2006 Abandoned Mine Lands Initial Investigation performed by Hart Crowser on behalf of Ecology (Hart Crowser 2006a). Samples were collected from soil, waste rock, surface water, and seeps throughout the property. Results from the sampling indicated that surface soil samples collected from the waste rock piles and tailings piles contained significant concentrations of target analyte list metals including cadmium (425 mg/kg), lead (13,300 mg/kg), mercury (3.2 mg/kg), and zinc (123,000 mg/kg). Analytes detected at elevated concentrations in the surface water included lead (12.9 µg/L) and zinc (558 µg/L), with pH measured at 4.9 and 5.0. The investigation report concluded that soil and waste rock at the site contained concentrations of metals at levels greater than the human health screening criteria, with contaminants of concern including arsenic, cadmium, lead, mercury, selenium, and zinc. Impacts to human health were noted as a possibility for homeowners living within 700 feet of the site. Sampling of nearby residential water wells was recommended. Potential releases to the nearby Deep Creek were noted to be possible during rainfall events. A terrestrial ecological evaluation was recommended to assess ecological risks.

Further action has not been taken at the Deep Creek Mine site. However, this site is listed as "awaiting cleanup" by Ecology under MTCA (Ecology 2024b).

3.3 LAST CHANCE MINE/MILL

The Last Chance Mine/Mill is a former lead, silver, and zinc facility southeast of Northport, Washington, that began operation in the early 1900s (Map A-1). The flotation mill reportedly began construction in 1940. The mine workings are in the Middle Unit of the Metaline Formation, which is primarily dolomite (USEPA 2002). The site is listed in EPA's Superfund Enterprise Management System database (USEPA 2023), but it is not on the National Priorities List. An Eligible Response Site Exclusion decision has been made for this site. Last Chance Mine/Mill is listed on the Ecology Toxic Cleanup Program site under Cleanup Site ID 2073, Facility Site ID 1855805, and the current site status is "Awaiting Cleanup" (Ecology 2024b). Areas of interest (AOIs) at the site include waste rock piles, adits, and the mill building.

As part of the Stevens County Mines and Mills PA/SI (USEPA 2002), 12 samples were taken at the site: 1 surface water; 9 surface soil samples from waste rock, tailings, and mill areas; and 2 sediment samples. Surface soil samples from the waste rock, tailings pile, and the mill area contained elevated concentrations of metals including cadmium (518 mg/kg), lead (170,000 mg/kg), copper (2,790 mg/kg), mercury (2.7 mg/kg), and zinc (112,000 mg/kg). The sediment samples contained elevated concentrations of metals including cadmium (56.9 mg/kg), lead (14,600 mg/kg), mercury (1.2 mg/kg), and zinc (13,400 mg/kg). The surface water contained an elevated concentration of zinc (459 µg/L). The Stevens County Mines and Mills PA/SI concluded that metals concentrations indicate that harmful substances are migrating to targets/receptors (USEPA 2002).

The Last Chance Mine/Mill was evaluated in a 2006 Abandoned Mine Lands Initial Investigation performed by Hart Crowser on behalf of Ecology (Hart Crowser 2006b) to evaluate areas of concern at the mine. Samples were collected from soil and waste rock. Results from the sampling indicated that waste rock samples contained arsenic, mercury, selenium, and silver above MTCA Method A, MTCA Method B, or ecological screening criteria. The arsenic concentration in one sample was characterized as having the potential to fail Toxicity Characteristic Leaching Procedure (TCLP) criteria for hazardous waste. The investigation report concluded that human health risks were possible for recreational users. Potential releases to the nearby Eureka Creek were noted to be possible during rainfall events. A terrestrial ecological evaluation was recommended to assess ecological risks.

No information was available for additional investigation or remedial activities completed at the Last Chance Mine/Mill. However, the site is listed as "awaiting cleanup" by Ecology under MTCA (Ecology 2024b).

3.4 SIERRA ZINC MINE/MILL

Sierra Zinc Mine/Mill is a former gold, lead, silver, and zinc mine and mill located approximately 24 miles northeast of Colville (Map A-1). The mine and mill operated from 1889 sporadically through to the 1970s. After 1949, the mill's capacity reached 500 tons per day. Sierra Zinc Mine/Mill is listed on the Ecology Toxic Cleanup Program site under Cleanup Site ID 1838, Facility Site ID 1786484. The site status is "Construction Complete- Performance Monitoring" (Ecology 2024b).

EPA performed a PA/SI of the site in 2001 (USEPA 2002). During the investigation, 35 total samples were collected: 34 surface soil samples from waste rock, tailings piles, and the mill and 1 surface water sample. Surface soil samples contained elevated concentrations of metals including cadmium (130 mg/kg), lead (15,800 mg/kg), mercury (2.7 mg/kg), and zinc (33,400 mg/kg) and the surface water sample contained an elevated concentration of zinc (292 µg/L). No further action was required under CERCLA.

Following the PA/SI, the Washington State Department of Natural Resources completed an Inactive and Abandoned Mine Lands Investigation in 2003 (WDNR 2003). During the investigation, soil samples were collected from the tailings and rock piles, and surface water samples were collected from water flowing from the adit. Sample results indicated that metals lead, zinc, and cadmium concentrations exceeded MTCA cleanup levels for unrestricted land use in soil samples. Zinc exceeded the limit for chronic effect to aquatic life in one water sample.

Ecology and Environment, Inc., completed a Removal Site Evaluation for EPA in 2013 (Ecology and Environment 2013). Resource and Environmental Management Consultants conducted site characterization work concurrent with the Removal Site Evaluation. These investigations included collecting 25 surface soil, 7 surface water, 3 groundwater, and 3 sediment samples from the mine area and adjacent properties. Soil samples exceeded the removal management levels for arsenic, cadmium, lead, thallium, and zinc. Mercury concentrations in soil exceeded the MTCA Method A cleanup levels but not the removal management level. Cadmium, lead, and zinc exceeded the screening criteria for surface water; arsenic, cadmium, copper, and silver exceeded screening criteria for sediment; and arsenic, cadmium, copper, and iron exceeded screening criteria for groundwater. Data collected during the investigations were used to define the extents of impacts and to define removal areas and processes.

Removal actions for contaminated areas at the mine/mill were completed in accordance with the time-critical removal action for the Sierra Zinc Mine/Mill site. (Resource and Environmental Management Consultants 2015). Beginning in October 2014 through September 2015, the mill and barn buildings were demolished; soil with elevated lead concentrations (approximately 86,000 cubic yards) was excavated from near the tailings impoundment and placed into a high density polyethylene (HDPE) lined containment area within the onsite impoundment; and the impoundment was re-contoured with approximately 106,000 cubic yards clean of cover, revegetated, and a fence was placed around the impoundment. An environmental covenant was required to prohibit land disturbance. X-ray fluorescence (XRF) confirmation samples were collected to confirm the extent of the soil removal actions.

A periodic review was conducted at the mine in November 2023 to confirm protection of human health and the environment post-cleanup because residual concentrations of arsenic, cadmium, lead, and zinc greater than MTCA Method A cleanup levels were present post-cleanup (Ecology 2024a). The review confirmed that an environmental covenant was filed on November 22, 2017, to restrict land use. During the review, Ecology determined that the remedy was functioning as intended and no additional actions were required.

3.5 VAN STONE MINE/MILL

The Van Stone Mine/Mill is near the southern end of the Kootenay Arc in the Onion Creek watershed east of the Columbia River, within the Northport Mining District (Map A-1). The site is listed on the Ecology Toxic Cleanup Program site under Cleanup Site ID 461, Facility Site ID 1554858, and the current site status is "Cleanup Started" (Ecology 2024b).

The Van Stone Mine/Mill was operated intermittently as both an underground and open pit lead and zinc mine between 1938 and 1993, and 8.77 million tons of ore and waste rock were produced. Mining occurred periodically with multiple operators from 1971 through 1993, at which time it was put on standby status by the then-owner, Equinox Resources, Inc. Mineralization at the Van Stone Mine/Mill is hosted by the Middle Unit of the Metaline limestone. Site activities included drilling, blasting, and hauling rock; milling and ore benefaction; and disposal of waste rock and tailings. Lead and zinc concentrates were transferred offsite for refining (Hart Crowser 2013; Ecology 2017a). Data from RI and Feasibility Study (FS) investigations at the Van Stone Mine/Mill are described in Section 3.8 of the Upland RI report.

Investigations at the Van Stone site conducted by EPA as part of the development of the 2001 Stevens County Mines and Mills PA/SI (USEPA 2002) indicated the presence of waste rock, tailings piles, dispersed tailings, and stained soil covering an area of approximately 328 acres (USEPA 2002). Forty-six samples were collected at the site, including 21 surface soil samples from tailings, 19 additional surface soil samples from waste rock and stained soil, 1 surface water sample, and 5 sediment samples. The Stevens County Mines and Mills PA/SI concluded that metals concentrations indicated that harmful chemicals may be migrating to receptors (USEPA 2002). The Washington State Department of Natural Resources completed an Inactive and Abandoned Mine Lands Investigation for Van Stone Mine in 2005 (WDNR 2005). During the investigation, soil samples were collected from the tailings and rock piles and surface water samples were collected several pits and ponds. Sample results indicated that metals cadmium, copper, lead, and zinc concentrations exceeded MTCA cleanup levels for unrestricted land use in soil samples. Lead and zinc exceeded the limit for chronic effects to aquatic life in three water samples.

The Van Stone Mine/Mill was added to Ecology's Confirmed and Suspected Contaminated Sites list on September 6, 2006, with Facility Site ID Number 1554858.

In 2013, Ecology completed an RI at the Van Stone site (Hart Crowser 2013). The RI outlined five AOIs, including 1) the open pits, mill and waste rock area; 2) the upper tailings pile; 3) the lower tailings pile; 4) pipeline access roads; and 5) Onion Creek and associated tributaries. Samples collected for the RI identified elevated metals (antimony, arsenic, cadmium, copper, lead, and/or zinc) in soil, surface water, and/or sediment at each of the AOIs.

An FS was conducted in 2017 to develop and evaluate cleanup alternatives to address contamination identified in the 2013 RI and select a preferred cleanup alternative (Hart Crowser 2013; Ecology 2017a). Six alternatives were identified in the FS. Based on a disproportionate cost analysis, Alternative #5, creation of a centralized repository for tailings waste, was the recommended alternative. In this remedial strategy, the tailings and waste material from the mill

area/waste rock area, upper tailings pile, and pipeline access roads would be excavated and transported to the lower tailings pile. The lower tailings pile would be used as a central repository for the waste at the site, with a seven-layer cover placed on top of the waste. The excavated areas would be graded and revegetated.

A Cleanup Action Plan based on the findings of the RI and FS was developed by Ecology in 2023. Site-specific cleanup levels were identified for each media (soil, surface water, groundwater, and sediment) for indicator metals (antimony, arsenic, cadmium, copper, lead, mercury, selenium, silver, thallium, and/or zinc) (Ecology 2023). The selected remedy included the following: consolidation of contaminated soil from the upper tailings pile, mill area/waste rock area, and dispersed tailings associated with the pipeline access roads into the lower tailings pile; regrading of the lower tailings pile; installation of a six-layer cover system including an impermeable liner, multiple geotextile liners, and 3 feet of burrowing material and topsoil at the lower tailings pile; and installation of a buttress at the spillway at North Pit Lake per Dam Safety requirements. Groundwater monitoring, institutional controls, financial assurances, and periodic review were also required as part of the cleanup strategy. The cleanup action is currently underway at the site (Ecology 2024b).

3.6 YOUNG AMERICA MINE/MILL

The Young America Mine/Mill site is located near Bossburg Flat Beach (Map A-1). The site is listed on the Ecology Toxic Cleanup Program site under Cleanup Site ID 2712, Facility Site ID 6136163, and the current site status is "No Further Action" (Ecology 2024b).

The Young America Mine operated from 1897 to 1953 and produced gold, lead, silver, and zinc (USEPA 2012a). Production before 1905 is unknown; however, cumulative production between 1905 and 1954 is estimated to be 13,389 tons of raw ore containing approximately 940,000 pounds of lead, 772,000 pounds of zinc, 50 ounces of gold, and 70,000 ounces of silver (Fulkerson and Kingston 1958). Material was mined from the Cambrian Metaline Limestone (WDNR 2008). A mill that processed approximately 12,800 tons of raw ore in total during operation was located near the mine site, along the eastern shore of Lake Roosevelt. The mill operated from 1948 to 1954 (USEPA 2012a). Between 1950 and 1951, it is reported that a total of 23 tons of lead concentrate and 50 tons of zinc concentrate were shipped from the mill (Huntting 1956).

Data from investigations at the Young America Mine/Mill are described in Section 3.4 of the Upland RI report. Investigations at the Young America site conducted by the Washington State Department of Natural Resources as part of the development of their Inactive and Abandoned Mine Lands database indicated the presence of a water impoundment, tailings from the mill with an estimated volume of about 9,500 cubic yards covering an area of approximately 2 acres, and three waste rock dumps of less than 500 tons. In the water impoundment, the pH was 8.4; cadmium, copper, lead, and zinc met the requirements for groundwater; and lead and zinc exceeded hardness-based water quality standards for surface water. Analyses of arsenic, cadmium, lead, and zinc in a grab sample of tailings exceeded MTCA Method A levels for unrestricted and industrial or commercial land use. Material from the waste rock dump was not analyzed (WDNR 2008).

In 2011, EPA conducted a Removal Assessment (RA) at the Young America site. The RA focused on approximately 6 acres of the mill area, including the waste tailings impoundment and surrounding property, and approximately 17 acres of private property near the mine. Field XRF analysis was used to delineate the extent of potential soil contamination. Soil, sediment, surface water, and groundwater samples were collected and analyzed in the laboratory for total metals, and several soil samples were also analyzed using the TCLP and Synthetic Precipitation Leaching Procedure (SPLP). Laboratory results were compared to applicable screening levels (USEPA 2012a).

The RA concluded that the tailings impoundment, berm material, and some surface soils exceeded human health screening criteria. Approximately 700 cubic yards were estimated to be contaminated in the berms and surface soils outside the berm, along with approximately 13,000 square feet (0.3 acre) of soil between the mill and the impoundment. The depth of the tailings impoundment was not measured, so the volume of contaminated material could not be estimated. The mine and mill areas were referred to EPA for additional evaluation (USEPA 2012a).

Due to the presence of hazardous substances at the Young America site that posed risks to public health or welfare or the environment, a removal action was approved by EPA in August 2012. The intent of the removal action was to consolidate and cover the contaminated media to prevent exposure to humans and the ecosystem. The removal action included engineering and institutional controls, grading of the impoundment berms, consolidation of excavated contaminated soil at the base of the mill slope, crushing and capping of mill buildings in place, and installation of a protective cover over contaminated soil where concentrations exceeded MTCA Method A soil cleanup levels for unrestricted land uses for lead and zinc. Long-term monitoring and maintenance was recommended to ensure continued effectiveness of the action (USEPA 2012b). EPA completed the work between October 9, 2012, and November 3, 2012 (USEPA 2012c). No documentation of long-term monitoring and maintenance has been identified.

4. CONCLUSIONS

Numerous investigations have evaluated potential impacts to soil and other environmental media at historical mine and mill sites in Stevens County, Washington. The extent of soil impacts around mine/mill sites is expected to be localized; however, because the PA/SI was focused on evaluating potential impacts to the Upper Columbia River via the surface water pathway, the data collected during the PA/SI are insufficient to support an evaluation of the extent of soil metals impacts at or surrounding the subset of sites that were selected for sampling. The data are inadequate for several reasons:

- The PA/SI was focused on evaluating potential impacts to the Upper Columbia River via the surface water pathway; therefore, the data collected during the PA/SI does not support an evaluation of the extent of soil metals impacts at or surrounding the subset of sites that were selected for sampling (USEPA 2002).

- Only a subset of mine and mill sites were sampled during the PA/SI[6] (Table A-2). Nine of the sites that did not meet the criteria for sampling during the PA/SA are listed as "awaiting cleanup" by Ecology under MTCA (Ecology 2024b).
- Few or no soil samples were collected at sites where sampling was conducted (Table A-2).
- Data collected during the PA/SI and to support removal action planning were compared to screening levels that are higher than the background threshold values and risk-based concentrations used for evaluating nature and extent in the Upland RI report.

Given the absence of adequate characterization data for most of the mine and mill sites, further characterization may be needed if areas in OU 3 identified for remedial action are located near historical mine and mill sites.

[6] The stated criteria for sample collection included: 1) the identification of potential sources of contamination, and 2) observation of possible impacts to receptors via the surface water migration pathway. Two sites, the Le Roi/Northport Smelter and Deep Creek Mine, were also evaluated for the soil exposure pathway.

5. REFERENCES

Cox, M.W., and V.F. Hollister. 1955. The Chollet Project, Stevens County, Washington. *Trans. Am. Inst. Min. Metall. Pet. Eng. Inc.* 202(10).

Derkey, R.E., N.L. Joseph, and R. Lasmanis. 1990. Metal Mines of Washington – Preliminary Report. Washington Division of Geology and Earth Resources Open File Report 90-18. Washington State Department of Natural Resources, Olympia, WA.

Ecology (Washington State Department of Ecology). 2017a. Feasibility Study, Van Stone Mine, Onion Creek, Washington. Prepared by GeoEngineers for Washington State Department of Ecology Toxics Cleanup Program – Eastern Region Office, Spokane, WA. May 2, 2017.

Ecology. 2017b. Periodic Review. US EPA Anderson Calhoun Mine Site, Facility Site ID 8070626, Cleanup Site ID 4519. Calhoun Road, Leadpoint, Washington 99114. Prepared by the Washington State Department of Ecology Toxics Cleanup Program Eastern Region Office, Spokane, WA. September.

Ecology. 2023. Cleanup Action Plan, Van Stone Mine Onion Creek, Stevens County, WA, Facility Site ID: 1554858, Cleanup Site ID: 461. Toxics Cleanup Program. Washington State Department of Ecology, Spokane, WA. December 2023.

Ecology. 2024a. Periodic Review Sierra Zinc Mine Stevens County Facility Site ID: 1786484, Cleanup Site ID: 1838. Toxics Cleanup Program, Central Region, Washington State Department of Ecology, Union Gap, WA. July 2024.

Ecology. 2024b. Cleanup and Tank Search. Washington State Department of Ecology. https://apps.ecology.wa.gov/cleanupsearch/reports/cleanup/all. Accessed on February 6, 2025.

Ecology and Environment, Inc. 2013. Sierra Zinc Mine and Mill Removal Site Evaluation, Northport, Washington. Prepared for United States Environmental Protection Agency by Ecology and Environment, Inc., Seattle, WA. December 2013.

Fulkerson, F.B., and G.A. Kingston. 1958. Mine production of gold, silver, copper, lead, and zinc in Pend Oreille and Stevens Counties, Wash., 1902–56; Annual totals by mines, districts, and counties. U.S. Bureau of Mines Information Circular 7872, 51 p.

Hart Crowser. 2006a. Abandoned Mine Lands Initial Investigation Report, Deep Creek Mine, Spirit, Washington. 17274-00(DC). Prepared for Washington State Department of Ecology by Hart Crowser, Seattle, WA. December 28, 2006.

Hart Crowser. 2006b. Abandoned Mine Lands Initial Investigation Report, Last Chance Mine, Republic, Washington. 17274-00(LA). Prepared for Washington State Department of Ecology by Hart Crowser, Seattle, WA. December 28, 2006.

Hart Crowser. 2013. Van Stone Mine Remedial Investigation. 17800-00. Prepared for Washington State Department of Ecology by Hart Crowser, Seattle, WA. November.

Huntting, M. 1956. Inventory of Washington Minerals – Part II Metallic Minerals. Bulletin No. 37. Division of Mines and Geology, State of Washington Department of Conservation and Development, Olympia, WA.

Mills, J.W. 1977. Zinc and Lead Ore Deposits in Carbonate Rocks, Stevens County, Washington. Bulletin No. 70. Division of Geology and Earth Resources. State of Washington Department of Natural Resources, Olympia, WA.

Resource and Environmental Management Consultants, Inc. 2015. Completion Report for Sierra Zinc Mine and Mill Colville, Washington. EPA ID No. WAN001002396. Prepared for The Goldfield Corporation, Melbourne, FL, by Resource and Environmental Management Consultants, Inc., Midvale, UT. November 20, 2015.

Stoffel, K.L., N.L. Joseph, S.Z. Waggoner, C.W. Gulick, M.A. Korosec, and B.B. Bunning. 1991. Geologic map of Washington – Northeast quadrant. Washington State Department of Natural Resources, Olympia, WA.

TAI (Teck American Incorporated). 2015. Upper Columbia River Final Soil Study Data Summary Report. Prepared for TAI by Windward Environmental LLC, Seattle, WA. October 2015.

USEPA (U.S. Environmental Protection Agency). 2002. Preliminary Assessments and Site Inspections Report Upper Columbia River Mines and Mills Stevens County, Washington. U.S. Environmental Protection Agency Region 10, Superfund Technical Assessment and Response Team, Seattle, WA.

USEPA. 2004. Le Roi Smelter/Northport Removal Site Evaluation Site-Specific Sampling Plan. EPA Contract: 04 02 0010. July 2004. Prepared for U.S. Environmental Protection Agency Region 10 by Weston Solutions, Seattle, WA.

USEPA. 2007. Engineering Evaluation/Cost Analysis – Anderson Calhoun Work Group. Anderson Calhoun Mine. Colville, Washington. Prepared for U.S. Environmental Protection Agency by Golder Associates. April.

USEPA. 2008. Upper Columbia River Work Plan for the Remedial Investigation and Feasibility Study, Volume I. U.S. Environmental Protection Agency, Washington, DC.

USEPA. 2009a. Human Health Risk Assessment Work Plan for the Upper Columbia River Site. Prepared for, and with oversight by, U.S. Environmental Protection Agency Region 10 by SRC, Syracuse, NY.

USEPA. 2009b. U.S. Environmental Protection Agency Risk Assessment Guidance for Superfund (RAGS) Part F: Inhalation Risk Assessment. https://www.epa.gov/risk/risk-assessment-guidance-superfund-rags-part-f.

USEPA. 2012a. Young America Mine Removal Assessment Trip Report, Evans, Stevens County, Washington. TDD: 11-06-0011. Prepared for U.S. Environmental Protection Agency by TechLaw, Inc.

USEPA. 2012b. Memorandum, Subject: Approval and Funding for a Removal Action at Young America Mine and Mill Site, Evans, Stevens County, Washington. U.S. Environmental Protection Agency, Region 10, Office of Environmental Cleanup, Seattle WA. August 13.

USEPA. 2012c. Young America Mine. October 31, 2012. https://response.epa.gov/site/sitrep_profile.aspx?site_id=7048. Accessed on January 19, 2025.

USEPA. 2023. Superfund Site Information, Last Chance Mine and Mill, EPA ID: WASFN1002162. https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=1002162.

USGS (U.S. Geological Survey). 2022. U.S. Geological Survey Mineral Resources Data System. https://mrdata.usgs.gov/mrds/. Accessed March 14, 2022.

WDNR (Washington State Department of Natural Resources). 2003. Inactive and Abandoned Mine Lands – Sierra Zinc Mine Chewelah Mining District, Stevens County, Washington. Washington State Department of Natural Resources Division of Geology and Earth Resources, Olympia, WA. https://www.dnr.wa.gov/Publications/ger_ofr2003-20_iaml_sierrazinc.pdf.

WDNR (Washington State Department of Natural Resources). 2005. Inactive and Abandoned Mine Lands – Van Stone Mine, Northport Mining District, Stevens County, Washington. Washington State Department of Natural Resources Division of Geology and Earth Resources, Olympia, WA. https://www.dnr.wa.gov/Publications/ger_ic100_iaml_vanstone.pdf.

WDNR. 2008. Inactive and Abandoned Mine Lands – Young America Mine, Bossburg Mining District, Stevens County, Washington. Washington State Department of Natural Resources Division of Geology and Earth Resources, Olympia, WA. http://www.dnr.wa.gov/Publications/ger_ic105_iaml_youngamerica.pdf.

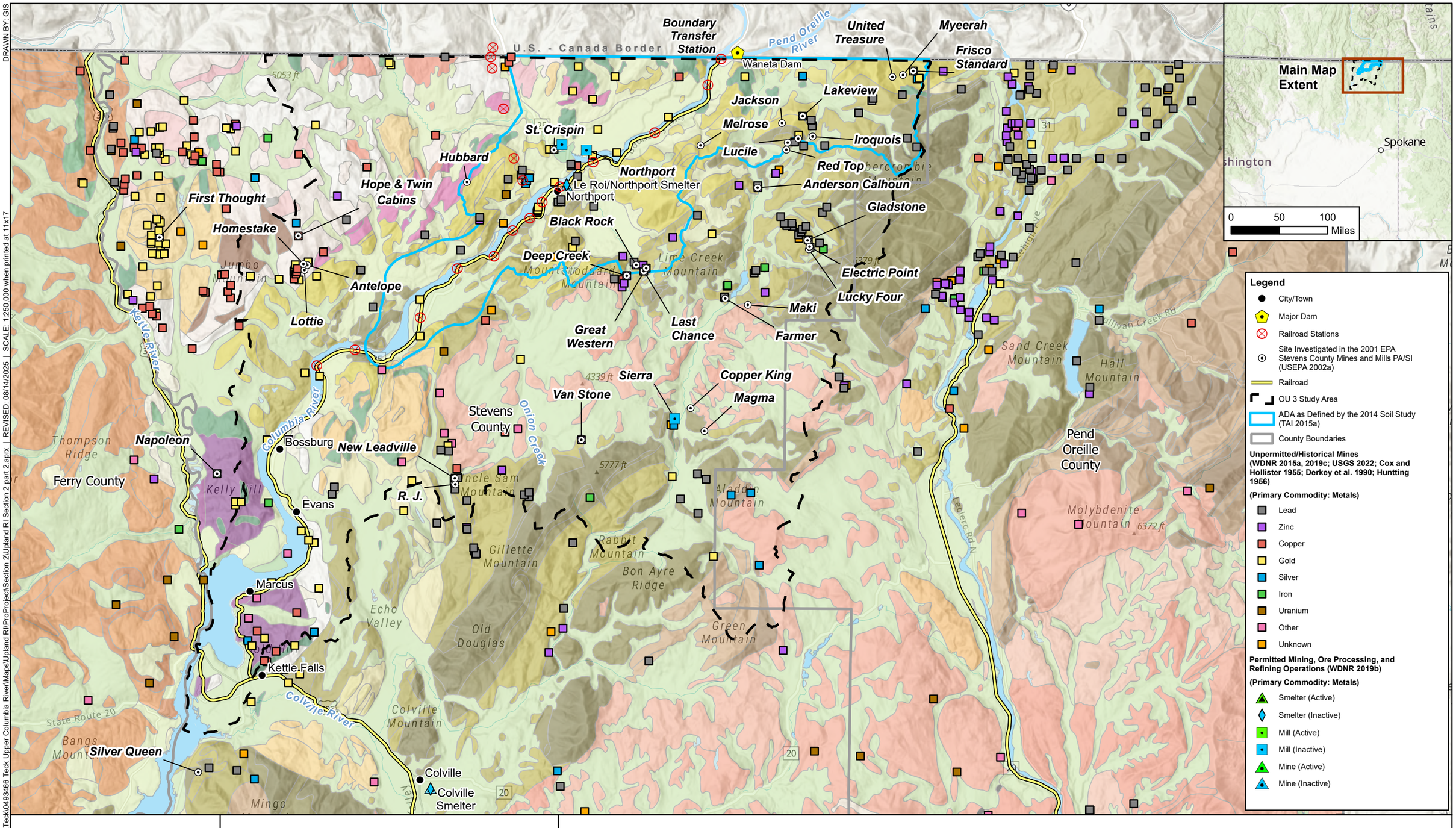
WDNR. 2015. Metallic Minerals Database for Washington State Digital Data Series 13 (DS 13). Washington State Department of Natural Resources Division of Geology and Earth Resources, Olympia, WA.

WDNR. 2019a. Active Mine Sites database. Version 4.0. Washington State Department of Natural Resources Geological Survey. https://www.dnr.wa.gov/programs-and-services/geology/publications-and-data/gis-data-and-databases. Accessed May 16, 2019.

WDNR. 2019b. IAML database. Washington State Department of Natural Resources. https://geo.wa.gov/datasets/wadnr::iaml-sites/about. Accessed May 16, 2019.

Weaver, C.E. 1920. The Mineral Resources of Stevens County: Washington Geological Survey Bulletin 20.

MAPS



DRAWN BY: GIS | REVISED: 08/14/2025 | SCALE: 1:250,000 when printed at 11x17

FILE: M:\US\Projects\S-U\Teck\0493466 Teck Upper Columbia River\Maps\Upland RI\ProProject\Section 2\Upland RI Section 2 part 2.aprx | Layout: Layout2

ERM
Environmental Resources Management
www.erm.com

0 2.5 5 10 Miles

N

Map A-1. **Metallic Mining and Mining-Related Operations in the OU 3 Study Area**
Final Upland RI Report
Upper Columbia River, Washington

Source: Esri - World Topographic Map; NAD 1983 UTM Zone 11N

TABLES

Table A-1
Mines and Mills Evaluated During the 2001 EPA Stevens County Mines and Mills PA/SI
Final Upland RI Report
Upper Columbia River, Washington

Facility Name	Dates Operated [a]	Source	Geologic Unit(s) Mined [a]	Source	Primary Commodity(ies) [a]	Source	Estimated Production Description [a]	Source	Cleanup Site ID [b]	Facility Site ID [b]	Site Status [b]
Anderson Calhoun Mine/Mill	1910–1980s	USEPA (2002); USEPA (2007); Ecology (2017b); Derkey et al. (1990); Mills (1977)	Metaline Formation	USEPA (2002); Derkey et al. (1990); Mills (1977)	barium, lead, zinc	USEPA (2002); Ecology (2017b); Derkey et al. (1990)	100,000 tons	USEPA (2002); Derkey et al. (1990)	4519	8070626	No Further Action
Antelope Mine	1898–unknown	USEPA (2002)	Rossland Group	Weaver (1920)	copper, gold	USEPA (2002); Huntting (1956)	50 tons	USEPA (2002); Huntting (1956); Derkey et al. (1990)	443	649154	No Further Action
Black Rock Mine/Mill	1920–1943	USEPA (2002)	Metaline Formation	Derkey et al. (1990)	lead, zinc	USEPA (2002); Huntting (1956)	5,280 tons in 1922–1924, 3,951 tons zinc, 70 tons lead	USEPA (2002); Derkey et al. (1990); Mills (1977)	3939	3984735	Awaiting Cleanup
Copper King Mine	1904–1941	USEPA (2002)	Wallace Formation, Metaline Formation	USEPA (2002); Derkey et al. (1990)	copper, silver	USEPA (2002)	na	na	1734	9171675	Awaiting Cleanup
Daisy Mine	1916–1935	USEPA (2002)	Ledbetter Slate	Derkey et al. (1990); Mills (1977); Weaver (1920)	copper, gold, lead, silver	USEPA (2002); Derkey et al. (1990)	2,000 tons prior to 1890, 1915, 1917, 1923, 1929, 1934–1935 (50 tons of conc.)	Huntting (1956)	4543	2000536	Awaiting Cleanup
Deep Creek Mine	1944–1956	USEPA (2002)	Metaline Formation	Derkey et al. (1990)	lead, silver, zinc	USEPA (2002)	33,000 tons zinc, 7,500 tons lead, 18 tons silver, 12 tons copper	USEPA (2002)	1969	7288890	Awaiting Cleanup
Electric Point Mine/Mill	1901–1955	USEPA (2002); Huntting (1956)	Metaline Formation	Derkey et al. (1990); Mills (1977)	copper, lead, silver, zinc	USEPA (2002)	15,355 tons lead, 5 tons zinc, 450 pounds silver	USEPA (2002)	4523	8278162	Awaiting Cleanup
Farmer Mine	1937–1951	Derkey et al. (1990)	Metaline Formation	Derkey et al. (1990); Mills (1977)	lead, silver, zinc	USEPA (2002); Huntting (1956)	19 tons	Mills (1977)	2740	8440149	No Further Action
First Thought Mine	1896–1910	USEPA (2002)	Rossland Group	Weaver (1920)	gold, silver	USEPA (2002); Huntting (1956); Weaver (1920)	40,000 tons	USEPA (2002); Huntting (1956); Weaver (1920)	1531	2891707	Awaiting Cleanup
Frisco-Standard Mine	1915–1944	Derkey et al. (1990)	Ledbetter Slate	Derkey et al. (1990)	copper, lead, silver, zinc, gold	USEPA (2002); Derkey et al. (1990); Huntting (1956)	3 tons lead, small, intermittent amounts other minerals	Mills (1977); Derkey et al. (1990)	2243	1883355	Awaiting Cleanup
Gladstone Mine/Mill	1901–1955	USEPA (2002); Huntting (1956); Derkey et al. (1990)	Metaline Formation	Derkey et al. (1990); Mills (1977)	copper, lead, silver, zinc	USEPA (2002); Huntting (1956)	7,792 tons lead, 22 tons zinc, 600 pounds silver, 835 pounds copper	USEPA (2002); Huntting (1956); Mills (1977)	2714	6228568	Awaiting Cleanup

Table A-1
Mines and Mills Evaluated During the 2001 EPA Stevens County Mines and Mills PA/SI
Final Upland RI Report
Upper Columbia River, Washington

Facility Name	Dates Operated [a]	Source	Geologic Unit(s) Mined [a]	Source	Primary Commodity(ies) [a]	Source	Estimated Production Description [a]	Source	Cleanup Site ID [b]	Facility Site ID [b]	Site Status [b]
Great Western Mine	1888–1929	Mills (1977); Weaver (1920)	Metaline Formation	Derkey et al. (1990)	lead, zinc	USEPA (2002); Huntting (1956)	468 tons zinc, 217 tons lead	USEPA (2002); Mills (1977)	381	9476268	Awaiting Cleanup
Homestake No. 1 Mine	unknown	na	Rossland Group	Derkey et al. (1990)	copper, gold, silver	USEPA (2002); Huntting (1956)	100 tons	Derkey et al. (1990); Weaver (1920)	1456	3646204	No Further Action
Hope and Twin Cabins Mine	unknown	na	Rossland Group	Derkey et al. (1990)	copper, gold, silver	USEPA (2002)	100 tons	USEPA (2002)	2025	9672131	No Further Action
Hubbard Mine	unknown	na	Flagstaff Mountain sequence	Derkey et al. (1990)	copper, gold, lead, silver, zinc	USEPA (2002)	1 carload	Huntting (1956)	2157	1955810	No Further Action
Iroquois Mine	1917–1950	USEPA (2002); Derkey et al. (1990)	Metaline Formation	Derkey et al. (1990); Mills (1977)	cadmium, lead, silver, zinc, gold	USEPA (2002); Huntting (1956); Derkey et al. (1990)	amounts vary, 60 tons–600,000 tons	Huntting (1956); Derkey et al. (1990); Mills (1977)	3803	109707	Awaiting Cleanup
Jackson Mine	1928–1935	Huntting (1956)	Grass Mountain sequence	Derkey et al. (1990)	copper, lead, silver, zinc	USEPA (2002); Huntting (1956); Derkey et al. (1990)	7 tons	USEPA (2002)	2579	2423034	Awaiting Cleanup
Lakeview Mine	1922	Derkey et al. (1990)	Grass Mountain sequence	Derkey et al. (1990)	lead, silver	USEPA (2002); Derkey et al. (1990)	1.2 tons lead, 48 pounds silver, 24 total tons ore	Derkey et al. (1990); Mills (1977)	4438	8897302	No Further Action
Last Chance Mine/Mill	1904–1954	USEPA (2002); Mills (1977)	Metaline Formation	Derkey et al. (1990)	lead, silver, zinc	USEPA (2002)	2,969 tons lead, 55 tons zinc, 9 tons silver	USEPA (2002); Mills (1977)	2073	1855805	Awaiting Cleanup
L-Bar/Northwest Magnesite	1916–1968, 1977–1986	USEPA (2002)	na	na	Thermax manufacturing, magnesite; then magnesium	USEPA (2002)	700 tons per day	USEPA (2002)	88	762	Construction Complete-Performance Monitoring
Le Roi/Northport Smelter	1897–1922	USEPA (2002)	na	na	copper, gold, lead, silver	USEPA (2002); Huntting (1956)	500 tons per day	USEPA (2002)	47	767	Cleanup Complete-Active O&M/Monitoring
Lottie Mine	1898–unknown	USEPA (2002)	Rossland Group	Mills (1977)	copper, gold, silver	USEPA (2002); Huntting (1956)	50 tons	USEPA (2002); Huntting (1956)	4786	6769855	No Further Action
Lucile Mine	1926–1949	USEPA (2002); Derkey et al. (1990)	Maitlen Phyllite	Derkey et al. (1990); Mills (1977)	cadmium, lead, silver, zinc	USEPA (2002); Huntting (1956)	21 tons lead, 12 tons zinc, 95 pounds silver, 254 tons of ore	USEPA (2002); Derkey et al. (1990); Mills (1977)	885	7562209	Awaiting Cleanup
Lucky Four Mine	1934	Huntting (1956); Derkey et al. (1990)	Metaline Formation	Derkey et al. (1990)	copper, gold, lead, silver	USEPA (2002); Huntting (1956)	1 truckload to 100 tons	USEPA (2002); Huntting (1956); Derkey et al. (1990)	188	3634437	No Further Action

Table A-1
Mines and Mills Evaluated During the 2001 EPA Stevens County Mines and Mills PA/SI
Final Upland RI Report
Upper Columbia River, Washington

Facility Name	Dates Operated [a]	Source	Geologic Unit(s) Mined [a]	Source	Primary Commodity(ies) [a]	Source	Estimated Production Description [a]	Source	Cleanup Site ID [b]	Facility Site ID [b]	Site Status [b]
Magma Mine	1927	USEPA (2002)	Metaline Formation	Derkey et al. (1990); Mills (1977)	copper, gold, lead, silver, zinc	USEPA (2002); Huntting (1956)	5 tons	Huntting (1956); Derkey et al. (1990)	244	3546084	No Further Action
Maki Mine	1921	Huntting (1956)	Metaline Formation	Derkey et al. (1990); Mills (1977)	cobalt, lead, zinc	USEPA (2002); Huntting (1956)	ore shipped	Huntting (1956)	3871	195512	Awaiting Cleanup
Melrose Mine	1913–1938	USEPA (2002)	Grass Mountain sequence	Derkey et al. (1990)	copper, lead, silver, zinc	USEPA (2002); Huntting (1956); Derkey et al. (1990)	97 tons	USEPA (2002); Derkey et al. (1990)	4787	6825039	Awaiting Cleanup
Myeerah Mine	1926–1942	Derkey et al. (1990)	Ledbetter Slate	Derkey et al. (1990)	gold, lead, silver, zinc	USEPA (2002); Huntting (1956); Derkey et al. (1990)	4 tons lead, 18 pounds silver	USEPA (2002); Derkey et al. (1990); Mills (1977)	3470	6489914	Awaiting Cleanup
Napoleon Mine/Mill	1907–1955	USEPA (2002); Huntting (1956)	unnamed Permian-Triassic metasedimentary rocks	Mills (1977); Derkey et al. (1990)	copper, iron, gold	USEPA (2002); Huntting (1956)	na	na	2075	3025813	Awaiting Cleanup
New Leadville Mine	unknown–1924	USEPA (2002); Huntting (1956); Derkey et al. (1990)	Metaline Formation	Derkey et al. (1990)	lead	USEPA (2002); Huntting (1956)	na	na	1632	7858378	Awaiting Cleanup
Northport Mill	unknown–1990s	USEPA (2002)	na	na	barite	USEPA (2002)	na	na	na	na	na
Northwest Alloys	1976–2001	USEPA (2002)	na	na	magnesium, ferrosilicon	USEPA (2002)	na	na	2494	4	Cleanup Started
R.J. Mine	1900–unknown	USEPA (2002)	Metaline Formation	Derkey et al. (1990)	lead, silver	USEPA (2002); Huntting (1956)	2 carloads	Huntting (1956); Derkey et al. (1990)	3342	8465344	Awaiting Cleanup
Red Top Mine	1938–1953	Huntting (1956); Derkey et al. (1990)	Maitlen Phyllite	Derkey et al. (1990); Mills (1977)	lead, silver, zinc	USEPA (2002)	103 tons lead, 70 tons zinc, 400 pounds silver	Mills (1977)	2439	9673298	Awaiting Cleanup
Sierra Zinc Mine/Mill	1909–1956	USEPA (2002)	Maitlen Phyllite	Derkey et al. (1990)	gold, lead, silver, zinc	USEPA (2002); Derkey et al. (1990)	2,870 tons zinc, 460 tons lead, 1 ton silver	Derkey et al. (1990)	1838	1786484	Construction Complete-Performance Monitoring
Silver Queen Mine	1917–1941	USEPA (2002); Derkey et al. (1990)	Metaline Formation or Stensgar Dolomite	Mills (1977); Derkey et al. (1990)	lead, silver, zinc	USEPA (2002); Huntting (1956)	7 tons lead, 8–9 tons silver	Derkey et al. (1990); Mills (1977)	4850	6784750	Awaiting Cleanup
St. Crispin Mine	1905–1941	Weaver (1920); Huntting (1956)	dark, carbonaceous argillite	Weaver (1920)	copper, gold, lead, silver	USEPA (2002); Huntting (1956)	na	na	1553	9267585	No Further Action

Table A-1
Mines and Mills Evaluated During the 2001 EPA Stevens County Mines and Mills PA/SI
Final Upland RI Report
Upper Columbia River, Washington

Facility Name	Dates Operated [a]	Source	Geologic Unit(s) Mined [a]	Source	Primary Commodity(ies) [a]	Source	Estimated Production Description [a]	Source	Cleanup Site ID [b]	Facility Site ID [b]	Site Status [b]
United Treasure Mine	1917–1953	USEPA (2002); Huntting (1956); Derkey et al. (1990)	Ledbetter Slate	Derkey et al. (1990)	copper, gold, lead, silver, zinc	USEPA (2002); Huntting (1956); Derkey et al. (1990)	84 tons	Derkey et al. (1990)	448	902477	No Further Action
Van Stone Mine/Mill	1938–1993	USEPA (2002); Hart Crowser (2013); Ecology (2017a); Huntting (1956)	Metaline Formation	Derkey et al. (1990); Mills (1977)	lead, zinc	USEPA (2002); Hart Crowser (2013); Ecology (2017a); Huntting (1956); Derkey et al. (1990)	2.2 million tons of ore	Derkey et al. (1990)	461	1554858	Cleanup Started

Notes:
[a] This information is reproduced directly from the listed sources.
[b] This information is compiled from the Washington State Department of Ecology Toxics Cleanup Program Cleanup and Tank Search website (Ecology 2024b).
na - not available
O&M - operation(s) and maintenance
PA/SI - preliminary assessment and site inspection

Table A-2
Sampling and Results for Mines and Mills Evaluated During the 2001 EPA Stevens County Mines and Mills PA/SI
Final Upland RI Report
Upper Columbia River, Washington

Facility Name	Information Compiled from 2001 EPA Stevens County Mines and Mills PA/SI [a]				Additional Reports Reviewed	Objective of Work Performed	Conclusions of Work Performed	Information Compiled from Ecology Toxics Cleanup Program [b]		
	Samples Collected?	Sampling Results	Conclusions	Further Action Recommended by EPA?				Cleanup Site ID	Facility Site ID	Site Status
Anderson Calhoun Mine/Mill	7 surface soil (3 tailings, 4 mill), 4 sediment (3 tailings, 1 probable point of entry) 1 surface water	Surface soil samples contained elevated concentrations of metals including cadmium (129 mg/kg), copper (115 mg/kg), lead (2,190 mg/kg), mercury (0.35 mg/kg), and zinc (49,000 mg/kg). Elevated metals in surface water included lead (192 µg/L) and zinc (1,480 µg/L). The sediment samples contained elevated concentrations of metals including arsenic (10.0 mg/kg), cadmium (7.5 mg/kg), copper (67.4 mg/kg), lead (320 mg/kg), mercury (0.17 mg/kg), and zinc (3,250 mg/kg).	Metals concentrations indicate that harmful chemicals may be migrating to receptors.	yes	Engineering Evaluation / Cost Analysis, Anderson Calhoun Work Group, Anderson Calhoun Mine, Colville, Washington (USEPA 2007)	This Engineering Evaluation / Cost Analysis (EE/CA) included a site investigation for soil, sediment, and water at the site. The purpose of the EE/CA was to summarize the nature and extent of contamination associated with the site, to review remediation alternatives, and select a remedial action to address contamination at the site.	Sampling activities confirmed that concentrations in soil were above cleanup levels. The removal action alternative chosen included institutional controls, excavation, consolidation and capping of the tailings and ore piles, in addition to the filling of wetlands adjacent to the mine property and re-establishment of new wetland areas with long-term monitoring.	4519	8070626	No Further Action
					Second Periodic Review, EPA Anderson Calhoun Mine Mill (Ecology 2017b)	Ecology accessed the site to review the conditions and monitoring data every 5 years to confirm protection of human health and the environment at the property.	In 2010, EPA implemented the selected remedy, which consisted of consolidation and capping of the contaminated material, demolition of several structures, environmental covenant, and installation of a fence to control access. Remedy repairs were required in 2011, and the site has been in long-term monitoring and maintenance with institutional controls since then. The last two 5-year reviews of the site indicated that the remedy is protective of human health and the environment, while concentrations of chemicals of concern in soil remain above cleanup levels. No additional cleanup actions are required by the property owner at this time. The property owner maintains responsibility for inspecting the site to ensure the integrity of the cap is maintained.			
Antelope Mine	no	NA	NA	no	no	NA	NA	443	649154	No Further Action
Black Rock Mine/Mill	3 waste rock surface soil, 2 surface soil	Waste rock soil samples contained elevated concentrations of metals including cadmium (1,090 mg/kg), copper (398 mg/kg), lead (1,040 mg/kg), mercury (26.4 mg/kg) and zinc (207,000 mg/kg). Other soil samples contained elevated concentrations of metals including cadmium (1,630 mg/kg), copper (192 mg/kg), lead (1,800 mg/kg), mercury (0.19 mg/kg), and zinc (402,000 mg/kg).	No further action recommended under CERCLA.	no	no	NA	NA	3939	3984735	Awaiting Cleanup

Table A-2
Sampling and Results for Mines and Mills Evaluated During the 2001 EPA Stevens County Mines and Mills PA/SI
Final Upland RI Report
Upper Columbia River, Washington

Facility Name	Information Compiled from 2001 EPA Stevens County Mines and Mills PA/SI [a]				Additional Reports Reviewed	Objective of Work Performed	Conclusions of Work Performed	Information Compiled from Ecology Toxics Cleanup Program [b]		
	Samples Collected?	Sampling Results	Conclusions	Further Action Recommended by EPA?				Cleanup Site ID	Facility Site ID	Site Status
Copper King Mine	2 waste rock surface soil, 1 surface water, 1 sediment	Waste rock surface soil samples contained elevated concentrations of metals including copper (1,700 mg/kg), mercury (0.12 mg/kg), selenium (18.9 mg/kg), and thallium (3.7 mg/kg). Surface water contained elevated concentrations of lead (17.9 µg/L), and zinc (180 µg/L). No elevated concentrations of metals were encountered in the sediment sample.	No further action recommended under CERCLA.	no	no	NA	NA	1734	9171675	Awaiting Cleanup
Daisy Mine	3 surface soil (tailings pile), 1 surface water, 1 sediment	Analytes in surface soil include arsenic (233 mg/kg) and mercury (up to 2.9 mg/kg). Analytes detected in the surface water discharge from the shaft include arsenic (95.3 µg/L), cadmium (7.1 µg/L), lead (5.2 µg/L), and zinc (829 µg/L). No elevated concentrations of target analyte list metals were detected in the sediment sample.	No further action recommended under CERCLA.	no	no	NA	NA	4543	2000536	Awaiting Cleanup
Deep Creek Mine	5 waste rock surface soil, 18 tailings surface soil, 1 surface water, 1 sediment	Surface soil samples from the waste rock and tailings contained elevated concentrations of metals including cadmium (425 mg/kg), lead (13,300 mg/kg), mercury (3.2 mg/kg), and zinc (123,000 mg/kg). The surface water sample contained elevated concentrations of lead (12.9 µg/L), and zinc (558 µg/L). No elevated concentrations were detected in the sediment sample.	No further action recommended under CERCLA.	no	Abandoned Mine Lands, Initial Investigation Report, Deep Creek Mine, Spirit, Washington (Hart Crowser 2006a)	Investigation was conducted to identify concentrations above MTCA human health or ecological screening levels, to identify sites requiring additional investigation, to investigate waste source areas, and to investigate the potential transport pathways and receptors.	The investigation report concluded that soil and waste rock at the site contained concentrations of metals at levels greater than the human health screening criteria, with contaminants of concern including arsenic, cadmium, lead, mercury, selenium, and zinc. Impacts to human health were noted as a possibility for homeowners living within 700 feet of the site. Sampling of nearby residential water wells was recommended. Potential releases to the nearby Deep Creek were noted to be possible during rainfall events.	1969	7288890	Awaiting Cleanup
Electric Point Mine/Mill	5 waste rock surface soil, 3 tailings pile surface soil, 3 mill area surface soil	Surface soil samples contained elevated concentrations of metals including cadmium (25.0 mg/kg JL), lead (97,800 mg/kg), mercury (0.69 mg/kg), and zinc (33,800 mg/kg).	No further action recommended under CERCLA.	no	no	NA	NA	4523	8278162	Awaiting Cleanup
Farmer Mine	no	NA	NA	no	no	NA	NA	2740	8440149	No Further Action
First Thought Mine	no	NA	NA	no	no	NA	NA	1531	2891707	Awaiting Cleanup
Frisco-Standard Mine	no	NA	NA	no	no	NA	NA	2243	1883355	Awaiting Cleanup
Gladstone Mine/Mill	3 mill surface soil, 3 tailings surface soil	Surface soil samples contained elevated concentrations of lead (94,000 mg/kg), mercury (0.30 mg/kg), and zinc (10,500 mg/kg).	No further action recommended under CERCLA.	no	no	NA	NA	2714	6228568	Awaiting Cleanup
Great Western Mine	2 waste rock surface soil	Samples contained elevated metals including cadmium (490 mg/kg JL), lead (24,000 mg/kg), mercury (4.3 mg/kg), and zinc (118,000 mg/kg JK).	No further action recommended under CERCLA.	no	no	NA	NA	381	9476268	Awaiting Cleanup

Table A-2
Sampling and Results for Mines and Mills Evaluated During the 2001 EPA Stevens County Mines and Mills PA/SI
Final Upland RI Report
Upper Columbia River, Washington

Facility Name	Information Compiled from 2001 EPA Stevens County Mines and Mills PA/SI [a]				Additional Reports Reviewed	Objective of Work Performed	Conclusions of Work Performed	Information Compiled from Ecology Toxics Cleanup Program [b]		
	Samples Collected?	Sampling Results	Conclusions	Further Action Recommended by EPA?				Cleanup Site ID	Facility Site ID	Site Status
Homestake No. 1 Mine	no	NA	NA	no	no	NA	NA	1456	3646204	No Further Action
Hope and Twin Cabins Mine	no	NA	NA	no	no	NA	NA	2025	9672131	No Further Action
Hubbard Mine	no	NA	NA	no	no	NA	NA	2157	1955810	No Further Action
Iroquois Mine	2 waste rock surface soil, 2 surface water	Surface soil samples contained elevated concentrations of metals including cadmium (39.1 mg/kg), mercury (0.49 mg/kg), and zinc (12,300 mg/kg). A water sample had an estimated concentration of zinc (583 µg/L).	No further action recommended under CERCLA.	no	no	NA	NA	3803	109707	Awaiting Cleanup
Jackson Mine	no	NA	NA	no	no	NA	NA	2579	2423034	Awaiting Cleanup
Lakeview Mine	no	NA	NA	no	no	NA	NA	4438	8897302	No Further Action
Last Chance Mine/Mill	1 surface water, 3 surface soil from mill, 3 waste rock surface soil, 3 surface soil from tailings, 2 sediment from probable points of entry	Surface soil samples from the waste rock, tailings pile, and the mill area contained elevated concentrations of metals including cadmium (518 mg/kg JH), lead (170,000 mg/kg), copper (2,790 mg/kg), mercury (2.7 mg/kg), and zinc (112,000 mg/kg). The sediment samples contained elevated concentrations of metals including cadmium (56.9 mg/kg JH), lead (14,600 mg/kg), mercury (1.2 mg/kg), and zinc (13,400 mg/kg). The surface water contained an elevated concentration of zinc (459 µg/L).	Metals concentrations indicate that harmful chemicals may be migrating to receptors.	yes	Abandoned Mine Lands Initial Investigation Report, Last Chance Mine, Republic, Washington (Hart Crowser 2006b)	Investigation was conducted to identify concentrations above MTCA human health or ecological screening levels, to identify sites requiring additional investigation, to investigate waste source areas, and to investigate the potential transport pathways and receptors.	Results from the sampling indicated that waste rock samples contained arsenic, mercury, selenium, and silver above MTCA Method A, MTCA Method B, or ecological screening criteria. The arsenic concentration in one sample had the potential to fail toxicity characteristic leaching procedure criteria for hazardous waste. The investigation report concluded that human health risks were possible for recreational users. Potential releases to the nearby Eureka Creek were noted to be possible during rainfall events. A terrestrial ecological evaluation was recommended to assess ecological risks.	2073	1855805	Awaiting Cleanup
L-Bar/ Northwest Magnesite	4 sediment samples plus 2 background sediment samples	Analytes were not detected at elevated concentrations from the sample at the West Ditch. Lead was detected at 115 mg/kg in the sediment sample collected from the Colville River, but not any other correlating samples.	Metals concentrations indicate that harmful chemicals may be migrating to receptors.	yes	no	NA	NA	88	762	Construction Complete-Performance Monitoring

Table A-2
Sampling and Results for Mines and Mills Evaluated During the 2001 EPA Stevens County Mines and Mills PA/SI
Final Upland RI Report
Upper Columbia River, Washington

Facility Name	Information Compiled from 2001 EPA Stevens County Mines and Mills PA/SI [a]				Additional Reports Reviewed	Objective of Work Performed	Conclusions of Work Performed	Information Compiled from Ecology Toxics Cleanup Program [b]		
	Samples Collected?	Sampling Results	Conclusions	Further Action Recommended by EPA?				Cleanup Site ID	Facility Site ID	Site Status
Le Roi/Northport Smelter	3 surface soil samples from tailings, 9 sediment samples from slag, 2 sediment samples from probable points of entry	Surface soil samples contained elevated concentrations of metals including arsenic (297 mg/kg JL), cadmium (105 mg/kg), copper (14,700 mg/kg), lead (10,500 mg/kg), mercury (0.40 mg/kg), and zinc (5,420 mg/kg). Sediment samples contained elevated concentrations of metals including arsenic (41.4 mg/kg), cadmium (4.9 mg/kg), copper (2,960 mg/kg), lead (845 mg/kg JK), mercury (0.29 mg/kg), and zinc (16,900 mg/kg). The probable point of entry samples contained elevated concentrations of metals including arsenic (39.9 mg/kg JK), cadmium (5.9 mg/kg JK), copper (1,090 mg/kg), lead (887 mg/kg JK), and zinc (223 mg/kg).	Metals concentrations indicate that harmful chemicals may be migrating to receptors.	yes	no [c]	NA [c]	NA [c]	47	767	Cleanup Complete-Active O&M/Monitoring
Lottie Mine	no	NA	NA	no	no	NA	NA	4786	6769855	No Further Action
Lucile Mine	no	NA	NA	no	no	NA	NA	885	7562209	Awaiting Cleanup
Lucky Four Mine	no	NA	NA	no	no	NA	NA	188	3634437	No Further Action
Magma Mine	no	NA	NA	no	no	NA	NA	244	3546084	No Further Action
Maki Mine	no	NA	NA	no	no	NA	NA	3871	195512	Awaiting Cleanup
Melrose Mine	1 surface water, 1 sediment sample	Elevated metals in the surface water sample included zinc (433 µg/L). The sediment sample contained elevated concentrations of cadmium (22.8 mg/kg JH) and zinc (1,650 mg/kg).	Metals concentrations indicate that harmful chemicals may be migrating to receptors.	no	no	NA	NA	4787	6825039	Awaiting Cleanup
Myeerah Mine	no	NA	NA	no	no	NA	NA	3470	6489914	Awaiting Cleanup
Napoleon Mine/Mill	1 surface water, 1 sediment sample	The surface water sample had detections of lead (11.3 µg/L) and zinc (937 µg/L). The sediment sample had elevated concentrations of copper (207 mg/kg) and silver (2.3 mg/kg).	Metals concentrations indicate that harmful chemicals may be migrating to receptors.	no	no	NA	NA	2075	3025813	Awaiting Cleanup
New Leadville Mine	no	NA	NA	no	no	NA	NA	1632	7858378	Awaiting Cleanup
Northport Mill	no	NA	NA	no	no	NA	NA	na	na	na
Northwest Alloys	3 sediment samples	Samples from the ditch at the probably point of entry contained elevated concentrations of arsenic (4.9 mg/kg), copper (18.7 mg/kg), lead (7.5 mg/kg), and zinc (47.9 mg/kg). No other samples had elevated target analyte list metals concentrations.	No further action recommended under CERCLA.	no	no	NA	NA	2494	4	Cleanup Started
R.J. Mine	no	NA	NA	no	no	NA	NA	3342	8465344	Awaiting Cleanup

Table A-2
Sampling and Results for Mines and Mills Evaluated During the 2001 EPA Stevens County Mines and Mills PA/SI
Final Upland RI Report
Upper Columbia River, Washington

Facility Name	Information Compiled from 2001 EPA Stevens County Mines and Mills PA/SI [a]				Additional Reports Reviewed	Objective of Work Performed	Conclusions of Work Performed	Information Compiled from Ecology Toxics Cleanup Program [b]		
	Samples Collected?	Sampling Results	Conclusions	Further Action Recommended by EPA?				Cleanup Site ID	Facility Site ID	Site Status
Red Top Mine	3 waste rock surface soil	Surface soil samples contained elevated concentrations for cadmium (177 mg/kg JH), copper (1,080 mg/kg), lead (28,900 mg/kg), mercury (1.1 mg/kg), and zinc (15,700 mg/kg).	No further action recommended under CERCLA.	no	no	NA	NA	2439	9673298	Awaiting Cleanup
Sierra Zinc Mine/Mill	12 waste rock surface soil, 21 tailings pile surface soil, 1 surface soil from mill, 1 surface water	Surface soil samples contained elevated concentrations of metals including cadmium (130 mg/kg), lead (15,800 mg/kg), mercury (2.7 mg/kg JL), and zinc (33,400 mg/kg). The surface water sample contained an elevated concentration of zinc (292 µg/L).	No further action recommended under CERCLA.	no	Inactive and Abandoned Mine Lands—Sierra Zinc Mine, Chewelah Mining District, Stevens County, Washington (WDNR 2003)	To develop a database and GIS coverage for mines in Washington State, including information related to hazards, physical characteristics, location, ownership, status, and environmental issues.	Soil samples were collected from the tailings and rock piles and surface water samples were collected from water flowing from the adit. Sample results indicated that metals lead, zinc, and cadmium concentrations exceeded MTCA cleanup levels for unrestricted land use in soil samples. Zinc exceeded the limit for chronic affect to aquatic life in one water sample.	1838	1786484	Construction Complete-Performance Monitoring
					Sierra Zinc Mine and Mill Removal Site Evaluation, Northport, Washington (Ecology and Environment 2013)	To delineate the extent of contamination, to determine if hazardous materials have potential to cause a release to the environment, and to collect data to support removal action from the site.	Soil samples exceeded the removal management levels for arsenic, cadmium, lead, thallium, and zinc. Mercury concentrations in soil exceeded the MTCA Method A cleanup levels but not the removal management level. Cadmium, lead, and zinc exceeded the screening criteria for surface water; arsenic, cadmium, copper, and silver exceeded screening criteria for sediment, and arsenic, cadmium, copper, and iron exceeded screening criteria for groundwater.			
					Completion Report for Sierra Zinc Mine and Mill, Colville, Washington (Resource and Environmental Management Consultants 2015)	To document that removal actions were completed in accordance with the time-critical removal action for the mine.	The mill and barn buildings were demolished, soil with elevated lead concentrations (approximately 86,000 cubic yards) was excavated from near the tailings impoundment and placed into a high density polyethylene (HDPE) lined containment area within the onsite impoundment, the impoundment was re-contoured with approximately 106,000 cubic yards clean of cover, revegetated, and a fence was placed around the impoundment. An environmental covenant was required to prohibit land disturbance.			
					Periodic Review Sierra Zinc Mine Stevens County, Facility Site ID: 1786484, Cleanup Site ID: 1838 (Ecology 2024a)	Ecology inspected the site conditions and monitoring data to confirm protection of human health and the environment post-cleanup at the Sierra Zinc Mine.	The review confirmed that an environmental covenant was filed on November 22, 2017, to restrict land use. During the review, Ecology determined that the remedy was functioning as intended and no additional actions were required.			
Silver Queen Mine	no	NA	NA	no	no	NA	NA	4850	6784750	Awaiting Cleanup
St. Crispin Mine	no	NA	NA	no	no	NA	NA	1553	9267585	No Further Action
United Treasure Mine	no	NA	NA	no	no	NA	NA	448	902477	No Further Action

Table A-2
Sampling and Results for Mines and Mills Evaluated During the 2001 EPA Stevens County Mines and Mills PA/SI
Final Upland RI Report
Upper Columbia River, Washington

Facility Name	Information Compiled from 2001 EPA Stevens County Mines and Mills PA/SI [a]				Additional Reports Reviewed	Objective of Work Performed	Conclusions of Work Performed	Information Compiled from Ecology Toxics Cleanup Program [b]		
	Samples Collected?	Sampling Results	Conclusions	Further Action Recommended by EPA?				Cleanup Site ID	Facility Site ID	Site Status
Van Stone Mine/Mill	12 waste rock surface soil, 21 surface soil from tailings, 7 surface soil from stained soil, 1 co-located surface water and sediment sample, 4 sediment samples	Waste rock samples contained elevated maximum concentrations of cadmium (234 mg/kg), lead (76,500 mg/kg), mercury (1.5 mg/kg), and zinc (20,600 mg/kg). Elevated maximum concentrations from tailings included lead (4,710 mg/kg), mercury (0.17 mg/kg), and zinc (5,870 mg/kg). Elevated maximum concentrations from stained soil include cadmium (940 mg/kg), copper (461 mg/kg), lead (181,000 mg/kg), mercury (6.0 mg/kg), and zinc (431,000 mg/kg). Elevated maximum concentrations in surface water included zinc (112 µg/L). Elevated maximum concentrations in sediment included lead (466 mg/kg), cadmium (11.9 mg/kg), and zinc (3,670 mg/kg).	Metals concentrations indicate that harmful chemicals may be migrating to receptors.	yes	Van Stone Mine Remedial Investigation, Onion Creek, Washington (Hart Crowser 2013)	To evaluate the extent of impact of mining operations and potential releases at the Van Stone Mine area and surrounding areas.	The investigation was conducted at five areas of concern, including the open pits, mill and waste rock area; the upper tailings pile; the lower tailings pile; pipeline access roads; and Onion Creek and associated tributaries. Samples contained elevated metals (antimony, arsenic, cadmium, copper, lead, and/or zinc) in soil, surface water, and/or sediment at each of the areas of interest.	461	1554858	Cleanup Started
					Feasibility Study, Van Stone Mine, Onion Creek, Washington (Ecology 2017a)	To develop and evaluate cleanup alternatives to address contamination identified in the 2013 Remedial Investigation and select a preferred cleanup alternative.	Alternative #5, creation of a centralized repository for tailings waste, was the recommended alternative by the Feasibility Study. In this remedial strategy, the tailings and waste material from AOIs 1, 2, and 4 would be excavated and transported to AOI 3. This area would be a central repository for the waste at the site, with a 7-layer cover placed on top of the waste. The excavated areas would be graded and revegetated.			
					Cleanup Action Plan Van Stone Mine, Onion Creek, Stevens County, Washington (Ecology 2023)	To explain the proposed cleanup action for the Van Stone Mine, including the extent of contamination, extent of contamination expected after the cleanup is completed, and steps and schedule required to complete the remediation.	The selected remedy included the following: consolidation of contaminated soil from the upper tailings pile, mill area/waste rock area, and dispersed tailings associated with the pipeline access roads into the lower tailings pile; regrading of the lower tailings pile; installation of a six-layer cover system including an impermeable liner, multiple geotextile liners, and 3 feet of burrowing material and topsoil at the lower tailings pile; and installation of a buttress at the spillway at North Pit Lake per Dam Safety requirements. Groundwater monitoring, institutional controls, financial assurances, and periodic review were also required as part of the cleanup strategy.			

Notes:
[a] USEPA (2002)
[b] This information is compiled from the Washington State Department of Ecology (Ecology) Toxics Cleanup Program Cleanup and Tank Search website (Ecology 2024b).
[c] Investigation and cleanup work completed in association with the Le Roi/Northport Smelter is described in Sections 2.10.1.2 and 3.7 of the Upland RI report and in Appendix B of the Upland RI report.
AOI - area of interest
CERCLA - Comprehensive Environmental Response, Compensation and Liability Act of 1980
EE/CA - Engineering Evaluation / Cost Analysis
GIS - geographic information system
JH - The analyte was positively identified. The associated numerical value is an estimate. High bias.
JL - The analyte was positively identified. The associated numerical value is an estimate. Low bias.
JK - The analyte was positively identified. The associated numerical value is an estimate. Unknown bias.
MTCA - Model Toxics Control Act
na - not available
NA - not applicable
PA/SI - preliminary assessment and site inspection

ERM HAS OVER 140 OFFICES ACROSS THE FOLLOWING COUNTRIES AND TERRITORIES WORLDWIDE

Argentina
Australia
Belgium
Brazil
Canada
China
Colombia
Denmark
France
Germany
Hong Kong
India
Indonesia
Ireland
Italy
Japan
Kazakhstan
Kenya
Malaysia
Mexico
Mozambique
Netherlands
New Zealand
Panama
Peru
Poland
Portugal
Romania
Singapore
South Africa
South Korea
Spain
Switzerland
Taiwan
Thailand
UAE
UK
US
Vietnam

ERM's Carpinteria Office
1180 Eugenia Place
Suite 204
Carpinteria, CA 93013

T: +1 805 684 2801
F: +1 805 684 1978

www.erm.com